COUNSELING OCCUPATIONS

Counselors help people to understand themselves and their opportunities so that they can make and carry out decisions and plans for a satisfying and productive life. Whatever the area of counseling—personal, educational, or vocational—counselors must combine objectivity with genuine concern for each client. They must believe in the uniqueness and worth of each individual, in his right to make and accept responsibility for his own decisions, and in his potential for development.

This chapter covers four counseling specialties: school; rehabilitation; employment; and college career planning and placement.

School counselors are the largest counseling group. Their main concern is the personal and social development of students and helping them plan and achieve their educational and vocational goals.

Rehabilitation counselors work with persons who are physically, mentally, or socially handicapped. Their counseling is generally job-oriented, but also involves personal problems.

Employment counselors are mainly concerned with career planning and adjustment of young, old, disabled, and other persons.

College career planning and placement counselors help college students examine their own interests, abilities, and goals; explore career alternatives; and make and follow through with a career choice.

Persons who want to enter the counseling field must be interested in helping people and have an ability to understand their behavior. A pleasant but strong personality that instills confidence in clients is desirable. Counselors also must be patient, sensitive to the needs of others, and able to communicate orally as well as in writing.

Many psychologists, social workers, and college student personnel workers also do counseling. These and other fields which entail some counseling such as teaching, health, law, religion, and personnel, are described elsewhere in the *Handbook*.

SCHOOL COUNSELORS

(D.O.T. 045.108)

Nature of the Work

School counselors are concerned about the educational, career, and social development of students. They work with students, both individually and in groups, as well as with teachers, other school personnel, parents, and community agencies.

Counselors use the results of interest, achievement, and intelligence tests as well as school and other records to help students evaluate themselves. Then, with each student and sometimes with the parents, they help develop an educational plan that fits the student's abilities, interests, and career aspirations.

School counselors often maintain a small library containing occupational literature so that students may find descriptions of work that they have heard about or in which they have an interest. Information on training requirements, earnings, and employment outlook often is included with these job descriptions. Computers that students can use to look up this information themselves are being tried in some instances.

Counselors sometimes arrange trips to factories and business firms, and show vocational films to provide a view of real work settings. To bring the workplace into the school, the counselor may conduct "career day" programs.

School counselors must keep up-to-date on opportunities for educational and vocational training beyond high school to counsel students who want this information. They must keep informed about training programs in 2-and 4-year colleges; in trade, technical, and business schools; apprenticeship programs; and available federally supported programs. Counselors also advise students about educational requirements for entry level jobs, job changes caused by technological advances, college entrance requirements, and places of employment.

Counselors in high schools often help students find part-time jobs, either to enable them to stay in school or to help them prepare for their vocation. They may help both graduates and dropouts to find jobs or may direct them to community employment services. They also may conduct surveys to learn more about hiring experiences of recent graduates and dropouts, local job opportunities, or the effectiveness of the educational and guidance programs. Many help students individually with personal and social problems or lead group counseling sessions and discussion groups on topics related to student interests and problems.

Elementary school counselors help children to make the best use of their abilities by identifying these and other basic aspects of the child's makeup at an early age, and by evaluating any learning problems. Methods used in counsel-

ing grade school children differ in many ways from those used with older students. Observations of classroom and play activity furnish clues about children in the lower grades. To better understand children, elementary school counselors spend much time consulting with teachers and parents. They also work closely with other staff members of the school, including psychologists and social workers.

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

Places of Employment

About 44,000 people worked full time as public school counselors during 1974. Most counselors work in large schools. An increasing number of school districts, however, provide guidance services to their small schools by assigning more than one school to a counselor.

Training, Other Qualifications, and Advancement

Most States require school counselors to have counseling and teaching certificates. However, a growing number of States no longer require teacher certification. (See statements on Elementary and Secondary School Teachers for certificate requirements.) Depending on the State, graduate work and from 1 to 5 years of teaching experience usually are required for a counseling certificate. People who plan to become counselors should learn the requirements of the State in which they plan to work since requirements vary among States and change rapidly.

College students interested in becoming school counselors usually take the regular program of teacher education, with additional courses in psychology and sociology. In States where teaching experience is not a requirement, it is possible to major in a liberal arts program. A few States substitute counseling internship for teaching experience. In some States teachers who have completed part of the courses required for the master's degree are eligible for provisional certification and may work as counselors under supervision while they take additional courses.

Counselor education programs at the graduate level are available in more than 440 colleges and universities, most frequently in the departments of education or psychology. One to two years of graduate study are necessary for a master's degree. Most programs provide supervised field experience.

Subject areas of required graduate level courses usually include appraisal of the individual student, individual counseling procedures, group guidance, information service for career development, professional relations and ethics, and statistics and research.

The ability to help others accept responsibility for their own lives is important for school counselors because their work concerns the development of young people. They must be able to coordinate the activity of others and work as part of the team which forms the educational system.

School counselors may advance by moving to a larger school; becoming director or supervisor of counseling or guidance; or, with further graduate education, becoming a college counselor, educational psychologist, or school psychologist.

Employment Outlook

Employment of school counselors is likely to grow more slowly than the average for all occupations through the mid-1980's as the decline in school enrollments continues during the remainder of this decade. However, some positions will continue to be available in elementary schools. An expected upswing in enrollments beginning in the early 1980's should stimulate some expansion in employment, and additional counselors will be required each year to replace those who leave the profession.

In 1974, the average ratio of counselors to students as a whole was still well below generally accepted standards, despite Federal aid to the States for support and expansion of counseling programs. Some school systems were forced to eliminate some counselor positions due to local financial problems. Over the long run, demand for school counselors will depend in large part on the Federal Government's Career Education Program. This program is designed to inform children about the world of work early in their education, so that by the time they leave the formal educational system they are prepared for a suitable and available career. The extent of future growth in counselor employment will depend largely on the amount of funds which the Federal Government provides to the States.

Earnings and Working Conditions

School counselors holding bachelor's degrees earned average annual salaries ranging from $9,000 to $13,000 during 1974, according to the limited data available. For those having master's degrees, average yearly salaries were from $10,400 to $15,500. School counselors with doctorates had an average maximum salary of almost $18,200 per year. School counselors generally earn more than teachers at the same school. (See statements on Kindergarten and Elementary School Teachers and Secondary School Teachers.)

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

Sources of Additional Information

State departments of education can supply information on colleges and universities that offer training in guidance and counseling as well as on the State certification requirements.

Additional information on this field of work is available from:

American School Counselor Association, 1607 New Hampshire Ave. NW., Washington, D.C. 20009.

EMPLOYMENT COUNSELORS

(D.O.T. 045.108)

Nature of the Work

Employment counselors (sometimes called vocational counselors) help jobseekers evaluate their abilities and interests so that they can choose, prepare for, and adjust to a satisfactory field of work. The extent of counseling services given by employment counselors varies, depending on the job-seeker and the type of agency. Job-seekers may include veterans, youth with little or no work experience, the handicapped, older workers, and individuals displaced by automation and industry shifts or unhappy with their present occupational fields. Sometimes jobseekers are skilled in specific occupations and ready for immediate job placement, while those who have little education and lack marketable skills need intensive training to prepare for jobs. In State employment services, the counselor is also concerned with helping those who are least employable, such as welfare recipients, prison releasees, and the educationally and culturally deprived.

Counselors interview jobseekers to learn employment-related facts about their interests, training, work experience, work attitudes, physical capacities, and personal traits. If necessary, they may get additional data by arranging for aptitude and achievement tests and interest inventories, so that more objective help may be given. They may get additional information from sources such as former employers and schools.

When a jobseeker's background—the person's limitations and abilities—has been thoroughly reviewed, the employment counselor discusses occupational requirements and job opportunities in different fields within the potential of the jobseeker. Then, the counselor and the client develop a vocational plan. This plan may specify a series of steps involving remedial education, job training, work experience, or other services needed to enhance the person's employability. Often, in developing this plan, the employment counselor works with a team of specialists.

In many cases, employment counselors refer jobseekers to other agencies for physical rehabilitation or psychological or other services before or during counseling. Counselors must be familiar with the available community services so that they can select those most likely to benefit a particular jobseeker.

Counselors may help jobseekers by suggesting employment sources and appropriate ways of applying for work. In many cases when further support and assistance are needed, counselors may contact

employers to develop jobs for counseled applicants, although jobseekers usually are sent to placement interviewers after 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 service counselors for improving the employability of disadvantaged persons has increased their contacts with these persons during training and on the job. Also, it has led to group counseling and the stationing of counselors in neighborhood and community centers.

Places of Employment

In 1974, about 3,500 persons, half of them women, worked as employment counselors in State employment service offices, located in every large city and many smaller towns. In addition, about 3,500 employment counselors worked for various private or community agencies, primarily in the larger cities. Some worked in institutions such as prisons, training schools for delinquent youths, and mental hospitals. Also, the Federal Government employed a limited number of employment counselors, chiefly in the Veterans Administration and in the Bureau of Indian Affairs. Some counselors teach in graduate training programs or conduct research.

Training, Other Qualifications, and Advancement

The national qualification standard for first level employment counselors in State employment service offices calls for 30 graduate semester hours of counseling courses beyond a bachelor's degree. However, 1 year of counseling-related experience may be substituted for 15 graduate semester hours.

All States require counselors in their public employment offices to meet State civil service or merit system requirements that include minimum educational and experience standards.

Applicants with advanced degrees and additional qualifying experience may enter at higher levels on the counselor career ladder. Many States also make provision for individuals with extensive experience in the employment service, whether or not they have college degrees, to enter the counselor career ladder and move upward by acquiring the prescribed university coursework and qualifying experience for each level.

Although minimum entrance requirements are not standardized among private and community agencies, most prefer, and some require, a master's degree in vocational counseling or in a related field such as psychology, personnel administration, counseling, guidance education, or public administration. Many private agencies prefer to have at least one staff member who has 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, teaching, social work, or psychology.

In each State, the public employment service offices provide some in-service training programs for their new counselors or trainees. In addition, both their new and experienced counselors are often given part-time training at colleges and universities during the regular academic year or at institutes or summer sessions. Private and community agencies also often provide in-service training opportunities.

College students who wish to become employment counselors should enroll in courses in psychology and basic sociology. At the graduate level, requirements for this field usually include courses in techniques of counseling, psychological principles and psychology of careers, assessment and appraisal, cultures and environment, and occupational information. Counselor education pro-

grams at the graduate level are available in about 370 colleges and universities, mainly in departments of education or psychology. To obtain a master's degree, students must complete 1 to 2 years of graduate study.

Young people aspiring to be employment counselors should have a strong interest in helping others make vocational plans and carry them out. They should be able to work independently and to keep detailed records.

Well-qualified counselors with experience may advance 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 may become consultants; and others may become professors in the counseling field.

Employment Outlook

Employment counselors with master's degrees or experience in related fields are expected to face some competition in both public and community employment agencies through the mid-1980's. Some growth in the number of employment counselors is expected as their role becomes more important in programs dealing with the training and retraining of unemployed workers, particularly those who are unskilled or whose jobs have been displaced by technological or industrial shifts. Expansion of these programs and consequently the extent of growth in employment of counselors will depend in large part on the level of funding by the Federal Government, as well as on the distribution of revenue sharing money allocated to these programs by the individual States. Some openings for employment counselors will result from the need to replace those who die, retire, or transfer to other occupations.

Earnings and Working Conditions

Salaries of employment counselors in State employment services vary considerably by State. In 1974, minimum salaries ranged from about $7,200 to $14,700 a year, with an average of $9,100. Maximum salaries ranged from $9,700 to $19,100, with an average of $11,900. More than three-quarters of the States listed maximum salaries of $11,900 or more. Trainees for counseling positions in some voluntary agencies in large cities were being hired at about $8,500 a year. Salaries of some employment counselors in private and community agencies were as high as $20,000 although the average was about $12,000 annually. In general, salaries of employment counselors are about 1 1/2 times as high as average earnings for all nonsupervisory workers in private industry, except farming.

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.

Sources of Additional Information

For general information on employment or vocational counseling, contact:

National Employment Counselors Association, 1607 New Hampshire Ave. NW., Washington, D.C. 20009.

National Vocational Guidance Association, Inc., 1607 New Hampshire Ave. NW., Washington D.C. 20009.

U.S. Department of Labor, Manpower Administration, USES, Division of Counseling and Testing, Washington, D.C. 20210.

The administrative office for each State's employment security agency, bureau, division, or commission can supply specific information about local job opportunities, salaries, and entrance requirements for positions in public employment service offices.

REHABILITATION COUNSELORS

(D.O.T. 045.108)

Nature of the Work

Rehabilitation counselors help people with physical, mental, or social disabilities to adjust their vocational plans and personal lives. Counselors learn about clients' interests, abilities, and limitations. They then use this information, along with available medical and psychological data, to help disabled persons evaluate themselves for the purpose of pairing their physical and mental capacity and interests with suitable work.

Together, the counselor and client develop a plan of rehabilitation, with the aid of other specialists responsible for the medical care and occupational training of the handicapped person. As the plan is put into effect, the counselor meets regularly with the disabled person to discuss his progress in the rehabilitation program and help resolve any problems that have been encountered. When the client is ready to begin work, the counselor helps him find a suitable job, and usually makes followup checks to insure that the placement has been successful.

Rehabilitation counselors must maintain close contact with the families of their handicapped clients, other professionals who work with handicapped people, agencies and civic groups, and private employers who hire the disabled. Counselors in this field often perform related activities, such as informing employers of the abilities of the handicapped and arranging for publicizing the rehabilitation program in the community.

An increasing number of counselors specialize in a particular area

of rehabilitation; some may work almost exclusively with blind people, alcoholics or drug addicts, the mentally ill, or retarded persons. Others may work almost entirely with persons living in poverty areas.

The amount of time spent in counseling each client varies with the severity of the disabled person's problems as well as with the size of the counselor's caseload. Some rehabilitation counselors are responsible for many persons in various stages of rehabilitation; on the other hand, less experienced counselors or those working with the severely disabled may work with relatively few cases at a time.

Places of Employment

About 19,000 persons, one-third of them women, worked as rehabilitation counselors in 1974. About 70 percent worked in State and local rehabilitation agencies financed cooperatively with Federal and State funds. Some rehabilitation counselors and counseling psychologists worked for the Veterans Administration. Rehabilitation centers, sheltered workshops, hospitals, labor unions, insurance companies, special schools, and other public and private agenices with rehabilitation programs and job placement services for the disabled employ the rest.

Training, Other Qualifications, and Advancement

A bachelor's degree with courses in counseling, psychology, and related fields is the minimum educational requirement for rehabilitation counselors. However, employers are placing increasing emphasis on the master's degree in vocational counseling or rehabilitation counseling, or in related subjects such as psychology, education, and social work. Work experience in fields such as vocational counseling and placement, psychology, education, and social work is an asset for securing employment as a rehabilitation counselor. Most agencies have work-study programs whereby employed counselors can earn graduate degrees in the field.

Rehabilitation counselor assisting blind person in use of cassette tape recorder.

Usually, 2 years of study are required for the master's degree in the fields preferred for rehabilitation counseling. Included is a semester of actual work experience as a rehabilitation counselor under the close supervision of an instructor. Besides a basic foundation in psychology, courses generally included in master's degree programs are counseling theory and techniques, occupational and educational information, and community resources. Other requirements may include courses in placement and followup, tests and measurements, cultural and psychological effects of disability, and medical and legislative aspects of therapy and rehabilitation. About 85 schools offered graduate training in rehabilitation counseling in 1974.

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 and other social sciences, as well as in research methods, is required.

Many States require that rehabilitation counselors be hired in accordance with State civil service and merit system rules. In most cases, these regulations require applicants to pass a competitive written test, sometimes supplemented by an individual interview and evaluation by a board of examiners.

Since rehabilitation counselors deal with the welfare of individuals, the ability to accept responsibility is important. It also is essential that they be able to work independently and be able to motivate and guide the activity of others.

Counselors who have limited experience usually are assigned the less difficult cases. As they gain experience, their caseloads are increased and they are assigned clients with more complex rehabilitation problems. After obtaining considerable experience and more graduate education, rehabilitation counselors may advance to supervisory positions or top administrative jobs.

Employment Outlook

Employment opportunities for rehabilitation counselors are expected to be favorable through the mid-1980's. Persons who have graduate work in rehabilitation counseling or in related fields are expected to have the best employment prospects.

Contributing to the long-run demand for rehabilitation counselors will be population growth and the extension of service to a greater number of the severely disabled, together with increased public awareness that the vocational rehabilitation approach helps the disabled to become self-supporting. The extent of growth in employment of counselors, however, will depend largely on levels of government funding for vocational rehabilitation. In addition to growth needs, many counselors will be required annually to replace those who die, retire, or leave the field for other reasons.

Earnings and Working Conditions

Salaries of beginning rehabilitation counselors in State agencies averaged $9,300 a year in 1974. Experienced counselors earned average salaries of $12,200 a year; the range was $9,800 to $16,400 among the States.

The Veterans Administration paid counseling psychologists with a 2-year master's degree and 1 year of subsequent experience—and those with a Ph. D.—starting salaries of $15,481 in late 1974. Those with a Ph. D. and a year of experience, and those with a 2-year master's degree and much experience, started at $18,463. Some rehabilitation counselors with a bachelor's degree were hired at starting salaries of $10,520 and $12,841. In general, salaries of rehabilitation counselors are above the average earnings for all nonsupervisory workers in private industry, except farming.

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

Rehabilitation counselors generally work a 40-hour week or less, with some overtime work required to attend community and civic meetings in the evening. They usually are covered by sick and annual leave benefits, and pension and health plans.

Sources of Additional Information

For information about rehabilitation counseling as a career, contact:

American Psychological Association, Inc., 1200 17th St. NW., Washington, D.C. 20036.

American Rehabilitation Counseling Association, 1607 New Hampshire Ave. NW., Washington, D.C. 20009.

National Rehabilitation Counseling Association, 1522 K St. NW., Washington, D.C. 20005.

COLLEGE CAREER PLANNING AND PLACEMENT COUNSELORS

(D.O.T. 166.268)

Nature of the Work

Choosing a career and deciding whether or not to go to graduate school are among the difficult decisions faced by many college students. Career planning and placement counselors are employed by colleges to offer encouragement and assistance in these decisions.

Career planning and placement counselors, sometimes called college placement officers, provide a variety of services to college students and alumni. They assist students in making career selections by encouraging them to examine their interests, abilities, and goals, and then helping them to explore possible career alternatives and to choose an occupational area that is best suited to their individual needs. They advise students considering dropping out of college of the opportunities open to them. They also help students to get part-time and summer jobs.

Career planning and placement counselors arrange for job recruiters to visit the campus to discuss their firm's personnel needs and to interview applicants. They provide employers with information about students and help in appraising students' qualifications. They must keep abreast of information concerning job market developments in order to contact prospective employers, help students prepare for promising fields, and encourage the faculty and college administration to provide pertinent courses. Most career counselors also assemble and maintain a library of career guidance information and recruitment literature.

Placement counselors may specialize in areas such as law, education, or part-time and summer work. However, the extent of specialization usually depends upon the size and type of college as well as the size of the placement staff.

Places of Employment

Nearly all 4-year colleges and universities and many of the increasing number of junior colleges provide career planning and placement services to their students and alumni. Large colleges may employ several counselors working under a director of career planning and placement activities; in many institutions, however, a combination of placement functions is performed by one director aided by a clerical staff. In some colleges, especially the smaller ones, the functions of career counselors may be performed on a part-time basis by members of the faculty or administrative staff. Universities frequently have placement officers for each major branch or campus.

About 4,100 persons, one-half of them women, worked as career planning and placement counselors in colleges and universities in 1974. Most were employed on a full-time basis. An additional 1,200 worked in junior colleges; about two-thirds worked part time.

Training, Other Qualifications, and Advancement

Although no specific educational program exists to prepare persons for career planning and placement work, a bachelor's degree, preferably in a behavioral science such as psychology or sociology, is customary for entry into the field, and a master's degree is increas-

ingly being stressed.

In 1974, more than 100 colleges and universities offered graduate programs in college student personnel work. Graduate courses that are helpful for career planning and placement counseling include counseling theory and techniques, vocational testing, theory of group dynamics, and occupational research and employment trends.

Some people enter the career planning and placement field after gaining a broad background of experience in business, industry, government, or educational organizations. An internship in a career planning and placement office also is helpful.

College career planning and placement counselors must have an interest in people. They must be able to communicate with and gain the confidence of students, faculty, and employers in order to develop insight into the employment needs of both employers and students. People in this field should be energetic and able to work under pressure, since they must organize and administer a wide variety of activities.

Advancement for career planning and placement professionals usually is through promotion to an assistant or associate position, director of career planning and placement, director of student personnel services, or 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.

Counselor discusses career alternatives with college student.

Employment Outlook

The overall employment outlook for well-qualified college career planning and placement counselors is expected to be favorable through the mid-1980's. Employment growth in the field is expected to be about as fast as the average for all occupations as college enrollments continue to increase through the early 1980's. Demand will be greatest for persons with specialized training in career counseling in junior and community colleges, where, in many cases, there are no career planning and placement programs at present. Also contributing to the demand will be expected continued expansion in services to students from minority and low-income groups, who require special counseling in choosing careers and assistance in finding part-time jobs to help pay for their education. Growth is also expected in services to the handicapped and to adults participating in continuing education.

However, many institutions of higher education faced financial problems in 1974. If this situation persists, colleges and universities may be forced to limit expansion of counseling and placement services, resulting in competition for available positions during this period.

Earnings and Working Conditions

The average salary of college career planning and placement directors was more than $17,000 a year in 1974, according to limited information. Average salaries for directors in large public universities were $19,300; in small private colleges, about $10,700. Salaries for college career planning and placement counselors ranged from $7,000 to $15,000 a year.

Career planning and placement counselors frequently work more than a 40-hour week; irregular hours and overtime often are neces-

sary, particularly during the "recruiting season." Most counselors are employed on a 12-month basis. They are paid for holidays and vacations and usually receive the same benefits as other professional personnel employed by colleges and universities.

Sources of Additional Information

A list of schools that offer courses in career counseling and placement and a booklet on the college student personnel professions, as well as other information on career counseling and placement, are available from:

The College Placement Council, Inc., P.O. Box 2263, Bethlehem, Pa. 18001.

CLERGY

Deciding on a career in the clergy involves considerations different from those involved in other career choices. When young persons choose to enter the ministry, priesthood, or rabbinate, they do so primarily because they possess a strong religious faith and a desire to help others. Nevertheless, it is important for young people 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.

The number of clergy needed depends largely on the number of people who participate in organized religious groups. This affects the number of churches and synagogues established and pulpits to be filled. In addition to the clergy who serve congregations, many others teach or act as administrators in seminaries and in other educational institutions; still others serve as chaplains in the Armed Forces, industry, correctional institutions, hospitals or on college campuses; or render service as missionaries or in social welfare agencies.

Persons considering a career in the clergy should seek the counsel of a religious leader of their faith to aid in evaluating their qualifications. The most important of these are a deep religious belief and a desire to serve the spiritual needs of others. The priest, minister, or rabbi also is expected to be a model of moral and ethical conduct. A person considering one of these fields must realize that the civic, social, and recreational activities of a member of the clergy often are influenced and restricted by the customs and attitudes of the community.

The clergy should be sensitive to the needs of others and able to help them deal with these needs. The job demands an ability to speak and write effectively, to organize, and to supervise others. The person entering this field also must enjoy studying because the ministry is an occupation which requires continuous learning. In addition, the ministry demands considerable initiative and self-discipline.

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, 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.

PROTESTANT MINISTERS

(D.O.T. 120.108)

Nature of the Work

Protestant ministers lead their congregations in worship services and administer the rites of baptism, confirmation, and Holy Communion. They prepare and deliver sermons and give religious instruction to persons who are to become new members of the church. They also perform marriages; conduct funerals; counsel individuals who seek guidance; visit the sick, aged, and handicapped at home and in the hospital; comfort the bereaved; and serve church members in other ways. Many Protestant ministers write articles for publication, give speeches, and engage in interfaith, community, civic, educational, and recreational activities sponsored by or related to the interests of the church. Some ministers teach in seminaries, colleges, and universities.

The services that ministers conduct differ among Protestant denominations and also among congregations within a denomination. In many denominations, ministers follow a traditional order of worship; in others they adapt the services to the needs of youth and other groups within the congregation. Most services include Bible reading, hymn singing, prayers, and a sermon. In some denominations, Bible reading by a member of the congregation and individual testimonials may constitute a large part of the service.

Ministers serving small congregations generally work on a personal basis with their parishioners. Those serving large congregations have greater administrative responsibilities, and spend considerable time working with committees, church officers, and staff, besides performing their other duties. They may have one or more associates or assistants who share specific aspects of the ministry, such as a minister of education who assists in educational programs for different age groups, or a minister of music.

Places of Employment

In 1974, about 185,000 ministers—about 3 percent of them women—served 72 million Protestants. Most ministers serve individual congregations. In addition, however, thousands of ministers were in closely related fields such as chaplains in hospitals and the Armed Forces. The greatest number of clergy are affiliated with the five largest groups of churches – Baptist, United Methodist, Lutheran, Presbyterian, and Episcopal.

All cities and most towns in the United States have at least one Protestant church with a full-time

minister. Although the majority of ministers are located in urban areas, many live in less densely populated areas where they may serve two or more congregations.

Training and Other Qualifications

Educational requirements for entry into the Protestant ministry vary greatly. Some denominations have no formal educational requirements, and others ordain persons having varying amounts and types of training in Bible colleges, Bible institutes, or liberal arts colleges. A large number of denominations require a 3-year course of professional study in a theological school or seminary following college graduation. A degree of bachelor or master of divinity is awarded upon completion.

In 1974, there were 132 theological institutes accredited by the American Association of Theological Schools. These admit only students who have received a bachelor's degree or its equivalent from an accredited college.

Recommended preseminary courses include English, history, philosophy, the natural sciences, social sciences, the fine arts, music, religion, and foreign languages. However, students considering theological study should contact, at the earliest possible date, the school or schools to which they intend to apply, in order to learn what will best prepare them for the program they expect to enter.

The standard curriculum recommended for accredited theological schools consists of four major types of courses: biblical, historical, theological, and practical. In recent years, greater emphasis has been placed on courses of a practical nature such as psychology, religious education, and administration. Many accredited schools require that students gain experience in church work under the supervision of a faculty member or experienced minister. Some institutions offer master of theology and 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 that reflect its particular doctrine, interests, and needs. However, many of these schools are open to students from other denominations. Several interdenominational schools associated with universities give both undergraduate and graduate training covering a wide range of theological points of view.

Persons who have denominational qualifications for the ministry usually are ordained following graduation from a seminary. In denominations that do not require seminary training, clergy are ordained at various appointed times. Men and women entering the clergy often begin their careers as pastors of small congregations or as assistant pastors in large churches.

Employment Outlook

The trend toward merger and unity among denominations, combined with the closing of smaller parishes and the downturn in financial support, has reduced demand for Protestant ministers in recent years. As a result, new graduates of theological schools will face increasing competition in finding positions. The supply-demand situation will vary among denominations and the chance of obtaining employment will depend, in part, on the length of the candidate's formal preparation. Most of the openings for clergy that are expected through the mid-1980's will therefore result from the need to replace those in existing positions who retire, die, or leave the ministry.

Although fewer opportunities may arise for Protestant ministers to serve individual congregations, newly ordained ministers may find work in youth, family relations, and welfare organizations; religious education; on the campus; and as chaplains in the Armed Forces, hospitals, universities, and correctional institutions.

Earnings and Working Conditions

Salaries of Protestant clergy vary substantially, depending on age, experience, education, denomination, size and wealth of congregation, type of community, and geographic location. According to a study by the National Council of Churches of Christ, median salaries for Protestant ministers in 1973 were about $10,500 plus $1,200 in fringe benefits. However, on the average, ministers had to pay over $1,100 out of their own monies for professionally related expenses, particularly travel. Annual vacations average 3 weeks and there is often opportunity for time off.

Because of the wide range of service that the minister provides, he or she may work long or irregular hours, often involving considerable travel.

Sources of Additional Information

Persons who are interested in the Protestant ministry should seek the counsel of a minister or church guidance worker. Additional information is available from many denominational offices. Each theological school can supply information on admission requirements.

RABBIS

(D.O.T. 120.108)

Nature of the Work

Rabbis are the spiritual leaders of their congregations and teachers and interpreters of Jewish law and tradition. They conduct religious services and deliver sermons at services on the Sabbath and on Jewish holidays. Rabbis customarily are available at all times to counsel members of their congregation, other followers of Judaism, and the community at large. Like other clergy, rabbis conduct weddings and funeral services, visit the sick, help the poor, comfort the bereaved, supervise religious education programs, engage in interfaith activities, and involve themselves in community affairs.

Rabbis serving large congregations may spend considerable time in administrative duties, working with their staffs and committees. Large congregations frequently have an associate or assistant rabbi. Many assistant rabbis serve as educational directors.

Rabbis serve either Orthodox, Conservative, or Reform congregations. Regardless of their particular point of view, all Jewish 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, the use of Hebrew as the language of prayer, or the use of music or a choir. 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.

Rabbis also may write for religious and lay publications, and teach in theological seminaries, colleges, and universities.

Places of Employment

About 4,000 rabbis served over 6 million followers of the Jewish faith in this country in 1974; approximately 1,550 were Orthodox rabbis, 1,350 were Conservative, and 1,100 Reform. Others work as chaplains in the military services, in hospitals and other institutions, or in one of the many Jewish community service agencies. A growing number are employed in colleges and universities as teachers in Jewish Studies programs.

Although rabbis serve Jewish communities throughout the Nation, they are concentrated in those States that have large Jewish populations, particularly New York, California, Pennsylvania, New Jersey, Illinois, Massachusetts, Florida, Maryland, and the Washington, D.C. metropolitan area.

Training and Other Qualifications

To become eligible for ordination as a rabbi, a student must complete a prescribed course of study in a seminary. Entrance requirements and the curriculum depend upon the branch of Judaism with which the seminary is associated.

Nearly 30 seminaries train Orthodox rabbis in programs of varying lengths. The required course of study to prepare for ordination is usually 3 or 4 years. However, students who are not college graduates may spend a longer period at these seminaries and complete the requirements for the bachelor's degree while pursuing the rabbinic course. Some

Orthodox seminaries do not require a college degree to qualify for ordination, although students who qualify usually have completed 4 years of college.

The Hebrew Union College—Jewish Institute of Religion is the official seminary that trains rabbis for the Reform branch of Judaism. It is the only branch that has approved the training and ordination of women as rabbis. The Jewish Theological Seminary of America is the official seminary that trains rabbis for the Conservative branch of Judaism. Both seminaries require the completion of a 4-year college course, as well as earlier preparation in Jewish studies, for admission to the rabbinic program leading to ordination. Normally 5 years of study are required to complete the rabbinic course at the Reform seminary, including 1 year of preparatory study in Jerusalem. Exceptionally well-prepared students can shorten this 5-year period to a minimum of 3 years. A student having a strong background in Jewish studies can complete the course at the Conservative seminary in 4 years; for other enrollees, the course may take as long as 6.

In general, the curriculums of Jewish theological seminaries provide students with a comprehensive knowledge of the 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; it offers, instead, a broad course of study that includes subjects such as human relations and community organization.

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

Newly ordained rabbis usually begin as leaders of small congregations, assistants to experienced rabbis, directors of Hillel Foundations on college campuses, teachers in seminaries and other educational institutions, or chaplains in the Armed Forces. As a rule, the pulpits of large and well established Jewish congregations are filled by experienced rabbis.

Employment Outlook

The demand for Rabbis has declined in recent years because some established congregations have closed and fewer new ones are being formed. As a result, many newly ordained Rabbis will take positions in smaller Jewish communities and as assistant Rabbis in larger Jewish congregations. Opportunities still exist for Rabbis to teach in colleges and universities, to serve as chaplains in the Armed Forces, and to work in hospitals and other institutions or in one of the many Jewish social service agencies. Openings in established congregations will come largely from a need to replace those Rabbis who retire or die.

Earnings and Working Conditions

In 1974, newly ordained Rabbis averaged about $17,000-$18,000 a year in salary and other benefits, including housing, pension, etc. Most established Rabbis earned between $20,000 and $35,000 a year, with some earning as much as $50,000-$60,000. Incomes vary depending on the size and financial status of the congregation, as well as its denominational branch and geographic location. Rabbis usually earn additional income from gifts or fees for officiating at ceremonies such as weddings.

Rabbis' working hours are determined by their role in the congregation. Besides conducting regular religious services, they may also spend considerable time in administrative, educational, and community service functions, as well as presiding over various ceremonial services. Rabbis must also be available to serve the emergency needs of their congregation members.

Sources of Additional Information

Young people who are interested in entering the rabbinate should seek the guidance of a rabbi. Information on the work of a rabbi and occupations allied to it is also available from many of the local Boards of Rabbis in large communities. Each Jewish theological seminary can supply information on its admission requirements.

ROMAN CATHOLIC PRIESTS

(D.O.T. 120.108)

Nature of the Work

Roman Catholic priests attend to the spiritual, pastoral, moral, and educational needs of the members of their church. Their duties include presiding at liturgical functions; offering religious enlightenment in the form of a sermon; hearing confessions; administering the Sacraments, (including the sacraments of Marriage and Penance); and conducting funeral services. They also comfort the sick, console relatives and friends of the dead, counsel those in need of guidance, and assist the poor.

Priests spend long hours working for the church and the community. Their day usually begins with morning meditation and Mass, and may end with the hearing of confessions or an evening visit to a hospital or a home. Many priests direct and serve on church committees, work in civic and charitable organizations, and assist in community projects.

There are two main classifications of priests—diocesan (secular) and religious. Both types have the same powers acquired through ordination by a bishop. The differences lie in their way of life, the type of work to which they are assigned, and the church authority to whom they are immediately subject. Diocesan priests generally work as individuals in parishes assigned to them by the bishop of their diocese. Religious priests generally work as part of a religious order, such as the Jesuits, Dominicans, or Franciscans. They engage in specialized activities such as teaching or missionary work assigned to them by superiors of their order.

Both religious and diocesan priests hold teaching and administrative posts in Catholic seminaries, colleges and universities, and high

schools. Priests attached to religious orders staff a large proportion of the institutions of higher education and many high schools, whereas diocesan priests are usually 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 abroad.

Places of Employment

Approximately 57,000 priests served nearly 49 million Catholics in the United States in 1974. There are priests in nearly every city and town and in many rural communities. The majority are in metropolitan areas, where most Catholics reside. Catholics are concentrated in the Northeast and Great Lakes regions, with smaller concentrations in California, Texas, and Louisiana. Large numbers of priests are located in communities near Catholic educational and other institutions.

Training and Other Qualifications

Preparation for the priesthood generally requires 8 years of study beyond high school. There are almost 400 seminaries offering post-high school education. Preparatory study may begin in the first year of high school, at the college level, or in theological seminaries after college graduation.

High school seminaries provide a college preparatory program that emphasizes English grammar, speech, literature, and social studies. Two years of Latin are required and the study of modern language is encouraged. The seminary college offers a liberal arts program, stressing philosophy and religion; the study of man through the behavioral sciences and history; and the natural sciences and mathematics. In many college seminaries, a student may concentrate in any of these fields.

The remaining 4 years of preparation include sacred scripture; apologetics (the branch of theology concerning the defense and proofs of Christianity); dogmatic, moral, and pastoral theology; homeletics (art of preaching); church history; liturgy (Mass); and canon law. Field work experience is usually required in addition to classroom study. 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. Priests are not permitted to marry.

Postgraduate work in theology is offered at a number of American Catholic universities or at ecclesiastical universities around the world, mostly in Rome. Also, many priests 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 church authorities may make arrangements for student scholarships or loans. Those in religious seminaries are financed by contributions of benefactors.

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. Many opportunities for greater responsibility exist within the church, depending on the talents, interests, and experience of the individual.

Employment Outlook

A growing number of priests will be needed in the years ahead to provide for the spiritual, educational, and social needs of the increasing number of Catholics in the Nation. The number of ordained priests has been insufficient to fill the needs of newly established parishes and other Catholic institutions, and to replace priests who retire or die. This situation is likely to persist. However, some of the duties of priests are being assigned to lay deacons. Although priests usually continue to 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 acting in many diverse areas of service—in social work; religious radio, newspaper, and television work; and labor-management mediation. They also have been serving in foreign posts as missionaries, particularly in countries that have a shortage of priests.

Earnings and Working Conditions

Diocesan priests usually receive a stipend of between $2,000 and $6,000 a year as well as maintenance provisions (room and board, housekeeping, etc.). Religious priests are generally supported by their religious order.

Priests who do special work related to the church, such as teaching, usually receive a partial salary which is less than a lay person in the same position would receive. The difference between the usual salary for these jobs and the salary that the priest receives is called "contributed service." In some of these situations, housing and related expenses may be provided; in other cases, the priest must make his own arrangements. Some priests doing special work may receive the same compensation that a lay person would receive. These may include priests working as lawyers, counselors,

consultants, etc.

Due to the wide range of duties which most clergy have, the priest often must work long and irregular hours. His working conditions vary widely with the type and area of assignment.

Sources of Additional Information

Young men interested in entering the priesthood should seek the guidance and counsel of their parish priest. For information regarding the different religious orders and the secular priesthood, as well as a list of the seminaries which prepare students for the priesthood, contact the diocesan Directors of Vocations through the office of the local pastor or bishop.

OTHER SOCIAL SERVICE OCCUPATIONS

COOPERATIVE EXTENSION SERVICE WORKERS

(D.O.T. 096.128)

Nature of the Work

Extension service workers are engaged with the rural area population in educational work in fields such as agriculture, home economics, youth activities, and community resource development. They are employed jointly by State land-grant universities and the U.S. Department of Agriculture. Extension workers must be proficient in both subject matter and teaching methods.

Extension workers help rural families analyze and solve their farm and home problems and aid in community improvement. Much of this educational work is carried on in groups, through meetings, tours, demonstrations, and use of local volunteer leaders. On problems that cannot be solved satisfactorily by such group methods, extension workers give individual assistance. In their work, they make much use of mass communication media such as newspapers, radio, and television.

County extension workers help farmers produce higher quality crops and livestock more efficiently. They also help them develop new markets and plan production to meet market demands, including those for product quality and variety. They also help community leaders to improve the community, by planning and providing for economic development, recreation, and more adequate public facilities such as schools, water supply and sewer systems, and libraries. They help homemakers to provide more family enjoyment from existing resources, a higher level of nutrition, and a more pleasant home environment. Some extension workers help youths to become more useful citizens and to gain more personal satisfaction through programs in career selection, recreation, health, and leadership. The essence of extension work is to help people help themselves to achieve the goals they think are important.

County extension workers are aided by State Extension Service specialists. The job of these specialists is to keep abreast of the latest research in their particular fields of interest, interpret this for use in extension work, and help county extension workers develop educational programs, activities, and events to use this new knowledge.

Cooperative Extension Services employ persons with a wide range of skills and with specialized training in all phases of crop and livestock production, conservation, environmental improvement, farm management and marketing, family living, human development, nutrition, home management, child development, sociology, psychology, veterinary medicine, engineering, textiles and clothing, resource economics, and business and public administration.

The usual career ladder for ex-

Extension workers help farmers produce higher quality crops.

tension workers is from assistant county agent to a more responsible job within that county, or in another county in the State, to an assignment on the State Extension Service staff.

Places of Employment

Extension workers are located in county offices, area offices serving multicounty units, and State offices, the last usually on the campus of the land-grant college or university.

Agents are located in nearly every county in the 50 States, in Puerto Rico, and in the District of Columbia. County staffs range in size from one agent (serving a wide variety of clientele interests) to a dozen or more specialized agents in counties with high population density and great diversity of interests. Staffs are located in counties ranging from the most rural to the most urban.

Training, Other Qualifications, and Advancement

Cooperative Extension Service agents are required to be proficient in disciplines related to the needs and programs of the clientele with whom they work. They must have a bachelor's degree in their subject-matter field; some training in educational techniques is desirable, as well.

Often, they receive training in extension techniques in a pre-induction training program, and are upgraded through regular in-service training programs in both educational techniques and the subject matter for which they are responsible. In addition to subject-matter proficiency, extension workers must like to work with people and to help them.

In most States, specialists and agents assigned to multicounty and State staff jobs are required to have at least one advanced degree and in many they must have a Ph. D.

Employment Outlook

Extension services employ more than 15,600 professional people. The demand for these workers is expected to increase, especially in depressed rural areas. As agricultural technology becomes more complicated, and as farm people become more aware of the need for organized activity, more help will be sought from trained Extension Service personnel. The Extension Service also will reach new segments of the population as residents recognize the value of its assistance, particularly in helping the disadvantaged.

Earnings

The salaries of extension workers vary by locality, but, for the most part, they are competitive with similar jobs in industry and government.

Sources of Additional Information

Additional information is available from County Extension offices, the State Director of the Cooperative Extension Service located at each land-grant university; or the Extension Service, U.S. Department of Agriculture, Washington, D.C. 20250.

HOME ECONOMISTS

(D.O.T. 096.128)

Nature of the Work

Home economists work to improve products, services, and practices that affect the comfort and well-being of the family. Some specialize in specific areas, such as consumer economics, housing, home management, home furnishings and equipment, food and nutrition, clothing and textiles, and child development and family relations. Others have a broad knowledge of the whole professional field.

Most home economists teach. Those in high schools teach students about foods and nutrition; clothing selection, construction and care; child development; consumer education; housing and home furnishings; family relations; and other subjects related to family living and homemaking. They also perform the regular duties of other high school teachers that are described in the statement on Secondary School Teachers elsewhere in the *Handbook*.

Teachers in adult education programs help men and women to increase their understanding of family relations and to improve their homemaking skills. They also conduct training programs on secondary, postsecondary, and adult levels for jobs related to home economics. Special emphasis is given to teaching those who are disadvantaged and handicapped. College teachers may combine teaching and research and often specialize in a particular area of home economics.

Home economists employed by private business firms and trade associations promote the development, use, and care of specific home products. They may do research, test products, and prepare advertisements and instructional materials. They also may prepare and present programs for radio and television; serve as consultants; give lectures and demonstrations before the public; and conduct classes for sales persons and appliance service workers. Some home economists study consumer needs and help manufacturers translate these needs into useful products.

Some home economists conduct research for the Federal Government, State agricultural experiment stations, colleges, universities, and private organizations. The U.S. Department of Agriculture employs the largest group of researchers to do work such as study the buying and spending habits of families in

Some home economists work with young children.

all socioeconomic groups and develop budget guides.

Home economists who work for the Cooperative Extension Service conduct adult education programs for men and women and 4-H Club and other youth programs for girls and boys, in areas such as home management, consumer education, family relations, and nutrition. Extension Service home economists also train and supervise volunteer leaders and paid aides who teach adults and youth. (See statement on Cooperative Extension Service Workers elsewhere in the *Handbook*.)

Federal, State, and local governments and private agencies employ home economists in social welfare programs to advise and counsel clients on the practical knowledge and skills needed for effective everyday family living. They also may help handicapped homemakers and their families adjust to physical as well as social and emotional limitations by changing the arrangements in the home; finding efficient ways to manage household chores; aiding in the design, selection, and arrangement of equipment; and creating other methods and devices to enable disabled people to function at their highest possible level. Other home economists in welfare agencies supervise or train workers who provide temporary or part-time help to households disrupted by illness.

Home economists in health services provide special help and guidance in home management, consumer education and family economics as these relate to family health and well-being. Activities of home economists working in health programs include the following: making home visits; conducting clinic demonstrations and classes in homemaking skills; counseling in the management of time and resources, including financial aspects; assisting mentally retarded parents in developing their potential skills for child care and home management; working with agencies and community resources; and supervising nutrition and home management aides.

Places of Employment

About 128,000 people worked in home economics professions in 1974. This figure includes 33,000 dietitians and 5,800 Cooperative Extension Service workers who are discussed in separate statements elsewhere in the *Handbook*.

About 75,000 home economists are teachers, about 50,000 in secondary schools and 7,000 in colleges and universities. More than 15,000 are adult education instructors, some of whom teach part time in secondary schools. Others teach in community colleges, elementary schools, kindergartens, nursery schools, and recreation centers.

More than 5,000 home economists work in private business firms and associations. Several thousand are in research and social welfare programs. A few are self-employed.

Although most home economists are women, men are entering the profession in increasing numbers. Most men specialize in foods and institutional management, although some are in the family relations and child development field, applied arts, consumer education, and other areas.

Training, Other Qualifications, and Advancement

About 360 colleges and universities offer 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, and for some jobs in nutrition.

Home economics majors study sciences and liberal arts—particularly social sciences—as well as specialized home economics courses. They may concentrate in a particular area of home economics or in

what is called general home economics. Advanced courses in chemistry and nutrition are important for work 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 high school, students must complete the courses required for a teacher's certificate.

Scholarships, fellowships, and assistantships are available for undergraduate and graduate study. Although colleges and universities offer most of these financial grants, government agencies, research foundations, businesses, and the American Home Economics Association Foundation provide additional funds.

Home economists must be able to work with people of various incomes and cultural backgrounds and should have a capacity for leadership. Poise and an interest in people also are essential for those who deal with the public. The ability to write and speak well is important. Among the subjects recommended for high school students interested in careers in this field are home economics, speech, English, health, mathematics, chemistry, and the social sciences.

Home economists frequently gain experience as teachers and advance to positions in business, extension service work, and teacher education.

Employment Outlook

Home economists, especially those wishing to teach in high schools, will face keen competition for jobs through the mid-1980's. Other areas of home economics also will experience competitive job market conditions as those unable to find teaching jobs look for other positions. However, for those willing to continue their education toward an advanced degree, employment prospects in college and university teaching are expected to be good.

Although employment of home economists is expected to grow more slowly than the average for all occupations, many jobs will become available each year to replace those who die, retire, or leave the field for other reasons. Growth will result from increasing awareness of the contributions that can be made by professionally trained home economists in quality child care, nutrition, housing and furnishings design, consumer education, and ecology. They also will be needed to promote home products, to act as consultants to consumers, and to do research for improvement of home products and services. The Vocational Education Amendments of 1968, which provide funds for consumer and homemaking education at the secondary, postsecondary, and adult levels, and focus on the needs of low-income families, should further stimulate the need for home economists.

Earnings and Working Conditions

Home economics teachers in public schools generally receive the same salaries as other teachers. In 1974, the average starting salary of public school teachers with a bachelor's degree was $7,700, according to a National Education Association survey. Public school teachers with a master's degree received average starting salaries of $8,600. Experienced teachers averaged $11,800. Median salaries of women teaching in colleges and universities in 1974 ranged from $9,700 for instructors to $18,200 for professors.

The Federal Government paid home economists with bachelor's degrees starting salaries of $8,500 and $10,500 in late 1974, depending on their scholastic record. Those with additional education and experience generally earned from $12,800 to $21,800 or more, depending on the type of position and level of responsibility. In late 1974, the Federal Government paid experienced home economists average salaries of $19,100 a year.

Cooperative Extension Service workers on the county level averaged $11,800 while those on the State level averaged $16,400 in 1974. In general, home economists earn about one and one-half times as much as the average for all nonsupervisory workers in private industry, except farming.

Home economists usually work a 40-hour week. Those in teaching and extension service positions, however, frequently work longer hours because they are expected to be available for evening lectures, demonstrations, and other work. Most home economists receive fringe benefits, such as paid vacation, sick leave, retirement pay, and insurance benefits.

Sources of Additional Information

A list of schools granting degrees in home economics and additional information about home economics careers, the types of home economics majors offered in each school granting degrees in home economics, and graduate scholarships are available from:

American Home Economics Association, 2010 Massachusetts Ave. NW., Washington, D.C. 20036

RECREATION WORKERS

(D.O.T. 079.128, 159.228, 187.118, 195.168, 195.228)

Nature of the Work

Participation in organized recreation activities has become an integral part of the increasing leisure time enjoyed by many Americans. Recreation workers plan, organize,

and direct individual and group recreation activities to help people better enjoy their nonworking hours.

. Recreation workers organize and lead social, cultural, and physical education programs at community centers, hospitals, workplaces, camps, and playgrounds for people of various ages and interests. They also manage recreation facilities and study the recreation needs of groups and communities. There are several basic types of recreation workers: recreation directors, supervisors, leaders, and activity specialists.

Recreation directors are responsible for the management and administration of recreation programs. They may evaluate the recreation needs of the population they serve, and plan activities according to these needs. They also hire personnel and prepare an operating budget. Particularly in smaller recreation programs, the director also may directly supervise various activities.

Recreation supervisors may plan recreation activities or assist the director in doing this. They then implement these activities, oversee their operation, and evaluate their success. They supervise the recreation leaders, activity specialists, and maintenance workers, and instruct them in many of the skills required to efficiently run a recreation program.

Recreation leaders work directly with the participants in recreation programs and are responsible for the program's day-to-day operation. They may give instruction in crafts, games, sports, and other activities and keep reports and records relating to these activities. Recreation leaders who give instruction in specialties such as art, music, drama, swimming, or tennis are called *activity specialists*. They often conduct classes and coach teams in the activity in which they specialize. A camp counselor is generally a recreation leader and may also be an activity specialist. Recreation leaders usually work under the direction of a supervisor.

The services of recreation workers are used in many different settings. Recreation personnel employed by local government and voluntary agencies provide leisure-time activities at neighborhood playgrounds and indoor recreation centers. They furnish instruction in the arts, crafts, and in sports. They may supervise recreational activities at correctional institutions and work closely with social workers to organize programs for the young and the aged. School recreation staff organize the leisure-time activities of school-age children during schooldays, weekends, and vacations.

Under the supervision of a camp director, recreation leaders and activity specialists lead and instruct campers in nature-oriented forms of recreation such as swimming, hiking, and horseback riding, as well as arts, crafts, and other sports. Some camps provide campers with specialized instruction in a particular area such as music, drama, gymnastics, or tennis. In resident camps, the staff also must insure that the campers have adequate living conditions.

Recreation personnel in industry and in the Armed Forces organize and direct recreation rooms, athletic programs such as bowling and softball leagues, social functions, and other leisure activities for company employees and service men and women.

Therapeutic recreation is a specialized field within the recreation profession. It provides recreational services to aid in recovery or adjustment to illness, disability, or a

specific social problem. Recreation specialists may work with the physically handicapped in a school or rehabilitation center, with mentally ill or retarded persons in a public or private institution, or with juvenile delinquents, older citizens, or disabled veterans. The jobs in this specialty are largely comparable to those for recreation workers in other settings.

Places of Employment

More than 65,000 recreation workers were employed year-round in 1974; nearly one-half of them were women. Government recreation departments employed about one-half, primarily in local recreation departments. Many others worked for schools, commercial recreation establishments like camps or resort hotels, and nonprofit voluntary organizations such as athletic or scouting organizations, churches, and community organizations.

Over two-fifths of all year-round recreation workers are employed part time. Many of these are students who work for local government recreation programs. An additional 100,000 recreation workers were employed for the summer months only, during 1974. Seasonal workers are mostly college students and teachers who work primarily as recreation leaders and camp counselors.

Recreation workers are employed mostly in urban areas where many people must use the same playgrounds and recreation centers. Camp recreation workers, however, often work in rural, less populated areas of the country. Camp recreation workers are employed at resident, day, family, and travel camps. Except for the directors of very large camps and workers at the few camps which remain open year-round, camp recreation workers generally are employed for 2 or 3 months only during the summer.

Training, Other Qualifications, and Advancement

Formal training in a college recreation curriculum is becoming increasingly important for those seeking a career in recreation.

Recreation directors generally should have a bachelor's degree, preferably in recreation, as well as considerable experience. Advanced courses leading to a master's degree often are desirable for persons interested in higher level administrative positions and are usually necessary for teaching at a college or university. Those with a bachelor's degree usually begin as supervisors or recreation leaders, and may advance to a director position.

A high school education is generally the minimum requirement for recreation leaders. However, an associate degree in recreation or a related subject from a community or junior college usually is preferred for both year-round and seasonal employment. In addition, those with college training generally start at a higher salary and have better advancement opportunities. Activity specialists must have specialized training in a particular field, such as art, music, drama, or athletics. In most cases, an associate degree in recreation with a concentration in one of these areas or a bachelor's degree in recreation or one of the arts is necessary for year-round employment. In general, camps prefer those with some college background to work as counselors or activity specialists.

In March 1974, 200 community colleges and 186 4-year colleges and universities had recreation and parks curriculums. In addition, 92 graduate programs were offered. The typical program of recreation study includes courses in communications, natural sciences, the humanities, philosophy, sociology, psychology, drama, and music. Specific courses in recreation include group leadership, program planning and organization, health and safety procedures, outdoor and indoor sports, dance, arts and crafts, and field work in which the student obtains actual recreation leadership experience. Students interested in industrial or other types of commercial recreation may find it desirable to take courses in business administration; those interested in therapeutic recreation should take courses in psychology, health education, and sociology.

Young people planning careers as recreation workers must have the ability to motivate people and be sensitive to their needs. Good health and physical stamina often are required. Activity planning frequently calls for creativity and resourcefulness. Recreation workers should be able to accept responsibility and exercise judgment since they usually work alone. To increase their leadership skills and understanding of people, students should obtain related work experience in high school and college. They may do volunteer, part-time, or summer work in recreation departments, camps, youth-serving organizations, institutions, and community centers.

After a few years experience, recreation leaders or activity specialists may become recreation supervisors. Although promotions to administrative positions may be easier for persons with graduate training, advancement is usually possible through a combination of education and experience.

Employment Outlook

The employment of recreation workers is expected to rise faster than the average for all occupations through the mid-1980's as public pressure for recreation areas results in the creation of many new parks, playgrounds, and national forests. Increased attention to physical fitness by government, educators, and others may produce a rise in public and industrial recreation programs. Longer life and earlier retirements also will increase the demand for

recreation programs for retired persons. All of these factors will increase the need for recreation workers and stimulate growth in the occupation.

The level of formal education and amount of related work experience will become increasingly important as more recreation graduates compete for positions. Those with a 2-year degree or less will generally be limited in advancement opportunities. Those with a bachelor's degree should have a favorable employment outlook, with increasing competition during economic slowdowns when recreation employment in both the public and private sectors may be adversely affected. Opportunities for those with a master's or Ph. D. degree should be good in teaching, supervisory, and administrative positions.

Job experience prior to graduation will greatly help a graduate find a position. Applicants with the most related job experience will receive the more responsible and higher paying positions.

Many opportunities will be available for part-time and summer employment as recreation leaders and assistants in local government recreation programs. Many of the summer jobs will be for counselors and activity specialists in camps.

Earnings and Working Conditions

Starting salaries for recreation leaders with a bachelor's degree in State and local governments averaged about $8,000 in 1974, according to a survey by the Public Personnel Association. There was a wide salary range among employers—in general, salaries were highest in the west and lowest in the south. Average earnings for recreation workers are higher than those for nonsupervisory workers in private industry, except in farming. According to the National Recreation and Park Association, recreation workers with a 2-year degree usually started at about $6,500 in 1974; those with a bachelor's degree, about $8,000; with a master's degree, $9,-10,000; with a Ph. D., $11-12,000. A person with at least a bachelor's degree and considerable (5-6 years) experience averaged about $14-15,000. Recreation directors' salaries ranged from $11,000 to more than $20,000 depending on their responsibilities.

Starting salaries for recreation workers in the Federal Government in late 1974 were $8,500 for applicants having a bachelor's degree; $10,500 with a bachelor's degree plus 1 year experience; $12,841 with a bachelor's plus 2 years experience or a master's degree; and $15,481 with a bachelor's plus 3 years experience or a Ph. D.

The average week for recreation personnel is 35-40 hours. Many camp recreation workers live at the camps where they work, and their room and board is included in their salaries. Most public and private recreation agencies provide from 2 to 4 weeks vacation and other fringe benefits such as sick leave and hospital insurance.

A person entering the recreation field should expect some night work and irregular hours since they often work while others are enjoying leisure time. Recreation workers often spend much of their time outdoors when the weather permits.

Sources of Additional Information

Information about recreation as a career, employment opportunities in the field, and colleges and universities offering recreation curriculums is available from:

National Industrial Recreation Association, 20 North Wacker Dr., Chicago, Ill. 60606.

National Recreation and Parks Association, 1601 North Kent St., Arlington, Va. 22209.

For information on careers in camping and job referrals, contact:

American Camping Association, Bradford Woods, Martinsville, Ind. 46151.

SOCIAL SERVICE AIDES

Nature of the Work

Social service or human service aides enable social service agencies to help greater numbers of people by providing services which supplement the work of professional social workers and rehabilitation counselors. Most social service aides work under the close guidance and supervision of other professional staff.

Social service aides serve as a link between professional social workers or rehabilitation counselors and people who seek help from social agencies. Aides explain the services and facilities of the agency and help new applicants fill out any required forms. In some agencies, aides visit the client's home, interview friends and relatives, and check documents such as marriage licenses or birth certificates to determine an individual's or family's eligibility for financial assistance or other services.

Much of the routine paperwork required in welfare programs may be done by social service aides. They may keep records on clients up to date, maintain a filing system of reports or a control system for periodic case reviews, and fill out school enrollment, employment, medical, and compensation forms.

Due to the wide variety of social services, social service aides work in many different job settings and perform a range of different job functions. Aides usually referred to as *casework aides* or *assistants*, often work directly with clients. They may help clients locate and obtain adequate housing, find jobs, or counsel parents about their children's dress and appearance. Casework aides serve as advocates

for clients by going with them to clinics to insure that they receive needed medical care or by helping them effectively communicate their needs to institutions that provide educational or welfare services.

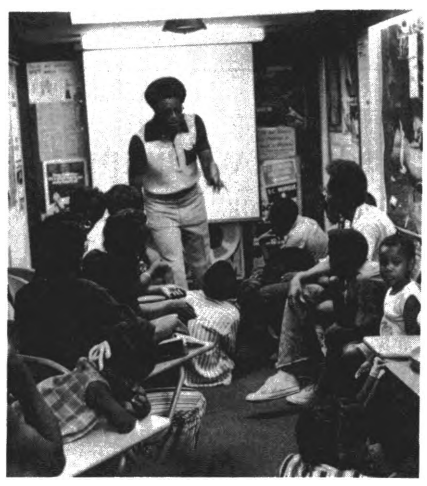
Homemaker aides help clients improve their skills in shopping, cleaning, sewing, budgeting, family health and hygiene, child care, and meal planning and preparation. They are assigned to a home for 1 day or more a week, or instruct groups of adults at a community or neighborhood center.

An important facet of the homemaker aide's work is the actual demonstration of homemaker skills. Stressing the importance of regularity and routine in the home, they set up a schedule of weekly activities. They get down to particulars of housekeeping by teaching homemakers how to clean stoves and refrigerators, prepare meals from leftovers, or recognize a bargain in inexpensive material for clothing. They encourage homemakers to take advantage of cost-saving opportunities such as the barber school for haircuts, the thrift shop, surplus foods, and free recreation. In addition to teaching domestic skills, some homemaker aides also help clients obtain needed social services and may do housekeeping chores during a parent's illness.

Some workers called *neighborhood workers* personally contact the residents of an area to explain and discuss agency services. They learn the needs of individuals and families and refer routine cases to a counselor or to the appropriate community service agency. They report more difficult problems to a supervisor. Neighborhood workers may inform residents about job openings, available housing, job training opportunities, and public services. On a broader scale, they assist in the organization of block and other neighborhood groups to conduct programs that benefit the neighborhood, foster a sense of community responsibility among residents, and encourage participation in the anti-poverty programs of social service agencies. They also may assist in routine neighborhood surveys and counts, keep records, and prepare reports of their activities for the supervisor.

Employment aides actively seek out the disadvantaged and help prepare them for employment by giving them assistance in getting special training and counseling. Working in neighborhood centers or mobile units, they locate candidates for available jobs and training programs by contacting unemployed residents in pool rooms, laundromats, and street corners or through employment or welfare agency referrals. They give the unemployed information about the services of the local State employment service office, available job and training opportunities, and help them fill out the necessary application forms. After clients are employed, aides maintain contact to help workers adjust to the new work environment and to iron out minor difficulties.

Another occupation that has much in common with social service aides is *child care aide*. They help care for children of working mothers at child development facilities and day care centers. Child care aides feed, entertain, and otherwise care for children who are usually too young to attend school. Under the direction of social workers, teachers, and other professionals, they help children develop socially and prepare for elementary school. Aides also may teach children counting, arithmetic, art, music, and other subjects that stimulate their curiosity and ability to think. In addition, they may work along with the child's family to help insure that the child is adequately fed and clothed and receives regular medical and dental care.



Apart from these specific duties, the most useful functions of social service aides are to be available when needed to offer encouragement and counsel, and to act as advocates for the needs of those in the community which they serve.

Places of Employment

About 70,000 people worked as social service aides in 1974; approximately 4 out of 5 were women. Most work in the inner cities of large metropolitan areas.

More than half of all social service aides work for government departments and agencies primarily on the State and local levels. They work for community and neighborhood organizations and centers, welfare and social service agencies, residential welfare facilities for children or adults, and rehabilitation agencies serving the blind, disabled, and otherwise disadvantaged.

Training, Other Qualifications, and Advancement

Graduation from high school generally is not required for social service aide jobs. Employers do not always look for the most highly skilled applicants. An individual's need for work, as well as potential for upgrading his or her skills and making a useful contribution to the agency, often is considered. For employment in some agencies, an examination or registration on a civil service list may be required.

Persons seeking jobs as social service aides should get along well with people and be able to work as part of a team. They should be tactful, courteous, and want to help others.

Homemaker aides should be persons who have demonstrated competence in managing a home and rearing children. Workers assigned to Puerto Rican or Mexican-American communities should speak and understand Spanish. Some social service aide jobs require typing skills.

Most employers emphasize the development of career ladders with opportunities for advancement through a combination of on-the-job training, work experience, and further education. Aides usually are trained on the job from 1 to several months. Those without high school diplomas often receive classroom instruction to help them pass a high school equivalency examination. Entry level positions as employment aides can lead to a job as an employment interviewer, and, after special training, to employment counselor. Employing agencies frequently pay part of the cost of further education for social services aides.

Employment Outlook

Employment of social service aides is expected to grow much faster than the average for all occupations through the mid-1980's. Many opportunities are expected for part-time work. A large number of openings will arise from the need to replace aides who die, retire, or transfer to other jobs.

Employment in this field will stem from population growth, coupled with this country's continuing commitment to aid those who are disadvantaged, disabled, or unable to care for themselves. In addition, as social welfare services and programs expand, social service aides increasingly will be used for much of the routine and less responsible work now done by professional personnel.

Earnings and Working Conditions

Full-time social service aides with no prior experience or minimum education earned salaries ranging from $5,000 to $6,500 a year in 1974. Those with experience or additional education usually earned more. The Federal Government paid beginning social service aides salaries of from $5,294 to $8,500 in late 1974 depending upon their education and prior work experience; experienced aides earned as much as $10,520. Many aides in both public and private agencies work part time and earn less.

Although they work much of the time in offices of social service departments and agencies, they may frequently visit the homes of clients or offices of other social service agencies, hospitals, and business establishments. Aides often must work evenings or weekends when clients can be reached.

Sources of Additional Information

Information on requirements for social service aide jobs is available from city, county, or State departments of welfare or social services, community or neighborhood development agencies, and local offices of the State employment service.

SOCIAL WORKERS

(D.O.T. 195.108, .118, .168, and .208, .228)

Nature of the Work

The ability of people to live effectively in society is often hampered by problems that range from personal ones to those arising from social unrest within a group or community. These problems, aggravated by the growing complexity of society, have greatly increased the need for social services. Social workers assist individuals, families, groups and communities in using these services to solve their problems.

The three basic approaches to social work are casework, group work, and community organization. The approach chosen is usually determined by the nature of the problem and the time and resources available for solving it. Social workers often combine these approaches in dealing with a specific problem.

In casework, social workers use interviews to identify the problems of individuals and families. They then help people to understand and solve their problems and to secure needed services, education, or job training. In group work, social workers help people to understand both themselves and others better, to overcome racial and cultural prejudices, and to work together with others in achieving a common goal. They plan and conduct group activities for children, adolescents, older persons and other adults in a variety of settings such as settlement houses, hospitals, homes for the aged, and correctional institutions. In community organization, social workers coodinate the efforts of groups, such as political, civic, religious, business, and union organizations, to combat social problems through community programs. For a neighborhood or larger area, they may help plan and develop health, housing, welfare, and recreation services. 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 are executives, administrators, or supervisors. Others are college teachers, research workers, con-

sultants, or private practitioners.

Social workers can apply their training and experience in a variety of social service settings.

Social workers in family service positions in State and local government offices and voluntary agencies provide counseling and social services that strengthen personal relationships and help clients to improve their social functioning. They also advise their clients on the constructive use of financial assistance and other social services.

Social workers in child welfare positions work to improve the physical and emotional well-being of deprived and troubled children and youth. They may advise parents on child care and child rearing, counsel children and youth with social adjustment difficulties, arrange homemaker services during a parent's illness, institute legal action for the protection of neglected or mistreated children, provide services to unmarried parents, and counsel couples who wish to adopt children. After making appropriate case evaluations and home studies, they may place children in suitable adoption or foster homes or in specialized institutions.

School social workers aid children whose unsatisfactory school progress is related to their social problems. These workers consult and work with parents, teachers, counselors, and other school personnel to identify and solve problems that hinder satisfactory adjustment.

Social workers in medical and psychiatric settings such as hospitals, clinics, mental health agencies, rehabilitation centers, and public welfare agencies aid patients and their families with social problems accompanying illness, recovery, and rehabilitation. As members of medical teams, they help patients respond to treatment and guide them in their readjustment to their homes, jobs, and communities. (The related occupation of rehabilitation counselor is discussed in a separate statement.)

Probation and parole officers and other social workers engaged in correctional programs help offenders and persons on probation and parole readjust to society. They counsel on social problems encountered in relation to their return to family and community life. Probation and parole officers also may help secure necessary education, training, employment, or community services.

In addition, the services of social workers are being sought in many fields where they have not been used significantly in the past. These include private practice (as counselors), industrial social work, drug and alcohol abuse counseling, and city and social policy planning.

Places of Employment

About 300,000 social workers were employed in 1974; nearly two-thirds of them were women. State, county, and city government agencies employ about two-thirds of all social workers; about 3,000 work for the Federal Government. Most of the remainder work for voluntary or private agencies, schools, hospitals, and other medical establishments. Although employment is concentrated in urban areas, many work with rural families. A small number of social workers—employed by the Federal Government and the United Nations or one of its affiliated agencies—serve in other parts of the world as consultants, teachers, or technicians and establish agencies, schools, or assistance programs.

Training, Other Qualifications, and Advancement

In recent years, there has been a growing acceptance of the bachelor's degree in social work (BSW), rather than the master's degree (MSW), as the minimum education of the professional social worker. The BSW programs generally offer an introduction to the social welfare system, the skills

and values of social work, and supervised field experience. Although the BSW is preferred, many employers will accept a bachelor's degree in another field as an acceptable level of education.

For many positions, a master's degree in social work is preferred or required. Two years of specialized study and supervised field instruction are generally required to earn an MSW. Previous training in social work is not required for entry into a graduate program, but courses in related fields such as psychology, sociology, economics, political science, history, and social anthropology, as well as social work, are recommended. Some graduate schools recently have established 1-year MSW programs for well-qualified BSW recipients. In 1974, 86 colleges and universities offered accredited graduate programs in social work.

Scholarships and fellowships are available for graduate education. 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.

A graduate degree and experience are generally required for supervisory, administrative, or research work, the last also requiring training in social science research methods. For teaching positions, an MSW is required and a doctorate usually is preferred. In most State and many local government agencies, applicants for employment must pass a written exam, particularly at the bachelor's level.

At the end of 1974, 14 States had licensing or registration laws providing for the use of professional social work titles by those who qualify. Usually work experience, an examination, or both, are necessary for licensing or registration, with periodic renewal required. The National Association of Social Workers allows the use of the title ACSW (Academy of Certified Social Workers) for those members having at least 2 years of post-master's job experience who have passed the ACSW examination.

Social workers should be emotionally mature, objective, and sensitive and should possess a basic concern for people and their problems. They must be able to handle responsibility, work independently, and form and sustain good working relationships with clients and co-workers.

Students should obtain as much related work 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 places such as camps, settlement houses, hospitals, community centers, or social welfare agencies. Some voluntary and public social welfare agencies hire students for jobs in which they assist social workers.

Employment Outlook

Employment opportunities for persons having bachelor's degrees in social welfare or related fields should be favorable through the remainder of the 1970's and into the 1980's. The outlook for graduates of master's degree programs in social work is expected to continue to be good through the mid-1980's. However, if the number of students graduating from social work programs continue to increase at the same rate as in the 1960's and early 1970's, competition for some positions will become stronger. At both the bachelor's and master's levels, it is possible that in certain geographic areas there will be greater job competition.

Employment of social workers is expected to increase faster than the average for all occupations through the mid-1980's. Many new positions will come from the expansion of community mental health centers, and growth of the newer social work services such as drug and alcohol abuse counseling and city and policy planning. Also, as the occupational structure of the economy continues to change, problems may be created for unskilled and displaced workers. This, coupled with the problems caused by social change, is expected to maintain a strong demand for persons in the social service field.

Earnings and Working Conditions

Salaries for social workers at all levels vary greatly by type of agency (private or public, Federal, State, or local) and geographic region. Salaries are generally highest in large cities and in States with sizable urban populations. In 1974, social workers with a bachelor's degree usually started at about $8,000-$8,500; with a master's degree, between $9,500 and $11,000. Salaries for experienced MSW social workers averaged $12,000-15,000 a year. Private practitioners and those in administration, teaching, and research often earn considerably more.

In the Federal Government, social workers with an MSW and no experience usually started at about $10,500 in late 1974. Graduates with an MSW and no work experience may start at $12,800 if they are well qualified for the position; with an MSW and 1 year of experience, usually at $12,800; with an MSW and 2 years of experience, at almost $15,500.

Men and women without graduate training in social work are generally limited in the advancement opportunities available to them, since most supervisory and administrative positions are staffed by master's degree recipients.

Most social workers have a 5-day, 35-40-hour week. However, many, particularly in private agencies, work part time. In some agencies, the nature of the duties requires some evening and

weekend work, for which compensatory time off is given. Most social work agencies provide fringe benefits such as paid vacation, sick leave, and retirement plans.

Sources of Additional Information

For information about career opportunities in the various fields of social work, contact:

National Association of Social Workers, 15th and H St. NW., 600 Southern Building, Washington, D.C. 20005.

Information on accredited graduate and undergraduate college programs in social work is available from:

Council on Social Work Education, 345 East 46th St., New York, N.Y. 10017.

ART, DESIGN, AND COMMUNICATIONS RELATED OCCUPATIONS

Creativity and the ability to communicate ideas are prerequisites for work in occupations related to art, design, and communications. For example, an architect's blueprint is the embryo of a building; floral designers express a mood of love, sympathy, or other emotion in a flower arrangement; and actors project a character on the stage or screen for the enjoyment of their audiences. Newspaper reporters communicate newsworthy events to their reading audiences; dancers express emotion, mood, or thought through physical movements; and photographers capture an emotion or idea through camera angle, lighting, and the flick of a shutter.

This section of the *Handbook* describes in detail occupations that require creative and communicative talents: the performing arts—actors, dancers, singers, and musicians; the design occupations—architects, urban planners, and seven other related occupations; and communications related Occupations—interpreters, newspaper reporters, technical writers, and radio and TV announcers.

PERFORMING ARTISTS

The performing arts include music, acting, singing, and the dance. In these fields, the number of talented persons seeking employment generally greatly exceeds the number of full-time 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 fact young persons should remember when they consider such a career. They should consider, therefore, the possible advantages of making their art a hobby rather than a profession. Aspiring young artists usually must spend many years in intensive training and practice before they are ready for public performances. They not only need great natural talent but also determination, a willingness to work long and hard, and an overwhelming interest in their chosen field, and some luck.

The statements which follow this introduction give detailed information on musicians, singers, actors, and dancers.

ACTORS AND ACTRESSES

(D.O.T. 150.028 and 150.048)

Nature of the Work

Making a character come to life before an audience is a job that has great glamour and fascination. This demanding work requires special talent and involves many difficulties and uncertanties.

Only a few actors and actresses achieve recognition as stars on the stage, in motion pictures, or on television or radio. A somewhat larger number are well-known, experienced performers, who frequently are cast in supporting roles. However, most actors and actresses struggle for a toehold in the profession, and are glad to pick up parts wherever they can.

New actors generally start in "bit" parts where they speak only a few lines. If successful, they may progress to larger, supporting roles, of which there are several in most stage, television, and screen productions. They also may serve as understudies for the principals.

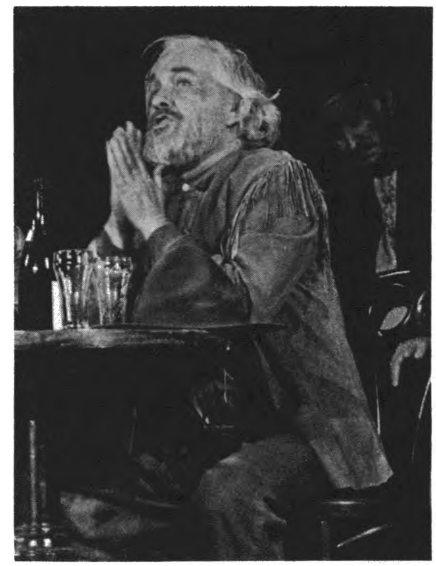
Actors who prepare for stage, screen, and television roles rehearse many hours. They must memorize their lines and know their cues.

In addition to the actors and actresses with speaking parts, "extras," who have no lines to deliver, are used in various ways in almost all motion pictures and many television shows and theatre productions. In "spectacular" productions, a large number of extras take part in crowd scenes.

Some actors find alternative jobs as coaches of drama or directors of stage, television, radio, or motion pictures productions. A few teach in drama departments of colleges and universities.

Places of Employment

About 10,000 actors and actresses work in stage plays, motion pictures (including films made especially for television), industrial shows and commercials.



In the winter, most employment opportunities on the stage are in New York and other large cities. About 400 actors and actresses worked on Broadway in 1974. In the summer, stock companies in suburban and resort areas provide employment. In addition, many cities now have—"little theatres," repertory companies and dinner theatres, which provide opportunities for local talent as well as for professional actors and actresses. Normally plays are produced and casts selected in New York City for shows that go "on the road."

Employment in motion pictures and film television is essentially centered in Hollywood and New York City, although a few studios are located in Miami and other parts of the country. In addition, many films are shot on location, and employ local nonprofessionals as "extras." A number of American-produced films are being shot in foreign countries. In television,

most opportunities for actors are at the headquarters of the major networks—in New York, Los Angeles, and, to a lesser extent, Chicago. A few local television stations occasionally employ actors.

Training, and Other Qualifications

Young persons who aspire to acting careers should take part in high school and college plays, or work with little theatres and other acting groups for experience.

Formal training in acting which is increasingly necessary, can be obtained at dramatic art schools, located chiefly in New York, and in more than 1,600 colleges and universities throughout the country. College drama curriculums usually include courses in liberal arts, speech, pantomime, directing, playwriting, play production, and history of the drama, as well as practical courses in acting. From these, the student develops an appreciation of the great plays and a greater understanding of the roles he may be called on to play. Graduate degrees in fine arts or drama are needed for college teaching positions.

Acting demands patience and total commitment, since aspiring actors and actresses must wait for parts or filming schedules, work long hours, and often do much traveling. Flawless performances require long rehearsal schedules and the tedious memorizing of lines. The actor needs stamina to withstand the heat of stage or studio lights, or the adverse weather conditions which may exist "on location." Above all, young persons who plan to pursue an acting career must have talent and the creative ability to portray different characters. They must have poise, stage presence, and aggressiveness to project themselves to the audience. At the same time, the ability to follow directions is important.

In all media, the best way to start is to use local opportunities and to build on the basis of such experience. Many actors successful in local productions eventually try to appear on the New York stage. Inexperienced actors find it extremely difficult to obtain employment in New York or Hollywood particularly in the motion picture field where employment often results from previous experience on Broadway.

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 persons 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 opportunity to advance to speaking roles.

The length of an actor's or actresses' working life depends largely on skill and versatility. Great actors and actresses can work almost indefinitely. On the other hand, employment becomes increasingly limited by middle age, especially for those who become typed in romantic, youthful roles. Due to the factors disccussed, persons who intend to pursue an acting career may find unstable employment conditions and financial pressures.

Employment Outlook

Overcrowding has existed in the acting field for many years and this condition is expected to persist. In the legitimate theater, motion pictures, radio, and television, job applicants greatly exceed the jobs available. Moreover, many actors are employed in their profession for only a part of the year.

Motion pictures and TV have greatly reduced employment opportunities for actors in the theater. Although a motion picture production may use a very large number of actors, during filming, films are widely distributed and may be used for years. Also, some American-produced films are shot in foreign countries resulting in reduced employment opportunites for American actors and actresses. Television employs a large number of actors on TV programs and commercials. However, employment on this media has been reduced by the FCC ruling that decreased major TV network prime time programming. Local stations often substitute with low cost game shows that employ few actors or reruns. Also, the trend toward 1 to 2-hour programs, and more reruns shortens the period of employment and reduces the number of persons needed.

One possibility for future growth in the legitimate theater lies in the establishment of year-round professional acting companies in cities. The number of such acting groups is growing. The recent growth of summer and winter stock companies, outdoor and regional theatre, repertory companies, and dinner theaters also has increased employment opportunities. Dinner theatres represent the fastest growing area of employment in the country for actors. Also, a possible growth in "Off-Broadway" theatre could result from the recent seating capacity expansion. In addition, some increases may be likely in the employment of actors on television in response to expansion of the Public Broadcasting System, UHF stations, and cable TV. The development and wider use of video cassettes also may result in some employment opportunities. These media will have a positive influence on employment if original material and programs result, not reruns or old movies.

Though the field of acting as a whole is expected to grow faster than the average for all occupa-

tions, through the mid-1980's, the number of persons who want to enter the profession is expected to be greater than employment opportunities. Even highly talented young people are likely to face stiff competition and economic difficulties.

Earnings and Working Conditions

Actors and actresses in the legitimate theater belong to the Actors' Equity Association, in motion pictures, including television films, to the Screen Actors Guild, Inc., or to the Screen Extras Guild, Inc., in television or radio, to the American Federation of Television and Radio Artists (AFTRA). These unions and the show producers sign basic collective bargaining agreements which set minimum salaries, hours of work, and other conditions of employment. Each actor also signs 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 about $245 in 1974. Those in small "off-Broadway" theaters received a minimum of $137.50 to $210 a week depending on the theater's gross receipts. For shows on the road, the minimum rate was about $347.50 a week. (All minimum salaries are adjusted upward automatically, by union contract, commensurate with increases in the cost of living as reflected in the Bureau of Labor Statistics Consumer Price Index.)

In 1974, motion picture and television actors and actresses earned a minimum daily rate of $172.50, or $604 for a 5-day week. For extras, the minimum rate was $46 a day. Actors and actresses who did not work on prime time network television received a minimum program fee of about $203.50 for a single half-hour program and 8 hours of rehearsal time. Because of the frequent periods of unemployment, characteristic of this profession, annual earnings may be low for many lesser-known performers. According to a recent survey by the Screen Actors Guild, three-quarters of their members earned less than $3,500 a year; only 3 percent earned more than $25,000 a year. In all fields, many well-known actors and actresses have salary rates above the minimums. Salaries of the few top stars are many times the figures cited.

Eight performances amount to a week's work on the legitimate stage, and any additional performances are paid for as overtime. After the show opens, the basic workweek is 36 hours, including 12 hours for rehearsals. Before it opens, however, the workweek usually is longer to allow 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 on weekends and holidays. When plays are on the road, weekend traveling often is necessary.

Most actors are covered by a pension fund and a growing number have hospitalization insurance to which employers contribute. All Equity and AFTRA members have paid vacations and sick leave. Most stage actors get little if any unemployment compensation solely from acting since they seldom have enough employment in any State to meet the eligibility requirements. Consequently, when a show closes, and while waiting for another role they often have to take any casual work obtainable.

Sources of Additional Information

Information on colleges and universities and conservatories which offer a major in drama is available from:

American Educational Theater Association, 1317 F St. NW., Washington, D.C. 20004.

DANCERS

(D.O.T. 151.028 and 151.048)

Nature of the Work

Dancing is an ancient and worldwide art that has many different forms. Professional dancers may perform in classical ballet or modern dance, in dance adaptations for musical shows, in folk dances, and in other popular kinds of dancing. In classical ballet, movements are based on certain conventional or styled "positions," and women dance "en point" (on the tips of their toes). In modern dance, movements are more varied but are nonetheless carefully planned and executed to follow a pattern.

In dance productions, performers most often work as a corps de ballet (chorus). However, a group of selected dancers may do special numbers, and a very few top artists do solo work.

Many dancers combine stage work with full-time teaching. The few dancers who become choreographers create new ballet or dance routines. Others are dance directors who train dancers in new productions.

(This statement does not include instructors of ballroom, American or international folk dance and other social dancing.)

Places of Employment

About 7,000 dancers worked on the stage, screen, and television in 1974. Many more teach at schools of the dance and in other schools and colleges and universities. A few teachers, trained in dance therapy, work in mental hospitals. About 85 percent of all dancers are women, but in some types of dance, particularly ballet and modern, women constitute only about one-half of the performers.

Dance teachers are located chiefly in large cities, but many smaller cities and towns have schools of the dance. New York City is the hub for performing dancers.

Training and Other Qualifications

Serious training for a career in dancing traditionally begins by age 12 or earlier. For example, persons who wish to become ballet dancers should begin taking lessons at the age of 7 or 8. Two to 3 years of prior preparation is needed before the young girl should start dancing "enpointe." Ballet training requires 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. Early and intense training is also important for the modern dancer.

The selection of a professional dancing school is important for (1) setting the pace of training, since too early and too severe exercise can permanently damage the legs and feet; and (2) for connections with producers may help the students obtain employment.

Because of the strenuous training a student's general education may not exceed the minimum. However, a dancer should study of music, literature, and history along with the arts to help in the interpretation of dramatic episodes and music. Also, more dancers are being trained in all forms of dance—ballet, ethnic, modern, and tap—for work on the professional stage or education.

About 200 colleges and universities confer bachelor's degrees on students who have majored in physical education and concentrated on the dance; majored in a dance; or majored in a dance program to prepare students as professional dance artists. Some schools also give graduate degrees.

A college education is an advantage in obtaining employment as a teacher of professional dancing or choreography. However, ballet dancers who postpone their first audition for openings in classical ballet until graduation may compete at a disadvantage with younger dancers.

Professional schools usually require teachers to have experience as a performer; colleges and conservatories generally require graduate degrees, but experience as a performer often may be substituted. Maturity and a broad educational background also are important.

The dancer's life is one of rigorous practice and self-discipline. Good health and physical stamina are necessary, both to keep in good condition and to follow the rugged travel schedule often required.

Body height and build should not vary much from the average. Good feet and normal arches also are required. Above all, one must have a natural aptitude for dancing, and a creative ability to express oneself through dance.

Seldom does a dancer perform unaccompanied. Therefore, young persons who consider dancing as a career should be able to function as part of a team. They also should be prepared to face the anxiety of unstable working conditions brought on by show closings and audition failures.

Except for outstanding stars, women past 30 are rarely hired by ballet companies, and women past 25 are rarely hired for Broadway shows unless they have had experience in such productions. Men in ballet and men and women in modern dance can usually work longer than other dancers. After the employable age for 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 to work as long as persons in other occupations.

Employment Outlook

The number seeking professional careers in dance will continue to exceed available positions, despite an expected faster than the average rate of growth in the employment of dancers.

Most openings in this relatively small occupation will result from replacement needs, and competition is expected to be keen. The best employment opportunities will be in teaching dance. Opportunities in stage production will be limited.

The number of stage productions is expected to decline due to increased competition from television and motion pictures, however, some jobs will be available in these media. Financial difficulties of domestic companies and competition from foreign dancers will reduce ballet employment. However, some performing dancers will find jobs in industrial exhibitions, art shows and state fairs. Others will work with new professional dance companies formed from the increasing number of civic and community dance groups.

Earnings and Working Conditions

Professional dancers who perform are members of one of the unions affiliated with the Associated Actors and Artists of America (AFL-CIO). Dancers in

opera ballet, classical ballet, and the modern dance belong to the American Guild of Musical Artists, Inc.; those on live or videotaped television belong to the American Federation of Television and Radio Artists; those perform in films, TV, and other forms of motion pictures belong to the Screen Actors Guild or the Screen Extras Guild; and those in musical comedies join Actors' Equity Association. Other dancers may be members of other unions, depending upon the fields in which they perform. The unions and producers sign basic agreements specifying minimum salary rates, hours of work, and other conditions of employment. The separate contract signed by each dancer with the producer of the show may be more favorable than the basic agreement regarding salary, hours of work, and working conditions.

In 1974, the minimum salary for dancers in ballet and other stage productions was about $240 a week. The single performance rate is about $75 for a solo dance and about $40 per dancer for a group. Dancers on tour received an allowance of $30 a day in 1974, to defray the cost of room and board. The employer pays the cost of transportation. 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 waiting for the next one. A few performers, of course, have much higher salaries.

Some dancers qualified to teach combine this work with engagements as performers. Many more dancers supplement their incomes by other types of work.

Salaries of ballet teachers vary with the location and prestige of the school. Dance teachers in college 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 (5 hours per day maximum) spent in rehearsals and matinee and evening performances. Extra compensation is paid for additional hours worked. Most stage performances take place, of course, in the evening, and rehearsals require very long hours, often on weekends and holidays. For shows on the road, weekend travel often is required.

Dancers are entitled to some paid sick leave and various health and welfare benefits provided by their unions, to which the employers contribute.

Sources Of Additional Information

Information on colleges and universities and conservatories of music which give a major in the dance or some courses in the dance, as well as details on the types of courses and other pertinent information is available from the National Dance Association, a division of the American Alliance for Health, Physical Education and Recreation, 1201 16th St. NW., Washington, D.C. 20036.

MUSICIANS

(D.O.T. 152.028 and 152.048)

Nature of the Work

Professional musicians—whether they play in a symphony orchestra, dance band, rock group, or jazz combo—generally have behind them many years of formal or informal study and 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, organ, 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, rock groups, and solo performers sometimes give concerts and perform on television.

Classical musicians play in symphonies, opera and theater orchestras, and for other groups that require orchestral accompaniments. Most of these musicians play strings, brass, or woodwinds instruments. Some form small groups—usually a string quartet or a trio—to give concerts of chamber music. Many pianists accompany vocal or instrumental soloists, choral groups or provide background music in restaurants or other places. Most organists play in churches; often they direct the choir.

A few exceptionally brilliant musicians give their own concerts and appear as soloists with symphony orchestras. Both classical and popular musicians make individual and group recordings.

A very high proportion of all musicians teach instrumental and vocal music in schools and colleges. Some direct vocal and instrumental music, teach music appreciation, and give group instruction on an instrument in elementary and secondary school. Many public school teachers and performing musicians, give private lessons in their own studios or in pupil's homes.

A few musicians work in the field of music therapy in hospitals, and in music libraries.

Places of Employment

About 85,000 persons worked as performing musicians in 1974. Many thousands more taught in elementary and secondary schools and in colleges and universities. Almost every town and city has at least one private music teacher.

Most professional musicians who perform work in cities where entertainment and recording activities are concentrated, such as New

York, Chicago, Los Angeles, Nashville, Miami Beach, and New Orleans. Many perform with one of the 28 major symphonies, 88 metropolitan, or 1,100 community orchestras. Many communities have orchestras and dance bands, but in the small towns such work is usually part time.

In addition, thousands of qualified instrumentalists have other full-time jobs and only occasionally work as musicians in dance bands, that are hired to play at private parties or for special occasions. Classical musicians occasionally play 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 acquire great technical skill, a thorough knowledge of music, and the ability to interpret music, young people need intensive training through private study with an accomplished musician, in a college or university which has a strong music program, or in a conservatory of music. For advanced study in one of these institutions an audition frequently is necessary. Many teachers in these schools are accomplished artists who will train only promising young musicians.

More than 700 conservatories and colleges and universities offer a bachelor's degree program in music education to qualify graduates for the State certificate for elementary and secondary school teaching positions. Over 400 conservatories and collegiate music schools have been accredited by the National Association of Schools of Music to award the degree of bachelor of music to students who major in instrumental or vocal music. These programs provide training in musical performance, history and theory, and some liberal arts courses. College teaching positions, usually require advanced degrees but exceptions may be made for well-qualified artists.

Musicians who play jazz and other popular music must have an understanding of and feeling for that style of music, but classical training may expand their employment opportunities. As a rule, they take lessons with private teachers when young, and seize every opportunity to play in amateur or professional performances. Some young people form small dance bands or rock groups. As they gain experience and become known, they may audition for other local bands, and still later, for the better known bands and orchestras.

Young persons who consider careers in music should have musical talent, creative ability, and poise and stage presence to face large audiences. Since quality of performance requires constant study and practice, self-discipline is vital. Moreover, musicians who do concert and nightclub engagements must have physical stamina because of constant travel and rugged time schedules that often include long night hours.

Employment Outlook

The music performance field is expected to remain keenly competitive through the mid-1980'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 usually is keen for positions which offer stable employment, such as jobs with major orchestras and teaching positions. Because of the ease with which a musician can enter private music teaching, the number of music teachers has been more than sufficient and probably will continue to be. Although many opprotunities are expected for single and short-term emgagements, playing popular music in night clubs, theaters, and other places, the supply of qualified musicians who seek such jobs is likely to exceed demand. On the other hand, first-class, experienced accompanists and outstanding players of stringed instruments are likely to remain relatively scarce.

Employment of musicians who perform is expected to grow about as fast as the average for all occupations through the mid-1980's. Although the number of civic orchestras in smaller communities has been growing steadily, many provide only part-time employment. The decline in opportunities for musicians in theater, radio, and motion pictures has more than offset these openings. The increased use of recorded music has lead to the decline of opportunities in these areas. Additional employment is expected from the expanded use of TV satellites, cable TV, and wider use of video cassettes.

The employment outlook in music education for people who are qualified as teachers as well as musicians is better than for those qualified as performers only. However, the supply of music teachers in the Nation's schools is adequate—a situation which is likely to continue through the mid-1980's.

Earnings and Working Conditions

The amount received for a performance by either classical or popular musicians depends to a large extent on their professional reputation. Musicians in 1 of the 28 major symphony orchestras in the United States in 1974 received minimum salaries that ranged from about $190 to $350 a week according to the American Symphony Orchestras League, Inc. Eight orchestras—New York, Boston, Philadelphia, Cleveland, Cincinnati, Houston, Chicago, and the National—have year-round seasons (50 weeks or more) and minimum salaries ranging from $10,000 to $18,000. Other major symphony orchestras have seasons ranging from 34 to 52 weeks.

Musicians who played at dances, club dates, water shows, ballets, musical comedies, concerts, and industrial shows earned a minimum of $33 to $40 for 3 hours of work. The minimum scale for recording is $100 for a 15 minute tape (3 hours actual taping time).

Full-time church musicians earned from $7,500 to $16,000 a year—according to hours worked a week and level of training.

The salary schedule for all teachers determines earnings of music teachers in public schools. (See statements on Elementary and Secondary School Teachers elsewhere in the *Handbook*.) Many teachers give private music lessons to supplement their earnings. However, earnings are uncertain and vary according to the musician's reputation, the number of teachers and students in the locality, and the economic status of the community.

Musicians customarily work at night and on weekends. They also must spend considerable time in practice and in rehearsal.

Many musicians, primarily those employed by symphony orchestras, work under master wage agreements, which guarantee a season's work up to 52 weeks. Musicians in other areas, however, may face relatively long periods of unemployment between jobs. Thus, their earnings generally are lower than those of many other occupations. Moreover, they may not work steadily for one employer. Consequently, some performers cannot qualify for unemployment compensation, and few have either sick leave or vacations with pay.

Most professional musicians belong to the American Federation of Musicians (AFL-CIO). Concert soloists also belong to the American Guild of Musical Artists, Inc. (AFL-CIO).

Sources of Additional Information

For information about wages, hours of work, and working conditions for professional musicians, contact:

American Federation of Musicians (AFL-CIO), 641 Lexington Ave., New York, N.Y. 10022.

Information about the requirements for certification of organists and choir masters is available 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, 11250 Roger Bacon Dr., Reston, Va. 22090.

Further information about music teaching in elementary and secondary schools is available from:

Music Educators National Conference, Suite 601, 8150 Leesburg Pike, Vienna, Va. 22180.

SINGERS

(D.O.T. 152.028 and .048)

Nature of the Work

Professional singing is an art that usually requires not only a fine voice but also a highly developed technique and 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 concert sologists in oratorios and other types of performances. 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, in concerts and in nightclubs and other enterainment 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 they often have other jobs and sing only in the evenings or on weekends. Some give private voice lessons. A number of singers teach courses in general music and direct elementary and secondary school choruses. Others give voice training or direct choral groups in churches, in music conservatories or in colleges and universities.

Places of Employment

About 36,000 persons worked as professional singers in 1974. Opportunities for signing engagements are mainly in New York City, Los Angeles, Las Vegas, San Francisco, Dallas and Chicago—the Nation's chief entertainment centers. Nashville, Tennessee, a major center for country and western music, is one

of the most important places for employment of singers for "live" performances and recordings. Singers who teach music in elementary and secondary schools, colleges, universities, and conservation are employed throughout the country. Many work part-time, chiefly as church singers and choir masters.

Training and Other Qualifications

Young persons who want to sing professionally should acquire a broad background in music, including its theory and history. The ability to dance may be helpful, since singers are sometimes required to dance. In addition, those interested in a singing career should start piano lessons at an early age to become familiar with the musical scale and music composition. 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 voice training often continues for years after the singer's professional career has started, a prospective singer must have great determination. An audition before a competent voice teacher to decide whether professional training is warranted is also important.

To prepare for careers as singers of classical music young people can enroll in a music conservatory, a school or department of music connected with a college or university, or take private voice lessons. These schools provide voice training, and training in understanding and interpreting music, including music-related training in foreign languages and sometimes dramatic training. After completing 4-years of study, the graduate may receive 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 in public schools need at least a bachelor's degree with a major in music education and must meet the State certification requirements for teachers. Over 700 colleges and universities offer such training. Most college teachers must have a master's degree or doctor's degree, but exceptions may be made for 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 use of a microphone.

Young singers of popular songs may become known by participating in local amateur and paid shows. These engagements may lead to employment with local dance bands or rock groups and possibly later with better known ones.

In addition to musical ability, perseverance and an outstanding personality, a singing career requires an attractive appearance, good contacts, and good luck. Singers also must have physical stamina to adapt to rigorous time and travel schedules which often include working night hours.

Employment Outlook

The employment outlook for singers is expected to remain keenly competitive through the mid-1980's despite an expected faster than the average rate of employment growth. Many short-term jobs are expected in the opera and concert stage, movies, theater, nightclubs, radio and television, dance bands, and other areas—but not enough to provide steady employment for all qualified singers. Singers who can meet State certification requirements may find positions as music teacher.

Recorded music has replaced the "live" singer on radio; television performances by singers are limited. However, the demand is growing for singers who record popular music to do radio and television commercials. Additional employment is expected from the expanded use of TV satellites, cable TV, and wider use of video cassettes.

A singing career is sometimes relatively short, since it depends on a good voice and public acceptance of the artists, both of which may be affected by age. Due to these circumstances and factors discussed elsewhere in the text, singers may be subject to unstable employment conditions and the pressure of unreliable financial circumstances.

Earnings and Working Conditions

Except for a few well-known concert soloists, opera stars, top recording artists of popular music, and some dance band singers. Most professional singers experience difficulty in obtaining regular employment and have to supplement their incomes.

Singers generally work at night and on weekends. Work in the entertainment field is seasonal and few performers have steady jobs.

Singers who appeared in theatrical and TV motion picture productions received a minimum of $187.50 a day or $604 a week in 1974. Singers in opera choruses received $40 per performance. A few opera soloists and popular singers earned thousands of dollars a performance.

Professional singers usually belong to a branch of the AFL-CIO union, the Associated Actors and Artists of America. Singers on the concert stage or in opera belong to the American Guild of Musical Artists, Inc.; those who sing on radio or live television or make phonograph recordings are members of the American Federation of Television and Radio Artists; singers in the variety and nightclub 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.

Sources of Additional Information

Information about accredited schools and departments of music is available from:

National Association of Schools of Music, 11250 Roger Bacon Dr., Reston, Va. 22090.

For information about music teaching in elementary and secondary schools contact:

Music Educators National Conference, Suite 601, 8150 Leesburg Pike, Vienna, Va. 22180.

DESIGN OCCUPATIONS

Good design can improve the appearance and usefulness of the products that we use and the places where we live and work, as well as increase sales by improving their "eye appeal." Making products or places more appealing and functional and bringing them to the attention of the public is the job of people in design occupations.

Different design careers require varying levels of training and education. For example, while floral designers often learn their duties on the job and do not need a high school diploma, architects must have at least 5 years of college and professional education. Regardless of the amount of formal training required, people in design occupations should be creative and be able to communicate ideas through their designs and displays.

Job opportunities in design occupations are expected to increase through the mid-1980's, primarily because a growing and more affluent population is becoming more design conscious.

This chapter describes 10 design occupations: architects, commercial artists, display workers, floral designers, industrial designers, interior designers, landscape architects, models, photographers, and urban planners. (Other jobs that often require design skills—for example, engineers—are described elsewhere in the *Handbook*.)

ARCHITECTS

(D.O.T. 001.081)

Nature of the Work

Attractive buildings improve the physical environment of a community. But buildings also must be safe and allow people both inside and around them to properly perform their duties. Architects design buildings that successfully combine these elements of attractiveness, safety, and usefulness.

Most architects provide professional services to clients planning a building project. These services begin in the early stages of the project's development and continue until all work is completed.

The architect and client first discuss the purposes, requirements, and cost of a project, as well as any preference on design that the client may have. The architect then prepares a rough drawing to show the scale and structural relationships of the building.

After discussing preliminary drawings with the client, the architect develops a final design showing the floor plans and the structural details of the project. For example, in designing a school, the architect determines the width of corridors and stairways so that students may move easily from one class to another; the type and arrangement of storage space, and the location and size of classrooms, laboratories, lunchroom or cafeteria, gymnasium, and administrative offices.

Next the architect prepares working drawings showing the exact dimensions of every part of the structure and the location of plumbing, heating units, electrical outlets, and air conditioning.

Architects also specify the project's building materials, construction equipment, and in, some cases, interior furnishings. In all cases, the architect must insure that the structures' design and specifications conform to local and State building codes, zoning laws, fire regulations, and other ordinances.

After all drawings are completed, the architect assists the client in selecting a contractor and in negotiating the contract. As construction proceeds, there are periodic visits to the building site to insure that the contractor is following the design and using the specified materials. The job is not completed until construction is finished, all required tests are made, and guarantees are received from the contractor.

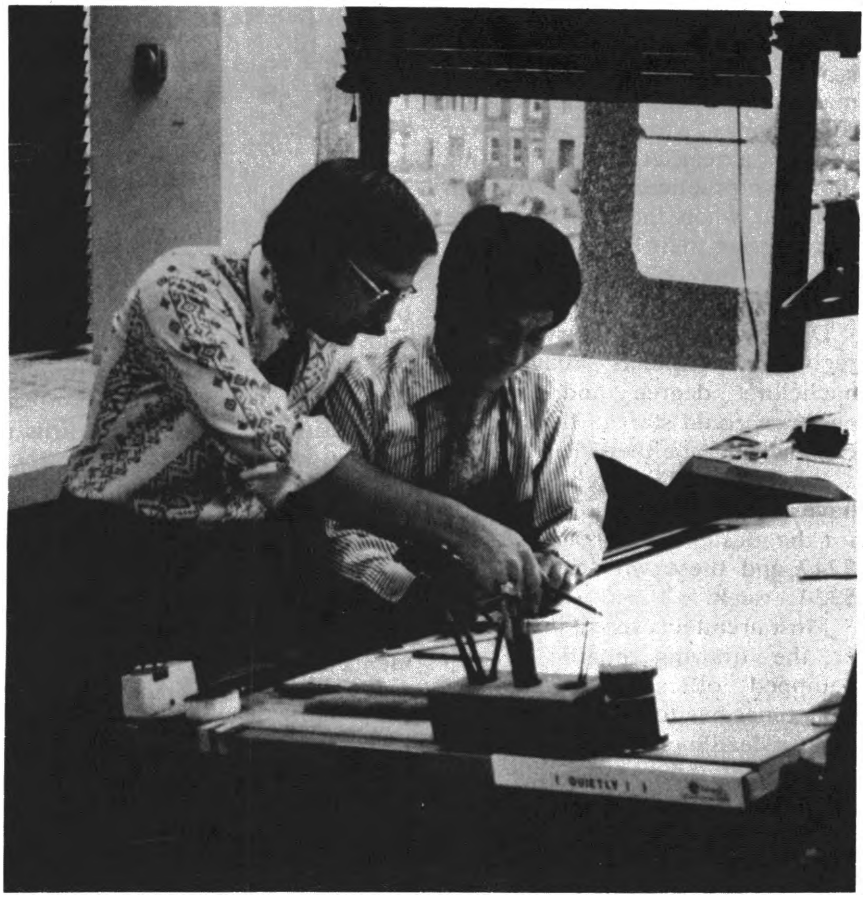
Architects design a wide variety of structures such as houses, churches, hospitals, office buildings, and airports. They also design multibuilding complexes for urban renewal projects, college campuses, industrial parks, and new towns. Besides designing structures, architects also may help in selecting building sites, in preparing cost and land use studies, and in long range planning for site development.

When working on large projects or for large architectural firms, architects often specialize in one phase of the work such as designing, or administering construction contracts. This often requires working with engineers, urban planners, landscape architects, and other design personnel.

Places of Employment

About 40,000 registered (licensed) architects were employed in 1974. Many unlicensed architectural school graduates also work as architects.

About two-fifths of all architects are self-employed, either practicing individually or as partners. Most of the others work in architectural firms, for builders, for real estate firms, or for other businesses that have large construction programs. Some work for government agencies, often in city and community planning or urban redevelopment.



Architects design floor plans for new building.

About 1,300 architects work for the Federal Government, mainly for the Departments of Defense, Housing and Urban Development, and the General Services Administration.

Although found in many areas, a large proportion of architects were employed in seven cities: Boston, Chicago, Los Angeles, New York, Philadelphia, San Francisco, and Washington.

Training, Other Qualifications, and Advancement

All States and the District of Columbia require architects to be licensed. To qualify for the 2-day licensing exam, a person must have either a bachelor of architecture degree followed by 3 years of experience in an architect's office or a master of architecture degree followed by 2 years of experience. As a substitute for formal training, most States accept additional experience (usually 12 years) and successful completion of an equivalency test for admission to the licensing examination. Many architectural school graduates work in the field even though they are not licensed. However, a registered architect is required to take legal responsibility for all work.

In 1974, the National Architectural Accrediting Board had accredited 76 of the 100 schools offering professional degrees in architecture. Most of these schools offer a 5-year curriculum leading to a Bachelor of Architecture degree or a 6-year curriculum leading to a Master of Architecture degree. Students may also transfer to professional degree programs after completing a 2-year junior or community college program in architecture. Many architectural schools also offer graduate education for those who already have their first professional degree. Although such training is not essential for practicing architects, it is often desirable for those in research and teaching. A typical college architectural program includes courses in architectural theory, design, graphics, engineering, and urban planning, as well as courses in English, mathematics, chemistry, sociology, economics, and a foreign language.

Persons planning careers in architecture should be able to work independently, have a capacity for solving technical problems, and be artistically inclined. They also must be prepared to work in the competitive environment of business where leadership and ability to work with others are important. Working for architects or building contractors during summer vacations is useful for gaining practical knowledge.

New graduates usually begin as junior drafters in architectural firms, where they make drawings and models of structures under the direction of a registered architect. After several years of experience, they may advance to chief or senior drafters responsible for all major details of a set of working drawings and for supervising other drafters. Others may work as designers, construction contract administrators, or specification writers who prepare directions explaining the architect's plan to the builder. Employees who become associates in their firms receive, in addition to a salary, a share of the profits. Usually, however, the architect's goal is to establish a private practice.

Employment Outlook

Job prospects for architects are expected to be favorable through the mid-1980's. Employment of

architects is expected to rise at a much faster rate than the average for all workers during this period. In recent years, the number of degrees granted in architecture also has been increasing rapidly. If this trend continues, the number of people seeking employment in the field should be roughly in balance with the number of openings from growth, deaths, and retirements. The outlook for these workers may change, however, during shortrun periods. Since the demand for architects is highly dependent upon the level of new construction, any significant upsurge or downturn in building could temporarily alter demand.

Most job openings are expected to be in architectural firms but some openings are also expected to occur in colleges and universities, construction firms and the Government as agencies become more involved in environmental design and planning. (See statement on Urban Planners elsewhere in the *Handbook*.)

The major factor contributing to the increase in employment of architects is the expected rapid growth of nonresidential construction. In addition, the projected increase in enrollments in architectural programs should result in additional requirements for architects to teach in colleges and universities.

Growing public concern about the quality of the physical environment is expected to increase the demand for urban redevelopment and city and community environmental planning projects. This should create further opportunities for employment.

Earnings and Working Conditions

The average salary for architects in 1973 was $23,000 according to the limited information available. Architects with well-established private practices generally earn much more than high-paid salaried employees of architectural firms. Although the range in their incomes is very wide, some architects with many years of experience and good reputations earned well over $35,000 a year. Architects starting their own practices may go through a period when their expenses are greater than their incomes. Annual incomes may fluctuate due to changing business conditions.

Depending on their college records, architects having a bachelor's degree and no experience could start in the Federal Government at either $163 or $202 a week in 1974. Architects who have completed all requirements for the master's degree can start at $247 and those with a Ph. D. at $334 a week.

Most architects spend long hours at the drawing board in well equipped offices. An architect sometimes has to work overtime to meet a deadline. The routine often is varied by interviewing clients or contractors, and discussing the designs, construction procedures, or building materials of a project with other architects or engineers. Contract administrators frequently work outdoors during inspections at construction sites.

Sources of Additional Information

General information about careers in architecture including a catalog of publications can be obtained from:

The American Institute of Architecture, 1735 New York Ave., Washington, D.C. 20036.

Information about schools of architecture and a list of junior colleges offering courses in architecture are available from:

The Association of Collegiate Schools of Architecture, Inc., 1735 New York Ave., Washington, D. C. 20036.

COMMERCIAL ARTISTS

(D.O.T. 141.031 and .081, 970.281 and .381, and 979.381)

Nature of the Work

A team of commercial artists with varying skills and specializations often creates the artwork in newspapers and magazines and on billboards, brochures, catalogs, and television commercials. This team is supervised by an art director, who develops the artistic aspects of an advertising plan, and then turns it over to a layout artist for further refinement. The layout artist who constructs or arranges elements of the advertisement, also selects and lays out illustrations and photographs, plans use of typography, and determines color and other elements of design. Preparation of a "rough visual" or sketch is the next step. The layout artist may change the visual after consulting with the director and complete a more comprehensive layout for the customer.

A variety of specialists work with the layout artist to turn out the finished product. These include *renderers*, who use magic markers to make rough drafts; *letterers*, who execute appropriate lettering either freehand or with mechanical aids; *illustrators*, who sketch and draw in more finished form; and *pasteup* and *mechanical workers*, who cut and paste basic parts of the advertisement or other artwork by using a ruling pen and other drafting tools. Some workers, called *general board workers*, spend nearly all their time at the drawing board performing many of these specializations. Apprentices help general board workers or other specialists by doing routine jobs such as separating colors and cutting mats.

In a small office, the art director may perform the layout and board work with the aid of apprentices. In a large office, the art director develops concepts with the copywriter; sets standards; deals with clients; and purchases needed

photographs, illustrations, lettering, and other artwork from freelancers.

Advertising artists create the concept and artwork for a wide variety of items. These include direct mail advertising, catalogs, counter displays, slides, and filmstrips. They also design or lay out the editorial pages and features and produce or purchase the necessary illustrations or artwork. Some commercial artists specialize in producing fashion illustrations, greeting cards, or book illustrations, or in making technical drawings for industry.

Places of Employment

About 64,000 persons, one-third of them women, worked as commercial artists in 1974. Although some commercial artists can be found in nearly every city, the majority work in large cities, such as New York, Los Angeles, Boston, Washington, D.C., and Chicago, where the largest users of commercial art are located.

Most commercial artists work as staff artists for advertising departments of large companies, printing and publishing firms, textile companies, photographic studios, television and motion picture studios, department stores, and a variety of other business organizations. Many are self-employed or freelance artists. Some salaried commercial artists also do freelance work in their spare time. About 2,400 commercial artists work for Federal Government agencies, principally in the Defense Department. A few teach in art schools.

Training, Other Qualifications, and Advancement

Artistic ability, judgment, imagination and a capacity to visualize ideas on paper are important qualifications for success in commercial art. However, these qualities must be developed by specialized training in the techniques of commercial and applied art.

Education in the fine arts—painting, sculpture, or architecture—and in academic studies generally provides a good foundation for obtaining employment in commercial art, and may be essential for promotion. Special courses in visualization, typography and production, and TV commercial creation and production also are desirable.

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, an applicant must usually have a high school education. Some schools admit only applicants who submit 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 years or more of study and confer a bachelor's degree—commonly the bachelor of fine arts (B.F.A.). About 300 colleges and universities confer such degrees. In these schools, commercial art instruction is supplemented by liberal art courses, such as English and history. Limited training in commercial art also may be obtained through public vocational high schools and practical experience on the job. However, supplemental training usually is needed for advancement. Beginners also should supplement their formal education and training by experience in doing posters, layouts, illustrations and similar projects for schools and other organizations.

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.

The various specialties, however, differ in some of the specific abilities required. For example, letterers and retouchers must do precise and detailed work that requires 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, typography, and printing production is useful in art direction or design. Freelance commercial artists must sell both ideas and finished work to clients. A knowledge of type specifications and printing production methods is very helpful. A business sense and responsibility in meeting deadlines are assets, also. Art directors need a strong educational background in art and business practices and the liberal arts. Advertising art directors require a special kind of creativity—the ability to conceive ideas that will stimulate the sale of the client's products or services.

Beginning commercial artists usually need some on-the-job training to 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 salaried commercial artists leave to do freelance work. Most illustrators are freelancers; many of them have an agent.

Commercial artists usually assemble their best artwork into a "portfolio," to display their work. A good portfolio is essential in obtaining initial employment and freelance assignments as well as for job changes.

Employment Outlook

Talented and well-trained commercial artists may face competition for employment and advancement in most kinds of work through the mid-1980's. Those with only average ability and little specialized training probably will encounter keen competition for beginning jobs and have limited opportunities for advancement.

Employment of commercial artists is expected to increase about as fast as the average for all occupations through the mid-1980's. One anticipated area of growth is in visual advertising such as television graphics, packaging displays, and poster and window displays. The expanding field of industrial design also is expected to require more qualified artists to do three-dimensional work with engineering concepts. (See statement on Industrial Designers.) In addition, several thousand jobs for commercial artists are expected to open each year throughout the period to replace workers who will die, retire, or leave the field for other reasons.

The demand for commercial artists is expected to vary by specialization or type. For example, demand for freelance artists is expected to increase; experienced paste-up and mechanical artists are always needed; jobs for designers, art directors, and layout men will be fewer, much sought after and open only to experienced, high talented, and creative artists.

Commercial art occupations are particularly sensitive to changes in business conditions. Therefore, jobseekers may find opportunities in any one year more or less plentiful in accordance to economic conditions.

Earnings and Working Conditions

In 1974, beginning commercial artists having no training beyond vocational high school typically earned from $85 to $90 a week; graduates of 2-year professional schools, $90 to $100 a week; and graduates of 4-year post-high school programs, $100 to $120 a week, according to the limited data available. Talented artists who had strong educational backgrounds and good portfolios, however, started at higher salaries. After a few years of experience, qualified artists may expect to earn $140 to $160 a week or more. Art directors, designers, executives, well-known freelance illustrators, and others in top positions generally have much higher earnings, from $300 to $500 a week or more.

Earnings of freelance artists vary widely, since they are affected by factors such as skill level, variety, and popularity of work. Freelancers receive from $25 for a single black-and-white fashion sketch to $2,000 for a color cover for a national magazine. Freelance artists may be paid by the hour or by the assignment. Commercial artists who worked for the Federal Government in 1974 had an average annual salary of $13,196 or $256 a week.

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.

Sources of Additional Information

Information on institutions offering programs in commercial art is available from:

National Art Education Association, National Education Association, 1916 Association Dr., Reston, Va. 22091.

DISPLAY WORKERS (RETAIL TRADE)

(D.O.T. 298.081)

Nature of the Work

It happens every shopping day: A person browsing through a clothing store notices a mannequin wearing an attractive suit and, without having planned to, purchases a similar outfit. A fishing enthusiast sees a display of angling equipment in a store window, goes in, and buys a new reel.

Incidents like these show how displays in stores and store windows can attract customers and encourage them to buy. Knowing the effectiveness of this form of advertising, some stores allot a large share of their publicity budget to displays.

Display workers specialize in designing and installing such exhibits. Their aim is to develop attractive, eye-catching ways of showing store merchandise to best advantage. To create a setting that enhances the merchandise, display workers need imagination as well as knowledge of color harmony, composition, and other fundamentals of art. They may, for example, choose a theme—a beach setting to advertise bathing suits or surfing equipment—and design a colorful display around this theme. After the design has been approved by the store's management, display workers obtain the props and other necessary accessories. This is where their craft skills come into play.

Display workers often construct many of the props themselves using hammers, saws, spray guns, and other tools. They may be assisted in these tasks by a helper or by store maintenance workers. Display workers also may use props out of storage, designed for previous displays, or order props from firms which specialize in them. The display workers install the props, background settings, and lighting equipment. They also dress mannequins and add finishing touches. Periodically, they dismantle old displays and replace them with new ones.

In large stores that employ several display workers, each may specialize in a particular activity such as carpentry, painting, making signs, or setting up displays. Overall planning and administration in large stores is usually the responsibility of a display director who supervises and coordinates the activities of the department. The director confers with architects and executives, such as advertising and sales managers, to select merchandise to be promoted and to design displays.

Places of Employment

About 34,000 persons worked as display workers in retail stores in 1974. Most worked in department, clothing, and homefurnishing stores; others in variety, drug, and shoe stores and in book and gift shops. Several thousand additional freelance or self-employed display workers serviced small stores that needed professional window dressing but could not afford full-time display workers. Freelancers are among the most highly skilled workers in this field.

While major department stores may have as many as 30 or 40 display workers, most stores have only one or two.

Geographically, employment is distributed much like the Nation's population, with most jobs in larger towns and cities.

Training, Other Qualifications, and Advancement

Most display workers learn their trade through informal on-the-job training. Beginners are hired as helpers to dismantle displays, carry props, and do other routine tasks. Gradually, they are given the opportunity to do more difficult work such as building props and, if they show artistic talent, planning simple designs. A beginner usually can become skilled in 2 to 3 years. Training time varies, however, depending on the beginner's ability and the variety and complexity of displays that the employer requires.

When hiring inexperienced workers, most employers will consider only applicants who have finished high school. Courses that provide helpful training for display work include art, woodworking, mechanical drawing, and merchandising. Some employers seek applicants who have completed college courses in art, interior decorating, fashion design, advertising, or related subjects. College training improves opportunities for advancement to managerial jobs.

Creative ability, manual dexterity, and mechanical aptitude are among the most important personal qualifications needed in this field. Good physical condition and agility are needed to carry equipment, climb ladders, and work in close quarters without upsetting props.

Advancement may take several forms. A display worker with supervisory ability might become display director in a large store. A display director might in turn progress to sales promotion director or be placed in charge of store planning.

Freelance work is another avenue of advancement. Some workers moonlight until they have enough clients for full-time work on

their own. Relatively little money is needed to start a freelance business, but since this is a highly competitive field, self-employment is likely to be a struggle, particularly at the outset.

The display worker's skills could lead to jobs in other art-related occupations such as interior decoration or photography. These occupations, however, require additional training.

Employment Outlook

Employment of display workers is expected to grow about as fast as the average for all occupations through the mid-1980's. The chief spur to employment gains will be the construction of additional stores as population grows. Also, many stores are placing greater emphasis on window and interior displays as a means to stimulate sales. In addition to the jobs resulting from employment growth, many openings will arise each year to replace experienced workers who retire, die, or transfer to other occupations.

Employment opportunities will be concentrated in large stores, most of which are located in metropolitan areas. Although many jobs will be available for applicants who have no more than a high school education, opportunities will be best for those who have completed college courses in art, interior decorating, fashion design, advertising, or related subjects.

Earnings and Working Conditions

Among large employers, weekly salaries for beginners ranged from $80 to $125 in 1974. Beginners who have completed college courses in art, interior decorating, or related subjects generally receive the higher starting salaries. Experienced display workers' salaries range from $120 to $225 a week, depending largely on experience and ability. Most display directors earn between $10,000 and $15,000 a year. Experienced directors in large metropolitan department stores may earn considerably more, particularly those who occupy executive positions.

The earnings of freelancers depend on their talent and prestige, on the number and kinds of stores they service, and on the amount of time they devote to the work. Many freelancers earn more than $15,000 a year, and some earn more than $30,000.

Display personnel enjoy the satisfaction of doing creative work. Developing an original design and transforming it into reality can be a highly rewarding experience.

Display workers usually work 35 to 40 hours a week. During busy seasons, such as Christmas and Easter, they may work overtime, nights, and weekends to prepare special displays.

Constructing and installing props frequently require prolonged standing, bending, stooping, and working in awkward positions. Display workers risk injury from falls off ladders, from contact with sharp or rough materials, and from the use of power tools, but serious injuries are uncommon.

Sources of Additional Information

Details on career opportunities can be obtained from local retailers, such as department stores, and from local offices of the State employment service.

FLORAL DESIGNERS

(D.O.T. 142.081)

Nature of the Work

Floral designers assemble selected flowers and foliages for a specific design to express the thoughts and sentiments of the sender. Knowledge of flower forms (shapes), plant materials, and floral design enables designers to create floral and plant gifts, decorations, and tributes.

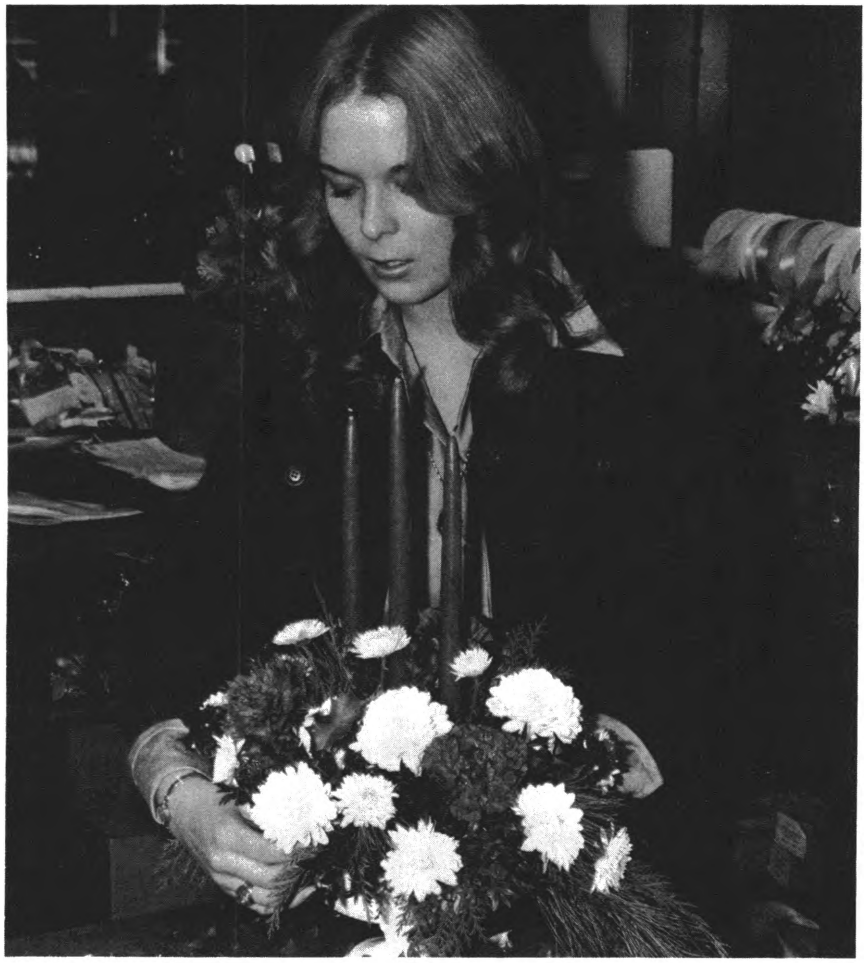
In any given day, designers may receive a variety of orders including decorative potted plants, bouquets, corsages, funeral work, and dried flower arrangements. Special orders, such as weddings and parties, also incorporate the creative design and decorating talents of the floral designer.

Designers work from a written order indicating customer preference for color and type of flower, as well as the cost, date, time, and place the arrangement or plant is to be delivered. Customers may leave the choice of flowers, color, and design to the discretion of the designer.

Designers must know the names and keeping (lasting) qualities of flowers as well as growing information of potted plants. They also know the seasonal availability of flower and plant material. Flowers are obtained from local wholesalers or shipped directly from growers.

A funeral order may read "easel spray of red and white flowers." For the foundation, the designer attaches a base (styrofoam, needle pack, etc.) near the top of a three-legged wire stand. Appropriate flowers are selected from the floral refrigerator. White gladiolas and red carnations are a possible combination. The price of the order and the cost of the flowers determine the number of flowers used. The flowers are cut to the needed length and wired for security. Stems are strengthened with wood sticks for easy insertion into the base.

To background the flowers, designers insert leafy branches such as chamadorea or fern into the base. Gladiolas are evenly spaced so that the tips of the flowers approximate a spear or diamond shape. Carnations are placed between the gladioli to provide contrasting forms, color harmony, and depth. A bow placed at the focal



Floral arrangements express the designer's artistic and creative talent.

point of the spray may vary according to converging lines. Foliage is added to hide construction. On the back of the handwritten sympathy card are the description of the spray and the donor's name and address for easy acknowledgement. The spray is ready for delivery. This type order is usually completed in 15 minutes.

Floral designers have other duties. They help customers select flowers, plants, gifts and floral accessories available in the shop. During slack periods, designers decorate potted plants, arrange planters, and terrariums and prepare accessories for a coming season—for example, bows and streamers for football corsages or dressings for potted plants.

Places of Employment

About 33,000 floral designers were employed in 1974. Nearly all designers work in the retail flower shops common to large cities, suburban shopping centers, and small towns. Most shops are small and employ only one or two floral designers; Many designers manage their own stores. Geographically, employment is distributed much the same as population.

Training, Other Qualifications, and Advancement

Many floral designers are trained on the job. Beginners usually prepare flowers for storage, deliver orders, and do general cleanup work. Shop managers look for bright, eager helpers, who dress neatly, have pleasant personalities, and can deal effectively with customers. After a few weeks, helpers learn enough about flowers, potted plants, and gift items to assist customers in making selections.

Young people who want to become designers usually are trained on the job by the manager or an experienced floral designer. Initially they copy simple arrangements that use one type of flower. If they work quickly with their hands and recognize the shape, color and position of flowers which make attractive arrangements, instruction in more complex arrangements is given. As experience is gained, original designs required for special orders can be attempted. Usually a person can become a fully qualified floral designer after 2 years of on-the-job training.

Good color vision, manual dexterity, and the ability to arrange various shapes and colors in attractive patterns are the primary qualifications for this occupation. A high school diploma generally is not required, but applicants must be able to write legibly and do simple arithmetic in order to write up bills for customers. High school courses in business arithmetic, selling techniques, and other business subjects are helpful. While still in school, a student may work part time in a flower shop, especially before holiday seasons such as Christmas and Easter.

An increasing number of floral designers take courses in floral arrangement in public and private schools and junior colleges. However, whether they last from 6 weeks to 2 years, courses are not a substitute for on-the-job training and experience. Longer courses provide training in flower marketing and shop management for floral designers who plan to operate their own shops.

Floral designers have limited advancement possibilities. Those with

supervisory ability may advance to manager in large flower shops. Managers who have the necessary capital may open their own shops.

Employment Outlook

The outlook for employment as a floral designer is expected to be good through the mid-1980's. Employment is expected to increase faster than the average for all occupations. In addition to job openings created by employment growth, many openings will arise each year as workers retire, die, or change occupations. However, designer employment depends on the income of customers, and the number of job openings may vary with ups and downs in the economy.

Studies of sales in retail florist stores indicate that customers with higher incomes spend a greater proportion of their income to buy flowers. Since the income of each person, as well as the number of people is expected to increase, flower sales should increase significantly. As a result, more floral designers will be needed to prepare arrangements.

Earnings and Working Conditions

Limited information indicates that in 1974 qualified designers earned between $2.50 and $6 an hour. Rates for trainees ranged from $1.60 to $2 an hour, but seldom exceeded the legal minimum wage. Because most flower shops are small, designers may be exempt from minimum wage laws. Besides earning money, designers achieve the satisfaction of doing creative work and seeing their ideas transformed into reality.

In small shops, floral designers usually work 8 hours a day, Monday through Saturday. In many large shops, designers who work Saturday get a day off during the week.

Most designers receive holiday and vacation pay. Because most shops are small, other fringe benefits are limited. Some employers pay part of the cost of group life and health insurance but few contribute to retirement plans other than social security. Floral designers in a few cities are members of the Retail Clerks International Association.

Floral designers must be able to stand for long periods. Work areas are kept cool and humid to preserve the flowers and designers are exposed to sudden temperature changes when entering or leaving storage refrigerators. Aside from the possibility of small cuts from knives or scratches from flower thorns, this occupation has few hazards.

Sources of Additional Information

For additional information about careers in floral design and addresses of schools offering courses in this field, write to:

Society of American Florists and Ornamental Horticulturists, 901 N. Washington St., Alexandria, Va. 22314.

INDUSTRIAL DESIGNERS

(D.O.T. 142.081)

Nature of the Work

When people buy a product, whether it's a home appliance, a new car, or a ball point pen, they want it to be attractive as well as useful. Industrial designers combine artistic talent with knowledge of marketing, materials, machines, and methods of production to improve the appearance and functional design of products so that they compete favorably with similar goods on the market.

As the first step in their work, industrial designers study the product and competing products to determine possible uses. Then they sketch different designs and consult with engineers, production supervisors, and sales and market research personnel about the practicability and sales appeal of each idea.

After company officials select the most suitable design, the industrial designer or a professional modeler make a model, often of clay so that it can be easily changed. After any necessary revisions, a final or working model is made, usually of the material to be used in the finished product. The approved model is then put into production.

Some industrial designers seek to create favorable public images for companies and for government services such as transportation by developing trademarks or symbols that appear on the firm's product, advertising, brochures, and stationery. Some design containers and packages which both protect and promote their contents. Others prepare small display exhibits or the entire layout for industrial fairs. Some design the interior layout of special purpose commercial buildings such as restaurants and supermarkets.

Industrial designers employed by a manufacturing company usually work only on the products made by their employer. This may involve filling day-to-day design needs of the company or long-range planning of new products. Consultants for more than one industrial firm may plan and design a great variety of products.

Places of Employment

About 10,000 persons—about 10 percent women—were employed as industrial designers in 1974. Most worked for large manufacturing companies designing either consumer or industrial products or for design consulting firms. Others did freelance work, or were on the staffs of architectural and interior design firms.

Industrial design consultants work mainly in large cities, for ex-

ample, New York, Chicago, Los Angeles, and San Francisco. Those with industrial firms usually work in or near the manufacturing plants of their companies, which often are located in small and medium size cities.

Training, Other Qualifications, and Advancement

Completing a course of study in industrial design in an art school, in the design or art department of a university, or in a technical college is the usual requirement for entering this field of work. Persons majoring in engineering, architecture, and fine arts may qualify as industrial designers if they have appropriate experience and artistic talent. Most large manufacturing firms hire only industrial designers who have a bachelor's degree in the field.

In 1974, 41 colleges and art schools offered programs or courses in industrial design. The Industrial Designers Society of America recognizes 25 of these programs as effective in preparing students for employment as industrial designers.

Industrial design programs usually take 4 years, although a few colleges and universities require 5 years. These schools award a bachelor's degree in industrial design or fine arts; some also award a master's degree. Admittance to most of these schools requires a high school diploma. In some cases, students must present sketches and other examples of their artistic ability.

Industrial design programs differ considerably among schools. Most college and university programs stress the engineering and technical aspects of the field; art schools generally stress a strong background in art. In most programs, students spend much time in the lab designing objects in three dimensions. In studio courses, students make drawings and models with clay, wood, plaster, and other easily worked materials. In schools that have the necessary machinery, students make models of their designs while learning to use metalworking and woodworking machinery. Students also take basic and abstract art and sculpture courses. Some schools require courses in basic engineering and in composition of materials. Courses in business administration and marketing can be helpful in getting a job.

Industrial designers must have creative talent, drawing skills, and the ability to see familiar objects in new ways. They must understand and meet the needs and tastes of the public, rather than design only to suit their own artistic sensitivity. Designers should not be discouraged when their ideas are rejected—often designs must be resubmitted many times before one is accepted. Since industrial designers must cooperate with engineers and other staff members, the ability to work and communicate with others is important. Design consultants should also understand business practices and have sales ability.

Applicants for jobs should assemble a "portfolio" of drawings and sketches to demonstrate their creativity and ability to communicate ideas.

New graduates of industrial design programs frequently assist experienced designers and do simple assignments. As they gain experience, they may become supervisors with major responsibility for the design of a product or a group of products. Those who have an established reputation and the necessary funds may start their own consulting firms.

Industrial designers confer on plans for new product design.

Employment Outlook

Employment in this relatively small occupation is expected to grow about as fast as the average for all occupations. A growing population and rising incomes will create markets for newly designed products, for improved designs of existing products and packaging and, in turn, for industrial designers who create them. Some employment opportunities also will arise each year as designers die, retire or leave the field.

Employment opportunities are expected to be best for college graduates with degrees in industrial design. Opportunities will also arise for engineering, and architectural school graduates.

Demand for industrial designers may fluctuate over short-run periods. During times of economic downturns when consumer and industrial demand for new products is dampened, requirements for these workers may decline.

Frequent redesign of household products, automobiles, and industrial equipment has always created a need for designers. Although recently the trend has been away from annual style changes, further emphasis on safer products should increase demand for industrial designers since a safer product is usually a better designed product.

Small companies probably will make increasing use of services offered by industrial design consulting firms to compete more effectively with larger firms. However, some of these services, such as trademark and package design, could be offered by advertising agencies.

Earnings and Working Conditions

Salaries for inexperienced industrial designers with a bachelor's degree generally ranged from $9,000 to $12,000 a year in 1974, according to limited data. After several years experience, it is possible to earn $14,000 to $18,000 a year. Salaries of those with many years of experience averaged more than $20,000 a year, but varied according to individual talent and the size and type of firm.

Though earnings of industrial designers who own their consulting firms fluctuate markedly, in recent years most consultants earned between $24,000 and $32,000; heads of large well-known firms earned considerably more.

Sources of Additional Information

A brochure about careers and a list of schools offering courses and degrees in industrial design are available for 50 cents from:

Industrial Designers Society of America, 1750 Old Meadow Rd., McLean, Va. 22101.

INTERIOR DESIGNERS

(D.O.T. 142.051)

Nature of the Work

The creative work of interior designers, sometimes called *interior decorators*, helps make our living, working, and playing areas more attractive and useful. Interior designers plan and supervise the design and arrangement of building interiors and furnishings. They help clients select and estimate the cost of furniture, draperies, other fabrics, floor coverings, and accessories. Interior designers may do "boardwork," particularly on large assignments. Boardwork includes work on floor plans and elevations and preparing sketches or other perspective drawings so clients can visualize their plans. After the client approves both the plans and the cost, the designer may make arrangements for buying the furnishings; for supervising the work of painters, floor finishers, cabinetmakers, carpet layers, and other craft workers; and for installing and arranging the furnishings.

Many large department and furniture stores have separate design departments to advise their customers on decorating and design plans. The designer's principal function in these departments is to help sell the store's merchandise, although materials from outside sources may be used occasionally when they are essential to the customer's plans. Department store designers frequently advise the store's buyers and executives about style and color trends in interior furnishings.

Interior designers may work on private homes or commercial buildings. Those who specialize in commercial structures often work for clients on large design projects such as the interiors of entire office buildings, hospitals, and libraries. Generally they plan the complete layout of rooms without changes to the structure of the building. Sometimes they redesign or renovate the interiors of old buildings. In these cases, an architect must check the plans to assure compliance with building requirements and to solve structural problems. Some interior designers also design the furniture and accessories to be used in various structures, and then arrange for their manufacture. A few have unusual jobs such as designing interiors of ships and aircraft, while others design stage sets used for motion pictures or television.

Places of Employment

About 34,000 persons—half of them men—worked as interior designers in 1974. Most workers in this occupation are employed in large cities.

Some interior designers own their own establishment, either alone or as members of a firm with other designers. Large design firms employ designers who work independently or as assistants to more senior designers.

Other interior designers work in large department or furniture stores, and a few have permanent jobs with hotel and restaurant chains. Some work for architects, furniture suppliers, antique dealers, furniture and textile manufacturers, or other manufacturers in the interior furnishing field.

Interior designers work for magazines that feature articles on home furnishings. Some large industrial corporations employ interior designers on a permanent basis.

Training, Other Qualifications, and Advancement

Formal training in interior design is becoming increasingly important for entrance into this field. Most department stores, well-established design firms, and other major employers will accept only professionally trained people for beginning jobs. The types of training available include 3-year programs in a professional school of interior design, 4-year college or university programs which issue a bachelor's degree, or post-graduate programs leading to a master's degree or the Ph. D. The basic course of study usually includes the principles of design, history of art, freehand and mechanical drawing, painting, study of the essentials of architecture as they relate to interiors, design of furniture and exhibitions, and study of various materials, such as woods, plastics, metals, and fabrics. A knowledge of furnishings, art pieces, and antiques is important. In addition, courses in sales, business procedures, and other business subjects are valuable.

Membership in the American Society of Interior Design is a recognized mark of achievement in this profession. Membership usually requires the completion of 3 or 4 years of post-high school education in design, and several years of practical experience in the field, including supervisory work.

Interior designers and clients discuss furniture selection.

Persons starting in interior design usually serve a training period, either with design firms, in department stores, or in furniture stores. They may act as receptionists, as shoppers with the task of matching materials or finding accessories, or as stockroom assistants, salespersons, assistant decorators, or junior designers. In most instances, from 1 to 5 years of on-the-job training is required before a trainee becomes eligible for advancement to designer. Beginners who do not get trainee jobs often work selling fabric, lamps, or other interior furnishings to gain experience in dealing with customers and to become familiar with the merchandise. This experience may help in obtaining a job in design or may lead to a career in merchandising.

After considerable experience, designers may advance to design department head, interior furnishings coordinator, or to other supervisory positions in department stores or in large design firms. If they have the necessary funds, they may open their own businesses. Exceptionally talented people can advance rapidly.

Artistic talent—color sense, good taste, imagination—good business judgment, and ability to work with detail and to deal with people are important assets for success in this field. An advantage to interior design as a career is the satisfaction of seeing the results of one's work.

Employment Outlook

Persons seeking beginning jobs in interior designing are expected to face competition through the mid-1980's. Interior designing is a competitive field that requires talent, training, and business ability, and many applicants vie for the better

jobs. Talented college graduates who major in interior design and graduates of professional schools of interior design will find the best opportunities for employment. Those with less talent or without formal training will find it increasingly difficult to enter this field.

Employment of interior designers is expected to increase about as fast as the average for all occupations through the mid-1980's. Growth in population, personal incomes, expenditures for home and office furnishings, and the increasing use of design services in both homes and commercial establishments should contribute to a greater demand for these workers. In addition to new jobs, some openings will be created by the need to replace designers who die, retire, or leave the field.

Department and furniture stores are expected to employ an increasing number of designers as their share in the growing volume of design work for commercial establishments and public buildings increases. Interior design firms also are expected to continue to expand.

Employment of interior designers, however, is sensitive to changes in general economic conditions because people often forego design services when the economy slows down.

Earnings and Working Conditions

Beginners are usually paid a straight salary plus a small commission. Starting salaries can range from $85 to $125 a week; firms in large metropolitan areas usually pay the higher salaries.

Some experienced interior designers are paid straight salaries, some receive salaries plus commissions based on the value of their sales, while others work entirely on commissions.

Incomes of experienced designers vary greatly. Many persons earn from $6,000 to $12,000 a year, while highly successful designers earn around $25,000 annually. A small number of nationally recognized professionals earn well over $50,000.

The earnings of self-employed designers vary widely depending on the volume of business, their professional prestige, the economic level of their clients, and their own business competence.

Designers' work hours are sometimes long and irregular. Designers usually adjust their work day to suit the needs of their clients, meeting with them during the evenings or on weekends, when necessary.

Sources of Additional Information

For information about careers in interior design and a list of schools offering programs in this field, contact:

American Society of Interior Design, 730 Fifth Ave., New York, N.Y. 10019.

Foundation for Interior Design Education Research, 1750 Old Meadow Rd., McLean, Va. 22101.

LANDSCAPE ARCHITECTS

(D.O.T. 019.081)

Nature of the Work

Everyone enjoys attractively designed private yards, public parks, and commercial areas. Landscape architects design these areas to fit in with people's needs and aesthetic sense.

Landscape architects assist many types of organizations in planning and designing a project from a real estate firm starting a new suburban development to a city constructing an airport or park. They may plan and arrange trees, shrubbery, walkways, open spaces, and other features as well as supervise the necessary grading, construction, and planting.

Landscape architects first consider the nature and purpose of the project, the funds available, and the proposed buildings in planning a site. Next, they study the site itself, mapping features such as the slope of the land and the position of existing buildings and trees. They also observe the sunny parts of the site at different times of the day, soil texture, existing utilities, and many other landscape features. Then, after consulting with the project architect or engineer they draw up plans to develop the site. If the plan is approved, landscape architects prepare working drawings showing all existing and proposed features such as buildings, roads, walkways, terraces, grading, and drainage structures in planted areas. Landscape architects outline in detail the methods of constructing features and draw up lists of building materials. They then may invite landscape contractors to bid for the work.

Although landscape architects help design and supervise a wide variety of projects, some specialize in certain types of projects such as parks and playgrounds, hotels and resorts, shopping centers, or public housing. Still others specialize in services such as regional planning and resource management, feasibility and cost studies, or site construction.

Places of Employment

More than 12,000 persons worked as landscape architects in 1974; less than 5 percent were women. Most landscape architects are self-employed or work for architectural, landscape architectural, or engineering firms. Government agencies concerned with forest management, water impoundment, public housing, city planning, urban renewal, highways, parks, and recreation employed about 40 percent of all landscape architects. The Federal Government employed about 500 landscape architects, mainly in the De-

partments of Agriculture, Defense, and Interior. Some landscape architects were employed by landscape contractors, and a few taught in colleges and universities.

Training, Other Qualifications, and Advancement

A bachelor's degree in landscape architecture which takes 4 or 5 years is usually the minimum educational requirement for entering the profession. In 1974 the American Society of Landscape Architects accredited 38 of the 66 colleges and universities offering this training.

Entrance requirements for landscape architecture programs vary by college. Some colleges recommend completion of a high school course in mechanical or geometrical drawing, and most schools advise high school students to take courses in art, botany, and more mathematics than the minimum required for college entrance.

College courses include technical subjects such as surveying, landscape construction, sketching, and city planning. Other courses include horticulture and botany as well as English, science, and mathematics. Most college programs also include field trips to view and study examples of landscape architecture.

Twenty-eight States require a license for independent practice of landscape architecture. Admission to the licensing examination usually requires a degree from an accredited school of landscape architecture plus 2 to 4 years of experience. Lengthy apprenticeship training (6-8 years) under an experienced landscape architect may sometimes be substituted for college training.

Persons planning careers in landscape architecture should be interested in art and nature. Self-employed landscape architects also must understand business practices. Working for landscape architects or landscape contractors during summer vacations helps a person understand the practical problems of the profession, and may be helpful in obtaining employment after graduation.

New graduates usually begin as junior drafters, tracing drawings and doing other simple drafting work. After gaining experience, they help prepare specifications and construction details and handle other aspects of project design. After 2 or 3 years they can usually carry a design through all stages of development. Highly qualified landscape architects may become associates in private firms; landscape architects who progress this far, however, often open their own office.

Employment Outlook

Employment of landscape architects is expected to grow at a much faster rate than the average for all occupations through the mid-1980's, resulting in hundreds of new positions each year. Additionally, new entrants will be needed as replacements for landscape architects who retire or die.

A major factor underlying the increased demand for landscape architects is the growing interest in city and regional environmental planning. Metropolitan areas will require landscape architects to develop land for the efficient and safe use of growing populations. Legislation to promote environmental protection could spur demand for landscape architects to participate in planning and designing a growing number of projects, such as transportation systems, outdoor recreation areas, and land reclamation.

Anticipated new construction may also increase demand for landscape architects. However, during slow periods the demand could be limited.

Earnings and Working Conditions

Though earnings fluctuate widely according to the educational background, experience, and size of the firm, landscape architects who own their own practice often earn more than salaried employees with considerable experience.

The Federal Government, in late 1974, paid new graduates with a bachelor's degree annual salaries of $8,500 or $10,520 depending on their qualifications. Those with an advanced degree had a starting salary of $12,841 a year. Landscape architects in the Federal Government averaged $21,000 a year.

Salaried employees both in government and in landscape architectural firms usually work regular hours, although employees in private firms may also work overtime during seasonal rush periods or to meet a deadline. Self-employed persons often work long hours.

Sources of Additional Information

Additional information including a list of colleges and universities offering accredited courses of study

in landscape architecture is available from:

American Society of Landscape Architecture, Inc., 1750 Old Meadow Rd., McLean, Va. 22101.

For information on a career as a landscape architect in the Forest Service, write to:

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

PHOTOGRAPHERS

(D.O.T. 143.062, .282, and .382)

Nature of the Work

Photographers use their cameras and film to portray people, places, and events much as a writer uses words. Those who are skillful can capture the personality of individuals or the mood of scenes they photograph. Some specialize in scientific, medical, or engineering photography and their pictures enable thousands of persons to see a world normally hidden from view.

Although their work varies widely, all photographers use the same basic equipment. The most important piece, of course, is the camera, and most photographers own several. Because the procedures involved in still photography are quite different from those in motion picture photography, most photographers specialize in one or the other. Unlike snapshot cameras which have a lens permanently attached to the camera body, professional cameras are constructed to use a variety of lenses designed for close-up, medium-range, or distance photography.

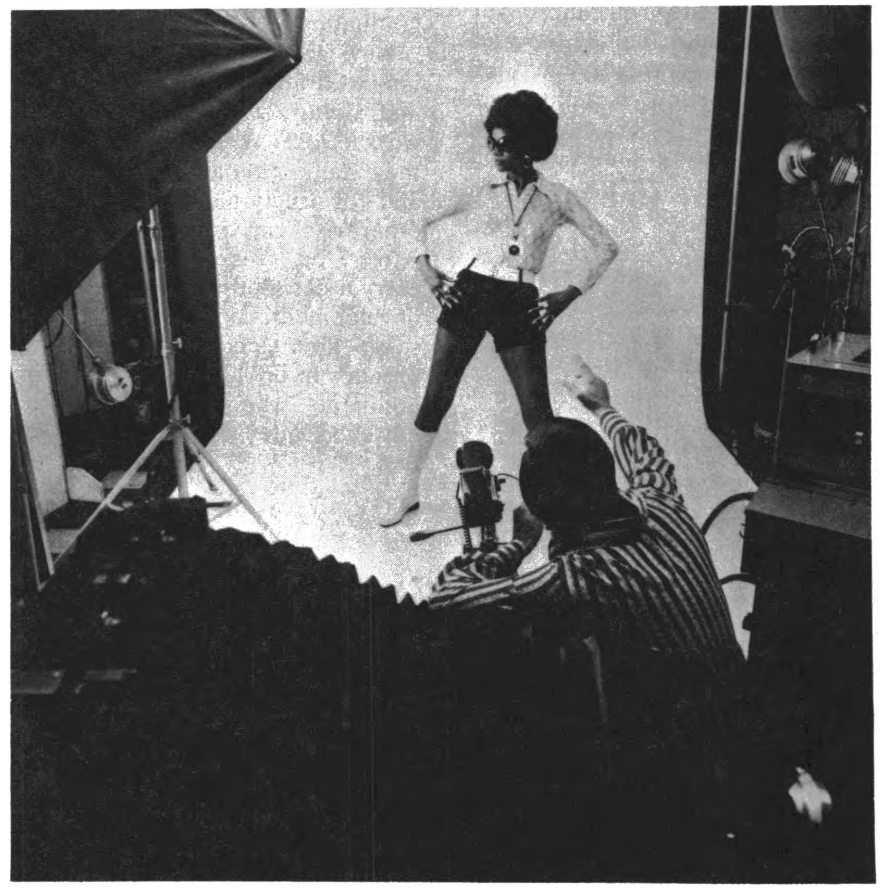
Besides cameras and lenses, photographers use a variety of film and colored filters to obtain the desired effect under different lighting conditions. When taking pictures indoors or after dark, they use electronic flash units, floodlights, reflectors, and other special lighting equipment.

Some photographers develop and print their own photographs in the darkroom and may enlarge or otherwise alter the basic image. Other photographers send their work to photographic laboratories for processing.

In addition to knowing how to use their equipment and materials, photographers must know how to compose the subjects of their photographs and be able to recognize a potentially good photograph.

Many photographers specialize in a particular type of photography such as portrait, commercial, or industrial work. Portrait photographers take pictures of individuals or groups of persons and usually work in their own studios. For special events, such as weddings or christenings, however, they take photographs in churches and homes. Commercial photographers generally take pictures to advertise clothing, automobiles, furniture, food, and other items. The work of industrial photographers is used in company publications to report to stockholders or to advertise company products or services. These photographers also may take motion pictures of workers operating equipment and machinery for management's use in analyzing production or work methods.

Other photographic specialties include photojournalism or press photography that combines a "nose for news" with photographic ability; aerial photography; educational photography (preparing slides, filmstrips, and movies for use in the classroom); and science and engineering photography (the development of photographic techniques for use in space, medical, or biological research).



Places of Employment

About 80,000 photographers were employed in 1974. About half worked in commercial studios, but newspaper and magazine publishers also employed many photographers. Government agencies, photographic equipment suppliers and dealers, and many industrial firms employed large numbers of these workers. In addition, some photographers taught in colleges and universities, or made films. Still others worked freelance, taking pictures to sell to advertisers, magazines, and other customers. About one-fourth of all photographers were self-employed.

Jobs for photographers are found in all parts of the country, in small towns and large cities, but employment is concentrated in the most populated areas.

Training, Other Qualifications, and Advancement

People may prepare for work as professional photographers in a commercial studio, through 2 or 3 years of on-the-job training. Trainees generally start in the darkroom where they learn to develop film and do photo-printing and enlarging. Later they may set up lights and cameras, or help an experienced photographer take pictures.

Photographic training also is available in colleges, universities, junior colleges, and art schools. About 25 colleges and universities offer 4-year curriculums, leading to a bachelor's degree in photography that include courses in the liberal arts. Some colleges and unversities grant master's degrees in specialized areas, such as color phtography. In addition, a few colleges have 2-year curriculums leading to a certificate or an associate's degree in photography. Art schools offer useful training in design and composition, but not the technical training needed for professional photographic work. (See the statement on Commercial Artists elsewhere in the *Handbook*.) The Armed Forces also trains many young people in photographic skills during service.

The type of training determines the type of work for which prospective photographers qualify. Amateur experience is helpful in getting an entry job in a commercial studio, but post-high school training and experience usually are needed for industrial, news, or scientific photography. Work in scientific, medical, and engineering research, such as photographing microscopic organisms, requires a background in the particular science or engineering specialty, as well as skill in photography.

Photographers must have good eyesight and color vision, artistic ability, and manual dexterity. Some knowledge of mathematics, physics, and chemistry is helpful for understanding the use of various lenses, films, light sources, and development processes. They also should enjoy working with detail.

Some photographic specialties require additional qualities. Commercial or freelance photographers must be imaginative and original in their thinking. Those who specialize in photographing news stories must be able to recognize a potentially good photograph and act quickly or an opportunity to capture an important event on film may be lost. Photographers who specialize in portrait photography need the ability to help people relax in front of the camera.

Newly hired photographers are given relatively routine assignments that do not require split-second camera adjustments or decisions on what subject matter to photograph. News photographers, for example, may be assigned to cover civic meetings or photograph snow storms. After gaining experience they advance to more demanding assignments and some may move to staff positions on national news magazines. Photographers with exceptional ability may gain national reputations for their work and often exhibit their photographs in art and photographic galleries, or publish them in books. A few industrial or science photographers may be promoted to supervisory positions. Magazine photographers may become heads of graphic arts departments or photography editors.

Employment Outlook

Employment of photographers is expected to grow about as fast as the average for all occupations through the mid-1980's. In addition to openings resulting from growth, many others will occur each year as workers die, retire, or transfer to other occupations.

Job opportunities in newspapers and magazines should continue to be good for persons with college training in photography. Business and industry also will offer good opportunities for photographers as greater importance is placed on visual aids for use in meetings, stockholders' reports, and sales campaigns. Photography is becoming an increasingly important part of scientific and medical research, and opportunities are expected to be good for persons with the highly specialized background this type of work requires.

Competition for jobs as portrait and commercial photographers, however, is expected to be keen. These fields are relatively crowded since photographers can go into business for themselves with a modest financial investment, or work part time while holding another job.

Earnings and Working Conditions

Beginning photographers generally earned from $100 to $125 a week in 1974, according to the limited information available.

Those who worked for newspapers that have contracts

with the Newspaper Guild had weekly earnings between $104 and $359 in 1974, with the majority falling in the $150 to $200 range.

Newspaper photographers with some experience (usually 4 to 6 years) averaged about $265 a week in 1974. Contract minimums for experienced photographers were seldom less than $200 a week. A number of newspapers paid their photographers $300 a week or more, with the top salary over $420.

Photographers in the Federal Government earned an average of $13,970 a year in 1974. Depending on their level of experience, newly hired photographers earned from $7,600 to $10,520 a year and most experienced photographers earned between $12,840 and $18,460.

Many experienced photographers with established reputations earn salaries that are above the average for nonsupervisory workers in private industry, except farming. Although self-employed and freelance photographers often earn more than salaried workers, their earnings are affected greatly by general business conditons and the type and size of their community and clientele.

Photographers who have salaried jobs usually work the standard 5-day, 40-hour week and receive benefits such as paid holidays, vacations, and sick leave. Those in business for themselves usually work longer hours. Freelance, press, and commercial photographers travel frequently and may have to work in uncomfortable surroundings. Sometimes the work can be dangerous, especially for news photographers assigned to cover stories on natural disasters or military conflicts.

Sources of Additional Information

Career information on photography is available from:

Photographic Art & Science Foundation, 1100 Executive Way, Des Plaines, Ill. 60018.

COMMUNICATIONS-RELATED OCCUPATIONS

Communication is important to people, either individually as citizens, workers, or employers, or collectively in groups, organizations, or government. This section of the *Handbook* describes four occupations that specialize in communications—interpreters, technical writers, newspaper reporters, and radio and television announcers.

Interpreters and technical writers work as intermediaries translating messages for people to understand: interpreters help people understand languages foreign to them; technical writers help people understand technical information. Newspaper reporters and radio and television announcers inform people about current events and happenings that might interest or affect them. Newspaper reporters gather information on events which they describe, analyze, and interpret in newspapers for rapid dissemination to large numbers of people. Radio and television announcers use electronic communications equipment to tell people of products and services they might obtain, current happenings, and other items of interest.

INTERPRETERS

(D.O.T. 137.268)

Nature of the Work

Interpreters help people of different nations and different cultures overcome language barriers by translating what has been said by one person into a language that can be understood by others.

There are two basic types of interpretation: simultaneous and consecutive. In simultaneous interpretation, the interpreter translates what is being said as the speaker continues to talk. This technique requires speed and fluency, and it is made possible by the use of electronic equipment. Conference interpreters often work in a glass-enclosed booth from which they can see the speaker. While listening through earphones to what is being said, they simultaneously give the translation by speaking into a microphone. People attending the conference who do not understand the language being spoken may listen to an interpreter's translation by simply pushing a button or turning a dial to get the translation in the language they know. Simultaneous interpretation is generally preferred for conferences, and the development of portable equipment has extended its use to other large-scale situations.

Consecutive interpretation also involves oral translation. However the speaker and the interpreter take turns speaking. A consecutive interpreter must have a good memory and generally needs to take notes of what is said to be certain to give a complete translation. The chief drawback of consecutive interpretation is that the process is time consuming, because the speaker must wait for the translation before proceeding.

Since interpreters are needed whenever people find language a barrier, their work involves a variety of topics and situations. They may be used, for example, to explain to a group of foreign visitors various aspects of American life, such as points of political or social interest, or they may be required to interpret highly technical speeches and discussions for medical or scientific gatherings. They may work at the United Nations, or find themselves in a courtroom or escorting foreign leaders or business people visiting the United States.

Places of Employment

An estimated 150 persons worked full time as interpreters in the United States in 1974. The largest single concentration of interpreters was at the United Nations in New York where over 60 people held full-time posts. Various other international organizations, located primarily in Washington, D.C., also employed regular staff interpreters. Within the Federal Government, the Departments of State and Justice were the major employers of full-time interpreters.

An estimated 450 persons worked as freelance interpreters. Freelance interpreters may work for various employers under short-term contracts. About four-fifths were under contract on a temporary basis to the Department of State and the Agency for International Development to serve as escort interpreters for foreign visitors to the United States. Some of these interpreters worked a great portion of the year; others

worked for only a few days. The remainder of the freelance interpreters constituted the freelance conference field. These interpreters provided for both the supplementary needs of the international and Federal agencies and for the periodic, short-term needs of various international conferences that are held in this country. Besides persons who work strictly as interpreters, many others do some interpretation work in the course of their jobs.

About one-half of the Nation's conference interpreters are women; most escort freelance workers, however, are men.

Training, Other Qualifications, and Advancement

A complete command of two languages or more is the usual requirement for becoming an interpreter. Interpreters must instantaneously call to mind words or idioms corresponding to the foreign ones. An extensive working vocabulary and ease in making the transition from one language structure to another are necessary.

Students who want to become interpreters should become fluent in several languages. Interpreters who work at the United Nations, for example, must know at least three of the five official U.N. languages: English, French, Spanish, Russian, and Chinese. Portuguese and, to some extent, Japanese and German are also valuable to interpreters in the United States.

Two schools in the United States offer special programs for interpreter training. Both require foreign language proficiency upon entry. The Georgetown University School of Languages and Linguistics in Washington, D.C. has a 1- or 2-year course of study leading to a Certificate of Proficiency. Applicants to Georgetown University must qualify on the basis of an oral aptitude test and satisfactory performance in a basic first-year college program. The Monterey Institute of Foreign Studies in Monterey, Calif., offers a 2-year program leading to a master's degree in Language and International Studies and a certificate from the Department of Translation and Interpretation. Applicants to the Monterey Institute must have a bachelor's degree with a language major, or its equivalent. Students also must pass a qualifying examination for the Interpreters Certificate Program.

Many individuals may qualify as interpreters principally on the basis of their foreign backgrounds for positions in which extensive experience and a broad education are not as crucial as for other types of interpretation. For example, consecutive interpreters employed by the Immigration and Naturalization Service of the U.S. Department of Justice serve primarily in interpreting legal proceedings, such as hearings for aliens.

Besides being proficient in languages, interpreters are expected to be generally well informed on a broad range of subjects, often including technical subjects such as medicine or scientific or industrial technology. Work as a translator may serve as a useful background in maintaining an up-to-date vocabulary in various specialized or technical areas. The experience of living abroad also is very important for an interpreter.

Although there is no standard requirement for entry into the profession, a university education usually is considered essential.

People interested in becoming interpreters should be articulate speakers and have good hearing. The exacting nature of this profession requires quickness, alertness, and a constant attention to accuracy. Working with all types of people requires good sense, tact, and the emotional stamina to deal with the tensions of the job. It is essential that interpreters maintain confidentiality in their work and that they give honest interpretations.

Advancement in the interpreting field is generally based on satisfactory service. There is some advancement from escort level interpreting to conference level work.

Employment Outlook

Interpreters may face competition for the limited number of openings. Little change is expected in the number of full-time interpreters through the mid-1980's. Most opportunities, therefore, should result from the need to replace workers who die, retire, or leave their jobs for other reasons. Experience has shown that any slight or sporadic increase in the demand for interpreters can be met by the existing pool of freelance workers. Only highly qualified applicants will find favorable employment opportunities.

Qualified interpreters also may find work abroad. For example, the demand for interpreters in Europe, where so many different languages are spoken, is greater than in the United States.

People who have linguistic abilities also may find some employment opportunities as translators. In fact, many interpreters find the ability to do translation work, if not requisite, an occupational asset. Foreign language competence also is important for careers in the fields of foreign service, international business, and language education.

Earnings and Working Conditions

Salaries of interpreters depend upon the type of interpreting done as well as the ability and performance of the individual. The tax-free annual starting salary for conference interpreters at the United Nations was $10,000 in 1974. Outstanding U.N. interpreters could expect to earn more than $20,000. Beginning salaries for interpreters in various other international organizations were about $9,000 a

year, according to the limited information available. In addition, international organizations often paid supplementary living and family allowances.

Junior interpreters who worked for the U.S. Department of State received $12,841 a year in late 1974. Starting salaries were somewhat lower for Government interpreters with limited education, experience, or skills.

In the freelance field, interpreters are paid on a daily basis. Conference interpreter salaries ranged from about $110 to $135 a day in late 1974, depending on experience. The U.S. Department of State paid a daily salary of $110.

Freelance escort interpreters received salaries ranging from about $36 to over $56 a day, based on the individual's skill and prior performance. Interpreters on assignment usually could expect to be paid for a 7-day week. Interpreters are paid transportation expenses by the employing agency and also receive an allowance to cover the cost of accommodations, meals, and other expenses incidental to their assignments.

The conditions under which interpreters work vary widely. In freelancing, there is little job security because of demand fluctuations, and the duration of various freelance assignments ranges from a few days for a typical conference to several weeks for some escort assignments. Although the hours interpreters work are not necessarily long, they are often irregular. In some instances, especially for escort freelance workers, a great deal of travel to a wide variety of locations is required.

Sources of Additional Information

Information on the interpreting profession is available from:

The American Association of Language Specialists, 1000 Connecticut Ave. NW., Suite 9, Washington, D.C. 20036.

For information on entry requirements and courses of study at the two schools offering specialized programs for interpreters, contact:

Division of Interpretation and Translation, School of Languages and Linguistics, Georgetown University, Washington, D.C. 20007.

Department of Translation and Interpretation, Monterey Institute of Foreign Studies, P.O. Box 1978, Monterey, Calif. 93940.

Information about employment opportunities is available from:

Language Services Division, U.S. Department of State, Washington, D.C. 20520.

Secretariat Recruitment Service, United Nations, New York, N.Y. 10017.

NEWSPAPER REPORTERS

(D.O.T. 132.268)

Nature of the Work

Newspaper reporters gather information on current events and use it to write stories for publication in daily or weekly newspapers. In covering events, they may interview people, review public records, attend news events, and do research. As a rule, reporters take notes or use electronic recording devices while collecting facts, and write their stories upon return to the office. Sometimes, to meet deadlines, they telephone their information or stories to other staff members known as "rewrite men," who write or transcribe the stories for them.

Large dailies frequently assign some reporters to "beats," such as police stations or the courts, to gather news originating in these places. General assignment reporters handle various types of local news, such as a story about a lost child or an obituary of a community leader. Specialized reporters with a background in a particular subject interpret and analyze the news in fields such as medicine, politics, science, education, business, labor, and religion.

Reporters on small newspapers may cover not only all aspects of local news, but also may take photographs, write headlines, lay out pages, and write editorials. On some small weeklies, they also may solicit advertisements, sell subscriptions, and perform general office work.

Places of Employment

About 40,000 persons, two-fifths of them women, worked as newspaper reporters in 1974. The majority of reporters work for daily newspapers; others work for weekly papers and press services.

Reporters work in cities and towns of all sizes. Of the 1,775 daily and 7,650 weekly newspapers, the great majority are in medium-sized towns. However, most reporters work in cities, since big city dailies employ many reporters, whereas a smalltown paper generally employs only a few.

Training, Other Qualifications, and Advancement

Most newspapers will consider only applicants who have a college education. Graduate work is increasingly important. Many editors prefer graduates who have a degree in journalism, which usually provides a liberal arts education along with professional journalism training. Some editors consider a liberal arts degree sufficient. Others prefer applicants who have a liberal arts bachelor's degree and a master's degree in journalism. Although talented writers having little or no academic training beyond high school sometimes become reporters on city newspapers, most reporters without college training begin on rural, small-town, or suburban papers. High school courses that are useful include English, journalism, social science, and typing.

Bachelor's degree programs in journalism are available in more than 200 colleges. About three-

fourths of the courses in a typical undergraduate journalism curriculum are in liberal arts. Journalism courses include reporting, copyreading, editing, feature writing, history of journalism, law, and the relation of the press to society.

More than 500 junior colleges offer journalism programs. Twelve to fifteen hours of credit earned is transferable to most 4-year college programs in journalism. A few junior colleges also offer programs especially designed to prepare the student directly for employment as a general assignment reporter on a weekly or small daily newspaper. The Armed Forces also provide some training in journalism.

A graduate degree in journalism was offered by more than 75 schools in 1974. About one-fifth of those offer a doctoral degree in mass communications.

Persons who wish to prepare for newspaper work through a liberal arts curriculum should take English courses that include writing, as well as subjects such as sociology, political science, economics, history, psychology, and speech. Ability to read and speak a foreign language is desirable. Those who look forward to becoming technical writers or reporters in a specialized field such as science, should concentrate on course work in their subject matter areas. (See statement on Technical Writers.) Skill in typing is essential because reporters type their own news stories. On small papers, knowledge of news photography also is valuable.

The Newspaper Fund and individual newspapers offer summer internships that provide college students with an opportunity to practice the rudiments of reporting or editing. In addition, more than 2,500 journalism scholarships, fellowships, assistantships, and loans were awarded to college journalism students by universities, newspapers, and professional organizations in 1974.

News reporting involves a great deal of responsibility, since what a reporter writes frequently influences the opinion of the reading public. Reporters should be dedicated to serving the public's need for accurate and impartial news. Although reporters work as part of a team, they have an opportunity for self-expression. Important personal characteristics include a "nose for news," curiosity, persistence, initiative, resourcefulness, an accurate memory, and the physical stamina necessary for an active and often fast-paced life.

Some who compete for full-time reporter jobs find it is helpful to have had experience as a newspaper "stringer"—a part-time reporter who covers the news in a particular area of the community and is paid on the basis of the stories printed. Experience on a high school or college newspaper also is helpful in getting a job.

Many beginners start on weekly or on small daily newspapers where they acquire a broad range of reporting experience. Some college graduates are hired by large city papers as general assignment reporters while a few others start as copy editors. Beginning reporters usually are assigned duties such as reporting on civic and club meetings, summarizing speeches, writing obituaries, interviewing important visitors to the community, and covering police court proceedings. As they gain experience, they may report more important events, cover an assigned "beat," or specialize in a particular field.

Newspaper reporters may advance to reporting for larger papers or press services. Some experienced reporters become columnists, correspondents, editorial writers, editors, or top executives; these positions represent the top of the field and competition for them is keen. Other reporters transfer to related

fields such as public relations, writing for magazines, or preparing copy for radio and television news programs.

Employment Outlook

Beginners with exceptional writing talent are expected to find favorable employment opportunities through the mid-1980's. Others, however, will face strong competition for jobs, especially on large city dailies. Employment opportunities for reporters able to handle news about highly specialized scientific or technical subjects are expected to be favorable.

Weekly or daily newspapers located in small towns and suburban areas are expected to continue to offer the most opportunities for beginners entering newspaper reporting. Openings arise on these papers as reporters gain experience and move up to editing positions or transfer to reporting jobs on larger newspapers or to other types of work. Beginning reporters able to help with photography and other specialized aspects of newspaper work and who are acquainted with the community are likely to be given preference in employment on small papers.

In addition to jobs in newspaper reporting, recent college graduates who have journalism training may enter related fields such as advertising, public relations, trade and technical publishing, and radio and television. Good job opportunities also will be found in teaching journalism for those who have professional experience and at least a master's degree.

Although the broad field of mass communication should continue to expand due to rising levels of education; increasing expenditures for newspaper, radio, and television advertising; and a growing number of trade and technical journals, newspapers are not expected to share equally in this growth. As a result, employment of reporters should increase more slowly than the average for all occupations. Most job openings will continue to arise from the need to replace reporters who are promoted to editorial or administrative positions, transfer to other fields of work, retire, or leave the profession for other reasons.

Earnings and Working Conditions

Reporters working for daily newspapers having contracts negotiated by The Newspaper Guild had average starting salaries of $8,750 in late 1974. In general, earnings of newspaper reporters in 1974 were above average earnings received by nonsupervisory workers in private industry, except farming.

Minimum salaries of reporters having 4 or 5 years of experience who worked for daily newspapers with Guild contracts averaged $14,265 in 1974. The minimums ranged from $9,100, paid by the smallest dailies, to more than $22,000 paid by the largest. Many reporters, however, were paid salaries higher than these minimums. Reporters working for national wire services received annual salaries of at least $14,000.

Most newspaper reporters generally work a 5-day, 35- or 40-hour week. Reporters working for morning papers usually start work in the late afternoon and finish at about midnight. Most reporters also receive benefits such as paid vacations, group insurance, and pension plans.

Sources of Additional Information

Information about opportunities for reporters with daily newspapers is available from:

American Newspaper Publishers Association Foundation, P.O. Box 17407, Dulles International Airport, Washington, D.C. 20041.

For information on opportunities in the newspaper field and starting salaries of journalism graduates, as well as a list of journalism scholarships, fellowships, assistantships, and loans available at colleges and universities, write to:

The Newspaper Fund, Inc., Box 300, Princeton, N.J. 08540.

Information on union wage rates is available from:

The Newspaper Guild, Research and Information Department, 1125 15th St. NW., Washington, D.C. 20005.

For general information about careers in journalism contact:

American Council on Education for Journalism, School of Journalism, University of Missouri, Columbia, Mo. 65201.

Association For Education in Journalism, Murphy Hall, University of Minnesota, Minneapolis, Minn. 55455.

The Society of Professional Journalists, Sigma Delta Chi, 35 East Wacker Dr., Chicago, Ill. 60601.

Information on the opportunities for women in newspaper reporting and other communications fields is available from:

Women In Communications, Inc., 8305 A Shoal Creek Blvd., Austin, Tex. 78758.

Names and locations of daily newspapers and a list of schools and departments of journalism are published in the *Editor and Publisher International Year Book*, available in public libraries and in most large newspaper offices.

RADIO AND TELEVISION ANNOUNCERS

(D.O.T. 159.148)

Nature of the Work

Most radio announcers act as disc jockeys, introducing recorded music, presenting news and commercials, and commenting on other matters of interest to the audience. They may "ad-lib" much of the commentary, working without a detailed script. They also may operate the control board, sell time for commercials, and write commercial and news copy. In large sta-

tions, however, other workers handle these jobs. (See statement on radio and television broadcasting occupations elsewhere in the *Handbook.*)

Announcers employed by television stations and large radio stations usually specialize in particular kinds of announcing such as sports, news, or weather. They must be thoroughly familiar with their areas of specialization. If a written script is needed for parts of the program, the announcer may do the research and writing. Announcers frequently participate in community activities. A sportscaster, for example, might be the master of ceremonies at a touchdown club banquet or greet customers at the opening of a new sporting goods store. Some announcers become well-known and highly paid personalities.

Places of Employment

About 19,000 staff announcers were employed full time by commercial radio and television broadcasting stations in 1974. More than 80 percent of them worked in radio broadcasting. The average commercial radio or television station employed three announcers, although larger stations sometimes employed six or more. In addition to staff announcers, several thousand freelance announcers sell their services for individual assignments to networks and stations, or to advertising agencies and other independent producers.

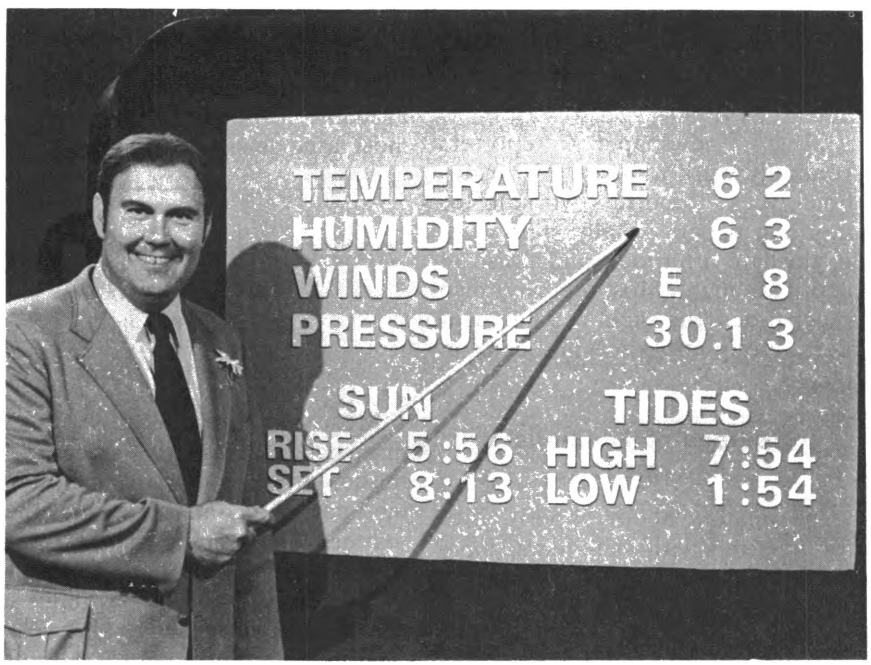
Training, Other Qualifications, and Advancement

Announcers must have a pleasant and well-controlled voice, a good sense of timing, and excellent pronunciation. Correct English usage and a knowledge of dramatics, sports, music, and current events improve chances for success. The most successful announcers have a combination of personality and a knack for dramatization that makes them attractive to audiences.

High school courses in English, public speaking, dramatics, foreign languages, and electronics, plus sports and music hobbies, are valuable background for prospective announcers. A college liberal arts education provides an excellent background for an announcer, and many universities offer courses of study in the broadcasting field. Students at these institutions also may gain valuable experience by supplementing their courses with part-time work at the campus radio station and summer work at local stations, filling in for vacationing staff members. A number of private vocational schools also offer training in announcing. However, those considering training at such a school should contact the personnel managers of stations and broadcasting trade organizations in their area to determine the school's performance in producing suitably trained candidates.

Most announcers get their first broadcasting jobs in small stations. Because announcers in small radio stations sometimes operate transmitters, prospective announcers often obtain an FCC Radiotelephone Third Class Operator License which enables them to operate a radio transmitter and, therefore, makes them much more useful to these stations. (For information on how to obtain a license, see the statement on broadcast technicians elsewhere in the *Handbook.*)

Announcers usually work in several different stations in the course of their careers. After acquiring experience at a station in a small community, an ambitious and talented announcer may move to a better paying job in a large city. An announcer also may advance by getting a regular program as a disc jockey, sportscaster, or other specialist. In the national networks, competition for jobs is intense, and announcers usually must be college graduates and have several years of successful announcing experience before they are given an audition.



Successful announcers have a personality which makes them attractive to audiences.

Employment Outlook

The employment of announcers

is expected to increase about as fast as the average for all occupations through the mid-1980's as new radio and television stations are licensed. Employment growth, however, will be limited by the increased use of automatic programming. Most job openings in this relatively small occupation will result from the need to replace experienced announcers who transfer to other occupations, retire, or die.

It will be easier to get an entry job in radio than in television because of the greater number of radio stations that hire beginners. These jobs generally will be located in small stations, and the pay will be relatively low. A few jobs also will become available as more cable television stations begin their own programming. However, the great attraction of the broadcasting field for young persons, and its relatively small size, will result in keen competition for entry jobs.

Earnings and Working Conditions

Salaries of beginning announcers in commercial television ranged from about $160 to $200 a week in 1974, and those of experienced announcers ranged from about $225 to $350, according to information from union contracts. Many well-known announcers earn much more. As a rule, salaries increase with the size of the community and the station, and salaries in television are higher than those in radio. Announcers employed by educational broadcasting stations generally earn less than those who work for commercial stations.

Most announcers in large stations work a 40-hour week and receive overtime pay for work beyond 40 hours. In small stations, many announcers work 4 to 12 hours of overtime each week. Working hours consist of both time on the air and time spent in preparing for broadcasts. Evening, night, weekend, and holiday duty occurs frequently since many stations broadcast 24 hours a day, 7 days a week.

Working conditions are usually pleasant because of the variety of work and the many personal contacts that are part of the job. Announcers also receive some satisfaction from becoming well known in the area their station serves.

Sources of Additional Information

For general career information, write to:

National Association of Broadcasters, 1771 N St. NW., Washington, D.C. 20036.

Corporation for Public Broadcasting, 888 16th St. NW., Washington, D.C. 20006.

TECHNICAL WRITERS

(D.O.T. 139.288)

Nature of the Work

Technical writers organize, write, and edit materials about science and technology in order to establish clearer communication between those who develop information—scientists, engineers, and design technicians—and the users of their information—operators, repairers, scientists, engineers, executives, or consumers. Their writing must always be clear and easy to follow, and when it is to be used by specialists it often must include technical detail and a highly specialized vocabulary. Technical writers usually arrange for the preparation of tables, charts, illustrations, and other artwork, and may work with technical illustrators, drafters, or photographers.

Before starting a writing assignment, technical writers usually learn as much as they can about their 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 they prepare a rough draft that may be revised several times before it is accepted in final form.

The technical writer's product takes many forms—publicity releases on a company's scientific or technical achievements, manufacturers' contract proposals to government agencies, manuals that explain how to operate, assemble, disassemble, maintain, or overhaul components of a missile system or a home appliance, or articles for scientific and engineering periodicals or popular magazines.

Places of Employment

An estimated 20,000 technical writers and editors—about one-fifth women—were employed in 1974. Many technical writers are employed in the electronic and aerospace industries. Some work for research and development firms or for the Federal Government—mainly in the Departments of Defense and Agriculture, the Energy Research and Development Administration, and the National Aeronautics and Space Administration. Others work in firms that specialize in technical writing. A few are in business for themselves as freelance technical writers.

Technical writers are employed all over the country but the largest concentrations are in the Northeastern States, Texas, and California.

Training, Other Qualifications, and Advancement

Although there are no prescribed requirements for entry into the technical writing field, a combination of technical experience and writing ability will generally qualify a person to work as a technical writer.

While a college background is helpful and sometimes necessary, most technical writers do not enter

Technical writers discuss specifications of fighter plane component to be included in technical manual.

the occupation as recent college graduates. The majority, whatever their level of educational attainment, work initially as technicians, scientists, or engineers. In time, usually as a part of their technical assignment, they assume some writing duties, and develop technical communication skills. Eventually they decide to work entirely in technical writing.

Some employers, however, demand a 4-year college education. Many prefer the applicant to have a degree in science or engineering, with a strong background in English, while others emphasize writing ability.

In 1974, 12 colleges and universities offered 4-year programs leading to a bachelor's degree in technical writing, technical communication, or technical journalism; three schools offered graduate work and degrees in the field. More than 400 4-year colleges offered at least one course in technical writing as part of the regular curriculum. Almost all colleges, and some engineering schools, offer English courses to sharpen writing skills, and some conduct summer workshops and short-term seminars for technical writers.

Besides having writing skills, technical writers should be able to think logically, understand scientific and technical concepts, and do detailed and accurate work. They should be able to work and talk easily with others since they often work as part of a team. At other times, however, technical writers must work alone with little or no supervision, so they must be able to accept responsibility and exercise initiative.

Beginners often assist experienced technical writers by doing library research, and by preparing drafts of reports. Experienced writers in organizations that have large technical writing staffs may advance to technical editor or other supervisory and administrative positions. After gaining experience and contacts, a few go into business for themselves. 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

Employment of technical writers is expected to increase about as fast as the average for all occupations through the mid-1980's. In addition to openings due to growth, opportunities will result from the need to replace those who die, retire, or transfer to other occupations. Employment opportunities will be best for experienced technical writers and for beginners who have good writing ability and the appropriate technical education. Those with only minimum qualifications, however, may face stiff competition for beginning jobs.

Requirements for technical writers are expected to increase because of the need to put the growing amount of scientific and technical information into language that can be understood by managers for decisionmaking and by technicians for operating and maintaining complex industrial equipment. Since many products will continue to be assembled from components manufactured by different companies, technical writers also will be needed to describe, in simple terms, how the components fit together. Others will be needed to improve and simplify operating and maintenance instructions for consumer products.

However, since many technical writers work in defense- and space-

related activities, including research and development, future job opportunities are related to government expenditures in these areas. Through the mid-1980's, R & D expenditures of Government and industry are expected to increase, although at a slower rate than during the 1960's.

Technical writers, as discussed in this statement, include only those persons whose primary job is to write about, interpret and edit technical subject matter. Those primarily employed as scientists, engineers or other technical specialists who may do a considerable amount of writing are not covered here. As technology becomes increasingly complex, more writing assignments may require technical and scientific knowledge equivalent to that of an engineer or scientist.

Technical writers who have training in journalism may find opportunities in other fields that employ writers such as advertising, public relations, trade publishing, and television and radio broadcasting.

Earnings and Working Conditions

Technical writers have high earnings compared with average earnings for nonsupervisory workers in private industry, except farming. Salaries of technical writers depend not only on ability, education, and experience, but also on the type, size, and location of their employing firm.

Starting salaries in 1974 ranged from about $7,000 a year for those with minimal qualifications to over $15,000 a year for those with technical experience and college education. Experienced technical writers average around $17,500 a year, while those in supervisory positions earned $20,000 or more.

Earnings of freelance writers vary greatly and depend on the writer's ability and reputation.

In the Federal Government in late 1974, inexperienced technical writers with a bachelor's degree and about five science courses could start at either $8,500 or $10,520 a year, depending on their college grades. Those with 2 years of experience could start at $12,841 and with 3 years of experience, $15,481.

Technical writers generally work in clean well-lighted places, though they may work under considerable pressure, frequently working overtime when a publication deadline has to be met.

Sources of Additional Information

For information about careers in technical writing, contact:

Society for Technical Communication, Inc., Suite 421, 1010 Vermont Ave. NW., Washington D.C. 20005.

THE OUTLOOK FOR INDUSTRIES

AGRICULTURE

Agriculture—broadly defined—is a genuine growth industry. It has become a vast and vital industry that reaches into all levels of society and into dozens of other industries and professions. It employs millions of persons—both professional and nonprofessional. For several decades, U.S. agriculture has been immersed in a technological revolution which has had a tremendous impact on the industry's labor force—both in numbers and composition. Agriculture, or agribusiness as it is more commonly referred to today, is a multifaceted complex that produces food and fiber and then assembles, processes, stores, transports, and markets it to meet ever-growing demands. Consumers now insist upon more attractively packaged and ready-to-cook foods. They also demand that it be available all year. Thus, science and business are as much a part of agriculture today as is farming. As a result, employment needs in agribusiness have changed significantly and will continue to change.

Tomorrow's agriculture and related natural resource management areas are expected to be more dynamic. They will offer many more and diverse kinds of employment opportunities. In addition, the U.S. Department of Agriculture has many diverse services organized to help increase the productivity of agriculture, to regulate practices, to protect the environment and the consumer, and to expand research and educational programs.

The ever-increasing technology has decreased the need for nonprofessional workers (farm or agribusiness laborers) while simultaneously increasing the need for professional workers (college-trained personnel). Present trends are expected to be amplified in the decades ahead. Enrollment in the 70 Land-Grant Colleges of Agriculture and Natural Resources increased from 35,000 in 1963 to 82,000 in 1974. A recent report showed an additional 33,000 agricultural students currently enrolled in the many non-land-grant 2- and 4-year colleges. Increased demand for food and fiber and continued public concern about the quality of the environment, proper management of our renewable natural resources, and consumer protection issues will cause these upward trends in college enrollment in agriculture and related fields to continue.

Opportunities on Farms

In brief, fewer farmers and farm workers will be needed to produce America's food and fiber products. For instance, in 1950 the average farmer could produce enough food and fiber for about 16 other persons. Today, each farmer feeds and clothes 53 other persons. By 1980, it is expected that each farmer will be able to produce enough for 65 persons.

Employment on U.S. farms and ranches has declined from 7.2 million in 1950 to nearly 3.5 million in 1974. By 1985, with a continued increase in size of farms and greater use of power and machinery, there are expected to be 2 million farm workers. Farm output has increased by 52 percent since 1950. This was accomplished with 17 percent fewer crop acres.

This phenomenal increase in farm productivity was accomplished by significantly increased use of farm power, machinery and equipment, higher application of fertilizers and other agrichemicals, improved crop varieties and strains of livestock, and improved farming practices in general. Farms increased in size and considerably more total capital is required of each farm operator. (See accompanying table.)

Management is the key to success in modern farming. Today's farmers need a much higher level of knowledge and skills than did their predecessors. For example, the dairy farmer used to feed each cow an amount of grain based on the amount of milk she had produced the previous day or week. Modern dairy farmers feed their cows on the basis of their potential—"pushing" potential high-performance cows to their limits, cutting back on expensive feed for cows that already have peaked out. Figuring the potential is a much more difficult technique than weighing milk.

The need for better trained farm operators and farm workers will increase as farming becomes more scientific. The knowledge and capital required to start farming a generation ago is no longer adequate. College training is becoming the rule rather than the exception for young "commercial" farmers. It gives them the technical basis that they need to keep up with new developments in research and technology and to apply them intelligently on their own farms. Biology, engineering, chemistry, and agronomy—not to mention economics, marketing, and accounting—are part of the necessary kit of tools for a successful farmer today.

Capital requirements are another obstacle the beginning farmer must overcome. It was estimated that the average commercial farm in 1974 had 470 acres, with a value of more than $190,000 in real estate,

livestock, crops, and equipment. Regionally, the estimated value of commercial farms varied from an average of $70,000 in Appalachia to $475,000 in the Pacific region.

For the person who has the training, the capital, and the management ability, the modern farm can offer much higher incomes than the old-style farm. Nevertheless, while agriculture production will still offer challenging and rewarding careers with larger incomes and better living conditions than it used to, it will offer them to fewer and fewer people.

Opportunities of Specific Types of Farms

Although the number of farms and farm jobs is decreasing, some desirable and rewarding opportunities remain in agriculture. The decision to enter farming may be made simply because an opening exists on the family farm or on a farm nearby. To be successful, however, young people should know the requirements of the specific type of farm operation they wish to enter. They should take into consideration their aptitudes, interests, preferences, experience, knowledge, and skills in directing labor and handling livestock and machinery. Young people also must consider family labor supply and financial resources, as the labor and capital requirements for an operation of adequate size vary widely from one type of farm to another.

A realistic decision to go into farming can be made only in terms of a particular area or community. This section evaluates, from an occupational standpoint, some of the more common types of farms. The accompanying table gives illustrative data on size of farm, capital requirements, and net farm incomes received by operators of typical or representative farms in various parts of the country. Many farms are larger than these and offer more return than is shown here. Some are smaller and offer the operators little income or opportunity to improve their status without major changes. On most of the farms, the major part of the work is done by the farm operators and their families. Whereas some of the smaller farms hire workers only during the peak labor season, large ones often use hired labor the whole year.

Table 1. Average size of farm by product and location, capital invested, and net farm income on commercial farms, 1974

Type of farms and location	Size of farm as measured by	Land and buildings	Capital invested in—			Net farm income
			Machinery and equipment	Livestock	Crops	Total	
Dairy farms:							
Central New York	40 milk cows	$61,200	$25,347	$23,547	$16,764	$126,855	$15,364
Southeastern Wisconsin	40 milk cows	120,212	26,593	25,436	18,352	190,593	19,857
Egg-producing farms, New Jersey	5,550 layer chickens	66,280	3,655	9,596	0	79,531	6,043
Broiler farms, Georgia	44,600 produced annually	33,109	6,615	991	330	41,045	2,663
Corn Belt farms:							
Hog-beef feeding	280 acres of cropland	226,440	28,119	49,536	43,302	347,397	14,749
Cash grain crop	375 acres of cropland	428,400	45,526	0	6,186	480,112	30,423
Cotton farms							
Mississippi Delta	900 acres of cropland	694,237	102,367	0	0	796,604	100,017
Southern High Plains, Texas:							
Irrigated	870 acres of cropland	632,961	54,899	0	0	687,860	73,412
Nonirrigated	860 acres of cropland	296,437	21,558	0	0	317,995	66,810
Tobacco farms, Coastal Plain, North Carolina	50 acres of cropland	67,106	7,391	783	1,423	76,703	7,837
Tobacco-livestock farms, Bluegrass area, Kentucky	64 acres of cropland	188,190	9,400	12,119	4,722	214,431	14,950
Wheat-fallow farms:							
Northern Plains	1,800 acres of cropland	303,705	53,560	0	0	357,265	30,694
Central Plains	1,800 acres of cropland	379,440	53,560	0	0	433,000	63,334
Pacific Northwest	1,800 acres of cropland	548,505	66,950	0	0	615,455	69,484
Cattle ranches							
Northern Plains	307 beef cows	513,254	27,677	107,896	10,661	659,488	34,714
Northern Rocky Mountain	314 beef cows	342,491	26,271	100,616	20,702	490,080	34,272
Southwest	278 beef cows	678,356	16,416	91,434	0	786,206	11,319
Migratory-Sheep Ranches, Utah-Nevada	2,025 breeding ewes	205,571	20,286	91,757	2,846	320,460	27,163

[1] The information presented here is on an owner-operated basis, primarily for comparability between types of farm. Net farm income is the combined return to total capital plus return to operator and other unpaid members of the family for their labor and management. No allowance has been made for payment of rent, interest, or mortgage.

SOURCE: Prepared in the Commodity Economics Division, Economic Research Division, U.S. Department of Agriculture.

The figures in the table on capital invested mean that the operator controls or uses resources valued at that amount. Many farmers supplement their own capital with borrowed funds; others rent part or all of the land they use, thus reserving more of their funds for the purchase of livestock, feed, machinery, and equipment. Still others have partners who provide most of the working capital. For example, many farmers who raise broilers are in partnership with a feed dealer.

No brief general statement can be made about specialization versus diversification in farming operations that would apply in all parts of the country. The general trend favors more specialized farming. Farms that produced many products a generation ago now may produce only two or three. Efficient production of most farm products requires a substantial investment in specialized equipment. To receive the full benefit from this investment, the farmer must produce on a large scale. Two other factors contributing to specialization are the increased emphasis on quality of farm products, and the greater knowledge and skill required for effective production. Few farmers, however, find it advantageous to produce only one product. The main reasons for producing more than one product are the desirability of spreading risk, the more effective use of labor (particularly family labor), and the fuller utilization of most other resources than can be realized in a one-product system.

Dairy Farms

While dairy farms are located throughout the country, their greatest concentration is near large population centers. There is work to be done every day thoughout the year on dairy farms, and they tend to be family operations. However, some farms are large enough so that more than one worker is required to handle the chores and equipment. In this way, the work can be divided up to allow some workers to take a day off.

Dairy farmers who produce their own feed have a variety of jobs to accomplish. Dairy herds are decreasing in number, but are becoming larger and more productive each year. Income from dairying is distributed somewhat evenly throughout the year.

Livestock Farms (Other Than Dairy and Poultry)

A livestock farm may handle only beef, swine, sheep, or horses. But it also may combine all of these enterprises. Persons who like livestock and who have developed some skills and knowledge about them and the mechanical equipment necessary for handling these farms can find livestock production rewarding and profitable. Farm chores tend to be more flexible than on dairy farms. Most labor tends to be family labor.

Various systems of livestock production allow for some specialization so that the system can fit the size of farm, the types of feed production available locally, and the needs of consumers. Incomes on livestock farms tend to be variable, and risks are quite high. Capital investments in housing and livestock can be considerable. Ability to understand the markets and to adjust management practices to changing costs and prices is the key to success in livestock production.

Poultry Farms

Poultry farms concentrate on egg production or on the production of broilers. Poultry farmers do not raise their own feed. They purchase feeds which are suited to their specific purposes. As in many farming enterprises, poultry farming requires specialized skill. The handling of the birds and of the mechanical feeding equipment requires specialized knowledge but usually not much physical strength. Poultry farms often make considerable use of family help.

Poultry farmers often experience sharp year-to-year fluctuations in income. These operations have high cash costs and thin profit margins. Many broiler producers have contracts with a financing agency such as a feed dealer, so that the profit margin can be somewhat dependable.

Cash Grain Farms

The production of corn, wheat, grain sorghums, and other grains requires the use of tractors, farm machinery, and equipment. For many of these farms the work requirements are seasonal. That is, during the soil preparation, planting, and harvesting times the farm operators are very busy. During other seasons and in slack periods the farmer often will seek employment off the farm.

Knowledge of farm machinery, seed bed preparation, varieties, planting times, depths, as well as methods of weed, insect, and disease control are required if producers are to be successful. Cash grain farmers are subject to major risks due both to weather and prices for their grains. This is particularly true for specialized crop farmers. Investments in land, power, and equipment on the usually large acreage can be very high. Thus, total risk is very high and management is critical.

Cotton, Tobacco, and Peanut Farms

Cotton, tobacco, and peanuts are grown on farms of varying size, depending upon the region. As in many other products, growers have been forced to enlarge their acreage and often to diversify. Still many farms are small and are part-time farming operations.

Some of the cotton farms, particularly in the West and Southwest, have gone under irrigation. Other

such farms in the Southeast have added beef cattle or poultry to their farming operations. Prices of these crops are usually government supported, so price risks tend to be less than for other cash-grain farms.

Specialty Crop Farms

Specialty crop farms may produce potatoes, grapes, oranges, sugar cane, melons, broomcorn, popcorn, or a combination of these and other specialty crops. These farms exist because of the demand for the product and because of the unique background, skills, and resources which a farmer has for this kind of production. These enterprises often require seasonal workers and relatively expensive specialized equipment. These producers need specific skills which may be obtained through experience or through special training.

Profits from specialty farms usually vary greatly from year-to-year. Specialty crop farmers usually study the demand picture well and make adjustments so that the particular operation will produce according to the effective demand.

Private Outdoor Recreation Farms

Since the demand for outdoor recreation facilities exceeds the supply, many farm operators in the vicinity of national, State, and local parks, or near wildlife preserves, have taken advantage of their location to establish recreation businesses. These farmers sell hunting or fishing rights to individuals, form hunting clubs, or establish private campgrounds. Some will enlarge or improve their farm ponds or irrigation reservoirs which they then stock with fish or make available for swimming and boating. Old farm buildings, sheds, and barns may be converted into riding stables or horse boarding stables. In making these facilities available, many farmers have converted a liability into an asset. Such farmers only represent 1 percent of all farms in the United States, but their numbers are increasing. The average amount reported earned from such recreation activity was about $1,630 per farm. For persons with recreational interests in favored locations, this type of supplemental recreational enterprise can add substantially to farm income.

Other Specialty Farms

Agriculture also includes such specialized areas as nurseries, greenhouses, honey bees, fur farms, and riding stables. For many of these, special knowledge and skilled management are required. Risks are high—but, for persons who have the abilities and the resources, these ventures are often profitable and rewarding.

Training Opportunities Available for Farm Production Jobs

A good initial background in farming can be obtained by growing up on a successful farm. Necessary experience also may be gained by working as a closely supervised tenant or hired worker on a successful farm. In addition, college training in agriculture and agricultural business management is of sustantial value to the modern farmer.

Several types of vocational training are available under federally assisted programs. Training is offered in the following ways:

1. High school courses in agriculture.
2. Short courses for young farmers at colleges of agriculture, including intensive training in farm planning, farm structures, construction, welding and related shop and repair work, as well as instruction in crop production, livestock feeding and management, recordkeeping, and other aspects of farming.
3. Adult evening classes (or day classes in off-seasons) that provide intensive instruction in subjects such as land and soil management, crop and livestock production, new technology and equipment, and financial management.

Opportunities in Off-Farm Agribusinesses

The same technological revolution that hit the farm sector simultaneously extended itself into the off-farm agribusiness sector, altering farm product assembling, processing and handling practices. It changed the organizational structure of both the farm and off-farm sectors of today's modern agriculture. These technologies significantly increased the capital requirements of the off-farm sector. It also called for much greater managerial and technical knowledge and skills on the part of both professional and nonprofessional workers in the total agricultural complex. As a result, the number and kinds of personnel needed in the off-farm agribusiness labor force have changed significantly over the past three decades and they are likely to continue to change.

For example, as farms increase in size, more and more custom services will be used by farm operators. Operating this custom equipment will require special training and skills. Thus, there will continue to be a wide range of occupations which require technical knowledge below that required at the 4-year college level. Many 2-year community-junior colleges and vocational and technical schools now provide excellent training to meet these needs. Examples of such jobs include assistant feedlot managers, feed mill supervisors, general farm and ranch managers, irrigation system servicers, farm service center assistant managers, fertilizer and pesticide applicators, farm welders, petroleum distributors, diesel mechanics, agricultural accountants, elevator operators, fertilizer bulk blending plant assistant managers, and artificial inseminators.

Persons with 4-year bachelor's

degrees in agriculture will be increasingly needed in the off-farm agribusiness professional occupations. Nearly one-half of 4-year agriculture college graduates are now employed in off-farm positions in agribusiness. They have taken jobs such as sales and technical service center managers with agricultural supply firms selling feed, seed, fertilizer, agrichemicals, power, machinery, equipment and farm building supplies.

Others have taken jobs as buyers for meatpackers and other food processors; in advertising and public relations work; in management positions with agricultural product assembly, storage, processing and marketing firms operating in both the United States and abroad. Some take jobs with farm cooperatives, food chains, dairy product distributors, and farm credit agencies. Others work as agricultural consultants, economic analysts, field contractors, agricultural attaches, insurance specialists, farm appraisers, agrichemical applicators, inspectors of food processing plants, landscape architects, farm magazine writers, farm radio and TV broadcasters, and meat and grain inspectors and graders.

Occupations in the Public Sector of Agriculture

The public service sector of agriculture provides employment opportunities for College of Agriculture bachelor's degree graduates in positions as soil conservationists, vocational agriculture teachers, county extension directors, 4-H agents, rural and community planners, Farm and Home Administration supervisors, Department of Agriculture inspectors, Crop and Livestock Reporting Service employees, Peace Corps workers, vocational technical school teachers, agricultural market reporters, and agricultural attaches.

Those having advanced degrees in agriculture (master's and Ph. D. degrees) qualify for positions as educators, industry research and development scientists, agribusiness managers and upper level administrators, veterinarians, and researchers or administrators with governmental agencies such as the U.S. Department of Agriculture. In addtion to the governmental agencies, numerous private foundations also employ agricultural scientists, technicians, and administrators. (For more detail, see section on agriculture-related professional occupations.)

Occupations in Renewable Natural Resource Management

Proper management of our renewable natural resources is a national obligation. It involves the wise use of land and forests, water and minerals, and fish and wildlife. It involves preserving parks and other natural recreation areas (including unspoiled wilderness, virgin prairies, and scenic riverways).

Soil must be managed; timber must be used wisely; wildlife must be protected; water must be conserved and protected from pollution. Land-use planning is becoming more important as public pressures build both to protect our farm land to produce more food and fiber and to devote more land to highways, urban development, mining and quarrying, lumbering, and recreation. People with more leisure time are voting for more park facilities and lakes, planned recreation programs, camping sites, hunting preserves, fishing facilities, and areas for water sports and nature studies.

Therefore, many opportunities are available for persons holding degrees from colleges of agriculture and natural resources (Forestry) in such curriculums as: Natural resource management, wildlife conservation, forestry, wood science and technology, environmental biology, fisheries biology, landscape architecture, horticulture, urban and regional planning, urban forestry, soil and water conservation, crop protection, pest management, park and recreational area management, land-use planning, and range management. Many of these are relatively new college degree curriculums, brought on by greater public concern for proper management of the Nation's renewable natural resources and pressures to provide facilities for use of leisure time.

People trained in the above curriculums take jobs as park and recreation area managers, park rangers, regional park supervisors, outdoor recreation specialists, private recreation firm managers, soil and water conservationists, wildlife managers, foresters, forestry technicians, environmental biologists, range managers, fishery biologists, and land-use planners. (See the statement on Conservation Occupations elsewhere in the *Handbook*.) Some work in urban agriculture—parks, zoos, botanical gardens, golf courses, open areas, and landscaping; and in city and county planning.

Sources of Additional Information

The most significant sources of information and guidance available to farmers are the services provided by the land-grant colleges and universities and the U.S. Department of Agriculture, Washington, D.C. 20250. These services include research, publication, teaching, and extension work. The county agricultural agent is often the best contact for the young person seeking advice and assistance in farming. The Farmers' Home Administration system of supervised credit is one example of credit facilities combined with a form of extension teaching. Organized groups, such as the Future Farmers of America and

the 4-H Clubs, also furnish valuable training to young farm people.

For information about opportunities in off-farm activities, contact individual colleges of agriculture or the U.S. Department of Agriculture, Washington, D.C. 20250.

AGRICULTURE-RELATED PROFESSIONAL OCCUPATIONS

Nature of the Work

The discussion that follows deals primarily with job categories that are generally termed professional fields. These occupations usually require at least a bachelor's degree, and master's and Ph. D. degrees are becoming increasingly necessary. Some of these jobs are discussed more fully elsewhere in the *Handbook*. (See index.)

Agricultural economists (D.O.T. 050.088) deal with problems related to production, financing, pricing, and marketing of farm products both in the United States and in foreign countries. These economists are factfinders, evaluators, analysts, and interpreters who provide economic information to farmers, agri-business firms, policymakers, consumers, and other interested persons. They provide cost-benefit analyses for evaluating farm programs at the National, State, and farm level. They study the effects of mechanization, technological advances, and other developments that influence the supply of and demand for farm products and the accompanying effects on costs and prices of farm products.

Agricultural engineers (D.O.T. 013.081) develop new and improved farm machines and equipment; deal with the physical aspects of soil and water problems in farming; design and supervise installation of systems for irrigation, watershed protection and flood prevention; devise new techniques for harvesting and processing farm products; and design more efficient farm buildings.

Agronomists (D.O.T. 040.081) are concerned with growing, breeding, and improving field crops such as cereals and grains, legumes and grasses, tobacco, cotton, and others. They do research also in the fundamental principles of plant sciences.

Animal physiologists (D.O.T. 041.081) study the functions of the animal body and any of its parts.

Animal scientists (D.O.T. 040.081) deal with production and management of farm animals. They are concerned with genetics, nutrition, breeding, physiology, environment, and animal health.

Veterinarians (D.O.T. 073.081) inspect livestock at public stockyards and points of entry into the United States; inspect establishments that produce veterinary biological supplies; administer tests for animal diseases; conduct programs for the control and eradication of animal disease; conduct research on livestock diseases and vaccines for disease control; work directly with farmers in protection or restoration of livestock health; and provide services for the health and care of small animals and pets.

Geneticists (D.O.T. 041.081) try to develop strains, varieties, breeds, and hybrids of plants and animals that are better suited than those presently available for the production of food and fiber.

Microbiologists (D.O.T. 041.081) study bacteria and the relation of other microorganisms to human, plant, and animal health and the function of these microorganisms in the making of products such as vitamins, antibiotics, amino acids, grain alcohol, sugars, and polymers.

Plant scientists (D.O.T. 041.081) study plant diseases and their nature, causes, and methods of control. They also study the structure of plants and the growth-related factors in plants. Methods of improving fruits, vegetables, flowers, and ornamental plants are also of major concern.

Plant quarantine and *plant pest control inspectors* (D.O.T. 041.081), who are trained in the biological sciences, supervise and perform professional and scientific work in enforcing plant quarantine and pest control laws. Plant quarantine inspectors inspect ships, planes, trucks, and autos coming into the country to keep out dangerous insect pests. Plant pest control inspectors conduct programs to protect the crops of the country by prompt detection, control, and eradication of plant pests.

Entomologists (D.O.T. 041.081) study insects both beneficial and harmful. They identify the populations and distributions of insects that injure growing crops and animals; that harm human beings; and that damage agricultural commodities during shipping, storage, processing, and distribution. Their research is directed toward finding means by which these harmful insects may be controlled, and desirable insects managed to increase their impact on pests.

Foresters (D.O.T. 040.081) are concerned with the protection, production, processing, and distribution of our timber resources. They also study means by which wood may be seasoned, preserved, and given new properties.

Human nutritionists (D.O.T. 077.128) are concerned with the science of food, nutrients, and other substances; their action, interaction, and balance in relation to health and disease; and the means by which the body utilizes these substances. They also study certain social, economic, cultural, and physiological implications of food and eating.

Rural sociologists (D.O.T. 054.088) study the structure and functions of the social institutions (customs, practices, and laws) that are a part of rural society or affect it.

School teachers (D.O.T. 091.228) in vocational agriculture and related fields supervise and give instruction in farm management, agricultural production, agricultural supplies and services, operation and repair of farm equipment and structures, inspection and processing of farm products, ornamental horticulture, conservation of natural resources, and uses of forests.

Farm managers, including agriculture management specialists, supervise and coordinate the production, marketing, and purchasing and credit activities of one farm or a group of farms.

Places of Employment

Government agencies, colleges, and agricultural experiment stations hire many agricultural research workers. They also hire people to take technical and administrative responsibilities in programs involving or affecting farmers such as the production, processing, marketing, inspection, and grading of farm products; prevention and spread of plant pests, animal parasites, and diseases; and management and control of wildlife.

States, counties, and municipalities hire many who serve as vocational agriculture teachers. Through a nationwide, federally aided program, teachers of vocational agriculture not only teach high school students interested in farming, but also provide organized instruction for adult farmers, giving individual consultation at their farms to keep them abreast of modern farm technology.

Agribusinesses, farmer cooperatives, and commercial and financial companies that buy from, sell to, or serve farmers also employ many professionals with agriculture-related training, as do farmers' organizations or trade associations whose members deal with farmers. Such companies and organizations tend to be located either in industrial centers or in areas of high agricultural activity, and include producers of feed, seed, fertilizer, and farm equipment; and of insecticides, herbicides, and other chemical dusts and sprays. Employment in these organizations may be expected to expand, as farmers rely increasingly on them to provide farm supplies, machinery, equipment, and services, and to market farm products. The size of the organization and the types of services it offers determine the number of its employees and the nature of their jobs. Large farm supply cooperatives and businesses, for example, may have separate divisions for feed, seed, fertilizer, petroleum, chemicals, farm machinery, public relations, and credit, each supervised by a department head. In smaller businesses and cooperatives, such as local grain-marketing elevators, the business is run almost entirely by the general manager who has only two or three helpers.

Research activities related to agriculture have grown very rapidly. The largest agencies in this field are the State agricultural experiment stations connected with the land-grant colleges and the various research branches of the U.S. Department of Agriculture. The U.S. Department of Agriculture employs workers in research positions in various parts of the country: in Washington, D.C.; at the Agricultural Research Center at Beltsville, Md.; and at land-grant colleges. Other Government departments also have many agricultural research jobs.

Public and private lending institutions which make loans to farmers employ people with broad training in agriculture and business. These workers ordinarily are required to have had practical farm experience, as well as academic training in agriculture, economics, and other subjects. Making financially sound loans involves careful analysis of the farm business and proper evaluation of farm real estate and other farm property. These workers are employed by the Cooperative Farm Credit Administration in its banks and in associations operating under its supervision throughout the country; by the Farmers Home Administration in its Washington, D.C. office, and in State and county offices throughout the country; by rural banks; and by insurance companies that have substantial investments in farm mortgages.

Agricultural communications is another expanding area of specialization. Crop reporters and market news reporters are employed by the U.S. Department of Agriculture in field offices throughout the United States. Crop reporters gather information on crop production during all stages of the growing season. Market news reporters collect information on the movement of agricultural produce from the farm to the market. Radio and TV farm directors are employed by many radio and TV stations to report prices, sales, grades, and other agricultural information to farm residents. Agricultural reporters and editors compile farm news and data for farm journals, bulletins, and broadcasts.

The qualifications of workers in all of these fields ordinarily include a college education and special training in a particular line of work. In most of these fields, the demand for workers exceeds the supply. In recent years, the demand has increased because of the need to recruit professional personnel to staff agricultural missions to other countries and to give technical aid to agricultural institutions and farmers there.

Sources of Additional Information

Opportunities in Research. Additional information on research opportunities at land-grant colleges may be obtained from the dean of agriculture at the State land-grant

college. Information on employment in the U.S. Department of Agriculture is available from the USDA recruitment representatives at land-grant colleges and from the Office of Personnel, U.S. Department of Agriculture, Washington, D.C. 20250.

The following publication will be valuable:

Careers in Agriculture and Natural Resources—Agriculture. American Association of Land-Grant Colleges and State Universities, Washington, D.C. Copies can be obtained free from State agricultural colleges.

Opportunities in Agricultural Finance. For information about employment opportunities in agricultural finance, contact:

Farm Credit Administration, Washington, D.C. 20578.

Farmers Home Administration, U.S. Department of Agriculture, Washington, D.C. 20250.

Agricultural Director, American Bankers Association, 90 Park Ave., New York, N.Y. 10016.

Opportunities with Cooperatives. Cooperatives in the individual communities are a good source of information on jobs either in their own organizations or in other cooperatives. Most States have a State Council or association of cooperatives that can provide information on cooperative locations and some job information.

The Cooperative Foundation, 59 E. Van Buren St., Chicago, Ill. 60605, offers a publication, *Careers in Cooperatives*, which describes about 100 different kinds of jobs available in these businesses.

Opportunities for Agricultural Economists. For additional information about opportunities in agricultural economics, write the Department of Agricultural Economics at State land-grant colleges. For information on Federal employment opportunities, applicants may get in touch with USDA recruitment representatives at the State land-grant college or write directly to the Office of Personnel, U.S. Department of Agriculture, Washington, D.C. 20250.

Opportunities as Vocational Agriculture Teachers. Prospective teachers should contact the Head Teacher Trainer in Agriculture Education at the land-grant college or the State Supervisor of Agricultural Education at the State Department of Public Instruction in their respective States.

MINING AND PETROLEUM

The mining and petroleum industry provides most of the basic raw materials and energy sources for industry and consumer use. Metal mines provide iron, copper, gold, and other ores. Quarrying and other nonmetallic mining yield many of the basic materials such as limestone and gravel for building schools, offices, homes, and highways. Nearly all of the Nation's energy for industrial and personal use comes from oil, gas, and coal. Few products from mines reach the consumer in their natural state; nearly all require further processing.

The mining and petroleum industry employed about 672,000 wage and salary workers in 1974. Over four-tenths of these worked in the exploration and removal of crude petroleum and natural gas. Coal mining accounted for about one-fourth of the industry's workers, and quarrying and nonmetallic mineral mining nearly one-fifth. The remaining workers were in metal mining.

As shown in the accompanying tabulation, blue-collar workers (craft workers and operatives) account for nearly seven-tenths of the industry's employment. Operatives are the largest occupational group in the industry. Included in the operative group are oil well drillers, mining machinery operators, and truck and tractor drivers. Skilled craft workers constitute the second largest occupational group. Mechanics and repairers maintain the complex equipment and machinery used in mining and in oil well drilling. Many operators of heavy equipment, such as power shovels and graders, work in open pit mining. Large numbers of pumpers, gaugers, and engine workers hold jobs in the removal and transportation of petroleum and natural gas. Supervisors of blue-collar workers also constitute an important part of the craft worker group.

The industry's white-collar employees are divided among three occupational groups—professional and technical, clerical, and managerial workers. Taken together, these groups compose the remaining three-tenths of the industry's employment.

Major occupational group	*Estimated employment, 1974 (percent distribution)*
All occupational groups...	100
Professional, technical, and kindred workers	15
Managers and administrators	6
Clerical and kindred workers	10
Salesworkers	(1)
Craft and kindred workers	26
Operatives[2]	41
Service workers	2

[1] Less than 0.5 percent.
[2] Includes mine laborers.

Professional, technical, and kindred workers are concentrated largely in petroleum and gas extraction. Most are engineers, geologists, or technicians engaged in exploration and research. Two out of three clerical employees work in petroleum and gas extraction. Most are secretaries, office machine operators, and typists.

Employment in the mining and petroleum industry is expected to increase about as fast as the average for all industries through the mid-1980's, but different growth patterns are likely within the industry. Employment in coal mining and in petroleum and natural gas extraction should increase as the Nation strives to become self-sufficient in energy sources. Employment in metal mining also is expected to grow. Employment in quarrying and nonmetallic mining, on the other hand, is expected to decline as laborsaving equipment leads to higher output with fewer workers.

The statements that follow provide information on employment opportunities in the petroleum and natural gas extraction industry and the coal mining industry. More detailed information about many of the major occupations in the mining and petroleum industries also appears elsewhere in the *Handbook*.

COAL MINING

Nature of the Industry

Coal has played a vital role in the development of this Nation. Originally used only as a source of heat, the demand for coal grew rapidly with the coming of the steam engine. By the beginning of the 20th century coal emerged as a major ingredient in the production of steel and electric power.

Coal is usually divided into two classes, bituminous and anthracite. Bituminous, or "soft" coal, is the most widely used and the most plentiful, and accounts for most coal production. Production of anthracite, or "hard" coal, on the other hand, is steadily declining due to dwindling reserves and difficulty of recovery. Other forms of coal, such as lignite and peat, are classified in the subbituminous category, and are used in limited amounts.

Most of the Nation's coal is mined in the Appalachian area which extends from Pennsylvania through Eastern Ohio, West Virginia, Virginia, Kentucky, Tennessee, and Alabama. A large amount of coal also is mined in Indiana, Illinois, and in the Rocky Mountain States.

Types of Mines

Coal is either mined underground or extracted from the earth's surface. Underground mines produce slightly less than half of the bituminous coal and employ most of the miners. Surface mines account for the remaining coal, but employ only a small proportion of the industry's workers.

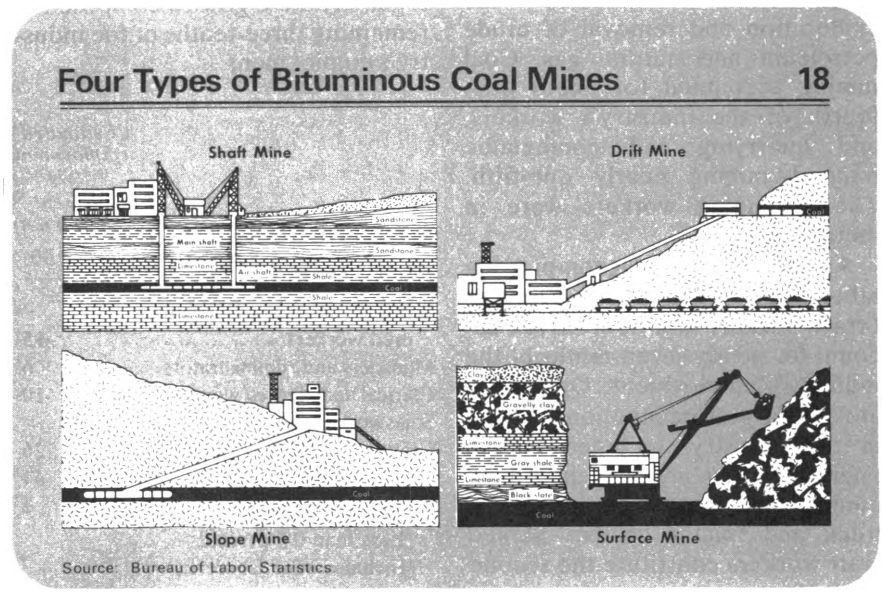
The type of mine a company decides to open depends on the geological formation and the depth and location of the coal seam. Underground mines are used to reach coal that lies deep below the surface. A series of entries must be constructed so that air, and miners and equipment can reach the seam and coal can be carried out. Depending on the depth of the coal seam, the entry may be vertical (shaft mine), horizontal (drift mine), or at an angle (slope mine). (See chart.) Shaft mines are used to reach coal lying far below the surface. Drift and slope mines are usually not as far underground as shaft mines.

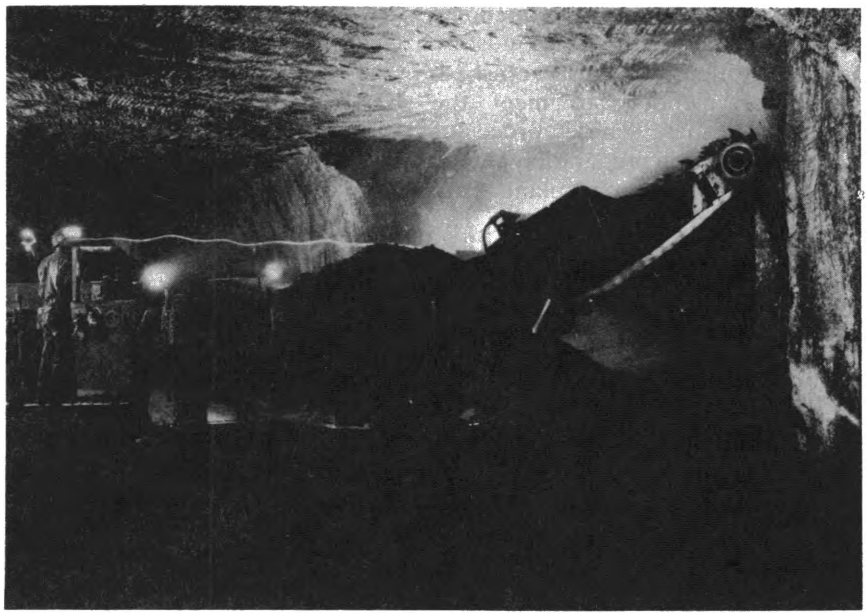
After the coal seam has been reached, nearly all underground mines are constructed the same way. Miners make a network of interconnecting tunnels so that the mine resembles a maze with passageways going off in predetermined directions, sometimes extending over many miles. As coal is removed, the tunnels become longer and longer. Throughout this process, a significant amount of coal (pillars) is left between the tunnels to support the roof. When miners reach the end of the company's property they start working back toward the entrance, mining most of the remaining coal as they retreat. This is called retreat mining.

If the coal seam is not too far below ground, surface mining is practiced. Two types of surface mines are strip and auger. At strip mines, huge machines tear the earth away and dig out the coal. Auger mining is used to remove coal from extremely steep hillsides. A large auger (drill) bores into the hill and pulls the coal out.

Occupations in the Industry

In 1974 about 169,000 people worked in the coal mining industry. About 85 percent were production workers who mined and processed coal. Mining jobs range from apprentice miners who usually act as helpers in several occupations, to highly skilled and experienced miners who operate equipment





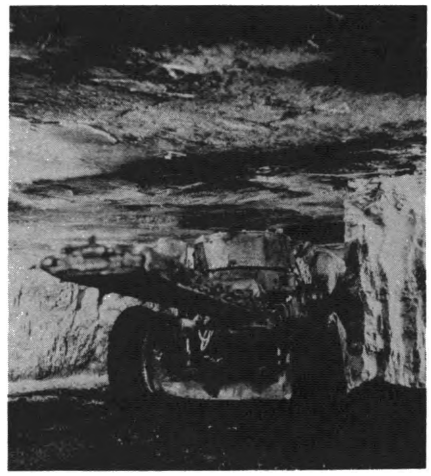
Miner runs a continuous mining machine which tears coal from the seam.

worth several hundred thousand dollars. Jobs available in a mine, however, vary by type and method of mining.

Mining Occupations. Two basic methods of mining underground coal, conventional and continuous, account for 96 percent of total underground production. A third method, longwall, makes up the remaining.

Conventional mining is the oldest method and requires the most workers and procedures. In conventional mining, the *cutting machine operator* (D.O.T. 930.883) uses a huge electric chainsaw, with a cutter ranging in length from 6 to 15 feet, to cut a strip, or kerf, underneath the coal seam to control the direction of the coal as it falls after it has been blasted. Next the *drilling machine operator* (D.O.T. 930.782) drills holes into the coal where the *shot firer* (D.O.T. 931.281) places explosives. After the blast, the *loading machine operator* (D.O.T. 932.883) scoops up and dumps the coal into small rubber-tired cars, which are run by the *shuttle car operator* (D.O.T. 932.883). Depending on the type of haulage system used, these cars take the coal to a conveyor belt for shipment to the main entry or to the surface, or onto mine cars which are transported on tracks to the surface.

The continuous mining method eliminates the drilling and blasting operations of conventional mining. The *continuous-mining machine operator* (D.O.T. 930.883) runs a machine that cuts or rips out the coal and loads it directly onto a conveyor or shuttle cars.



A miner moves a cutting machine into position at the coal face.

Longwall mining is basically an extension of continuous mining. In this method, the *longwall machine operator* runs a set of machines which cut and automatically load coal onto a conveyor. At the same time hydraulic jacks reinforce the roof. As the coal is cut and the face progresses, the jacks are hydraulically wrenched forward and the roof is allowed to cave behind.

Many other workers are required to run a safe and efficient underground mine. Before miners are allowed underground, the *fire boss* or preshift examiner (D.O.T. 939.387) inspects the work area for loose roof, dangerous gases and adequate ventilation. The *rock-dust machine operator* (D.O.T. 939.887) sprays limestone on the mine walls and ground to hold down dust since coal dust is extremely explosive, and interferes with breathing.

The *roof bolter* (D.O.T. 930.883) operates a machine to install roof support bolts. This operation is extremely important because of the ever-present threat of roof cave-ins. The *stopping builder* (D.O.T. 869.884) constructs doors, walls or partitions in the passageways to force air through the tunnels to working areas, and the supervisor, called a *face boss* (D.O.T. 939.138), is in charge of all operations at the work site where coal is actually mined.

Most surface miners operate the large machines that either remove the earth above the coal, or dig and load the coal. The number of workers required to operate a surface mine depends on the types of machines used and the amount of overburden above the coal seam. The more overburden present, the greater the number of workers usually required.

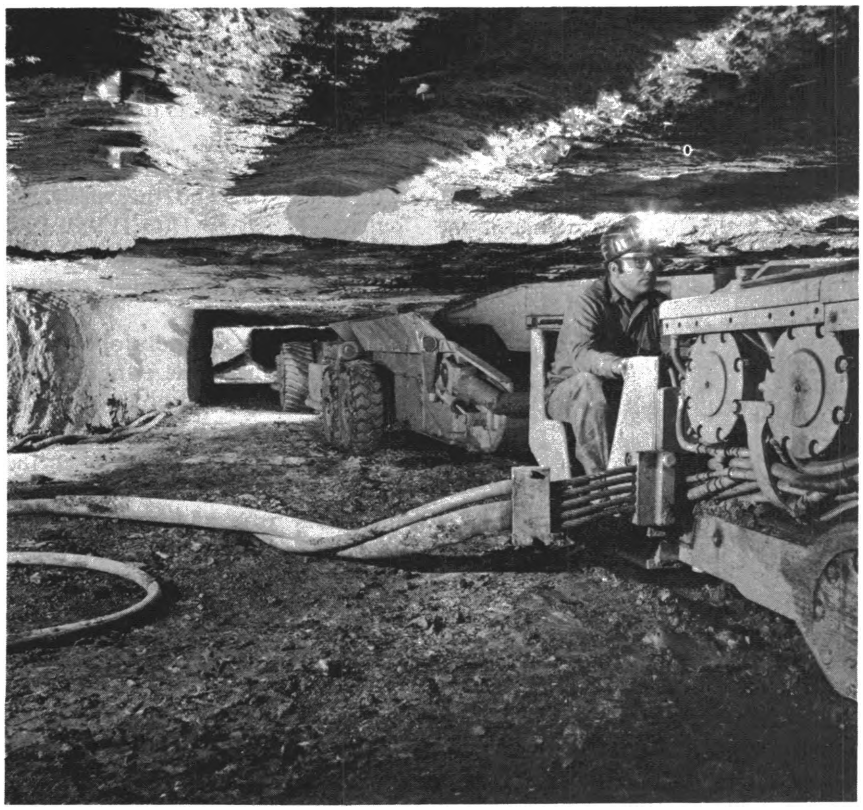
In many strip mines, the overburden is first drilled and blasted. Then the *overburden stripping operator* or *dragline operator* (D.O.T. 859.883) scoops the earth away to expose the coal. Next the *coal loading machine operator* (D.O.T. 932.883) rips coal

from the seam and, loads the coal into trucks to be driven to the preparation plant. In auger mines, the *rotary auger operator* (D.O.T. 930.782) runs the machine that pulls the coal from sides of hills. *Tractor operators* (D.O.T. 929.883) drive bulldozers to move materials or pull out imbedded boulders or other objects. Helpers assist in operating these machines.

Other workers, not directly involved in the mining processes, work in and around coal mines. For example, skilled repairers, called *fitters* (D.O.T. 801.281), fix all types of mining machinery, and electricians check and install electrical wiring. Carpenters construct and maintain benches, bins, and the wooden bodies of mine cars. Many mechanics and electricians assemble, maintain, and repair the machines used in mines. Truckdrivers haul coal to preparation plants and supplies to the mine.

Preparation Plant Occupations. Rocks and other impurities must be removed before coal is crushed, sized or blended, to meet the buyer's wishes. These processes take place at the preparation plant.

Many preparation plants are located next to the mine. The plant's size and number of employees vary by the amount of coal processed and degree of mechanization. Some plants have all controls centrally located and require only one worker to oversee all washing, separating, and crushing operations. This worker is known as a *preparation plant central control operator* (D.O.T. 549.138). Plants that are not as mechanized, however, need workers at each step, such as the *wash box attendant* (D.O.T. 541.782) and *separation tender* (D.O.T. 934.885). Wash box attendants operate equipment which size and separate impurities from coal. The separation tender operates a device that further cleans coal with currents of water.



Miner operates loading machine.

Administrative Professional, Clerical, and Technical Occupations. A wide range of administrative, professional, technical and clerical personnel work in the coal industry. At the top of the administrative group are executives who make all policy decisions. A staff of specialists, such as accountants, attorneys, and market researchers supply legal, technical, and market information for decisionmaking. Clerical and secretarial workers assist the administrative staff.

A variety of engineering and scientific personnel work in the coal industry. *Mining engineers* (D.O.T. 010.081 and .187) examine coal seams for depth and purity, determine the type of mine to be built, and supervise the construction and maintenance of mines. *Mechanical engineers* (D.O.T. 007.081, .151, .168, and .187; and 019.187) oversee the installation of equipment, such as centralized heat and water systems, while *safety engineers* (D.O.T. 010.181) are in charge of all health and safety programs.

The scientific staff conducts research on means to make coal a cleaner, more efficient, and more easily transportable energy source. Presently, many physicists, chemists, and geologists are studying feasible alternatives for converting coal into a gas or liquid.

Other technical personnel are required to assist scientists and engineers. For example, *surveyors* (D.O.T. 018.188) help map out the mining areas. Engineering and science technicians may assist in research efforts.

Training, Other Qualifications, and Advancement

Most miners start out as helpers to experienced workers and learn

skills on the job. Formal training, however, is becoming more important due to the growing use of technologically advanced machinery and mining methods. As a result, most companies supplement on-the-job training with formal programs and actively seek recent graduates of a program in mine technology.

Mine technology programs are available in a few colleges throughout the country, mostly in coal mining areas. The programs lead either to a certificate, after 1 year, or an associate degree, after 2 years, in mine technology. Courses cover areas such as mine ventilation, roof bolting, and machinery repairs. Prospective students do not need a high school education but must pass an entrance examination in basic math and English.

The type of formal training administered by coal companies varies. For example, some companies have training mines where skills are taught; others give classroom instruction for a few weeks before allowing workers into a mine.

Many courses also are available on health and safety procedures, mining techniques, and mining machinery. The U.S. Mining Enforcement and Safety Administration, coal companies, and the United Mine Workers of America conduct classes on health, safety, and mining methods. Mine machinery manufacturers offer courses in machine operation and maintenance.

As miners gain more experience, they can move to higher paying jobs. When a vacancy occurs, an announcement is posted and all workers qualified may bid for the job. A mining machine operator's helper, for example, may become an operator. The position is filled on the basis of seniority and ability. A small number of miners advance to supervisory positions and, in some cases, to administrative jobs in the office.

Miners must be at least 18 years old and in good physical condition. A high school diploma is not required. All miners should be able to work in close areas and have quick reflexes in emergencies.

Requirements for scientific and engineering, administrative, and clerical jobs are similar to those in other industries. College graduates are preferred for jobs in advertising, personnel, accounting, and sales. For clerical and secretarial jobs, employers usually hire high school graduates who have training in areas such as stenography and typing.

Employment Outlook

Coal is expected to play an increasingly important role as a basic energy source. Rising demand for electric power coupled with greater emphasis on developing domestic energy supplies should result in accelerated coal production. The extent of growth in production, however, is uncertain. Oil, natural gas, and nuclear energy also are used to generate electricity, and the demand for coal will be determined, to some extent, by the price and availability of these fuels. Growth in production also depends on how quickly economical methods of coal gasification and liquification are developed. Environmental standards relating to strip mining and the use of high sulfur content coal, which causes air pollution, may also affect coal output. More coal however, will be needed to make steel, chemicals, and other products.

Employment is expected to increase but the amount of growth will depend on the level of production, on the types of mines opened, and the mining methods and machinery used. In addition to openings due to growth, several thousand openings will occur each year as experienced miners retire, die, or transfer to other fields of work.

Earnings and Working Conditions

In 1974, union wage rates for miners ranged from $5.34 to $7.59 an hour, with workers in underground mines generally earning slightly more than those in surface mines or preparation plants. In comparison, production workers in manufacturing averaged $4.40 an hour.

Because underground miners spend time traveling from the mine entrance to their working areas, they have a slightly longer day than surface miners. Those in surface occupations work a 7 1/4- hour shift (36 1/2- hour week), while underground miners work an 8-hour day (40-hour week).

Union miners receive 10 holidays and 14 days of paid vacation each year. As their length of service increases, they gain extra vacation days up to a total of 29. Union workers also receive benefits from a welfare and retirement fund, and workers suffering from pneumoconiosis (black lung) receive Federal aid.

Miners have unusual and harsh working conditions. Underground mines are damp, dark, noisy, and cold. At times, several inches of water may be on tunnel floors. Although mines have electric lights, many areas are illuminated only by the lights on the miners' caps. Workers in mines with very low roofs have to work on their hands and knees, backs, or stomachs in cramped areas.

Though safety conditions have improved considerably, miners must constantly be on guard for hazards. There is also the risk of developing pneumoconiosis from coal dust and silicosis from the rock dust generated by the drilling in the mines. Surface mines and preparation plants are usually less hazardous than underground mines.

Sources of Additional Information

For details about job opportunities in mining, contact individual coal companies. General information on mining occupations is available from:

United Mine Workers of America, 900 15th St. NW., Washington, D.C. 20005.

Bituminous Coal Operators' Association, 918 16th St. NW, Washington, D.C. 20006.

Mining Enforcement and Safety Administration, Department of Interior, Washington, D.C. 20240.

OCCUPATIONS IN PETROLEUM AND NATURAL GAS PRODUCTION AND GAS PROCESSING

Nature and Location of the Industry

Petroleum is a natural fuel formed from the decay of plants and animals. Buried beneath the ground for millions of years under tremendous pressure, this organic matter became petroleum, or what is usually called oil.

Oil and natural gas have assumed a position of such importance that they now furnish more than three-fourths of our energy needs. Oil and natural gas run our factories and transportation systems, heat our homes and places of work, and are basic raw materials for many products such as plastics, chemicals, medicines, fertilizers, and synthetic fibers.

In 1974, the Nation consumed 17 million barrels of oil a day—enough to fill a railroad train of tank cars that would stretch from Pittsburgh to St. Louis.

People with many different skills are needed to explore for oil and gas fields, drill new wells, improve existing wells, and process natural gas.

In 1974, about 290,000 workers were employed in these activities. Firms that work on contract for oil companies employed a large proportion of these workers, and the major oil companies employed the rest. Occupations in oil refining are discussed in a separate chapter elsewhere in the *Handbook*.

Since oil and gas are difficult to find, exploration and drilling are key activities in the petroleum industry. After scientific studies indicate the possible presence of oil, the company selects a well site and installs a towerlike steel rig to support the drilling equipment. A hole is bored deeper and deeper into the earth until oil or gas is found or the company decides to write the effort off as a loss. Although a few large oil companies do their own drilling, most is done by contractors. More than 7,000 firms are engaged in the search for and production of oil and natural gas.

When oil or gas is discovered, pipes, valves, tanks, and other equipment are installed to control the flow of these raw materials from the well. There were more than 600,000 wells in this country in 1974, and about half of all the petroleum industry's 200,000 production workers were needed to operate and maintain them.

Oil and gas are transported to refineries by pipeline, ship, railroad, barge, or truck. Many refineries are thousands of miles from oil fields, but gas processing plants usually are near the fields so that water, sulfur compounds, and other impurities can be removed before the liquid gases are piped to customers. These gases—chiefly ethane, propane, butane, and natural gasoline—are important raw materials for refineries and chemical plants. Some are widely used as heating fuels.

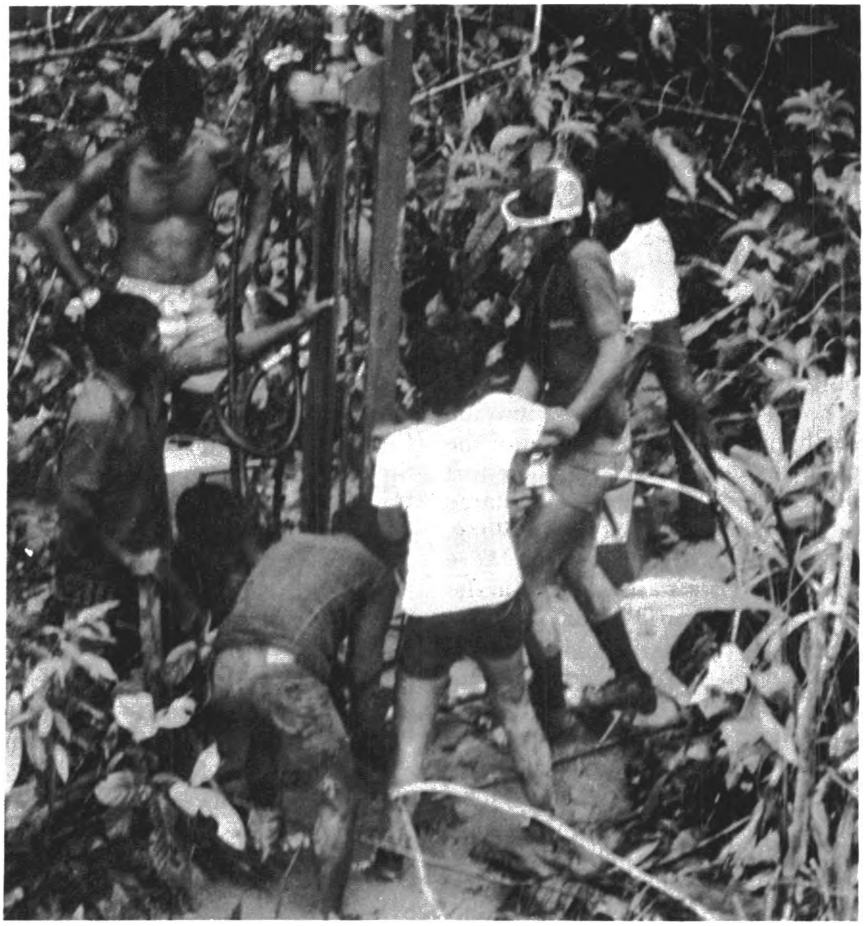
Although drilling for oil and gas is done in 32 States, about nine-tenths of the industry's workers are employed in 10 States. Texas leads in the number of oilfield jobs, followed by Louisiana, Oklahoma, California, New Mexico, Wyoming, Kansas, Colorado, Ohio, and Mississippi. Thousands of additional Americans are employed by oil companies overseas, mostly in the Middle East, Africa, Western Europe, South America, and Indonesia.

Occupations in the Industry

Workers with a wide range of education and skills are needed to find oil and gas and to drill, operate, and maintain wells and process natural gas.

Exploration. Exploring for oil is the first step in petroleum production. Small crews of specialized workers travel to remote areas to search for geological formations likely to contain oil. Exploration parties, led by a *petroleum geologist* (D.O.T. 024.081), study the surface and subsurface of the earth. Geologists seek clues to the possibility of oil traps by examining types of rock formations on and under the earth's surface. Besides making detailed ground surveys, petroleum geologists depend on aerial exploration and magnetic surveys for a broad picture of the area. Subsurface evidence is collected by boring and bringing up core samples of the rocks, clay, and sands that form the layers of the earth. From these examinations geologists draw cross-section maps of the underground formations to pinpoint areas where oil or gas may be located. In offshore exploration, they also may obtain rock samples from the bottom of the sea in their search for clues to oil-bearing formations. Many geologists work in district offices of oil companies or exploration firms where they prepare and study geological maps. They also study samples from test drilling to find any clues to oil.

In addition to the petroleum geologist, exploration parties may include other geology specialists: *Paleontologists* (D.O.T. 024.081) study fossil remains in the earth to locate oil-bearing layers of rock; *mineralogists* (D.O.T. 024.081)



Seismic survey crew explores for oil and gas.

study physical and chemical properties of mineral and rock samples; *stratigraphers* (D.O.T. 024.081) determine the rock layers most likely to contain oil and natural gas; *photogeologists* (D.O.T. 024.081) examine and interpret aerial photographs of land surfaces; and *petrologists* (D.O.T. 024.081) investigate the history of the formation of the earth's crust. Exploration parties may also include *drafters*(D.O.T. 010.281) and *surveyors*(D.O.T. 018.188), who assist in surveying and mapping operations.

Most geophysical exploration is done by seismic prospecting. The seismograph is a sensitive instrument that records natural and man-made earthquakes. Artificial earthquakes in petroleum exploration are made by detonating explosives in the ground. The time it takes for sound waves to reach an underground rock layer and return indicates the depth of the layer. By setting off explosions at a number of locations, scientists can map underground formations with considerable accuracy, thus providing a clue to the whereabouts of traps that may contain oil.

A *geophysicist* (D.O.T. 024.081) usually leads a seismograph crew that may include: *prospecting computers* (D.O.T. 010.288), who perform the calculations and prepare maps from the information recorded by the seismograph; *observers* (D.O.T. 010.168) who operate and maintain electronic seismic equipment; *shothole drillers* (D.O.T. 930.782) and their *helpers* (D.O.T. 930.886), who operate portable drilling rigs to make holes into which explosives are placed; and *shooters* (D.O.T. 931.381) who place and detonate explosives.

Before exploration, the oil company must obtain permission to use the land. The *lease buyer*(D.O.T. 191.118) makes the necessary business arrangements with landowners or with owners of mineral rights.

Drilling. Exploration methods are used to find likely oil fields but only drilling can prove the presence of oil. Overall planning and supervision of drilling usually are the responsibilities of the petroleum engineer.

Wells are almost always started in the same way. *Rig builders* (D.O.T. 869.884) and a crew of *rig-builder helpers* (D.O.T. 869.887) install a portable drilling rig to support the machinery and equipment that raises and lowers the drilling tools. Rotary drilling is the normal way petroleum is brought to the surface. A revolving steel bit bores a hole in the ground by chipping and cutting rock. The bit is attached to a length of pipe which is turned by a diesel engine. As the bit cuts deeper into the earth, more pipe is added. Drilling pipe is hollow and runs the entire depth of the well. A stream of mud is continuously pumped into the hollow pipe and comes out through holes in the drill bit. This mud, a mixture of clay, chemicals, and water, cools the drill bit, plasters the walls of the hole to prevent cave-ins, and carries crushed rock to the surface so that drilling is continuous until the bit wears out. When a new bit is needed, all of the pipe must be pulled up out of the hole, a section at a time, a new bit placed on the end of the pipe, and the pipe returned to the hole.

The *tool pusher* or *drilling supervisor* (D.O.T. 930.130) supervises one or more drilling rigs and supplies materials and equipment to rig crews.

A typical rotary drilling crew consists of five workers: driller, derrick operator, engine operator, and two helpers. Because drilling rigs are operated 24 hours a day, 7 days a week, two to four crews are needed for each rig.

The *rotary driller* (D.O.T. 930.782) supervises the crew and operates machinery that controls drilling speed and pressure, and records operations. The rotary rig engine operator (D.O.T. 950.782) is in charge of engines that provide the power for drilling and hoisting. The *derrick operator* (D.O.T. 930.782), who is second in charge, works on a small platform high on the rig to help run pipe in and out of the well hole, and operates the pumps that circulate mud through the pipe. *Rotary drill helpers* (D.O.T. 930.844), also known as roughnecks, guide the lower end of the pipe to and from the well opening and connect and disconnect pipe joints and drill bits.

Roustabouts (D.O.T. 869.884) or general laborers, though not considered part of a drilling crew, do general oilfield maintenance and construction work, such as cleaning tanks and building roads.

Well Operation and Maintenance. When oil is found, the drill pipe and bit are pulled from the well, and metal pipe known as casing metal is lowered into the hole and cemented in place. The upper ends of the casing are fastened to a system of valves called a "Christmas tree." Pressure in the well forces crude oil and gas to the surface, through the Christmas tree, and into gas traps and storage tanks. If natural pressure is not great enough to force the oil to the surface, pumps are used.

Petroleum production engineers generally plan and supervise well operation and maintenance. To prevent waste, they decide the rate of oil flow and anticipate performance of oil reservoirs by analyzing information such as pressure readings from the well. Engineers are increasingly using computers for analytical work. Some engineers specialize in overcoming effects of corrosion on well casings, in the selection and design of production equipment and processes, or in the prevention of pollution. Some companies hire engineer aides to make tests, keep records, post maps, and otherwise assist engineers.

Pumpers (D.O.T. 914.782) and their helpers operate and maintain motors, pumps, and other equipment to force oil from wells. Their chief duty is to regulate the flow of oil according to a schedule set up by the petroleum engineer and production supervisor. Generally, a pumper operates a group of wells. *Switchers* work in fields where oil flows under natural pressure and does not require pumping. Pumpers open and close valves to regulate the oil flow from wells to tanks or into pipelines *Gaugers* (D.O.T. 914.381) measure and record the flow and take samples to check quality. *Treaters* (D.O.T. 541.782) test the oil for water and sediment and remove these impurities by opening a drain at the tank's base or by using special chemical or electrical equipment. In some fields, pumping, switching, gauging, and treating operations are automatic.

Many skilled workers are employed in maintenance operations. Welders, pipefitters, electricians, and machinists repair and install pumps, gauges, pipes, and other equipment.

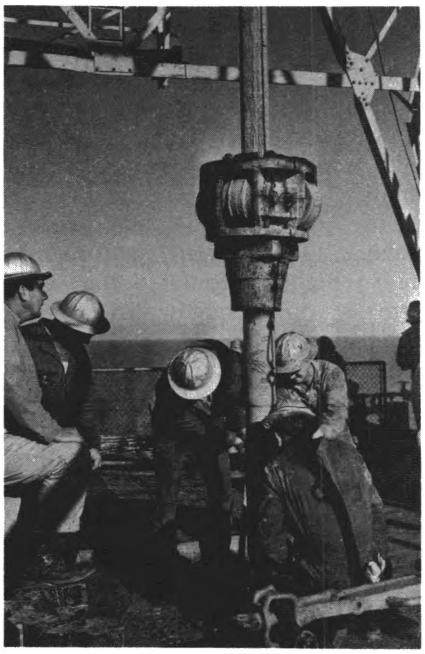
Natural Gas Processing. Most gas processing workers are operators. The *dehydration-plant operator* (D.O.T. 541.782) tends an automatically controlled treating unit which removes water and other impurities from natural gas. The *gasoline-plant operator* tends compressors that raise the pressure of the gas for transmission in the pipelines. The *gas-compressor operator* (D.O.T. 950.782) assists either of these two employees.

Many workers in the larger natural gas processing plants are employed in maintenance activities. These include instrument repairers, electricians, welders, and laborers.

In numerous smaller natural gas plants, workers combine skills, usually of operator and maintenance worker. Many small plants are so highly automated they are virtually unattended. They are checked at periodic intervals by maintenance workers or operators, or they are checked continuously by instruments which automatically report problems and shut down the plant if an emergency develops.

Other Oilfield Services. Companies that offer services on a contract basis provide another important source of employment. Among these employees are skilled workers such as *cementers* (D.O.T. 930.281), who mix and pump cement into the space between steel casings and well walls to prevent cave-ins; *acidizers* (D.O.T. 930.782), who force acid into the bottom of the well to increase the flow of oil; *perforator operators* (D.O.T. 931.782), who use subsurface "guns"to pierce holes in drill pipes or casings to make openings for oil to flow through; *sample-taker operators* (D.O.T. 931.781), who take samples of soil and rock formations from wells to help geologists determine the presence of oil; and *well pullers* (D.O.T. 930.883), who remove pipes, pumps, and other subsurface devices from wells for cleaning, repairing, or salvaging.

Offshore Operations. Most exploration, drilling, and producing activities are on land but an increasing amount of this work is done offshore, particularly in the Gulf of Mexico off the coasts of Louisiana and Texas. Some additional offshore work is being done in the Pacific Ocean off California, Oregon, Washington, and Alaska and in many foreign locations such as the Persian Gulf, Bass Strait, and



Drill crew lowers section of drill pipe on offshore rig.

North Sea. Some wells have been drilled over 100 miles from shore and in water more than 1,000 feet deep. These offshore operations require the same type of drilling crews as are employed on land operations. In addition, offshore operations require radio operators, cooks, ship's officers and sailors, and pilots for work on drilling platforms, crewboats, barges, and helicopters.

(Detailed discussions of professional, technical, mechanical, and other occupations found not only in the petroleum and natural gas production industry, but in other industries as well, are given elsewhere in the *Handbook* in the sections covering individual occupations.)

Training, Other Qualifications,and Advancement

Most workers in nonprofessional jobs with an exploration crew begin as helpers and advance into one of the specialized jobs. Their training may vary from several months to several years. New workers usually are hired in the field by the crew chief or by local company representatives. College students majoring in physical or earth sciences or in engineering may work part-time or summers with exploration crews, and get full-time jobs after graduation.

Members of drilling crews usually begin as roughnecks. As they acquire experience, they may advance to more skilled jobs. For example, a worker hired as a roughneck may advance to derrick operator and, after several years, become a driller. A driller can advance to the job of tool pusher in charge of one or more drilling crews.

Companies generally hire people who live near wells for well operation and maintenance jobs. They prefer applicants who have mechanical ability and a knowledge of oilfield processes. Because this type of work is less strenuous than drilling and offers the advantage of a fixed locale, members of drilling crews or exploration parties who prefer not to travel often transfer to well operation and maintenance jobs. New workers may start as roustabouts and advance to jobs as switchers, gaugers, or pumpers. Training usually is acquired on the job; at least 2 years of experience are needed to become an all-round pumper.

Post-high school vocational training in oilfield occupations is available from Eastern New Mexico University, Roswell, N.M.; Extension Services of the University of Texas; and the Petroleum Industry Training Service, Edmonton, Alberta, Canada. Most graduates of these programs find jobs readily available.

For scientists, such as geologists and geophysicists, college training with at least a bachelor's degree is required. The preferred educational qualification for a petroleum engineer is a degree in engineering with specialization in courses on the petroleum industry. However, college graduates having degrees in chemical, mining, civil or mechanical engineering, or in geology, geophysics, or other related sciences often are hired for petroleum engineering jobs. Petroleum engineering aides include people with 2-year technical degrees as well as former roustabouts or pumpers who have been promoted.

Scientists and engineers usually start at junior levels; after several years of experience they can advance to managerial or administrative jobs. Scientists and engineers who have research ability, particularly those with advanced degrees, may transfer to research or consulting work.

Information on training, qualifications, and advancement in natural gas processing plants is similar to that for petroleum refining. A statement on petroleum refining can be found elsewhere in the *Handbook*.

Employment Outlook

Employment in petroleum and natural gas production is expected to increase faster than the average for all industries through the mid-1980's. Besides the job openings created by employment growth, many openings will occur as workers retire, die, or leave the industry for other reasons.

Increased demand for crude oil and natural gas, higher prices for these products, and a national policy to move toward energy self-sufficiency are expected to provide the incentive for the industry to expand rapidly. Growth will be concentrated in exploration and drilling, and more workers will be needed in most occupations associated with these activities. Opportunities should be particularly good in offshore drilling.

Earnings and Working Conditions

In 1974, nonsupervisory employees in oil and gas extraction

averaged $4.82 an hour. In comparison, the average for all nonsupervisory workers in private industry, except farming, was $4.22 an hour. Earnings usually are higher in offshore operations than in land operations.

Most oilfield jobs involve rugged outdoor work in all kinds of weather. They often are in remote areas in settings as varied as a Western desert, the Arctic Circle, or the Gulf of Mexico. Physical strength and stamina are important because the work involves standing most of the time, lifting moderately heavy objects, and climbing and stooping to work with power tools and handtools that often are oily and dirty.

Drilling employees may expect to move from place to place since their work in a particular field may be completed in less than a year. Exploration field personnel may be required to move even more frequently. They may be away from home for weeks or months at a time. Well operation and maintenance workers and natural gas processing workers usually remain in the same location for long periods.

On land, drilling crews usually work 7 days, 8 hours a day, and then have a few days off. In offshore operations, they may work 7 days, 12 hours a day, and then have 7 days off. If the well is far from the coast, they live on the drilling rig or on ships anchored nearby. Most workers in well operations and maintenance and natural gas processing work 8 hours a day, 5 days a week.

Sources of Additional Information

Further information about jobs in the petroleum industry may be available from the personnel offices of individual oil companies. For information on scientific and technical jobs, write to:

American Association of Petroleum Geologists, P.O. Box 979, Tulsa, Okla. 74101.

Society of Petroleum Engineers of AIME, 6200 N. Central Expressway, Dallas, Tex. 75206.

American Geological Institute, 2201 M St. NW., Washington, D.C. 20037.

CONSTRUCTION

The activities of the construction industry touch nearly every aspect of our daily lives. The houses and apartments in which we live; the factories, offices, and schools in which we work; and the roads on which we travel are examples of some of the products of this industry. The industry includes not only new construction, but also additions, alterations, and repairs to existing structures.

In 1974, about 4 million people worked in the contract construction industry. An additional 1.4 million workers are estimated to be either self-employed—mostly owners of small building firms—or are Federal, State, or local government employees who build and maintain our Nation's vast highway systems.

The contract construction industry is divided into three major segments. About half of the jobholders work for electrical, air-conditioning, plumbing, and other special trade contractors. Almost one-third work for the general building contractors that do most residential, commercial, and industrial construction. The remaining one-fifth build dams, bridges, roads, and similar heavy construction projects.

As illustrated in the accompanying tabulation, craft and kindred workers account for 55 percent of the total employment in this industry—a much higher proportion than in any other major industry. Some examples of craft workers are carpenters, painters, plumbers, and bricklayers. Laborers are the next largest occupational group and account for 15 percent of employment. They provide materials, scaffolding, and general assistance to skilled workers. Semiskilled workers (operatives), such as truckdrivers and welders, represent about 8 percent of the industry's work force. Managers and administrators—mostly self-employed—account for about 12 percent of employment. Clerical workers, largely typists, secretaries, and office machine operators, constitute another 7 percent of the industry's employment. Professional and technical workers, mostly engineers and engineering technicians, drafters, and surveyors, make up the remaining 3 percent of the work force.

Major occupational group	*Estimated employment, 1974 (percent distribution)*
All occupational groups...	100
Professional, technical, and kindred workers	3
Managers and administrators ...	11
Clerical and kindred workers ...	7
Salesworkers	(1)
Craft and kindred workers	55
Operatives	8
Service workers	(1)
Laborers	15

[1] Less than 0.5 percent.

NOTE: Due to rounding, sums of individual items may not add to total.

Construction industry employment is expected to rise faster than the average for all industries through the mid-1980's, as population and income growth create a demand for more houses, schools, factories and other buildings. Because of laborsaving improvements in tools, materials, and work methods, however, employment will not grow as rapidly as construction activity. Employment also may fluctuate from year to year because construction activity is sensitive to changes in economic conditions.

Contract construction is the major source of employment for skilled craft workers such as bricklayers, painters, and carpenters. For information on these and other construction crafts, see the chapter on Construction Occupations elsewhere in the *Handbook*. For information on occupations that are found in many other industries, see the index in the back of the book.

MANUFACTURING

Manufacturing is a key activity of our Nation's economy. The products of the manufacturing industries range in complexity from simple plastic toys to intricate electronic computers, and in size from miniature electronic components to gigantic aircraft carriers. Manufacturing involves many diverse processes. Workers process foods and chemicals, print books and newspapers, spin textiles and weave them, make clothing and shoes, and produce the thousands of other products needed for our personal and national welfare.

About 20 million people worked in manufacturing—the largest of the industry divisions—in 1974. About three-fifths of all manufacturing employees worked in plants that produced durable goods, such as steel, machinery, automobiles, and household appliances. The rest worked in plants that produced nondurable goods, such as processed food, clothing, and chemicals.

As illustrated in the accompanying table, blue-collar workers (craft workers, operatives, and laborers) make up about two-thirds of manufacturing employment. Operatives alone account for over four-tenths of the work force; many are spinners and weavers, sewing machine operators, machine tool operators and welders, or operators of the specialized processing equipment used in the food, chemical, paper, and petroleum industries.

Craft and kindred workers make up the next largest group and account for nearly one-fifth of employment in manufacturing. Many of these skilled workers install and maintain the wide assortment of machinery and equipment required in all factories. Others are employed in skilled production occupations. Machinists, for example, are especially important in the metalworking industries, as are skilled inspectors and assemblers. In the printing and publishing industries, compositors, typesetters, photoengravers, lithographers, and pressworkers make up a large share of the work force. The craft group also includes supervisors of blue-collar workers.

White-collar workers (professional, managerial, clerical, and salesworkers) account for nearly one-third of employment in manufacturing establishments. Clerical workers, such as secretaries and office machine operators, are the largest white-collar group. Clerical workers hold about 1 out of every 8 jobs in the manufacturing sector.

Professional, technical, and kindred workers account for about 1 out of every 10 jobs in manufacturing establishments. Engineers, scientists, and technicians represent a large share of the professional workers. These highly trained workers included not only those who oversee and guide the production processes, but also those who carry out the extensive research and development activities needed in the aerospace, electronics, chemical, petroleum, and other industries.

Major occupational group	*Estimated employment, 1974 (percent distribution)*
All occupational groups...	100
Professional, technical, and kindred workers	9
Managers and administrators.....	7
Clerical and kindred workers.....	12
Salesworkers	2
Craft and kindred workers.....	19
Operatives.....	44
Service workers.....	2
Laborers.....	5

Population growth, rising personal income, and expanding business activity will create a substantial increase in the demand for manufactured products through the mid-1980's. Employment in manufacturing, however, is expected to increase at a slower pace than production. The application of modern technology to manufacturing processes will make possible substantial increases in production of goods without corresponding increases in the work force. Although the average rate of employment growth will be slow, employment trends of individual industries will vary widely. In the industries manufacturing rubber and miscellaneous plastics products and medical and dental instruments employment should increase about one-third, far above the average increase. Employment in several other industries—including metalworking machinery, and computers and peripheral equipment—should increase faster than the average for all manufacturing. On the other hand, employment in some manufacturing industries—including tobacco, food, and radio and television sets—is expected to decline through the mid-1980's.

The statements that follow provide information on employment opportunities in several of the manufacturing industries. More detailed information about occupations that are found in manufacturing as well as in many other industries appears elsewhere in the *Handbook*. (See index in the back of the book.)

OCCUPATIONS IN AIRCRAFT, MISSILE, AND SPACECRAFT MANUFACTURING

Firms that manufacture and assemble aircraft, missiles, and spacecraft make up what is known as the "aerospace" industry. In 1974, more than three quarters of a million people worked in the industry: more than 500,000 in the manufacture and assembly of complete aircraft, aircraft engines, propellers, and auxiliary parts and equipment; 90,000, in the manufacture of missiles and spacecraft; and more than 160,000 in companies that make electronic equipment and instruments for aircraft, missiles, and spacecraft. Thousands of workers in other industries produced parts, machinery, and equipment used in the manufacture of aerospace vehicles. Also, thousands of Federal workers were engaged in aerospace-related work, since the Government is a major purchaser of the industry's products. These workers were primarily employed in the National Aeronautics and Space Administration (NASA) and the Department of Defense.

Aerospace jobs exist in almost every State. The largest concentration is in California. Other States with large numbers of aerospace jobs include New York, Washington, Connecticut, Texas, Florida, Ohio, Missouri, Pennsylvania, Massachusetts, Kansas, Alabama, Maryland, New Jersey, and Georgia.

Nature of the Industry

All aircraft, missiles, and spacecraft have the same basic components: a frame, an engine, and a guidance and control system. Missiles and spacecraft travel into space at speeds many times faster than sound, while aircraft fly in the earth's atmosphere at much slower rates. Missiles are powered by either jet or rocket engines; spacecraft are rocket-powered only. Aircraft are powered by piston, jet, or rocket engines.

Aircraft vary from small personal or business planes that do not cost much more than an automobile to multi-million dollar jumbo transports and supersonic fighters. In dollar value most aircraft production is for military use although the value of planes made for commercial and private use has been increasing.

Missiles are for military use and generally carry destructive warheads. While some are capable of traveling only a few miles, such as those that support ground troops and defend against low-flying aircraft, others have intercontinental ranges of 7,000 miles or more. Some missiles are launched from land; others from aircraft, submarines, or ships.

Most of the Nation's spacecraft are built for NASA and the Department of Defense to explore outer space or to monitor conditions within the earth's atmosphere. On manned flights, a cabin capsule carries the astronauts. Some spacecraft probe the space environment and then fall back to earth, while others enter into earth orbit and become artificial satellites. Still others orbit or land on the moon or go to other planets. All spacecraft carry instruments that record and transmit scientific data to earth stations.

Major aircraft, missile, and spacecraft firms contract with government or private business to produce an aerospace vehicle. As a contractor, the firm is responsible for managing and coordinating the entire project. This involves design, production, assembly, and inspection of the vehicle.

Although aircraft, missile, and spacecraft manufacturers generally make many components of a craft and do final assembly work themselves thousands of subcontractors are involved in the production of parts or supplies the original firm cannot produce, such as bearings, rocket fuels, or special lubricants. Other subcontractors produce subassemblies such as communication or guidance equipment, or jet engines. Some of these firms depend on still other subcontractors to supply parts for their subassemblies.

In producing an aerospace vehicle, the contractor's engineering department first prepares design drawings and specifications. Then, the production department works on details for machines, materials, and operations needed to manufacture the vehicle. Production includes designing and producing tools and fixtures to produce thousands of parts and accessories that make up an aerospace vehicle. Parts and components are inspected and tested many times before being assembled, and completed systems are examined for conformance to specifications. Before a finished vehicle is delivered, it is checked out by a team of mechanics, or flight-tested if it is an aircraft.

Occupations in the Industry

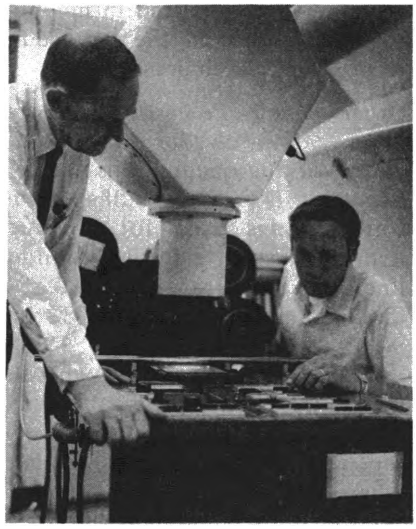
Because of the complex and changing nature of aerospace technology, firms need workers with many different types of skills. The types of workers required will also depend on the specific function of an aerospace plant. For example, a plant primarily engaged in research and development or in producing experimental prototypes requires many more scientists and engineers than a firm producing large quantities of parts for aircraft.

Major jobs in aerospace manufacturing are described under three main categories: professional and technical; administrative, clerical, and related occupations; and plant occupations. Many of these jobs are in other industries as well and are discussed in greater detail elsewhere in the *Handbook*.

Professional and Technical Occupations. Research and development (R&D) are vital to the aerospace industry. The pace of discovery in aerospace technology is so rapid, in fact, that much equipment becomes obsolete while still in an experimental stage or soon after being put into production. Today, research is conducted in many areas such as developing vehicles with greater speeds, ranges, and reliability; engines with more power; and more advanced sources of rocket propulsion such as nuclear and electric energy. Metals and plastics also are continually being developed for wider capabilities, as are electronic guidance and communication systems.

Emphasis on R&D makes the aerospace industry an important source of jobs for technical personnel. In 1974, about one-fourth of all employees were engineers, scientists, and technicians, a considerably higher proportion than in most other manufacturing industries.

Engineers, scientists, and technicians work together in developing



Engineer and technician run test on an aircraft design.

designs for aircraft, missiles, and spacecraft. Before an engineering department approves a design for production, it conducts tests to determine which designs can best withstand expected operating conditions. A scale model is made from a preliminary drawing and is tested in wind, temperature, and shock tunnels and other testing areas that simulate actual flight conditions. Next, a full-sized experimental model, or prototype, is thoroughly tested in the air and on the ground. The design is modified many times during this process until the test results are satisfactory. Then, actual production may begin. Even after production has started, however, further changes are often made.

Due to the wide range of research and development projects, many types of engineers and scientists work in the aerospace industry. Aerospace, chemical, electrical, electronic, industrial, and mechanical, engineers are among the larger engineering branches needed in this industry. Scientists in the industry include physicists, mathematicians, chemists, metallurgists, and astronomers. These engineers and scientists work in a wide and varied range of applied fields such as materials and structures, energy and power systems, and space sciences.

Among the many types of workers assisting scientists and engineers are drafters and engineering and science technicians. Others include *production planners* (D.O.T. 012.188), who plan the layout of machinery, movement of materials, and sequence of operations for efficient manufacturing processes; and *technical illustrators* (D.O.T. 017.281), who help prepare manuals and other technical literature describing the operation and maintenance of aerospace products.

Administrative, Clerical, and Related Occupations. Managerial and administrative jobs generally are comparable to similar jobs in other industries, except that in the aerospace industry these positions are often filled by people with technical backgrounds in engineering or science. These positions include executives responsible for the direction and supervision of research and production, and officials in departments such as sales, purchasing, accounting, and industrial relations. Many thousands of clerks, secretaries, computer personnel, and other office personnel work in aerospace firms.

Plant Occupations. About one-half of all workers in the aerospace industry have plant- or production-related jobs. 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 checkout; and materials handling, maintenance, and custodial.

Sheet-Metal Occupations. Following blueprints and other engineering information, *sheet-metal workers* (D.O.T. 804.281) shape complicated parts from sheets of thin metal by hand or machine. Hand methods include the shaping of

parts by pounding them with mallets and by bending, cutting, and punching them with handtools. Machine methods use power hammers and presses, saws, tube benders, and drill presses.

Less skilled workers usually specialize in the use of a single machine to fabricate parts required in large numbers. Some of these workers are *punch press operators* (D.O.T. 615.782), *power hammer operators* (D.O.T. 617.782) and *power shear operators* (D.O.T. 615.782 and .885).

Machining and Tool Fabrication Occupations. Machining and tool fabrication workers use a wide variety of machines and handtools to make metal parts of machines or other products. Many of these workers are in engine and propeller plants, which are basically metalworking establishments; fewer are required in plants that assemble complete aerospace vehicles.

The most skilled machinists are the *all-round machinists* (D.O.T. 600.280 and .281) who plan the work and set up and operate several types of machine tools. They perform highly varied, nonrepetitive machining operations, frequently producing parts for experimental and prototype vehicles.

Machine tool operators (D.O.T. 609.855) produce metal parts in large volume. They generally operate a single type of machine tool such as a lathe, drill press, or milling machine. Skilled operators set up work on a machine and handle more difficult and varied jobs. Less skilled operators do more repetitive work.

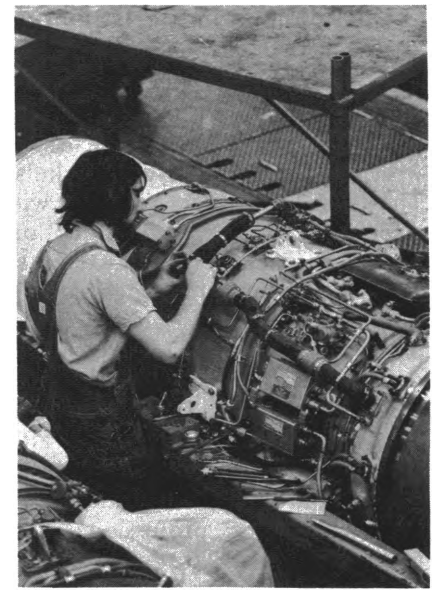
Other machining and tool fabrication workers produce parts needed for the manufacture of aerospace vehicles. On the basis of information received from an engineering department, *jig and fixture builders* (D.O.T. 693.280) build jigs—metal devices used as guides for tools. *Tool and die makers* (D.O.T. 601.280) make the cutting tools and fixtures used in machine tool operations, and the dies used in forging and punch press work.

Other Metal Processing Occupations. Some of the many other metalworking occupations are *tube benders* (D.O.T. 709.884), who form tubings used for oil, fuel, hydraulic, and electrical conduit lines; and *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), who use mechanical and electrical devices to join fabricated parts. Metalworking jobs also are in foundry plants where workers produce castings by pouring molten metal into molds.

Many workers chemically treat and heat-treat aircraft, missile, and spacecraft parts during their manufacture to clean, change, or protect their surfaces or structural condition. For example, *heat treaters* (D.O.T. 504.782) heat sheet-metal parts to keep the metal soft and malleable for metal-shaping work. *Painters* (D.O.T. 845.781) and *platers* (D.O.T. 500.380) either paint or plate surfaces.

Assembly and Installation Occupations. Practically all plants in the aerospace industry employ assembly and installation workers. Some assemble engines, electronic equipment, and auxiliary components, but most assemble major subassemblies or install major components in aircraft or spacecraft. In an aircraft, for example, this work involves joining wings and tails to the fuselage and installing the engine and auxiliary equipment such as the fuel system and flight controls. Assemblers rivet, drill, bolt, and solder parts together.

Many assemblers are skilled mechanics and installers who read blueprints and interpret other engineering specifications as they take apart, inspect, and install complex mechanical and electronic assemblies. *Final assemblers* (D.O.T. 806.781) of complete aircraft and *missile or rocket assembly mechanics* (D.O.T. 625.281) do general assembly work, and often work on experimental, prototype, or special craft. Other skilled assemblers work in plants that produce relatively large numbers of aircraft and missiles rather than a few experimental types. They often specialize in the assembly of one specific part of a space vehicle. Assemblers also specialize in systems such as electrical wiring, heating, and plumbing.



Skilled assemblers work on intricate engine components.

Inspecting and Testing Occupations. Because aircraft, missiles, and spacecraft are extremely complex and affect the life and safety of people, firms employ workers to conduct thousands of painstaking inspections and tests. Inspectors thoroughly test each component and part as it moves through the production and assembly process, as well as just before delivery. Inspections are made not only by employees of the manufacturers but also by commercial firms that have contracted for the equipment. Employees of the Federal Government also inspect vehicles under government contract.

Most inspectors specialize in a

Production inspector checks out spacecraft.

certain area of aerospace manufacturing. Using complex machinery, they check to assure that all parts and assemblies were made according to engineering specifications. Among the most skilled inspectors, especially in final assembly plants, are *outside production inspectors* (D.O.T. 806.381) who examine machined parts, subassemblies, and tools and dies ordered from other firms. They also serve as a 'link" between their own engineering department and supplying companies. *Machined parts inspectors* (D.O.T. 609.381) examine machined parts and fabricated sheet-metal and *assembly inspectors* (D.O.T. 806.381) inspect complete major assemblies and installations such as fuselage, wing, and nose sections to insure their proper fitting. They also check the functioning of hydraulic, plumbing, and other systems. Less skilled inspectors check subassemblies.

Flight Checkout Occupations. Checking out every part of an aircraft or spacecraft before its first flight requires a team of mechanics. The *crew chief*, the most skilled mechanic of the team, directs other workers in the entire checking out operation. *Engine mechanics* specialize in checking out the powerplant of a craft, including the engine, propellers, and oil and fuel systems; and *electronics checkout* workers do the final operational examination of radio, radar, automatic pilot, fire control, and electronic guidance systems. The checking out process may require making minor repairs and, in some cases, even returning the craft to the plant for extensive adjustments.

Materials Handling, Maintenance, and Custodial Occupations. Aerospace plants employ many materials handlers such as truckdrivers, shipping clerks, and toolroom attendants. Maintenance workers, such as electricians, maintenance mechanics, carpenters, and plumbers, keep equipment and buildings in good operating condition and make changes in the layout of the plant. Guards, firefighters, and janitors provide protective and custodial services.

Training, Other Qualifications, and Advancement

A college degree in engineering or in one of the sciences usually is the minimum requirement for an entry level position as an engineer or scientist in the aerospace industry. Technicians can sometimes advance to these positions without a college degree, but only after years of work experience and some college-level training.

New entrants may qualify for technician positions by attending a technical institute or junior college, or by obtaining related work experience. Entry level plant occupations generally do not require a high school diploma although graduates are often preferred. Inexperienced plant workers generally start out in semiskilled positions and learn skills on the job and in classroom courses. As they gain experience, they can move on to more highly skilled positions. For example, it usually takes 2 to 4 years of plant experience to become a skilled assembler.

Skilled inspectors often have several years of machine shop experience and must be able to install and use various kinds of testing equipment and instruments, read blueprints and other specifications, and use shop mathematics.

Mechanics who do final checkout of aircraft and spacecraft may qualify for their jobs by working in earlier stages of the production line,

by receiving training in checkout work, or by working as 'line maintenance" mechanics 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 a chief mechanic, usually need at least 2 years' experience. Less experienced helpers or assistants learn on the job, with plant training courses.

Apprenticeship programs are sometimes available for craft occupations such as machinists, tool and die makers, sheet-metal workers, aircraft mechanics, and electricians. The programs vary in length from 3 to 5 years depending on the trade. During this time, the apprentice handles work of progressively increasing difficulty as well as classroom instruction. Such instruction for a machinist apprentice, for example, includes courses in blueprint reading, mechanical drawing, shop mathematics, and physics.

Because complex and rapidly changing products require highly trained workers, aerospace plants sometimes support formal training to supplement day-to-day experience and help workers advance more rapidly. Although most are short-term programs to meet immediate needs, some major producers conduct training classes or pay tuition and related costs for outside courses. Some classes are held during working hours; others are after working hours.

Employment Outlook

Employment in the aerospace industry is expected to rise above recent levels by the mid-1980's. The number of people working in this industry, however, probably will remain below the peak levels of the late 1960's.

Thousands of jobs will open each year because of the growth expected in the industry, and to replace workers who retire, die, and transfer to jobs in other industries. Job opportunities are expected to increase for highly trained workers, such as scientists, engineers, and skilled plant personnel in all areas of the industry, especially with firms engaged in research and development and the manufacture of prototype and other technologically advanced aircraft. Less skilled and unskilled workers will also be needed to fill entry level plant positions.

Since many aerospace products are either military hardware or space vehicles, the industry's future depends, to a great extent, on the level of Federal expenditures. Changes in these expenditures usually have been accompanied by sharp fluctuations in aerospace employment. For example, aerospace employment declined sharply from the high levels of the late 1960's partly because of decreased aircraft requirements for Vietnam and reduced expenditures for space exploration. The outlook for this industry is based on the assumption that defense spending will increase moderately from the 1974 level, but will be slightly below the peak levels of the late 1960's. R&D spending is also expected to be above current levels. If actual expenditures should differ substantially from these assumed levels, the outlook will be affected accordingly.

Civilian aircraft production also is an important determinant of aerospace employment. Overall employment in this area is expected to remain fairly stable through the mid-1980's. Nevertheless, thousands of new workers will be required in this sector of the industry to replace those who die, retire or transfer to other fields.

Earnings and Working Conditions

Plant workers' earnings in the aerospace industry are higher than those in most other manufacturing industries. In 1974, for example, production workers in plants making aircraft and parts averaged $5.40 an hour; production workers in all manufacturing industries as a whole averaged about $4.22 an hour.

The following tabulation indicates an approximate range of hourly wages for selected occupations in 1974 obtained from the collective bargaining agreements of a number of major aerospace companies; these rates do not include incentive earnings. The ranges in 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	$4.00–6.88
Assemblers	4.28–5.51
Electronics technicians	4.50–6.00
Heat treaters	5.53–6.33
Inspectors and testers	4.38–6.63
Jig and fixture builders	5.06–5.98
Machinists	4.32–6.97
Maintenance crafts	4.32–6.97
Riveters	3.50–4.63
Tool and die makers	5.78–6.88
Welders	3.50–6.97

Fringe benefits in the industry usually include 2 weeks of paid vacation after 1 or 2 years of service, and 3 weeks after 10 to 12 years. Employees generally get 8 to 12 paid holidays a year and 1 week of paid sick leave. Other major benefits include life insurance; medical, surgical, dental, and hospital insurance; accident and sickness insurance; and retirement pensions.

Most employees work in modern factory buildings that are clean, well-lit, and well-ventilated. Some work outdoors. Operations such as sheet-metal processing, riveting, and welding may be noisy, and some assemblers may work in cramped quarters. Aerospace plants, however, are relatively safe.

Most plant workers in the aerospace field are union members. They are represented by several unions including 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 craft workers, guards, and truckdrivers are members of unions that represent their specific occupational groups.

Sources of Additional Information

Additional information about careers in the aerospace field is available from:

National Aeronautics and Space Administration, Washington, D.C. 20546.

Electronics Industries Association, 2001 Eye St. NW., Washington, D.C. 20006.

For specific information about an occupation, contact:

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, AFL-CIO, 1126 16th St. NW., Washington, D.C. 20036.

OCCUPATIONS IN THE ALUMINUM INDUSTRY

Aluminum was once considered a specialty metal having limited applications. Today it is produced in quantities second only to iron and steel. It is used in products that range from household appliances and cooking utensils to automobiles, aircraft, and missiles. In recent years, many new uses for aluminum have been developed, including house siding, containers, and electrical cables. In 1974, the industry produced about 12.0 billion pounds of primary aluminum, or about twice the output of only 10 years earlier.

This statement describes occupations in plants that produce ingots (bars) of primary aluminum. It also describes occupations in plants that shape the ingots into sheets, wire, and other forms by rolling, stretching, or forcing the aluminum through an opening. Occupations concerned with casting, forging, stamping, machining, and fabricating aluminum are discussed separately in the *Handbook* statements dealing with forge shop, foundry, and metalworking occupations.

About 105,000 persons worked in the aluminum industry in 1974. Approximately one-third helped make aluminum; the remainder helped convert large pieces into sheets, cables, and other industrial products.

Since the huge machinery necessary for making aluminum is very expensive, the production of primary aluminum is concentrated in a relatively small number of plants. These plants generally are located near abundant sources of alumina and electricity. Many are in Arkansas, Louisiana, Texas, Alabama, and Tennessee, where alumina is made from bauxite ore imported from the Caribbean area or mined locally and electricity is obtained from the Tennessee Valley Authority or generated from local deposits of natural gas or oil. About two-fifths of the employees who make aluminum work in these States. Another one-fifth work in the State of Washington where plants are located to serve customers on the West Coast. A significant number of employees also work in plants located in Ohio, Indiana, and New York.

Plants that shape aluminum into sheets, wire, and other products are more dispersed geographically. Over one-half of the employment in these plants is in California, Pennsylvania, Tennessee, Illinois, Alabama, New York, and Ohio. The remainder is widely scattered throughout a large number of States.

Occupations in the Industry

Employment in the aluminum industry falls into several categories. The biggest group—about three-fourths—are the production workers directly involved in operating or maintaining the industry's production equipment. The remaining one-fourth are in professional, technical, administrative, clerical, and supervisory positions.

Production Occupations. To illustrate the production occupations found in the industry, a description of the major steps in making and shaping aluminum follows.

Making Aluminum. Aluminum is obtained from alumina by using electricity to create chemical changes that separate pure aluminum from other materials. Alumina—a fine, white powder processed from bauxite ore—is placed in large containers called "pots" that are filled with a special liquid. Suspended in the liquid are poles (anodes); electric cables are attached to the pots and to poles. When the process is in operation, electricity flows from the poles, through the liquid containing the alumina, and to the walls and floors of the pots. As the electricity passes through the liquid, it heats and chemically changes the alumina to pure, liquid aluminum. Because the aluminum is heavier, it settles to the bottom of the pot; waste materials go to the top of the liquid. Periodically, pure aluminum is removed from the bottom of the pot.

Pot tenders (D.O.T. 512.885) see that the pots operate continuously. Each is responsible for a number of pots. As a result of the chemical changes, the alumina in each pot is slowly used up. By watching the surface of the liquid, or instruments, tenders determine when to add alumina from the overhead storage compartment.

Processing worker loads shredder with old aluminum cans that are to be recycled.

Every 24 to 72 hours, molten aluminum is siphoned from the bottom of the pots into huge brick-lined, steel containers or "crucibles." 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. Using automatic equipment, they break a hole in the crust of waste materials that forms on the top of the liquid. One end of a curved, cast iron tube is inserted into the pot; the other end is placed into a crucible and the molten metal is drawn from the pot into the crucible.

After aluminum has been taken from several pots and the crucible is full, *charge gang weighers* (D.O.T. 502.887) weigh and sample the molten metal for laboratory analysis. Then, workers operating overhead cranes pour the molten metal from the crucible into a remelting furnace. A *remelt operator* (D.O.T. 512.885) adds portions of aluminum scrap, other molten metal, or chemicals that will produce metal with the desired properties. Finally, hand skimmers remove waste products which have been forced to the surface of the molten metal.

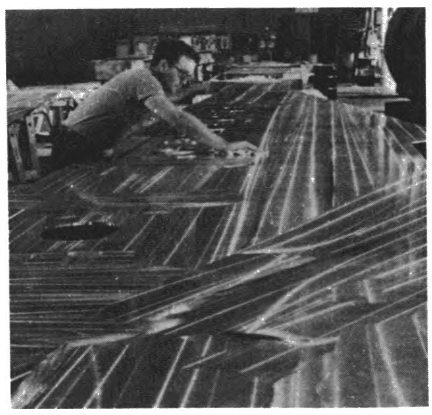
After operating for a number of months, the heat and chemical reactions make holes in the pot's lining so that the liquid metal contacts the steel container. When this happens, the pot is shut down and the liquid drained so that *pot liners* (D.O.T. 519.884) can make repairs. Depending on the condition of the pots, liners may patch holes in the lining or may completely remove and replace the lining.

The metal is then transferred to the second or holding compartment of the furnace until a sufficient supply is obtained for pouring. The *d.c. casting operator* (D.O.T. 514.782) has charge of the pouring station where the molten metal is cast into ingots—large blocks of metal. The operator controls the cooling conditions of the casting unit by keeping the molds full of metal and spraying water against the molds to produce ingots of uniform size and quality.

Shaping aluminum. The large ingots must be reduced in size before the aluminum is useful to customers. Depending on the final product desired, several methods may be used to shape the ingot. Aluminum products such as plate, sheet, and strip are produced by rolling.

The first step in rolling is to remove surface impurities from the ingot. The *scalper operator* (D.O.T. 605.782) manipulates levers of a scalper machine and cuts thin layers of rough metal from the ingots so that the surfaces are smooth. Then, the ingots are heated to proper working temperatures for rolling. Workers operating overhead cranes lower the ingots into furnaces, or "soaking pits," where they are kept sealed for 12 to 18 hours. *Soaking pit operators* (D.O.T. 613.782) manage the furnace and control the temperature and heating time.

After being heated, the huge ingots are positioned on the "breakdown" or hot rolling mill where they are converted into elongated slabs. *Rolling mill operators* (D.O.T. 613.782) manipulate the ingots back and forth between powerful rollers until they are reduced in thickness to about 3 inches. The slabs then move down the line on the rollers to additional hot mills that work them down to a thickness of about one-eighth of an inch. At the end of the hotline, a *coiler operator* (D.O.T. 613.885) tends a coiler that automatically winds the metal onto reels.



Worker polishes aluminum wing section for airliner.

The coiled aluminum cools at room temperature before being cold-rolled still thinner. Cold-rolling produces a better surface finish and increases the metal's strength and hardness. Since continuous cold-rolling could make the metal too brittle, an *annealer* (D.O.T. 504.782) occasionally heats (anneals) the metal.

As an alternative to being rolled, the metal now may be stretched. *Stretcher-level-operators* (D.O.T. 619.782) and *stretcher-level-operator helpers* (D.O.T. 619.886) position the finished plate or sheet in clamps, determine the stretch required to remove surface contours, and operate the machine that pulls the metal from end to end to stretch it.

In the rod and bar factory, square castings called "billets" are heated to make them softer and then are rolled through progressively smaller openings, until the desired size is obtained. To produce wire, hot-rolling continues until the rod is about three-eighths of an inch in diameter. Then, *wire draw operators* (D.O.T. 614.782) operate machines that pull the cold wire through a series of holes (dies) that gradually reduce its size. The machines also automatically coil the wire on revolving reels.

Structural products such as I-beams and angles may be hot-rolled or extruded. Hot-rolled products are made by passing a square billet with rounded corners between grooved rolls that gradually reduce the thickness and change the shape of the metal.

Extruding of metal often is compared with squeezing toothpaste from a tube. Extruded aluminum shapes are produced by placing hot

billets (bars) inside a cylinder in a powerful press. A hydraulic ram that usually has a force of several million pounds pushes the metal through a hole (die) at the other end of the cylinder. The metal takes the shape of the die and then may be cut into desired lengths. By designing different dies, almost any shape of aluminum product may be formed. *Extrusion press operators* (D.O.T. 614.782) regulate the rate at which the metal is forced through the press.

During both the production and shaping processes, workers and machines inspect the metal to assure quality. *Radiographers* (D.O.T. 199.381) operate various types of X-ray equipment to inspect the metal. Computers monitor operations and automatically adjust metal temperature and mill speed.

Other production workers in the aluminum industry keep machines and equipment operating properly. Some move materials, supplies, and finished products throughout the plants; still others are in service occupations such as guard and custodian. Many of these occupations are common to other industries. (See index to the *Handbook*.)

Since electricity is vital to making aluminum, the industry needs many electricians to install and repair electrical fixtures, apparatus, and control equipment. Other employees, such as millwrights and maintenance machinists, make and repair mechanical parts for plant machinery, while stationary engineers operate and maintain the powerplants, turbines, steam engines, and motors used in aluminum plants.

Other important groups are the diemakers who assemble and repair dies used in aluminum metalworking operations; the bricklayers who build and reline furnaces, soaking pits, and similar installations; and the welders who join metal parts together with gas or electric welding equipment. In addition, plumbers and pipefitters lay out, install, and maintain piping and piping systems for steam, water, and other materials used in aluminum manufacturing.

Professional, Technical, Administrative, Clerical, and Sales Occupations. About one employee in ten is a professional or technical worker; about the same proportion are clerks. The few remaining workers are in administrative and sales positions.

Companies employ a variety of professional specialists in producing aluminum. Quality control chemists analyze the aluminum and the raw materials used in its production while process metallurgists determine the most efficient methods of producing aluminum from raw materials. Physical metallurgists test aluminum and aluminum alloys to determine their physical characteristics and also develop new alloys and new uses for aluminum.

Chemical engineers and mechanical engineers design and supervise the construction and operation of production facilities. Mechanical engineers may design new rolling mills or improve existing mills and related equipment. Electrical engineers plan and oversee the installation, operation, and maintenance of the electric generators and distribution systems used in the manufacture of aluminum. Industrial engineers conduct work measurement studies and develop management control systems to aid in financial planning and cost analysis.

Engineering technicians, laboratory technicians, and chemical analysts assist engineers and chemists in research and development work. Drafters prepare the working drawings that are required to make or repair production machinery.

A wide range of other profesional and administrative workers is needed in the manufacture of aluminum. Top executives manage the companies and determine policy. Middle managers and superintendents direct individual departments, offices, and production operations. The industry also employs other adminstrative personnel, as well as accountants, lawyers, statisticians, economists, and mathematicians. Clerical workers, including bookkeepers, secretaries, stenographers, clerk typists, and keypunch and computer operators keep company records and do other routine office work.

Training, Other Qualifications, and Advancement

Aluminum companies generally hire and train inexperienced workers for processing and maintenance jobs. A bachelor's degree is required for most professional jobs, and graduate degrees in science or engineering are preferred for research and development work. Administrative and managerial positions usually are filled by workers who have engineering or science backgrounds and have been promoted to these jobs. Some new graduates who have degrees in business administration or liberal arts may fill entry level administrative jobs. Sales positions often are filled by persons with technical backgrounds.

Applicants and current employees who demonstrate an aptitude for technical work have opportunities to qualify as technicians, laboratory assistants, and other semiprofessional workers. However, some college background in engineering and science, or graduation from a technical institute or community college, is required for many technical jobs.

Unskilled workers begin their careers in a labor pool and sub-

stitute for absent workers until they become eligible for permanent positions in a shop or department. As these workers acquire additional skills and seniority with the company, they usually move to more responsible and better paying positions. Some eventually become supervisors.

Craft workers usually are trained on the job. A number of companies, particularly the larger ones, have craft apprenticeship programs that include classroom or home study courses, as well as on-the-job training. Generally, candidates for these programs are chosen from promising young workers already employed by the company. The length of the apprenticeship varies according to the craft, although most require 3 to 4 years. Examples of crafts that can be learned through apprenticeship are: electrician, welder, brickmason, carpenter, machinist, maintenance mechanic, pipefitter, and general maintenance mechanic.

Employment Outlook

Employment in the aluminum industry is expected to grow about as fast as the average for all industries through the mid-1980's. In addition to growth, many job opportunities will arise from the need to replace workers who retire, die, or leave the industry for other reasons. The number of job opportunities may vary from year to year, however, because the demand for aluminum fluctuates with ups and downs in the economy.

Over the long run, demand for aluminum is expected to grow as population increases and consumers have more money to spend on products made from aluminum. Industries that represent major markets for aluminum are growing industries with potential for new product development. For example, aluminum is being used widely in the construction of large buildings and for residential construction and remodeling. Furthermore, the aluminum industry supports a strong research and development program and an aggressive marketing program which should continue to develop new alloys, processes, and products. As a result, the number of engineers, scientists, and technical personnel is expected to increase as a proportion of total employment. On the other hand, technological developments, such as computer-controlled rolling operations, will limit employment growth among some production occupations.

Earnings and Working Conditions

Hourly earnings of plantworkers in the aluminum industry are higher than the average for manufacturing industries. In 1974, production workers in plants which make aluminum averaged $6.06 an hour, and those in aluminum rolling and drawing plants averaged $5.28. In comparison, production workers in manufacturing industries as a whole averaged $4.40 an hour.

Skilled operators and skilled maintenance and craft workers hold the highest paying plant jobs. Hourly rates in 1974 for selected occupations in a number of plants covered by one major union-management contract are shown below.

Occupation	*Hourly wage rate*
Making Aluminum:	
Anode rebuilder	$5.12
Pot liner	5.44
Pot tender	5.36
Tapper	5.60
Charge gang weigher	5.12
Shaping Aluminum:	
Scalper operator	5.60
Soaking pit operator	5.20
Hot mill operator, junior	5.52
Continuous mill operator	6.16
Annealer	5.20
Sheet stretcher-leveler operator	5.12
Inspector	5.28
Extrusion press operator	5.68
Maintenance:	
Boiler firer	5.28
Bricklayer	6.08
Welder	5.52
Pipefitter	6.00
Millwright	6.00
Electrician	6.24
Machinist	6.24

Aluminum workers receive many fringe benefits, such as paid vacations and holidays, retirement benefits, life and health insurance, shift differentials, supplemental jury-duty pay, and supplemental unemployment benefits. Most workers receive paid vacations ranging from 1 to 4 weeks, depending on length of service. In addition, there are extended vacation plans that provide a 10-week vacation every 5 years.

Making aluminum requires high temperatures; the potroom is often hot, dusty, and smoky. However, working conditions in plants have been improved as a result of smoke control programs and other projects. Because making aluminum is a continuous process, some production employees have to work nights and weekends.

The shaping sector of the industry offers more favorable work conditions though workers in certain jobs are subject to heat, noise, and other discomforts.

The industry stresses safe working conditions and conducts safety education programs. Plants where aluminum is made have had a lower rate of injuries than the average for all metal industries, while the rate for aluminum rolling and drawing mills has been about the same as the average. However, the average number of workdays lost for each injury in the aluminum industry has been greater than the average for metal industries.

Most process and maintenance

workers in the aluminum industry belong to labor unions. In addition, labor organizations represent some office and technical personnel. The unions having the greatest number of members in the industry are United Steelworkers of America; Aluminum Workers International Union; and International Union, United Automobile, Aerospace and Agricultural Implement Workers of America.

Sources of Additional Information

Information on aluminum production and uses, as well as careers, many be obtained from:

The Aluminum Association, 750 Third Ave., New York, N.Y. 10017.

OCCUPATIONS IN THE APPAREL INDUSTRY

The apparel industry is an important source of jobs for workers who have widely different skills and interests. Many of these jobs can be learned in a few weeks; others take several years.

Nature and Location of the Industry

Over 1.3 million people were employed in the apparel industry in 1974. Approximately 585,000 produced women's and children's apparel and about 495,000, men's. The rest made such items as fur goods, gloves, hats, curtains, and draperies.

Although apparel factories are located in nearly all States, about 80 percent of the workers are employed in 15 States: New York, Pennsylvania, California, North Carolina, New Jersey, Georgia, Texas, Tennessee, Massachusetts, South Carolina, Alabama, Mississippi, Virginia, Missouri, and Illinois. New York and Pennsylvania alone employ approximately 30 percent of the industry work force.

Some of the important Northeastern apparel manufacturing centers are in New York City, suburban New Jersey, Boston, Philadelphia, and in smaller cities in Pennsylvania such as Wilkes-Barre, Hazelton, and Allentown. Leading Midwestern and Western centers include Chicago, St. Louis, Dallas, El Paso, San Antonio, and Los Angeles. Apparel manufacturing in the Southeast tends to be widely dispersed. North Carolina, for example, has plants in about 80 of its 101 counties.

Most apparel plants are small. Only about 1 out of every 7 employs more than 100 workers. Plants that manufacture standard garments such as work pants usually are larger than those making expensive dresses and other items that are subject to rapid style change.

Occupations in the Industry

The major operations in making apparel are designing and pattern making, cutting and marking, sewing, and pressing. Generally, high grade and style-oriented apparel is more carefully designed and involves more handwork than cheaper, more standardized items. For example, much hand detailing goes into a fashionable cocktail dress or a high-priced suit or coat, while items such as undershirts and overalls usually are sewn entirely by machine. To make the many different kinds of garments, workers with various skills and educational backgrounds are needed.

Designing Room Occupations. Typically, the manufacturing process begins with the *designer* (D.O.T. 142.081), who creates new types and styles of apparel. Inspiration for a new design may come from any of a variety of experiences: traveling, observing life styles, and seeing the work of other designers, to name but a few. In addition to creativity, designers must have practical knowledge of the apparel business so that they can translate their ideas into styles that can be produced at competitive prices. They must, for example, be familiar with labor costs for various factory operations such as cutting, sewing, and pressing.

A large manufacturer generally has a head designer and several assistants. Many small firms, however, do not employ designers but purchase ready-made designs or patterns or copy higher priced designs.

A designer usually works with one type of apparel, such as suits or dresses, although some work with several. For a high-quality dress, designers usually start by drawing sketches and choosing fabrics, trim, and colors. Using these sketches as guides, designers and their assistants make an experimental dress. They cut materials and pin, sew, and adjust the dress on a form or a live model until it matches the sketch.

Sample makers (D.O.T. 785.381) use this experimental dress as a guide in cutting and sewing fabrics to make a finished sample of the dress. After management has approved the sample, a *pattern maker* (D.O.T. 781.381) constructs a master pattern. Working closely with the designer, the pattern maker translates the sketch or sample dress into paper or fiberboard pieces, each one representing a part of the garment. A *pattern grader* (D.O.T. 781.381) measures the pieces that make up this master pattern, and modifies them to fit various sizes. Some large plants use computers to reduce the time needed to draw up the patterns for each size.

Styles for many items, such as men's suits and jackets, do not change significantly from year to year; thus, some of the steps described above are not required. A designer may alter the style of a suit, for example, by simply making minor changes on the master pattern. Before making such changes, however, the designer must be able to sketch or mentally picture how the total appearance of the suit will be affected.

Cutter guides electric knife through layers of cloth.

Cutting Room Occupations. Workers in the cutting room prepare cloth for sewing. There are five basic operations in the cutting department: spreading, marking, cutting, assembling, and ticketing. Small shops may combine two or more of these operations into a single job.

Hand spreaders (D.O.T. 781.887) lay out bolts of cloth into exact lengths on the cutting table. *Machine spreaders* (D.O.T. 781.884) are aided by machines in laying the cloth evenly across the table.

Markers (D.O.T. 781.484) trace the fiberboard pattern pieces on large sheets of paper, and may make several carbons of these tracings. In some cases they trace the pattern pieces with chalk directly on the cloth itself, rather than on paper. To get the greatest number of garments from a minimum quantity of cloth, markers arrange pattern pieces so that there is just enough distance between them for the cutter to work.

A *cutter* (D.O.T. 781.884) cuts out the various garment pieces from layers of cloth. Sometimes these layers are as high as 9 inches. The cutter follows the outline of the pattern on the cloth with an electrically powered knife which slices through all the layers at once. The work of a cutter and a marker frequently is combined into a single job.

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 the pieces and accessories (linings, tapes, and trimmings) needed to make a complete garment. They match color, size, and fabric design and use chalk or thread to mark locations for pockets, buttonholes, buttons, and other trimmings. They identify each bundle with a ticket, which is also used to figure the earnings of workers who are paid according to the number of pieces they produce. The bundles are then routed to the various sections of the sewing room.

Sewing Room Occupations. About one-half of all apparel workers are handsewers and sewing machine operators. Expensive garments and finishing touches on moderate-priced clothing may need much hand sewing. Most sewing, however, is done with machines.

Sewing machine operators (D.O.T. 787.782) use industrial machines that are heavier and run faster than the ones found in the home. These workers generally specialize in a single operation such as sewing shoulder seams, attaching cuffs to sleeves, or hemming blouses. Some make sections such as pockets, collars, or sleeves; others assemble and join these completed sections to the main parts of the garment.

Sewing machine operators generally are classified by the type of machine they use, such as single-needle sewing machine operator or blind-stitch machine operator, and by the type of work performed, such as collar stitcher or sleeve finisher.

Most hand sewing is done on better quality or highly styled dresses, suits, and coats. *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 lapel basting or lining stitching.

Instead of being sewn, parts such as collars and lapels may be "fused" together by heat and pressure. A *fusing machine operator* places the garment part on a loading platform of a fusing press which is adjusted to apply the precise amount of pressure and temperature needed for a permanent bond.

In a typical apparel plant, 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. Many plants employ *material handlers* (D.O.T. 929.887) who move garment bundles from one sewing operation to another.

At various stages of the sewing operations, *inspectors* and *checkers*

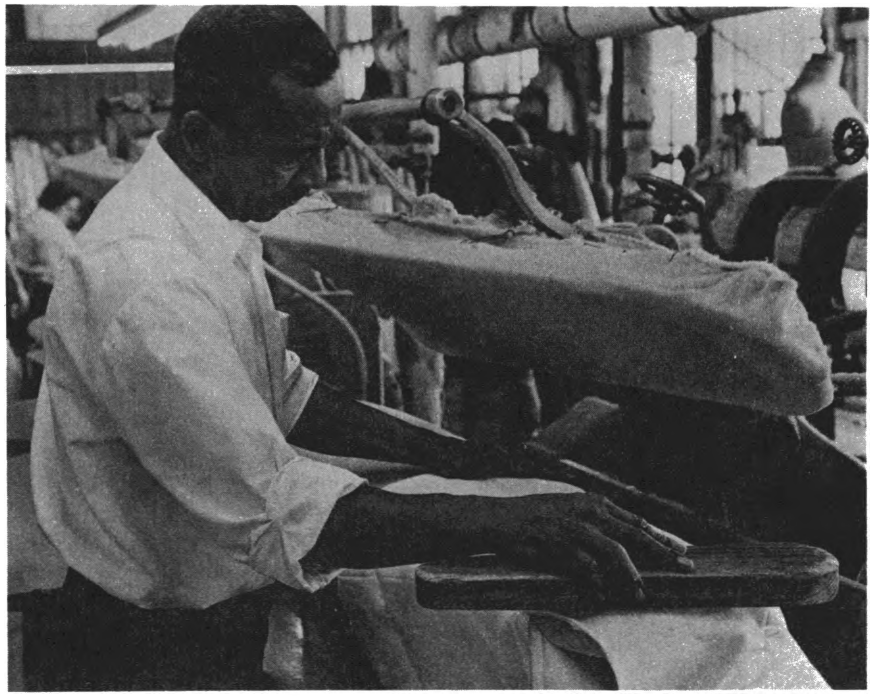
(D.O.T. 789.687) examine garments. They mark defects, such as skipped stitches or bad seams, which are repaired before the garments are passed on to the next sewing operation. Inspectors sometimes make minor repairs. *Trimmers, hand* (D.O.T. 781.887), often called thread trimmers and cleaners, remove loose threads, basting stitches, and lint from garments. This is called "in-process inspection."

Tailoring Occupations. Tailors (D.O.T. 785.261 and .381) and dressmakers (D.O.T. 785.361) are skilled workers who do difficult kinds of hand and machine sewing. Most of them are employed in making expensive clothing that needs precise shaping and finishing. Although some tailors and dressmakers make complete garments, most specialize in a few operations such as collar setting and lapel padding.

Bushelers (D.O.T. 785.281) are tailors who repair defects in finished garments rejected by the inspector. They alter 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 garments depend, to a large extent, on the pressing that is done during and after sewing operations.

Pressers (D.O.T. 363.782, .884, and .885) use various types of steam pressing machines, and may work with manikins and body forms, or use hand irons to flatten seams and to shape parts and finished garments. 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.



Appearance of the finished garment depends largely on the presser's skills.

Finish pressers generally do final pressing and ironing at the end of the sewing operations.

Fur Shop Occupations. Because furs are expensive and difficult to work with, making a fur garment requires workers who have special skills not found in plants that make other types of apparel.

The most skilled worker in a fur garment plant is the *fur cutter* (D.O.T. 783.781), who also may be the supervisor. The cutter selects and matches enough fur skins to make a single garment, such as a coat or jacket, and arranges and cuts the skins on pattern pieces so that the choice sections of fur are placed where they will show. Following the sewing instructions given by the cutter, *fur machine operators* (D.O.T. 787.782) sew these pelts together to make garment sections. A *fur nailer* (D.O.T. 783.884) wets the sewn garment sections, stretches them by hand, and either staples or nails them on a board so that they will cover the pattern. When the sections are dry, this worker removes the staples or nails and trims the fur exactly along the outline of the pattern. The fur machine operator then finishes sewing the various sections to complete the 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. Most administrative positions in an apparel plant are in the production department. Production managers are 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. In some small apparel firms, the production manager also is a designer.

Industrial engineers advise management about the efficient use of machines, materials, and workers. (Further discussion of industrial engineers is included elsewhere in the *Handbook*.)

Clerks, bookkeepers, stenog-

A large proportion of apparel industry employees are sewing machine operators.

raphers, and other office workers make up payrolls, prepare invoices, keep records, and attend to other paperwork. In some large plants, many clerical functions are handled with computers. This requires keypunch operators, computer programmers and operators, and systems analysts. Salesworkers, fabric buyers, models, accountants, and sewing machine mechanics and technicians are among other types of workers in the apparel industry. Discussions of many of these jobs can be found elsewhere in the *Handbook*.

Training, Other Qualifications, and Advancement

Most production (plant) workers in the apparel industry pick up their skills on the job by helping and observing experienced workers. Training time ranges from a few weeks to several years, depending on the type of occupation, the worker's aptitude, and the employer's training programs. A relatively small number of employees are trained in formal apprenticeship programs for highly skilled occupations, such as pattern maker, cutter, and tailor. Apprenticeships include both classroom and on-the-job training. Some private and public schools in apparel manufacturing centers offer courses in pattern making, cutting, and tailoring, as well as machine and hand sewing. Students who complete these courses, however, usually need additional on-the-job training.

Many production occupations are well suited for the handicapped because the work is done while the worker is seated. In many cases, little physical effort is required. Good eyesight and manual dexterity, however, are vital.

Entry into beginning hand or machine-sewing jobs is relatively easy, since there are few restrictions regarding education and physical condition. New workers start by sewing straight seams, under the supervision of a skilled worker or supervisor, and progress to more complicated sewing as they gain experience. Many large companies have special on-the-job training programs for sewing machine operators. The operator is taught how to perform each operation with minimal finger, arm, and body movement. The ability to do routine work rapidly is essential, since nearly all sewers are paid by the number of pieces they produce. Some sewers advance to other jobs in the plant, such as tailor or dressmaker; others become supervisors. Most sewers, however, stay on the same general operation throughout their working lives and can look forward only to moving from simple sewing tasks to more complicated ones that pay higher piece rates.

New workers usually enter the cutting room by taking jobs as assemblers (bundlers or fitters). Patience and the ability to match colors are necessary for these jobs. An assembler may be promoted to spreader, and after a few years, to marker or cutter.

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 pattern makers pick up the skills of the trade by working for several years as helpers to experienced pattern makers. Cutters and pattern graders are occasionally promoted to pattern making. Pattern makers must be able to visualize from a sketch or model the size, shape, and number of pattern pieces required for a particular garment. They also must have a

knowledge of fabrics, body proportions, and garment construction.

For beginning tailor and dressmaking jobs, many employers prefer to hire vocational school graduates who have had courses in these subjects. With a few years of additional apprenticeship or informal on-the-job training, graduates can qualify as skilled workers. Some of these workers eventually become designers or supervisors. They can also transfer to jobs outside the apparel manufacturing industry as fitters and alteration tailors in clothing stores and drycleaning shops.

Pressers usually begin as underpressers, working on simple seams and garment parts. Underpressing can be learned in a short time, and the worker can progress to the more difficult job of finish presser. These workers also can transfer to pressing jobs in drycleaning shops.

Many apparel firms prefer to recruit designers from colleges that offer specialized training in this field. Graduates usually start as assistant designers or sample makers. Some designers, however, have come up through the ranks by advancing from cutting, pattern making, or tailoring jobs.

Designers need a thorough knowledge of fabrics, a keen sense of color, and the ability to translate design ideas into a finished garment. They should also acquaint themselves with garment making techniques by working briefly in various plant jobs, such as sample making, cutting, and machine sewing. Designers should know how to sketch.

A production manager usually begins as a management trainee, and an industrial engineer as a junior engineer. A college education increasingly is being required for these jobs. For those without a college background, many years of on-the-job training in all production processes, ranging from selection of fabrics to shipment of finished apparel, are required to qualify as a production manager.

Employment Outlook

Apparel industry employment is expected to grow more slowly than the average for all industries through the mid-1980's. Most job openings will arise from the need to replace experienced workers who retire, die, or transfer to other fields of work. The number of openings may fluctuate greatly from year to year, as the demand for apparel is highly sensitive to changes in the economy.

Demand for apparel is expected to increase over the long run as population and incomes continue to grow. The industry's greater emphasis on styling also may stimulate demand. Employment in the industry, however, is not expected to keep pace with the production of apparel, because new mechanized equipment and improved methods of production and distribution are expected to result in greater output per worker. Examples of laborsaving 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; and computer-controlled pattern making, grading, and cutting. Computers also are improving managerial control over sales, inventories, shipping, and production.

Despite technological advances in equipment, apparel manufacturing operations will continue to require much manual labor. Most employment opportunities will be for sewing machine operators, as this occupational group constitutes approximately 50 percent of total industry employment. Job openings also will arise for pressers and designing and cutting room workers.

Opportunities are expected to be particularly favorable for production managers and engineers with college degrees in apparel management, engineering technology for apparel, and industrial engineering, as well as for salesworkers, fabric buyers, and sewing machine mechanics. People who plan to become designers, on the other hand, will face keen competition, because the number of people trying to get into this field exceeds the number of available jobs.

Earnings and Working Conditions

Earnings in the apparel industry are relatively low. In 1974, production workers in apparel averaged $2.99 an hour, compared with $4.40 an hour for those in all manufacturing industries. Production workers in the apparel industry also worked fewer hours per week than those in manufacturing as a whole.

Average hourly earnings of production workers varied among

Table 1. Average hourly earnings of production workers in the men's and boys' suits and coats industry, selected occupations and areas, 1973

Men's and boys' suits and coats	Estimated average hourly earnings		
	New York & Nassau–Suffolk	Baltimore	Chicago
All production workers	$3.79	$3.32	$3.88
Cutters and markers	5.02	4.42	4.92
Finishers, hand, coat fabrication	3.21	3.20	3.64
Sewing machine operators, coat fabrication	3.84	3.21	3.87
Sewers, hand, trouser fabrication	3.75	3.05	3.65
Sewing machine operators, trouser fabrication	4.10	3.09	3.50

different kinds of apparel plants, ranging from $2.58 in plants that made men's and boys' work clothing to $3.66 in those that made men's and boys' suits and coats. Earnings of apparel workers also varied by occupation and geographical area. Table 1 gives estimated average hourly earnings in 1973 for selected occupations and areas in one segment of the industry.

Because most production workers in the apparel industry are paid by the number of pieces they produce, their total earnings depend upon speed as well as skill.

Many apparel workers are union members, particularly those who work in metropolitan areas. The major unions in this industry are the International Ladies' Garment Workers' Union, the Amalgamated Clothing Workers of America, and the United Garment Workers of America. Some of these unions sponsor health care and child day care centers, cooperative housing, and vacation resorts for the benefit of their members.

Workers may be laid off for several weeks during slack seasons, particularly in plants that make seasonal garments, such as women's coats and suits. Employment is usually more stable in plants that produce standardized garments, such as pajamas and men's shirts, which are worn all year. In many plants, the available work during slack periods is divided so that all workers can be assured of at least some earnings.

While many plants are housed in old buildings, others are located in modern buildings that have ample work space, good lighting, and air conditioning.

Because most employees sit when they sew, the work is not physically strenuous, but the pace is rapid and many tasks are monotonous. A sewer may occasionally pierce a finger with a needle, but serious accidents are rare.

Working conditions in cutting and designing rooms are pleasant. These rooms often are in a separate area of the plant, away from the hustle and bustle of the sewing and pressing operations. Designing, pattern making, and cutting jobs are more interesting and less monotonous than most other apparel jobs.

Sources of Additional Information

Information on vocational and high schools that offer training in designing, tailoring, and sewing may be obtained from the Division of Vocational Education of the Department of Education in each State capital.

Information on apprenticeships may be obtained from the Apprenticeship Council of the State Labor Department or the local offices of State employment service. Some local employment service offices administer tests to determine aptitudes that are important for many apparel industry jobs.

For general information on jobs in the industry and information on schools which offer degrees in apparel management, engineering technology for apparel, design, and related professional and vocational fields, write to:

American Apparel Manufacturers Association, 1611 N. Kent St., Arlington, Va. 22209.

Amalgamated Clothing Workers of America, 15 Union Square, New York, N.Y. 10003.

Clothing Manufacturers Association of U.S.A., 135 W. 50th St., New York, N.Y. 10020.

Fur Information and Fashion Council, 101 W. 30th St., New York, N.Y. 10001.

International Ladies' Garment Workers' Union, 1710 Broadway, New York, N.Y. 10019.

National Dress Manufacturers' Association, Inc., 570 Seventh Ave., New York, N.Y. 10018.

National Outerwear and Sportswear Association, Inc., 1 Pennsylvania Plaza, New York, N.Y. 10001.

New York Coat and Suit Association, 225 W. 34th St., New York, N.Y. 10001.

United Garment Workers of America, 31 Union Square, New York, N.Y. 10013.

OCCUPATIONS IN THE ATOMIC ENERGY FIELD

Atomic energy is a source of heat and radiation that can be used for peaceful as well as military purposes. Although peaceful applications have been expanding rapidly in recent years, they are still in the early stages of development, and continuing research and development programs will be needed during the next several decades to find new and more efficient ways of utilizing this energy.

In 1974, nearly 250,000 people worked in atomic energy activities. Large numbers did research and development work. Others worked in industries that manufacture nuclear weapons and other defense materials, nuclear reactors, and nuclear fuels. Most atomic energy workers are scientists, engineers, technicians, and craft workers.

Applications of Atomic Energy

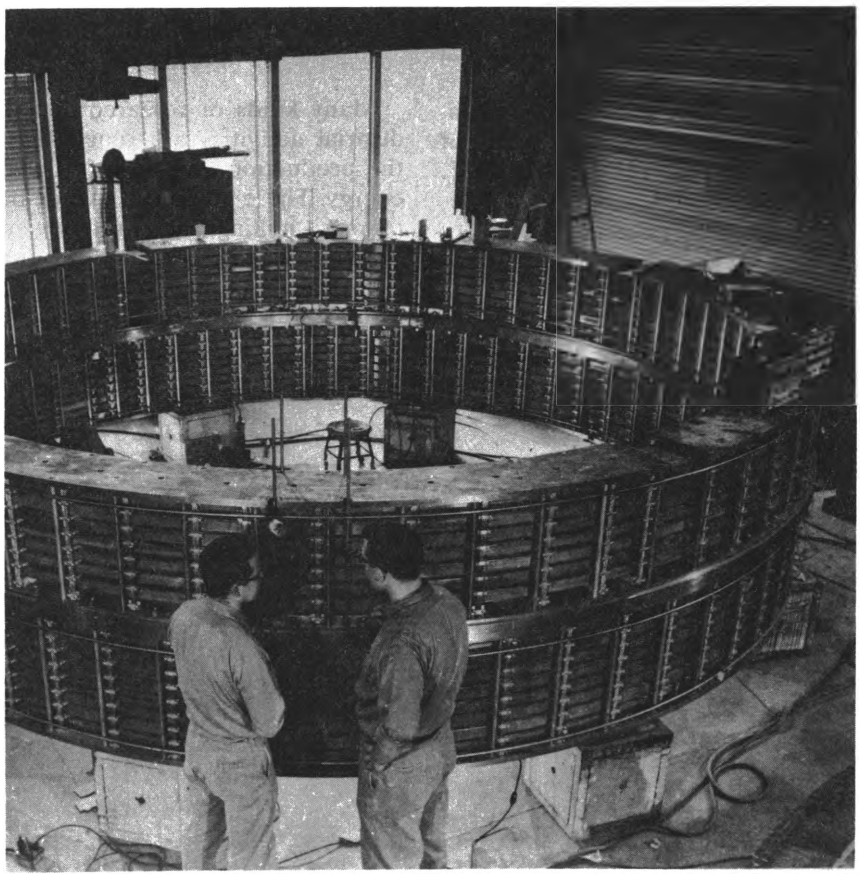
One significant use of atomic energy is the production of commercial electricity by nuclear reactors. Steam produced by reactors now generates electricity for many communities. These reactors have become competitive with systems that use fossil fuels (such as coal and oil). At the end of 1974, there were 55 nuclear reactors in commercial operation. About 175 plants are now either in the planning stage or being constructed. Dual-purpose nuclear power desalting plants, which would at the same time provide both a new source of fresh water and electric power, are being studied.

Nuclear reactors also power submarines and surface vessels. By eliminating refueling, nuclear propulsion extends the range and mobility of our naval forces.

Although existing reactors already generate huge quantities of power from a small amount of uranium, more efficient reactors may be operational by the mid-1980's. The Liquid Metal Fast Breeder Reactor, which may be commercially operable by the 1990's, actually produces more potential fuel than it consumes. Further in the future, controlled fusion reactors may provide an even more efficient method of producing electricity.

The U.S. Energy Research and Development Administration has continued the research begun by the Atomic Energy Commission's "Project Plowshare," a program to develop peaceful uses for nuclear explosives. The program has potential applications in areas such as gas, oil, and mineral recovery, and the excavation of harbors, canals, and mountain passes.

Another significant application of atomic energy is in the use of radioisotopes. The radioisotopes emit radiation that special instruments, such as thickness gauges, can detect, and are valuable research tools in environmental studies, agriculture, medicine, and industry.



Technicians complete assembly of experimental unit used in atomic energy research.

How Atomic Energy is Produced

Although there are several processes for producing atomic or nuclear energy, the most common method used today is the fission process. It involves splitting uranium or plutonium nuclei by neutron bombardment. When neutrons emitted from this fission process bombard other nuclei, further fission takes place and, under proper conditions, results in a "chain" reaction. This reaction releases energy which is converted into power. The detonation of an atomic bomb is an application of the explosive release of atomic energy. However, for commercial uses, this energy is controlled.

Controlled fission is the essential feature of a nuclear reactor. The reactor is like a furnace, and needs fuel to operate. The principal source material for reactor fuel is uranium 235. Uranium in its natural state contains less than 1 percent of readily fissionable material, U-235. Although natural uranium is sometimes used as reactor fuel, a more concentrated and enriched fuel is produced and used by increasing the proportion of U-235 isotopes through a process called gaseous diffusion. The rate of fission and energy produced in a nuclear reactor usually is controlled by inserting special neutron-absorbing rods into the fuel chamber or "core."

When atomic energy is used commercially for power, the heat generated must be converted to electricity by conventional equipment. The major difference between nuclear and conventional thermal electric power stations is that the steam to drive turbines comes from a nuclear reactor rather than from conventional power sources. (See accompanying chart.)

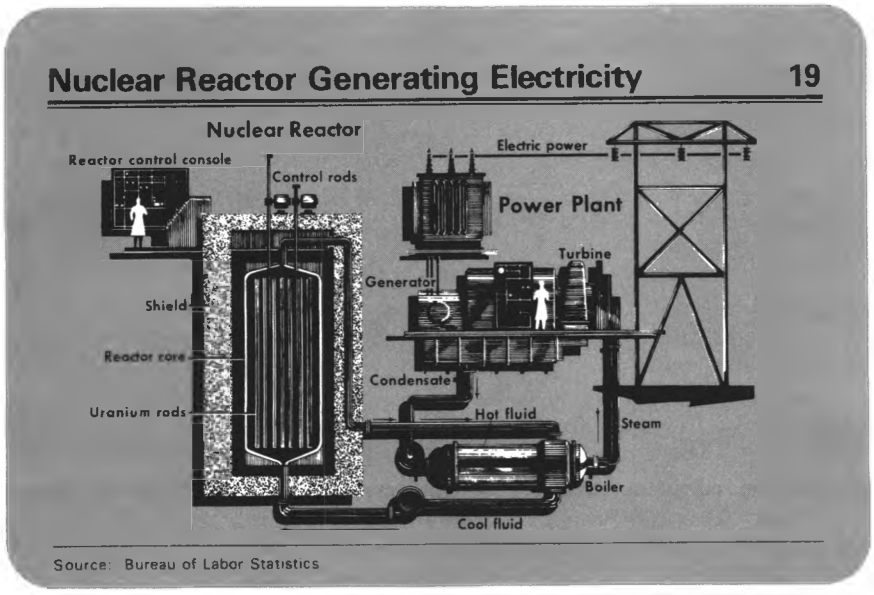
Because of the potential hazards of nuclear radiation, special radiation-resistant materials are used in reactors and precautions are taken to protect personnel.

Nature of the Atomic Energy Field

Many kinds of research and industrial activities are required for the production and use of nuclear energy. These processes include the mining, milling, and refining of uranium-bearing ores; the production of nuclear fuels; the manufacture of nuclear reactors, reactor components, and nuclear instruments; the production of special materials for use in reactors; the design, engineering, and construction of nuclear facilities; the operation and maintenance of nuclear reactors; the disposal of radioisotopes; the production of nuclear weapons; and research and development work.

These activities take place in plants, laboratories, and other facilities. Some work, such as mining and milling, manufacturing heat transfer equipment, and constructing facilities, differs little from similar work in other fields. Other activities, however, such as producing fuels needed to run reactors, are unique to the atomic energy field.

The Federal Government supports over half of the basic atomic energy activities, though private support has been increasing. The U.S. Energy Research and Development Administration (ERDA) directs the Federal Government's atomic energy research program, and the Nuclear Regulatory Commission (NRC) controls the use of nuclear materials by private organizations. The operation of ERDA-owned facilities, including laboratories, uranium processing plants, nuclear reactors, and weapons manufacturing plants, is contracted to private organizations. About half of all workers in the atomic energy field are employed in government-owned facilities. Privately owned facilities do all types of atomic energy work except for the development and production of military weapons and certain nuclear fuel-processing operations. A large amount of research and development work is carried out in ERDA-owned laboratories, university and college laboratories, nonprofit institutions, and industrial organizations under ERDA contracts.



Occupations in the Atomic Energy Field

Engineers, scientists, technicians, and craft workers account for a

higher proportion of total employment in this field than in most others, mainly because much of the work is still in the research and development phase. Office personnel in administrative and clerical jobs represent another large group. Most of the remainder are semiskilled and unskilled workers involved in production operations, plant protection, and services.

Although many engineers working in the atomic energy field are trained in nuclear technology, engineers trained in other fields also are employed. Mechanical engineers are the largest single group, but many electrical and electronic, chemical, civil, and metallurgical engineers also are needed. Many of these engineers do research and development work; others design nuclear reactors, nuclear instruments, and other equipment.

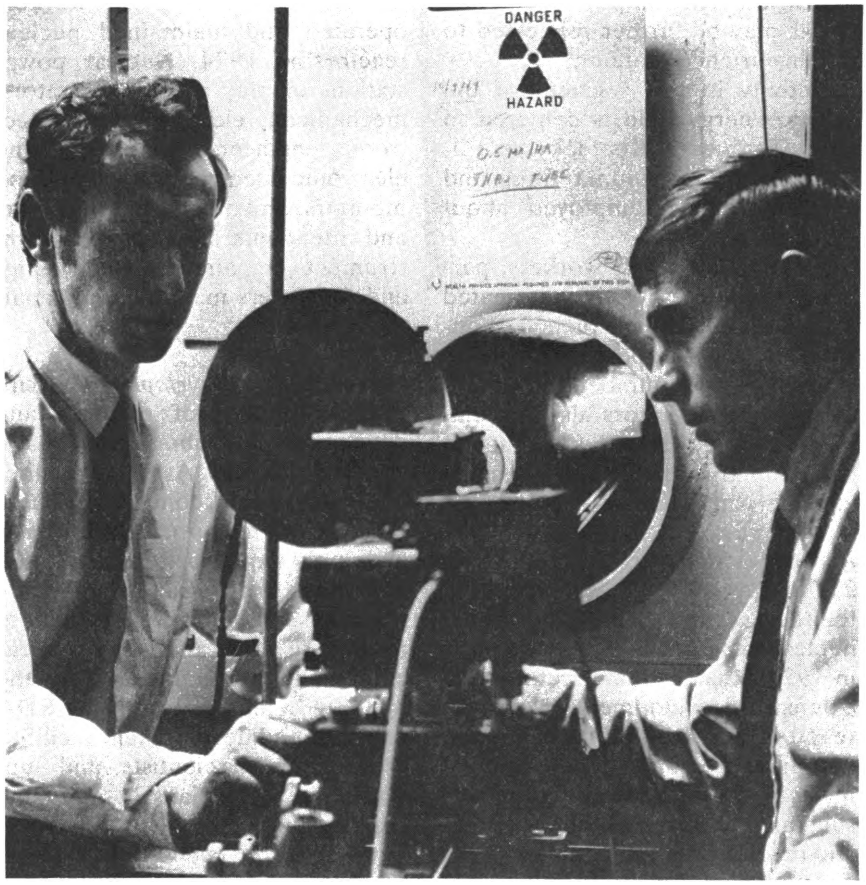
Research laboratories and other organizations that do atomic energy work employ scientists in basic and applied nuclear research. Most are physicists and chemists, but mathematicians, biological scientists, and metallurgists also do atomic energy research.

Large numbers of engineering and science technicians, drafters, and radiation monitors assist engineers and scientists in research and development and in designing and testing equipment and materials.

Many highly skilled workers build equipment for experimental and pilot work and maintain the complex equipment and machinery. Maintenance mechanics and all-round machinists work in most atomic energy activities, as do electricians, plumbers, pipefitters, and other craft workers and chemical process operators.

Activities in the Atomic Energy Field

The following briefly describes some major atomic energy activities and their workers.



Chemists operate "light splitting" device used in studying the motion of atomic particles.

Uranium Exploration and Mining. The 6,500 people employed in uranium exploration and mining in 1974 had jobs similar to those in mining of other metallic ores. They mainly work in the Colorado Plateau area of the Far West, in the States of New Mexico, Wyoming, Utah, Colorado, and Arizona. A relatively small number of mines account for the bulk of production and employment. Most workers in uranium mines are in production jobs such as miners and drillers in underground mines, and truckdrivers, bulldozer operators, and machine loaders at open pit mines. About 1 out of 8 employees in uranium exploration and mining is in a professional job, such as mining engineer or geologist.

Uranium Ore Milling. In uranium mills, metallurgical and chemical processes are used to extract uranium from mined ore. Uranium mills, located primarily in the Colorado Plateau, employed about 1,400 workers in 1974.

These mills employ skilled machinery repairers, millwrights, pipefitters, carpenters, electricians, and chemical process operators. A small proportion of those working in milling operations are scientists and engineers.

Uranium Refining and Enriching. Milled uranium is chemically processed to remove impurities and converted to metal or intermediate chemical products for reactor fuel preparation. Conventional chemical and metallurgical processes are used, but they must meet more exacting standards than in most other

industries. The output of refining plants may be further processed to obtain enriched uranium.

Activity in this segment of the atomic energy field is centered in Ohio, Tennessee, Kentucky, and Illinois. In 1974 uranium refining and enriching plants employed about 7,900 workers.

Maintenance craft workers, particularly in the highly automated uranium enriching plants, constitute a large proportion of skilled workers. Large numbers of chemical process operators also are employed. More than a third of the engineers and scientists are chemical engineers and chemists.

Reactor Manufacturing. About 27,700 people were employed in the design and manufacturing of nuclear reactors and reactor parts in 1974. Reactor manufacturers do extensive development work on reactors and auxiliary equipment, design reactors, and generally build most of the intricate components, such as fuel elements, control rods, and reactor cores.

About one-third of the employees in firms that design and manufacture reactors are scientists, engineers, and technicians. Engineers alone represent more than one-quarter of the employment. Most are mechanical engineers and reactor engineers who specialize in reactor technology. Assisting these engineers and scientists are many drafters and engineering technicians.

Skilled workers, mostly all-round machinists, are employed by reactor manufacturers in experimental, production, and maintenance work. Other craft workers such as sheetmetal workers, instrument makers, machinery repairers, instrument repairers, and electricians also are employed. Reactor manufacturers employ nuclear reactor operators to operate experimental and test reactors.

Reactor Operation and Maintenance. About 7,700 workers operated and maintained nuclear reactors in 1974. Nuclear power stations employ reactor operators, mechanical, electrical and electronic engineers, instrument and electronic technicians, radiation monitors, and other plant operators and attendants. Machinery and instrument repairers, electricians, and pipefitters maintain and repair the reactors.

Research and Development Facilities. A number of research and development laboratories are operated for ERDA by universities and industrial concerns. These facilities are major centers for basic and applied nuclear research in engineering, physical and life sciences, and in the development of nuclear reactors and other nuclear equipment. More than half of the 33,000 employed in ERDA research and development facilities are engineers, scientists, and supporting technicians, including radiation monitors.

Administrative and clerical workers account for a large proportion of employment. Skilled workers include large numbers of machinists, electricians, machinery repairers, and millwrights, and many tool and diemakers, instrument makers, and pipefitters. Nuclear reactor operators operate research and test reactors and many service workers are employed in plant protection and security operations.

Although most nuclear energy research is in ERDA research and development facilities, additional research is done in privately owned laboratories of educational institutions, other nonprofit institutions, and industrial concerns. In 1974, about 4,000 persons worked in such facilities, nearly 3 out of 4 in scientific, engineering, and technical jobs.

Production of Nuclear Weapons and Other Defense Materials. Establishments that produce nuclear weapons and weapon components, plutonium, and other defense materials employed about 31,000 people in 1974. Most skilled workers are machinery repairers and millwrights, chemical process operators, machinists, electricians, instrument repairers, pipefitters, tool and diemakers, and instrument makers.

Among the large number of scientists and engineers employed at these facilities are physicists, chemists, and mechanical, electrical, and electronic engineers. Many engineering and physical science technicians, drafters, and radiation monitors assist scientists and engineers.

Construction of Nuclear Facilities. In 1974, about 43,000 persons worked on the construction of nuclear facilities—almost all were craft workers. Over 11,000 of these were pipe- and steamfitters, 5,300 were electricians, and 7,300 were laborers. Several thousand carpenters, ironworkers, operating engineers, and boilermakers also were required in nuclear construction.

Other Atomic Energy Activities. Over 2,400 workers produce special materials such as beryllium, zirconium, and hafnium for use in reactors. About 8,000 workers are in companies that make reactor control instruments, radiation detection and monitoring devices, and other instruments. Production of these instruments is similar to other instrument manufacturing. Large numbers of engineers and technicians are employed in these industries.

Roughly 800 people were employed by manufacturers of particle accelerators and their specialized components. Particle accelerators enable scientists to study the structure and properties of elementary particles in the nucleus of an atom.

Other workers process and package radioisotopes, produce radiography units and radiation

gauges and package and dispose of radioactive waste.

Government Employment. In 1974, the Atomic Energy Commission employed nearly 8,000 workers (about 2,000 were scientists or engineers). In January 1975, however, the AEC was disbanded. About 6,000 workers began working in the new Energy Research and Development Administration, while about 2,000 joined the newly formed Nuclear Regulatory Commission. Since ERDA and NRC are primarily administrative and regulatory agencies, nearly 9 out of 10 employees are in administrative, professional, or clerical jobs. Several thousand employees are engaged in atomic energy work in other Federal agencies and in regulatory activities and radiological health programs of State and local governments.

Unique Atomic Energy Occupations. Most of the occupations discussed in the preceding sections are similar to those found in other industrial activities, even though they may have job titles unique to the atomic energy field (such as nuclear engineer, radiation chemist, and nuclear reactor operator) and require some specialized knowledge of atomic energy. (A detailed discussion of the duties, training, and employment outlook for most of these occupations appears elsewhere in the *Handbook*.)

The health physics occupations, which are unique to the atomic energy field, and some other occupations that require training in the field or in the handling and use of radioactive materials or radiation producing equipment, are discussed briefly in the following sections.

Health physicists (sometimes called radiation or radiological physicists or chemists) detect radiation and apply safety standards to control exposure to it. In 1974 nearly 800 health physicists were employed in radiation protection work, research, or teaching.

Health physicists are responsible for planning and organizing radiological health programs at atomic energy facilities. They establish inspection standards and determine procedures for protecting employees and eliminating radiological hazards. Some supervise the inspection of work areas with potential radiation hazards and prepare instructions covering safe work procedures.

Health physics technician counting routine smear surveys obtained from plantsite.

Health physicists also plan and supervise training programs dealing with radiation hazards and advise others on methods of dealing with them. In some cases, they work on research projects dealing with the effects of human exposure to radiation and may develop procedures for using radioactive materials.

Radiation monitors (also called health-physics technicians) generally work under the supervision of health physicists. Almost 2,000 radiation monitors were employed in the atomic energy field in 1974. They use special instruments to monitor work areas and equipment to detect radioactive contamination. Soil, water, and air samples are taken frequently to determine radiation levels. Monitors also may collect and analyze radiation detectors, such as film badges and pocket detection chambers, worn by workers. They calculate the amount of time that personnel may work in contaminated areas, considering maximum radiation exposure limits and the radiation level. Monitors also give instructions in radiation safety procedures and prescribe special clothing requirements and other safety precautions for workers entering radiation zones.

Nuclear reactor operators perform work in nuclear power stations similar to that of boiler operators in conventional ones; however, the controls they operate are different. They also help to load and unload reactor cores. Those who work with research and test reactors check reactor control panels and adjust controls to maintain specified operating conditions within the reactor. About 1,700 people worked as nuclear reactor operators in 1974.

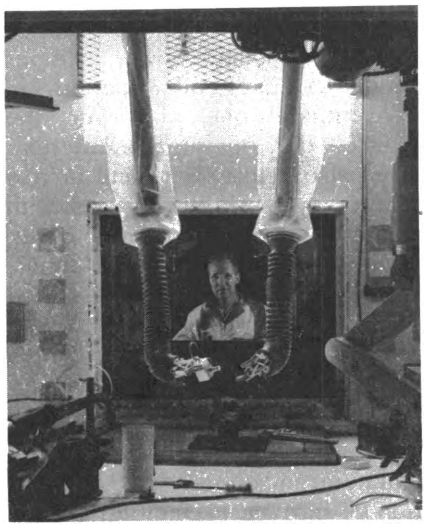
Accelerator operators set up, maintain, and coordinate the operation of particle accelerators. They adjust machine controls to accelerate electrically charged particles, based on instructions from the

scientist in charge of the experiment, and set up target materials that are to be bombarded by the particles.

Radiographers take radiographs to check the quality of metal castings, welds, and other objects by adjusting the controls of an X-ray machine, or by exposing the object to be radiographed to a source of radioactivity. They select the proper type of radiation source and film and use standard mathematical formulas to determine exposure distance and time.

Hot-cell technicians operate remote-controlled equipment to test radioactive materials that are placed in hot cells—rooms enclosed with radiation shielding materials such as lead and concrete. By controlling "slave manipulators" (mechanical devices that act as a pair of arms and hands) from outside the cell and observing their actions through the cell window, they perform standard chemical and metallurgical operations with radioactive materials. Hot-cell technicians also enter the cell wearing protective clothing to set up experiments or to decontaminate the cell and equipment. *Decontamination workers* use radiation-detection instruments to locate equipment, plant areas, and materials that have been exposed to radiation. They decontaminate these with special equipment, detergents, and chemicals and verify the effectiveness of the process. *Waste-treatment operators* operate heat exchange units, pumps, compressors, and other equipment to decontaminate and dispose of radioactive waste liquids. *Waste-disposal workers* seal contaminated wastes in concrete containers and transport the containers to a burial ground.

Radioisotope-production operators use remote control manipulators and other equipment to prepare radioisotopes for shipping and perform chemical analyses to ensure that radioisotopes conform to specifications.



Hot cell technician handles highly radioactive material with a remote control manipulator.

Training and Other Qualifications

Training and education requirements and advancement opportunities for most workers in the atomic energy field are generally similar to those doing comparable jobs in other industries. These are discussed elsewhere in the *Handbook* under the specific occupations. However, additional specialized training is required for many workers because the field requires exacting work standards in both its research and production activities, and because it has unique health and safety problems.

Many engineers and scientists in the atomic energy field have advanced training, particularly those doing research, development, and design work. About one-fourth of the scientists and engineers employed in research and development by major ERDA contractors have a Ph. D. degree. While the proportion of engineers with Ph. D. degrees is smaller than that of scientists, graduate training is preferred for an increasing number of both scientific and engineering jobs.

The specialized knowledge of nuclear energy essential for most scientific and engineering positions can be obtained at a college or university or through on-the-job experience.

Colleges and universities have expanded their facilities and curriculums to provide training in nuclear energy. Most people planning to work in the atomic energy field as scientists and engineers choose to major in a specific nuclear discipline, although a degree in a traditional engineering or science curriculum is generally sufficient to begin work in the field. Some colleges and universities award graduate degrees in nuclear engineering or nuclear science. Others offer graduate training in these fields, but award degrees only in the traditional engineering or scientific fields.

Health physicists should have at least a bachelor's degree in physics, chemistry, or engineering, and a year or more of graduate work in health physics. A Ph. D. degree often is required for teaching and research.

Skill requirements for craft workers in the atomic energy field are higher than in most industries because of the precision required to insure efficient operation and maintenance of complex equipment and machinery. For example, pipefitters may have to fit pipe to tolerances of less than one ten-thousandth of an inch and work with pipe made from rare and costly metals. Welding also must meet higher reliability standards than in most fields. These craft workers generally obtain the required additional specialized skills through apprenticeship training programs of employers and unions.

High school graduates who have taken science courses can qualify for on-the-job training as radiation workers, accelerator operators, radiographers, hot-cell technicians, decontamination workers, radioisotope-production operators, and ra-

dioactive waste disposal workers.

Nuclear power reactor operators need a basic understanding of reactor theory and a working knowledge of reactor controls. Most operator trainees are high school graduates. Trainees are often selected from conventional power plant personnel with experience operating boilers, turbines, or electrical machinery. Workers operating nuclear reactor controls must be licensed by the NRC. To qualify for a license, the trainee must pass an operating and written test given by the NRC, along with a medical examination. The preparation for NRC licensing generally lasts at least 1 year. Licenses must be renewed every 2 years however, due to rapid technological change. Consequently, continual retraining is necessary. Additional preparation beyond the operator's license is needed for a senior operator's license, which authorizes the holder to supervise a nuclear control room.

All employees who work in the vicinity of radiation hazards are given on-the-job training in the nature of radiation and the procedures to follow in case of its accidental release.

Individuals who handle classified data (restricted for reasons of national security) or who work on classified projects in the atomic energy field must pass a security clearance.

The Energy Research and Development Administration, at its contractor-operated facilities, supports on-the-job and specialized training programs to help prepare scientists, engineers, technicians, and other workers for the atomic energy field.

Additional educational and training opportunities are offered in cooperative programs arranged by ERDA laboratories with colleges and universities. Temporary employment at these laboratories is available to faculty members and students. Many undergraduate and graduate engineering students work at laboratories and other ERDA facilities on a rotation basis, and many graduate students do their thesis work at ERDA laboratories.

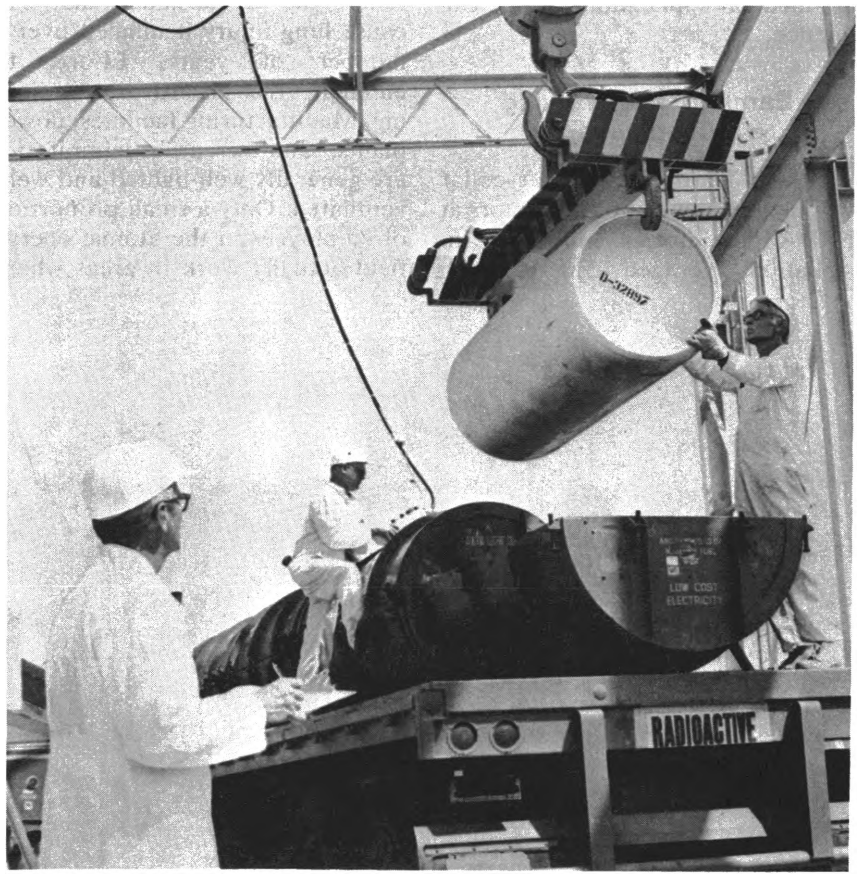
Government contractors often provide employees with training at their own plants or at nearby colleges and universities.

Employment Outlook

Employment in the atomic energy field is expected to grow much faster than the average for all industries through the mid-1980's. Expansion of nuclear generating capacity and continued increases in research and development expenditures will account for most of the growth in the field. Besides the job openings created by employment growth, many openings will occur as workers retire, die, or transfer to other occupations or industries.

The number of nuclear power plants is expected to be several times greater in 1985 than it was in 1974. This anticipated growth will require large increases in the number of workers in the design, construction, operation, and maintenance of these plants. In design, many more engineers and drafters will be required. Construction needs will call for large numbers of pipe- and steamfitters, electricians, carpenters, ironworkers, boilermakers, other craft workers and laborers. Many more reactor operators and maintenance personnel will be needed to bring these plants into operation and keep them running efficiently.

Expansion also will require substantial increases in the sectors involved in mining and milling urani-



Workers load cylinders of enriched uranium for shipment.

um ore, processing reactor fuel, and producing special materials for reactors. As planning of nuclear plants accelerates and more reactors become operable, more regulatory workers will be needed to ensure the quality and safety of these plants. However, public concern about environmental effects of nuclear power plants may cause delays in construction projects, resulting in a slower rate of growth than initially anticipated.

Employment associated with research and development also is expected to increase, though not nearly as fast as in the areas directly affected by nuclear construction. An increasing number of scientists, engineers, and technicians will study methods to improve the efficiency of the nuclear generation of electricity, peaceful uses for nuclear explosives, and the possible bio-medical applications of nuclear science.

Earnings and Working Conditions

Hourly earnings of blue-collar workers employed by contractors at ERDA laboratories and other installations averaged $5.04 in 1974, compared with $4.40 for those in all manufacturing industries.

Professional workers, mostly scientists and engineers, employed at ERDA installations averaged $18,700 a year in 1974, and other white-collar workers (largely clerical and other office personnel) averaged about $9,100 a year. (Earnings data for many of the occupations found in the atomic energy field are included in the statements on these occupations elsewhere in the *Handbook*.)

Working conditions in uranium mining and milling, instrument and auxiliary equipment manufacturing, and construction of facilities are generally similar to those in other industries, except for radiation safety precautions. All uranium mines are equipped with mechanical ventilation systems that reduce the concentration of radioactive radon gas—a substance that can cause lung injury if inhaled over a number of years. Efforts to eliminate this hazard are continuing. Manufacturing facilities, power plants, and research laboratories are generally well-lighted and well-ventilated. Only a small proportion of employees in the atomic energy field actually work in areas where direct radiation dangers exist. Even in these areas, shielding, automatic alarm systems, and other devices and clothing give ample protection to the workers.

Extensive safeguards and operating practices protect the health and safety of workers, and ERDA and its contractors have maintained an excellent safety record. The NRC regulates the possession and use of radioactive materials, and inspects nuclear facilities to insure compliance with health and safety requirements. Constant efforts are being made to provide better safety standards and regulations.

Most hourly paid plantworkers belong to unions that represent their particular craft or industry.

Sources of Additional Information

Information about research programs in the atomic energy field is available from:

U.S. Energy Research and Development Administration, Washington, D.C. 20545.

For information about licensing and safety requirements, contact:

U.S. Nuclear Regulatory Commission, Washington, D.C. 20555.

OCCUPATIONS IN THE BAKING INDUSTRY

The baking industry—one of the Nation's largest food-processing employers—provides steady, year-round employment for thousands of workers throughout the country. Jobs exist to suit a wide variety of interests, skills, and talents. Bakery workers make, wrap, pack, sell and deliver products. Mechanics maintain and repair plant machinery and service delivery trucks. Managers and sales specialists direct operations and clerical workers perform regular office duties.

Nature and Location of the Industry

About 250,000 persons worked in the Nation's 3,600 industrial bakeries in 1974. More than 4 out of 5 worked in bakeries that produced perishable goods such as bread, rolls, pies, cakes, and doughnuts. The remainder worked in those that made "dry" goods such as cookies, crackers, and pretzels.

Although there are many small bakeries, the larger plants account for most of the employment. About three-fourths of the industry's employees are in plants with more than 100 workers.

Besides the industrial bakeries, over 12,000 single-shop retail bakeries employed more than 100,000 people in 1974, including shopowners. Because many operations in small bakeries are performed by hand rather than by machine, these shops offer skilled bakers many job opportunities that are not available in large industrial bakeries.

Almost every community has at least one bakery, but jobs are concentrated in metropolitan areas. Most of the industry's employees are production workers. They do the actual baking, handle raw materials, maintain equipment, wrap and pack products, and keep the bakeries clean. Nearly 1 out of 4 drives a truck to deliver the industry's products; most of these workers sell to retail stores. Other drivers with no sales duties deliver bakery products to distribution centers, hotels, restaurants, and stores. The remaining 20 percent of the work force are in administrative, professional, technical, and clerical jobs.

Production Occupations. Although not all baked goods are made in exactly the same way, most bakery production jobs are similar. Production workers blend, sift, and mix ingredients to form a dough; shape and bake the dough; and wrap and pack the final product.

Baker prepares dough for baking.

Since bread is the primary product of the industry, occupations described here are those found in a bread bakery. Jobs may be somewhat different in a bakery which makes other products or is more automated.

The first step in baking is to combine the ingredients needed to make dough. *Mixers* (D.O.T. 520.885) load blending machines with the exact amounts of flour, water and yeast needed for the bread. Using instruments, they carefully control the temperature, timing, and mixing speed of the machines to insure a uniform, well-blended dough. After the dough is mixed, it is dropped into a trough and pushed to a warm proofing room where the yeast ferments and the dough rises. The risen dough is poured back into the blender and sugar, salt, shortening, and more flour and water are added. The dough is allowed to rise again before it is shaped into loaves.

Divider machine operators (D.O.T. 520.885) run machines which divide, round, proof, and shape dough into loaf-size balls. A conveyor carries these balls of dough to *dough molders* or *molding machine operators* (D.O.T. 520.885) who press out the air bubbles, form the balls into loaves, and drop the loaves into pans. If bread or rolls are to be made in fancy shapes, *bench hands* (D.O.T. 520.884) knead and form the dough by hand.

The pans of dough go back to the proofing room for about an hour before being placed in the oven. *Oven tenders* (D.O.T. 526.885) load and unload the ovens and adjust the temperature and timing of the ovens to make sure that the bread is properly baked.

Some bakeries use an automatic process called "continuous mix" that eliminates many of the steps described above. With this process all ingredients are mixed at once

and the dough is divided, shaped, put into pans, and then proofed only once before baking.

In small bakeries, *all-round bakers* (D.O.T. 526.781) assisted by helpers, usually handle all the steps needed to turn out finished baked products. In large bakeries, all-round bakers are employed as working supervisors. They direct their employees and coordinate their activity with that in other departments in order to meet production schedules.

A considerable number of *helpers* (D.O.T. 526.886) are employed in baking operations to grease pans, remove bread from pans, push troughs and racks, and wash pans. They may assist all-round bakers and other workers. They have job titles such as doughmixer helper, and oven tender helper.

After baked goods leave the oven and are cooled, several types of workers prepare them for delivery to customers. *Slicing-and-wrapping machine operators* (D.O.T. 521.885) feed loaves of bread onto conveyors leading to the machines, watch the slicing and wrapping operations, adjust the machines, and keep them supplied with bags and labels. A conveyor then takes the wrapped loaves to the shipping platform.

Bakery employees in icing departments give finishing touches to cakes, pastries, and other sweet goods following special formulas of the bakery. *Icing mixers* (D.O.T. 520.885) prepare cake icings and fillings. They weigh and measure ingredients and mix them by machine. They also prepare cooked fillings for pies, tarts, and other pastries. *Hand icers* (D.O.T. 524.884) are skilled workers who decorate special products such as wedding cakes, birthday cakes, and fancy pastries. When the product is uniform or requires no special decoration, the frosting may be applied by *machine icers* (D.O.T. 524.885).

Bakeries also employ many workers in storage, warehousing, and shipping departments. Receiving and stock clerks check, record, and deliver incoming supplies and ingredients to various departments. Packers and checkers make up orders of bakery products for delivery by route drivers.

Cake decorating requires some artistic ability.

Maintenance Occupations. Bakeries employ skilled maintenance workers such as machinists, electricians, and stationary engineers to keep machinery and equipment in good condition. Large plants need many of these workers because their baking operations are highly mechanized. Many bakeries also employ truck mechanics to service their delivery trucks.

Sales and Driving Occupations. Selling and delivering finished baked foods requires many thousands of workers. Some sell baked goods, some drive trucks, and many do both.

Route drivers, (D.O.T. 292.358), work for wholesale bakeries. They deliver baked foods to grocery stores along their routes and collect payment. Attracting new customers and urging old customers to buy more products are a major part of their job. Route drivers usually arrange their baked goods on shelves or display racks in grocery stores although some stores have begun to use their own employees to stock shelves. Drivers also list the items they think the grocers will buy the next day, and these lists are used to help make up the bakery production schedule for the next morning.

Route supervisors assign delivery routes and check delivery schedules. They train new route drivers and may temporarily replace those who are absent. A large bakery may employ several supervisors, each in charge of 6 to 10 route drivers.

Chain grocery store bakeries and multioutlet retail bakeries employ truckdrivers rather than route drivers to deliver baked foods to each of their company's stores. Truckdrivers do not have sales duties, nor do they stock shelves. Each store's stock clerks or sales clerks arrange the displays of baked foods.

Administrative, Clerical, and Professional and Technical Occupations. Administrators in large bakeries and owners of small bakeries coordinate all baking activities, from the purchase of raw materials to the production and delivery of finished goods. In large firms, activities are divided into separate departments or functions and are supervised by plant managers, comptrollers, sales managers, and other executives. Some administrative employees specialize in fields such as accounting, purchasing, advertising, personnel, and industrial relations. Bakeries employ many types of clerical workers, including bookkeepers, cashiers, clerks, business machine operators, typists, and switchboard operators. Some large baking companies have laboratories and test kitchens where chemists, home economists, and their assistants test ingredients and prepare formulas and recipes. (Detailed discussion of the duties, training, and employment outlook for maintenance, sales, driving, administrative, clerical, and technical

personnel appear elsewhere in the *Handbook*.)

Training, Other Qualifications, and Advancement

Training requirements for occupations in the baking industry range from a few days on the job to several years of experience or advanced education. Slicing and wrapping machine operators can learn their job in a few days, but skilled workers, such as all-round bakers, mixers, oven tenders, and other baking specialists, need 3 or 4 years of training. Professional personnel and some administrative workers must have a college degree or considerable experience in their specialty.

Most inexperienced production workers in the baking industry are hired as helpers. They are usually assigned such tasks as carrying ingredients to mixing machines, or pushing troughs of dough to the proofing room. Helpers are often able to learn more advanced baking skills while working alongside experienced bakers, and may be selected to enter an apprenticeship program. Employers usually require an apprentice to be at least 18 years old and have a high school or vocational school diploma. Apprenticeship programs last 3 or 4 years, and include on-the-job training in all baking operations and classroom instruction in related subjects.

Some workers take courses in vocational school or learn baking in the Armed Forces. Such training may not qualify a person as a skilled baker, but it may help in getting a job as an apprentice and perhaps shorten the apprenticeship training period.

Bakers may be promoted to jobs such as working or department supervisors. Some bakers who have developed special skill in fancy cakemaking or piemaking may find jobs in hotel or restaurant bakeries. All-round bakers with some business ability sometimes open their own bakeshops.

Production employees must be in good health because most States require a health certificate indicating that the worker is free from contagious diseases. Good health also is important because of the irregular working hours and high temperature in bakeries.

Some bakeries have apprenticeship programs for maintenance workers such as machinists, electricians, and mechanics. Others train maintenance workers informally on the job. Some bakeries hire only maintenance workers who are already skilled.

For jobs as route drivers or truckdrivers, baking firms generally hire inexperienced people with a high school education. These workers often begin as stock clerks, packers, or checkers, and are promoted to driving jobs. Applicants must be able to get a chauffeur's license and are sometimes tested by the baking companies to determine whether they are safe drivers. Classroom instruction in sales, display, and delivery procedures is sometimes given to new route drivers, but most training is given on the job by supervisors. Route drivers may be promoted to route supervisors or sales managers.

Administrative jobs are usually filled by upgrading personnel already employed in the firm. Some owners and production managers of bakeries have come from the ranks of plant workers and some others began their careers in sales occupations. In recent years, large baking firms have required their new administrative workers to have a college degree in an administrative field, such as marketing, accounting, labor relations, personnel, or advertising. Kansas State University at Manhattan offers a bachelor of science degree in baking science and management. The American Institute of Baking conducts a school of baking for persons with a bachelor's degree who wish to qualify for managerial positions.

Persons who have completed a commercial course in high school, junior college, or a business school are usually preferred for secretarial, stenographic, and other clerical jobs.

Employment Outlook

Employment in the baking industry is expected to change little through the mid-1980's. Nevertheless, several thousand job openings are anticipated each year because of the need to replace workers who retire, die, or transfer to other fields of work.

Population growth will increase the demand for bakery products. However, laborsaving technological innovations will enable many bakeries, particularly the large industrial ones, to meet the demand without increasing employment. Pneumatic handling systems and pumps quickly and easily transfer ingredients from trucks or railroad cars to storage containers. The "continuous mix" process eliminates doughmixing and proofing operations, and conveyor systems move panned dough from ovens to labeling machines in one continuous process. In addition, some bakeries can prepare a week's baked goods at one time and store them in the freezer until needed.

Although the baking industry as a whole is not expected to grow, small retail bakeries may experience employment gains. Because many of these shops produce a wide variety of baked goods in small quantities, laborsaving machinery often is too expensive to be practical.

Earnings and Working Conditions

In 1974, earnings of production workers in the baking industry averaged $170.31 a week, or $4.29 an hour, which is slightly higher than the average for all manufacturing industries. Bakeries producing perishable products generally offer

higher wages than those producing "dry" products.

According to union contracts covering employees in 24 wholesale bakeries producing bread and related products, minimum hourly rates in major occupations in 1974 were as follows:

Baking supervisors and all-round bakers	$4.59-6.64
Molders and dividers and molding and dividing machine operators	4.49-6.24
Mixers (dough or icing)	4.39-6.24
Oven tenders	4.39-6.24
Bench hands	4.26-6.05
Wrapping machine operators	3.47-5.89
Icers and decorators	4.16-5.24

Some plant employees work night shifts and weekends because many bakeries operate around the clock. Some bakeries are eliminating the night shift since baked goods can be frozen and stored until needed. Most plant workers are on a 40-hour workweek, but some work 35 or 37 1/2 hours, and others 44 to 48 hours.

Route drivers usually receive a guaranteed minimum salary plus a percentage of their sales. According to limited information from union contracts, route drivers for wholesale bakeries had minimum weekly salaries of from $119 to $221 in 1974. By selling more baked products to more customers, route drivers can increase their earnings. Companies generally pay for uniforms and their maintenance.

Working conditions in bakeries are generally good. However, many jobs involve some strenuous physical work, despite the considerable mechanization of baking processes. Work near ovens can be hot, especially in the summer.

Nearly all employees of industrial baking firms get paid vacations, which usually range from 1 to 5 weeks according to length of service. Employees also get from 5 to 11 paid holidays, depending on the locality. Most baking companies have life and health insurance programs and retirement pension plans. Many employees are covered by joint union-industry plans which are paid for entirely by the company.

Many bakery workers belong to labor unions. Bakers and other plant workers are organized by the Bakery and Confectionary Workers' International Union of America, and route drivers and truck drivers usually are members of the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.). Some maintenance workers are members of craft unions such as the International Association of Machinists and Aerospace Workers and the International Union of Operating Engineers.

Sources of Additional Information

Information on baking jobs and training opportunities may be obtained from bakeries in the community, local offices of the State employment service, or locals of the labor unions noted previously.

For general information on job opportunities in the industry and on schools which offer courses or degrees in baking science and technology, write to:

American Bakers Association, 1700 Pennsylvania Ave. NW., Washington, D.C. 20006.

For information on opportunities in retail bakeries, write to:

Associated Retail Bakers of America, 731-735 W. Sheridan Rd., Chicago, Ill. 60613.

OCCUPATIONS IN THE DRUG INDUSTRY

References to potions and spells for the cure and prevention of pain and disease are numerous in medical folklore. But 20th century science has created a supply of drug products undreamed of by even the most imaginative apothecaries of the past.

More than 10,000 prescription drugs are available to today's physician. These drugs have resulted in the control of cardiovascular disease, malaria, pneumonia, and even some forms of cancer. Hormones have relieved the pain and crippling effects of arthritis and other diseases. Tranquilizers and other drugs have done much to reduce the severity of mental illness. Vaccines have reduced dramatically the toll of polio, whooping cough, and measles. Discoveries in veterinary medicine have increased animal productivity and controlled various diseases, some of which are transmissible to humans.

The American drug industry has risen to a position of worldwide prominence by its activities in research and development of new drugs, spending a higher proportion of its funds for research than any other American industry. The largest share of research and development expenditures is devoted to the advancement of scientific knowledge and the development of new products. The remainder is allocated to the improvement of existing products. A large pharmaceutical firm may test 4,000 or more substances a year and spend millions of dollars to develop one new drug.

Because the drug industry looks to its many scientific and technical personnel to carry out its vast research programs, 2 out of every 5 jobs in the industry require more than a high school education.

Nature and Location of the Industry

In 1974, over 160,000 persons worked in the drug industry. About 130,000 worked in plants that made pharmaceutical preparations (finished drugs), such as tranquilizers, antibiotics, and analgesics. Another 18,000 worked in plants that made biological products, such as serums and vaccines; about 14,000 worked in plants that produced bulk medicinal chemicals and botanicals used in making finished drugs.

Drug manufacturing companies typically employ large numbers of workers. About two-thirds of the industry's employees are in plants having more than 500 workers, and some of the largest plants employ more than 5,000.

Nearly four-fifths of the industry's workers were employed in seven States: New Jersey, New York, Indiana, Pennsylvania, Illinois, Michigan, and California. Large drug manufacturing plants are located in Indianapolis, Ind.; Chicago, Ill.; Nutley and Rahway, N.J.; Philadelphia, Pa.; Detroit and Kalamazoo, Mich.; Pearl River and Brooklyn, N.Y.; and in the Los Angeles and San Francisco, Calif. areas.

For testing new drugs, a primary research method is used, called screening. In screening an antibiotic, for example, a sample is placed in a bacterial culture. If positive results follow, the antibiotic is next tested on infected laboratory animals. Promising compounds are studied further for evidence of useful—and harmful—effects. A new drug will be selected for testing in humans only if it promises to have therapeutic advantages over comparable drugs already in use, or if it offers the possibility of being safer.

After laboratory screening, a clinical investigation, or trial of the drug on human patients, is made. Supplies of the drug are given to a small circle of doctors who administer it to carefully selected consenting patients. The patients are then observed closely and special studies made to determine the drug's effect. If a drug proves useful, arrangements are made for more tests with a larger group of physicians, including some in private practice.

Once a drug has successfully passed animal and clinical tests and has been approved by the Food and Drug Administration (FDA), problems of production methods and costs must be worked out before manufacturing begins. If the original laboratory process of preparing and compounding the ingredients is complex and expensive, pharmacists, chemists, chemical engineers, packaging engineers, and production specialists are assigned to develop processes economically adaptable to mass production.

Drug manufacturers have developed a high degree of automation in many production operations. Milling and micronizing machines (which pulverize substances into extremely fine particles) are used to reduce bulk chemicals to the required size. These finished chemicals are combined and processed further in mixing machines. The mixed ingredients may then be mechanically capsulized, pressed into tablets, or made into solutions. One type of machine, for example, automatically stamps, fills, and seals capsules. Other machines fill bottles with capsules, tablets, or liquids, and seal, label, and package the bottles.

Drug products are inspected at various stages during the manufacturing process to insure that they conform to specifications. Although some inspection operations are mechanized, many are performed manually.

Occupations in the Industry

Employees with many different levels of skill and education work in the drug industry. More than half are in white-collar jobs (scientific, technical, administrative, clerical, and sales); most of the remainder are in plant jobs (processing or production, maintenance, transportation, and custodial).

Some of the important occupations are described briefly below. Detailed discussions of professional, technical, clerical, and other occupations found in drug manufacturing, as well as in other industries, are given elsewhere in the *Handbook*.

Scientific and Technical Occupations. About 1 out of every 5 employees in the industry is a scientist, engineer, or technician—a far greater proportion than in most other industries. The majority do research to develop new drug products. Others work to streamline production methods and improve quality control.

Chemists (D.O.T. 022.081) make up the largest group of scientific and technical personnel in the industry. Organic chemists combine new compounds for biological testing. Physical chemists separate and identify substances, determine molecular structure, help to create new compounds, and improve manufacturing processes. Biochemists study the action of drugs on body processes. Radiochemists trace the course of drugs through body organs and tissues. Pharmaceutical chemists set standards and specifications for the form of products and for storage conditions and see that labeling and literature meet the requirements of State and Federal laws. Analytical chemists test raw and intermediate materials and finished products for quality.

Several thousand *biological scientists* (D.O.T. 041.081, .181) work in the drug industry. Biologists and bacteriologists study the effect of chemical agents on infected animals. Microbiologists grow strains of microorganisms which produce antibiotics. Physiologists investigate the effect of drugs on body functions and vital processes. Pharmacologists and zoologists study the effect of drugs on animals. Virologists grow viruses, develop vaccines, and test them in animals. Botanists, with their special knowledge of plant life, contribute to the discovery of botanical ingredients for drugs. Other biological scientists include pathologists, who study normal and abnormal cells or tissues, and toxicologists, who are concerned with the safety, dosage levels, and the compatibility of different drugs. Pharmacists perform research in product development, studying many forms of medicines at various stages of production. Some set specifications for the purchase and manufacture of materials, and handle correspondence relating to products. Drug manufacturers also employ physicians and veterinarians.

Engineers make up a small fraction of scientific and technical workers. *Chemical engineers* (D.O.T. 008.081) design equipment and devise manufacturing processes. *Industrial engineers* (D.O.T. 012.081, .168, .187, .188, and .281) plan equipment layout and workflow to

Nearly one-fourth of the drug industry's employees are in scientific and technical occupations.

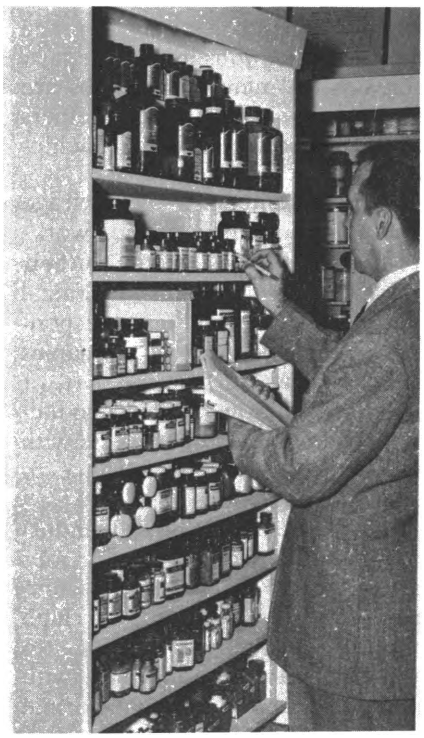
maintain efficient use of plant facilities. *Mechanical engineers* (D.O.T. 007.081, .151, .181, and .187) coordinate the installation and maintenance of sterilizing, heating, cooling, humidifying, and ventilating equipment.

Technicians (D.O.T. 073.381, 078.128, .168, .281, .381, and .687) represent about one-fourth of the drug industry's scientific and technical workers. Laboratory tests play an important part in the detection and diagnosis of disease and in the discovery of medicines. Laboratory technicians perform these tests under the direction of scientists in such areas as bacteriology, biochemistry, microbiology, virology (the study of viruses), and cytology (analysis of cells).

Administrative, Clerical, and Related Occupations. About 1 out of every 3 workers in drug manufacturing is in an administrative, clerical, or other office job. At the top of the administrative group are the executives who make policy decisions concerning matters of finance, marketing, and research. Other administrative and executive workers are accountants, lawyers, purchasing agents, personnel and industrial relations workers, and advertising and marketing research workers. Clerical employees keep records on personnel, payroll, raw materials, sales, shipments, and plant maintenance.

Pharmaceutical detailers (D.O.T. 266.158), often called pharmaceutical representatives, describe their companies' products to practicing and teaching physicians, pharmacists, dentists, and hospital administrators.

Plant Occupations. Nearly half of the industry's employees work in plant jobs. The majority of these workers can be divided into three major occupational groups: production or processing workers, who operate the drug producing equipment; maintenance workers, who



Pharmaceutical detailer checks hospital drug supplies.

install, maintain, and repair this equipment; and shipping clerks, truck drivers, and material handlers, who help transport the drugs.

Pharmaceutical operators (D.O.T. 559.782) control machines that produce tablets, capsules, ointments, and medicinal solutions. *Granulator machine operators* (D.O.T. 559.782) tend milling and grinding machines that reduce mixtures to particles of designated sizes. *Compounders* (D.O.T. 550.885) tend tanks and kettles in which solutions are mixed and compounded to make up creams, ointments, liquid medications, and powders. *Compressors* (D.O.T. 556.782) operate machines that compress ingredients into tablets. *Pill and tablet coaters* (D.O.T. 554.782), often called capsule coaters, control a battery of machines that apply coatings to tablets which flavor, color, preserve, add medication, or control disintegration time. *Tablet testers* (D.O.T. 559.687) inspect tablets for hardness, chippage, and weight to assure conformity with specifications.

Pharmaceutical operator fills capsules with powdered medication.

Ampoule fillers (D.O.T. 559.885) operate machines that fill small glass containers with measured doses of liquid drug products. *Ampoule examiners* (D.O.T. 559.687) examine the ampoules for discoloration, foreign particles, and flaws in the glass.

After the drug product is prepared and inspected, it is bottled or packaged. Most of the packaging and bottle filling jobs are done by semiskilled workers who operate machines that measure exact amounts of the product and seal containers.

The drug industry employs many skilled maintenance workers to assure that production equipment is operating properly and to prevent costly breakdowns. Included among maintenance workers are power plant operators who are responsible for high pressure boilers, turbogenerators, compressors, refrigeration equipment, and plant water systems; electricians who install, maintain, and repair the various types of electrical equipment; plumbers who install and maintain heating, plumbing, and pumping systems; machinists who make and

Compounder tends tank in which solutions are mixed.

repair metal parts for machines and equipment; and instrument repairers who periodically inspect instruments and controls and repair or replace malfunctioning parts.

Plant workers who do not operate or maintain equipment perform a variety of other tasks. Some drive trucks to make deliveries to other parts of the plant; some load and unload trucks and railroad cars; others keep inventory records. The industry also employs custodial workers, such as guards and janitors, whose duties are similar to those of such workers in other industries.

Training, Other Qualifications, and Advancement

The training requirements for jobs in the drug industry range from a few hours of on-the-job training to years of preparation.

For production and maintenance occupations, drug manufacturers generally hire inexperienced workers and train them on the job; high school graduates are preferred by most firms. Beginners in production jobs assist experienced workers and learn the operation of the processing equipment. With experience, employees may advance to more skilled jobs in their departments. Most maintenance jobs are filled by people who start as helpers to electricians, plumbers, machinists, and other craft workers.

Many companies encourage production and maintenance workers to take courses related to their jobs in local schools and technical institutes, or to enroll in correspondence courses. Some companies reimburse the workers for part, or all, of the tuition. Skilled production and maintenance workers with leadership ability may advance to supervisory positions.

For technicians in the drug industry, methods of qualifying for jobs vary in many ways. Most technicians enter the field with a high school education and advance to jobs of greater responsibility with experience and additional formal education. However, companies prefer to hire graduates of technical institutes or junior colleges, or those who have completed college courses in chemistry, biology, mathematics, or engineering. In many firms, inexperienced workers begin as laboratory helpers or aides, performing routine jobs such as cleaning and arranging bottles, test tubes, and other equipment.

The experience required for higher levels of technician jobs varies from company to company. Generally, a minimum of 1 year of experience is required for assistant technician jobs, 3 years for technician, 6 years for senior technician, and 10 years for technical associate. Some companies require senior technicians and technical associates to complete job-related college courses.

For most scientific and engineering jobs, a bachelor of science degree is the minimum requirement. Some companies have formal training programs for college graduates with engineering and scientific backgrounds. These trainees work for brief periods in the various divisions of the plant to gain a broad knowledge of drug manufacturing operations before being assigned to a particular department. In other firms, newly employed scientists and engineers are immediately assigned to a specific activity such as research, process development, production, or sales. Drug manufacturing companies prefer to hire college graduates, particularly those with strong scientific backgrounds as pharmaceutical detailers. Newly employed pharmaceutical representatives complete rigorous formal training programs revolving around their companies' product lines.

Job prospects and advancement are usually best for professionals with advanced degrees. Some companies offer training programs to help scientists and engineers keep abreast of new developments in their fields and to develop administrative skills. These programs may include meetings and seminars with consultants from various fields. Many companies encourage scientists and engineers to further their education; some provide financial assistance for this purpose. Publication of scientific papers is also encouraged.

Employment Outlook

Drug manufacturing employment is expected to grow about as fast as the average for all industries through the mid-1980's. Most job openings, however, will result from the need to replace experienced workers who retire, die, or transfer to other fields of work.

The demand for drug products is expected to grow very rapidly. Demand will be stimulated primarily by population growth, particularly the growing number of older people who require more health care services, and the growth of coverage under comprehensive health insurance programs including Medicare and Medicaid. Other factors which are expected to increase the demand for drugs include

greater personal income, the rising health consciousness of the general public, and the discovery of new drugs to treat illnesses not yet responding to therapy. A continued rise in drug sales to other countries, particularly developing countries with mounting health care requirements, also is anticipated.

The industry's employment will not increase as rapidly as the demand for drug products, because technological improvements in production methods will increase output per worker. The more widespread use of automatic processing and control equipment in operations formerly done by hand will tend to reduce labor requirements, particularly in plants where common drugs are mass-produced. For example, mixing and granulating processes, which precede tableting, have become completely mechanized in some plants. Computers in quality control systems are used to eliminate computational errors in analysis and testing and to speed up production and shipment.

Rates of employment growth will vary among occupations. The numbers of scientists, engineers, technicians, and maintenance workers are expected to increase faster than those of other occupational groups in the industry. Demand for scientists, engineers, and technicians will be spurred by continued expansion of research and development activities. More skilled maintenance workers (such as electricians, machinists, plumbers, and instrument repairers) will be needed to service the growing amount of automatic processing and control equipment. Employment of administrative and clerical workers is expected to increase moderately; however, most semiskilled plant occupations are expected to increase slowly, as more processes are adapted to automatic equipment.

Unlike many other manufacturing industries, drug industry employment is not highly sensitive to changes in economic conditions. Thus, even during periods of high unemployment, work is likely to be relatively stable in the drug industry.

Earnings and Working Conditions

Earnings of plant workers in the drug industry are higher than the average for all manufacturing industries. For example, in 1974, production workers in the drug industry averaged $4.62 an hour, while those in manufacturing as a whole averaged $4.40 an hour.

National wage data are not available for individual occupations in the drug industry. However, statements on specific occupations, such as chemist, pharmacist, and technician, in other parts of the *Handbook*, will give general earnings information.

Some employees work in plants that operate around the clock—3 shifts a day, 7 days a week. In most plants, workers receive extra pay when assigned to second or third shifts. Since drug production is subject to little seasonal variation, work is steady.

Working conditions in drug plants are better than in most other manufacturing plants. Much emphasis is placed on keeping equipment and work areas clean because of the danger of contamination to drugs. Plants are usually air-conditioned, well-lighted, and quiet. Ventilation systems protect workers from dust, fumes, and disagreeable odors. Special precautions are taken to protect the relatively small number of employees who work with infectious cultures and poisonous chemicals. With the exception of work performed by material handlers and maintenance workers, most jobs require little physical effort. The frequency of injuries in drug manufacturing has been about half the average for all manufacturing industries.

Some of the industry's production and maintenance employees are members of labor unions. The principal unions in the industry are The Oil Chemical and Atomic Workers International Union; the International Chemical Workers Union; and District 50, United Steel Workers of America (Ind.).

Sources of Additional Information

For information about careers in drug manufacturing, write to the personnel departments of individual drug manufacturing companies and to:

Pharmaceutical Manufacturers Association, 1155 Fifteenth St. NW., Washington, D.C. 20005.

OCCUPATIONS IN THE ELECTRONICS INDUSTRY

An astronaut, a doctor, a mechanic, and a business executive all have something in common; without electronic devices they would be unable to do much of their work. We would never have reached the moon without the thousands of people working in electronics research and production. Nor would doctors be able to diagnose and treat many diseases without modern electronic machines. Mechanics use electronic testing equipment to locate malfunctioning parts in numerous types of machines and engines. Business executives also owe a lot to electronics. Electronic computers, for example, have helped them in such areas as inventory control, market research, and production scheduling.

Nature and Location of the Industry

The electronics industry dates back to the early 1920's when the first radios were produced. By the end of World War II, the industry had diversified its production to include defense equipment. With the development of television and the computer, the electronics industry expanded even further to manufacture a wide range of products.

Today, the industry is divided into four main market areas: government products, industrial products, consumer products, and components. Products sold to the government make up a large portion of electronic sales. Included in government purchases are widely different products such as missile and space guidance systems, communications systems, and other electronic goods used in medicine, education, crime detection, and traffic control.

Electronic products have become an important part of daily business operations. Industrial purchases include computers, radio and television broadcasting equipment, and production control equipment.

Consumer products are probably the most familiar types of electronic products. Every day thousands of people buy television sets, radios, microwave ovens, stereos, and calculators.

Components are needed to manufacture and repair electronic products. Some of the most well-known components are capacitors, switches, transistors, relays, television picture tubes, and amplifiers.

Nearly 1.5 million workers were employed in the electronics industry in 1974. About 1,025,000 worked in plants that produce end products for government, industrial, and consumer use. The rest worked in plants that made electronic components.

Electronics manufacturing workers are located in all parts of the country, but the majority of the jobs in 1974 were in eight States: California, New York, Illinois, Massachusetts, Pennsylvania, Indiana, New Jersey, and Texas. Metropolitan areas with large numbers of electronics manufacturing workers include Los Angeles, Chicago, New York, Philadelphia, Newark, Boston, Baltimore, Indianapolis, and Dallas.

In addition to electronics manufacturing plants, electronics workers were employed by the Federal Government, in activities such as research, development, and contract negotiations. Universities and nonprofit research centers employed a relatively small number of electronics workers.

Occupations in the Industry

A wide variety of jobs exists in the electronics manufacturing industry. More than half of all workers are in plant jobs that include production, maintenance, transportation, and service occupations. The rest are scientists, engineers, and other technical workers, and administrative, clerical, and salesworkers.

Professional and Technical Occupations. The electronics industry is very dependent on research and development. As a result, a large proportion of its workers are in engineering, scientific, and other technical jobs. Engineers and scientists alone make up about 1 out of every 9 electronics workers.

Electrical and electronics engineers, the largest group of engineers in the industry, work on research and development, production, and quality control problems. Most of these engineers are highly specialized and may work in a specific area such as the design and implementation of solid-state circuitry in radar, computers, and calculators.

Mechanical engineers help develop new products, tools, and equipment by setting requirements for the strength of materials and designs. Industrial engineers work on production problems such as devising more efficient methods in manufacturing processes or plant layout. Chemical, metallurgical, and ceramic engineers also work for electronics companies.

Physicists work on research and development projects such as developing uses for solid-state circuitry or designing integrated circuits for satellites.

Chemists and metallurgists work mainly in research and in materials preparation and testing. Mathematicians and statisticians help engineers and scientists on complex mathematical and statistical problems, especially in the design of military and space equipment and computers. Statisticians also are employed in quality control, production scheduling, and sales analysis and planning. Industrial designers are concerned with the design of electronic products and the equipment used to manufacture them.

Technicians—such as electronics technicians, drafters, engineering aides, laboratory technicians, and mathematical assistants—make up about 1 out of every 20 electronics manufacturing workers. Many electronics technicians help engineers design and build experimental models. They also set up and repair electronic equipment for customers. Other electronics technicians do complex inspection and assembly work. Drafters prepare drawings from sketches or specifications furnished by engineers.

Engineering aides assist engineers by making calculations, sketches, and drawings, and testing electronic components and systems. Laboratory technicians help physicists, chemists, and engineers in laboratory analyses and experiments. Mathematical assistants follow procedures outlined by mathematicians to solve problems. They also operate test equipment to develop computers and other electronic products.

Technical writers prepare training and technical manuals that describe the operation and maintenance of electronic equipment. They also prepare catalogs, product literature, and contract proposals. Technical illustrators draw pictures of electronic equipment for technical publications and sales literature.

Administrative, Clerical, and Related Occupations. About 1 out of 4 workers in electronics manufacturing has an administrative or other office job. Administrative workers include purchasing agents, sales executives, personnel specialists, advertising workers, and market researchers. Secretaries, typists, and business machine operators are among the thousands of other office workers employed by electronics firms. A growing proportion of these office workers operate computers.

Plant Occupations. About half of electronics manufacturing employees work in plant operations: assembly, capacitor and coil winding, inspecting, machining, fabricating, processing, and maintenance.

Assembly Occupations (D.O.T. 729.884, 720.884, 726.781 and .884). Assemblers, most of whom are semiskilled workers, make up the largest group of employees. Most end products are assembled by hand with small tools, soldering irons, and light welding machines. Assemblers use diagrams to guide their work. Some assembly is done by following instructions presented on color slides and tape recordings. Color slide projectors flash a picture of an assembly sequence on a screen, while the assembler listens to recorded directions.

Precision assemblers and electronics technicians install components and subassemblies in complex products such as missiles. They also help make experimental models. Most of these workers are employed in the manufacture of military and industrial electronic equipment.

Machines are used in some assembly work. For example, in putting together circuit boards, automatic machines often are used to position components on boards and to solder connections. Here the assemblers work as machine operators or loaders. Most components are put together by machines, since their assembly involves simple and repetitive operations. Even some types of miniaturized semiconductors and other components, made with parts small enough to pass through a needle's eye, are assembled by machines.

Hand assembly is needed for some items, such as receiving tubes and some types of resistors and diodes. Hand assemblers may perform only a single operation as components move down the production line, but some put together complete components. Tiny parts often are assembled under magnifying lenses or microscopes. Precision welding equipment may be used to weld connections in microminiature components and circuit assemblies.

Machining Occupations. Machining workers are needed in most electronics manufacturing plants, particularly for military, space, and industrial products. Machine-tool operators and machinists make precise metal parts. Toolmakers construct and repair jigs and fixtures that hold metal while it is being stamped, shaped, or drilled. Diemakers build metal forms (dies) used in stamping and forging metal.

Fabricating Occupations. Fabricating workers are employed in many electronics manufacturing plants,

Assemblers make up the largest group of electronics industry employees.

but most are in plants that make industrial products. Sheet-metal workers make frames, chasis, and cabinets. *Glass blowers* and *glass lathe operators* (D.O.T. 674.782) make tubes for experimentation and development work.

In electron tube manufacturing, special fabricating workers are employed. For example, *grid lathe operators* (D.O.T. 725.884) wind fine wire around two heavy parallel wires to make grids (devices in tubes that control the flow of electrons). Other fabricating workers include *coil winders* (D.O.T. 724.781 and .884), *crystal grinders* and *finishers* (D.O.T. 726.884), and *punch press operators* (D.O.T. 617.885).

Processing Occupations. Many electronics workers process or prepare parts for assembly. *Electroplaters* and *tinners* (D.O.T. 501.885) coat parts with metal; *anodizers* (D.O.T. 501.782) treat these parts in electrolytic and chemical baths to prevent corrosion. Other processing workers also coat electronic components with waxes, oils, plastics, or other materials. Some operate machines which encase microminiature components in plastic. *Silk screen printers* (D.O.T. 726.887) print patterns on circuit boards and on parts of electronic components. *Etching equipment operators* (D.O.T. 590.885) do chemical etching of copper on circuit boards.

Operators of infrared ovens and hydrogen furnaces (D.O.T. 590.885) remove moisture and foreign deposits from ceramic, metal, and glass parts. In tube manufacturing, *exhaust operators* (D.O.T. 725.884) and *sealers* (D.O.T. 692.885) operate gas flame machines that clear tubes of impurities, exhaust the gas, and seal the tubes.

Inspection Occupations. Inspection begins when raw materials enter the plant and continues through manufacturing. Some inspection jobs require electronics technicians who have years of experience. These jobs are commonly found in complex production work such as the manufacture of computers and spacecraft. Most inspectors, however, do not need extensive technical training.

Some inspectors check incoming parts and components supplied by other firms. They may have job titles that indicate the work they do, such as incoming materials inspector or plating inspector.

During manufacturing, components are either checked manually by workers using test meters or routed mechanically through automatic test equipment. Although many of these workers simply are called testers, others have job titles that reflect the type of components they inspect, such as transformer-tester or coil-tester. Some automatic equipment can check components, produce a punched tape of the results, and sort the components into batches for shipping. Workers who feed or monitor automatic equipment often are called test-set operators or testing-machine operators.

Electronic assembly inspectors (D.O.T. 722.281) examine assembled products to make certain that they conform to blueprints and specifications. They inspect wiring, electrical connections, and other critical items to make sure everything will work properly.

Maintenance Occupations. Many workers repair and maintain machinery and equipment. Skilled electricians are responsible for the proper operation of electrical equipment; machine and equipment repairers make mechanical repairs; maintenance machinists and welders build and repair equipment and fixtures. Air-conditioning and refrigeration mechanics work in air-conditioned plants that have special refrigerated and dust free rooms to protect sensitive parts. Painters, plumbers, pipefitters, carpenters, and sheet-metal workers also are employed in electronics plants.

Other Plant Occupations. Many workers move and handle materials. Forklift operators stack crates in warehouses, and load and unload trucks and boxcars. Truckdrivers move freight outside the plant. The industry also employs guards and janitors.

(Detailed discussions of professional, technical, mechanical, and other occupations, found not only in electronics manufacturing plants, but also in other industries, are presented elsewhere in the *Handbook* in sections covering the individual occupations.)

Training, Other Qualifications, and Advancement

Training requirements for jobs in electronics manufacturing plants range from a few hours of on-the-job training to years of specialized preparation. Beginning engineering jobs usually are filled by recent college graduates, but some positions call for advanced degrees. A small number of workers without college degrees, however, are upgraded to professional engineering classifications from occupations such as engineering assistant and electronics technician. Workers who become engineers in this way usually take advanced electronics courses in night school or in other training programs. To keep up with new developments and to qualify for promotion, professional and technical personnel obtain additional training, read technical publications, and attend lectures and technical demonstrations.

Almost all mathematicians, physicists, and other scientists employed in electronics manufacturing have college degrees; most have advanced degrees.

Technicians generally need specialized training to qualify for their

jobs. Most electronics technicians attend either a public, private, or Armed Forces technical school. Some complete 1 or 2 years of college in a scientific or engineering field, and some receive training through a 3- or 4-year apprenticeship program. High school graduates who have had courses in mathematics and science are preferred for apprenticeship programs.

Some workers advance to electronics technician positions from jobs such as tester or laboratory assistant. A relatively small number of plantworkers become technicians. Opportunities for advancement are improved by taking courses either in company-operated classes, night school, junior college, or technical school, or by correspondence.

Electronics technicians need good color vision, manual dexterity, and good eye-hand coordination. Some technicians who test radio transmitting equipment must hold licenses from the Federal Communications Commission as first- or second-class commercial radiotelephone operators.

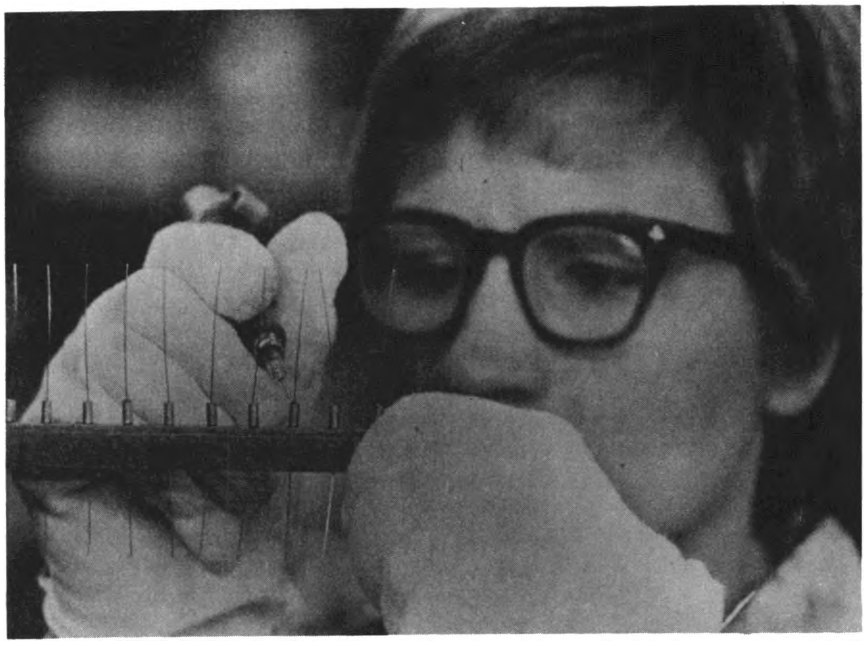
Drafters usually take courses in drafting at a trade or technical school; a few have completed a 3- or 4-year apprenticeship. Under an informal arrangement with their employers, some qualify for both on-the-job training and part-time schooling. Because many drafters in this industry must understand the basic principles of electronic circuits, they should study basic electronic theory.

Technical writers must have a flair for writing and are usually required to have some technical training. Employers prefer to hire those who have had some technical institute or college training in science or engineering. Many, however, have college degrees in English or journalism and receive their technical training on the job and by attending company-operated evening classes. Technical illustrators usually have attended art or design schools.

Many tool and diemakers, machinists, electricians, and other craft workers learn their trades by completing a 4- or 5-year apprenticeship; others are upgraded from helpers' jobs.

Formal training is not necessary for workers entering plant jobs, but a high school diploma or its equivalent is sometimes required. Job applicants may have to pass aptitude tests and demonstrate skill for particular types of work. A short period of on-the-job training generally is provided for inexperienced workers. Assemblers, testers, and inspectors need good vision, good color perception, manual dexterity, and patience.

Requirements for administrative and other office jobs are similar to those in other industries. Some beginning administrative jobs are open only to college graduates with degrees in business administration, law, accounting, or engineering. For clerical jobs, employers usually prefer high school graduates with training in stenography, typing, bookkeeping, and office machines.



Patience and manual dexterity are needed in some electronics assembly jobs.

Employment Outlook

Employment in electronics manufacturing is expected to increase faster than the average for all industries through the mid-1980's. In addition to the jobs resulting from employment growth, large numbers of openings will arise as experienced workers retire, die, or take jobs in other industries.

Production of electronic products will increase as business executives decide to buy more computers and other electronic equipment to automate paper work and production processes. Business spending for electronic communication and testing equipment also will grow. The demand for television receivers, video tape recorders, stereo systems, calculators, and two-way car radios will rise as population and personal incomes grow. Government purchases for defense will continue to account for a large proportion of electronics manufacturing output. An increasing share of government purchases, however, is likely to be for electronic equipment used in medicine, education, pollution abatement, and other fields.

Although employment in the electronics industry is expected to grow over the long run, it may fluctuate from year to year, because of changes in economic activity and defense spending. As a result, job openings may be plentiful in some years, scarce in others.

The rates of employment growth will vary among occupational groups and individual occupations. For example, employment of skilled maintenance workers is expected to rise at a more rapid rate than total employment, because of the need to repair the increasing amounts of complex machinery. On the other hand, employment of assemblers probably will rise at a slower rate, because of the growing mechanization and automation of assembly line operations.

Employment of engineers, scientists, and technicians is expected to increase faster than total employment, because of continued high expenditures for research and development and the manufacture of more complex products. Among professional and technical workers, the greatest demand will be for engineers, particularly those who have a background in certain specialized fields, such as quantum mechanics, solid-state circuitry, product design, and industrial engineering. Many opportunities also will be available for engineers in sales departments because the industry's products will require sales personnel with highly technical backgrounds. The demand for mathematicians and physicists will be particularly good because of expanding research in computer and laser technology.

Earnings and Working Conditions

As shown in the accompanying table, in 1974 electronics production workers who made products for government and industrial use had higher average hourly earnings than production workers in manufacturing as a whole. Those making other electronic products, however, made less than the average for all manufacturing industries.

Type of product	*Production workers' average hourly earnings, 1974*
All manufacturing industries	$4.40
Major electronics manufacturing industries:	
Government and industrial electronics end products	4.66
Radio and television receiving sets, and phonographs	3.88
Electron tubes	4.33
Semiconductors and other components, except tubes	3.37

Working conditions in electronics manufacturing compare favorably with those in other industries. Plants are usually well-lighted, clean, and quiet. Many plants are relatively new, and are located in suburban and semirural areas. The work in most occupations is not strenuous but assembly-line jobs may be monotonous.

The injury rate in electronics manufacturing has been far below the average in manufacturing as a whole, and injuries usually have been less severe.

Many workers in electronics manufacturing are union members. The principal unions are the International Union of Electrical, Radio and Machine Workers; International Brotherhood of Electrical Workers; International Association of Machinists and Aerospace Workers; and the United Electrical, Radio and Machine Workers of America (Ind.).

Sources of Additional Information

Information about careers in this field can be obtained from the public relations departments of electronics manufacturing companies, the unions previously listed, and from:

Electronic Industries Association, 2001 Eye St. NW., Washington, D.C. 20006.

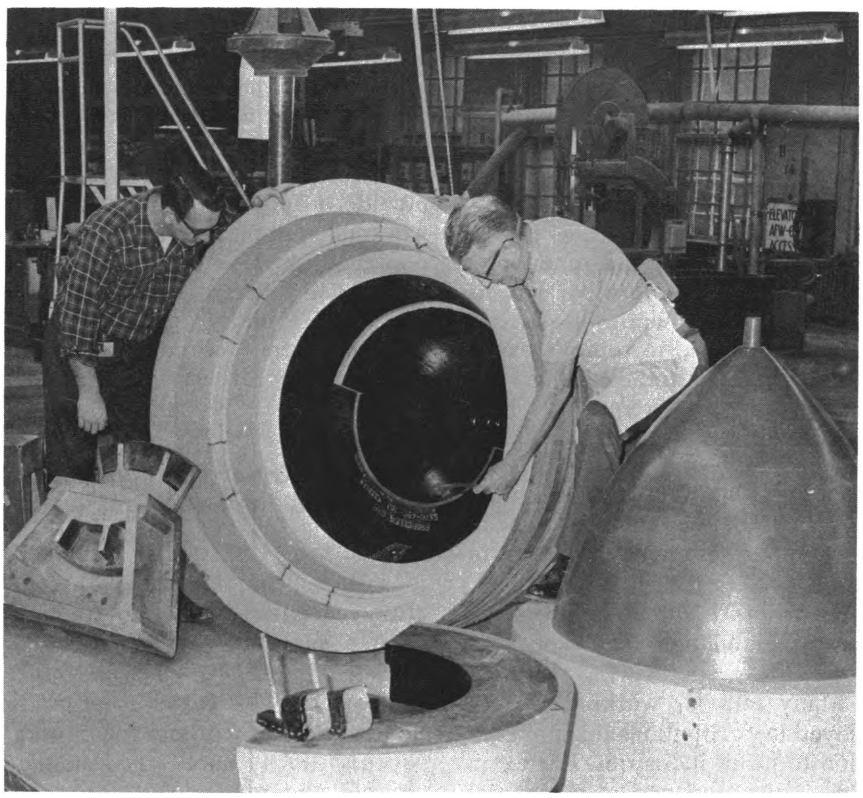
OCCUPATIONS IN FOUNDRIES

Metal castings produced by foundry workers are essential for thousands of products ranging from missiles to cooking utensils. In 1974, about 340,000 people worked in the foundry industry. Thousands of others worked in the foundry departments of plants which make and use castings in their final product, such as plants operated by manufacturers of automobiles or machinery.

Casting is a method of forming metal into intricate shapes. To cast metal, a mold is prepared with a cavity shaped like the object to be cast. Metal is then melted and poured into the mold to cool and solidify. The strength of metal which has been cast makes it suitable for many household and industrial items.

Nature and Location of the Foundry Industry

Nearly three-fourths of the foundry industry's employees work in iron and steel foundries. The remainder work in plants that cast nonferrous metals, such as aluminum, bronze, and zinc. Foundries usually specialize in a limited number of metals, because different methods and equipment are needed to melt and cast different alloys.



Foundry workers examine pattern for ship propeller cap.

There are six principal methods of casting, each named for the type of mold used. In the most common method, green-sand molding, a special sand is packed around a pattern in a boxlike container called a flask. After the pattern is withdrawn, molten metal is poured into the mold cavity and forms the desired metal shape. Sand molds can be used only once. A second method, called permanent molding, employs a metal mold that can be used many times. Permanent molding is used chiefly for casting nonferrous metals. Precision investment casting, a third method (often called the lost wax process), uses ceramic molds. A wax or plastic pattern is coated with refractory clay; after the coating hardens, the pattern is melted and drained so that a mold cavity is left. Castings produced from these molds are precise and require little machining. Shell molding, a fourth process, is becoming increasingly important. In this method, a heated metal pattern is covered with sand coated with resin. The sand forms a thin shell mold that, after curing, is stripped from the pattern. Castings produced from these molds are precise and have a smooth surface. Diecasting, a fifth process, is done mostly by machines. Molten metal under high pressure is forced into dies from which the castings are later automatically ejected or removed by hand. A sixth method, centrifugal casting, is used to make pipe and other products that have cylindrical cavities. Molten metal is poured into a spinning mold where centrifugal force distributes the metal against the walls of the mold.

Most foundries are small. More than 90 percent employ fewer than 250 workers, although several of the largest employ more than 5,000 workers.

Small foundries generally produce a variety of castings in small quantities. They employ hand and machine molders and coremakers (the key foundry occupations) and a substantial number

of unskilled laborers. Large foundries are often highly mechanized and produce great quantities of identical castings. These shops employ relatively few unskilled laborers, because cranes, conveyors, and other types of equipment replace manual labor in the moving of materials, molds, and castings. Since much of the casting in large shops is mechanized, they also employ proportionately fewer skilled molders and coremakers than small shops. However, many skilled maintenance workers, such as millwrights and electricians, are employed to service and repair the large amount of machinery.

Though foundries are located in many areas, jobs are concentrated in States which have considerable metalworking activity; for example, in Michigan, Ohio, Pennsylvania, Illinois, Indiana, and Wisconsin.

Foundry Occupations

Most of the industry's 340,000 employees in 1974 were plant workers. To illustrate more clearly the duties of these workers, a brief description of the jobs involved in the most common casting process—sand molding—follows:

After the casting is designed, the *patternmaker* (D.O.T. 600.280 and 661.281) makes a wood or metal pattern in the shape of the casting. Next, a *hand molder* (D.O.T. 518.381) makes sand molds by packing and ramming sand, specially prepared by a *sand mixer* (D.O.T. 579.782), around the pattern. A *molder's helper* (D.O.T. 519.887) may assist in these operations. If large numbers of identical castings are to be made, machines may be used to make the molds at a faster speed than is possible by hand. The operator of this equipment is called a *machine molder* (D.O.T. 518.782).

A *coremaker* (D.O.T. 518.381 and .885) shapes sand into cores (bodies of sand that make hollow spaces in castings). Most cores are baked in an oven by a *core-oven tender* (D.O.T. 518.887). After the cores are assembled, they are placed in the molds by *core setters* (D.O.T. 518.884) or molders. Now, the molds are ready for the molten metal.

A *furnace operator* (D.O.T. 512.782) controls the furnace that melts the metal which a *pourer* (D.O.T. 514.884) lets flow into molds. When the castings have solidified, a *shakeout worker* (D.O.T. 519.887) dumps them, and sends them to the cleaning and finishing department.

Dirty and rough surfaces of castings are cleaned and smoothed. A *shotblaster* (D.O.T. 503.887) operates a machine that cleans large castings by blasting them with air mixed with metal shot or grit. Smaller castings may be smoothed by tumbling. In this process, the castings, together with an abrasive material, are placed in a barrel which is rotated at a very fast speed. The person who controls the barrel is called a *tumbler operator* (D.O.T. 599.885). Sandblasters and tumbler operators may also operate a machine that both tumbles and blasts the castings. A *chipper* (D.O.T. 809.884) and a *grinder* (D.O.T. 809.884) use pneumatic chisels, powered abrasive wheels, powersaws, and handtools, such as chisels and files, to remove excess metal and to finish the castings.

Castings are frequently heat-treated in furnaces to strengthen the metal; a *heat treater*, or *annealer* (D.O.T. 504.782), operates these furnaces. Before the castings are packed for shipment, a *casting inspector* (D.O.T. 514.687) checks them to make sure they are structurally sound and meet specifications.

Many foundry workers are employed in occupations that are common to other industries. For example, maintenance mechanics, machinists, carpenters, and millwrights maintain and repair foundry equipment. Crane and derrick operators and truckdrivers move materials from place to place. Machine tool operators finish castings. Foundries also employ thousands of workers in unskilled jobs, such as guard, janitor, and laborer.

About one-sixth of all foundry workers are employed in professional, technical, administrative, clerical, and sales occupations. Of these personnel, the largest number are clerical workers, such as secretaries, typists, and accounting clerks.

Foundries employ engineers and metallurgists to do research, design machinery and plant layout, control the quality of castings, and supervise plant operations and maintenance. In recent years, many of these workers have been hired to sell castings and to assist customers in designing cast parts. Most foundry technicians are concerned with quality control. For example, they may test molding and coremaking sand, make chemical analyses of metal, and operate machines that test the strength and hardness of castings. Administrative workers employed in foundries include office managers, personnel workers, purchasing agents, and plant managers.

Detailed discussions of three principal foundry occupations—patternmakers, coremakers, and molders—appear elsewhere in the *Handbook*.

Training, Other Qualifications, and Advancement

Most workers start in unskilled jobs, such as laborer or helper, and, after receiving on-the-job training from a supervisor or experienced worker, gradually learn more skilled jobs. This is the usual practice in training workers for casting process jobs such as melter, chipper, and grinder.

Some skilled foundry workers—particularly hand molders, hand coremakers, and patternmakers—

learn their jobs through formal apprenticeship. Apprentices receive supervised on-the-job training for 2 to 4 years, usually supplemented by classroom instruction. High school graduates are preferred for apprenticeship programs, but applicants with less education sometimes are hired. Management prefers workers who have completed an apprenticeship, because they have a greater knowledge of all foundry operations and are therefore better qualified to fill supervisory jobs.

Skilled foundry workers also can learn their trades informally on the job or through a combination of trade school and on-the-job training. In some cases, trade school courses may be credited toward completion of formal apprenticeships. Some foundries and the American Foundry Society Cast Metals Institute conduct training programs to update and upgrade the skills of experienced workers.

Employment Outlook

Employment in the foundry industry is expected to show little or no change through the mid-1980's. Nevertheless, many job openings will become available because of the need to replace experienced workers who retire, die, or transfer to fields of work. The number of openings may fluctuate from year to year since the demand for foundry castings is sensitive to ups and downs in the economy.

Over the long run, population growth and higher incomes will create a demand for more automobiles, household appliances, and other consumer products that have cast parts. More castings also will be needed for industrial machinery as factories expand and modernize. However, technological developments will enable foundries to meet the increased demand for castings without increasing employment significantly. Continued improvements in production methods will result in greater output per worker.

Although foundry employment as a whole is not expected to change significantly through the mid-1980's, employment will rise in some occupations. For example, employment of scientists and engineers is expected to increase because of expanding research and development activities. Technicians also will be needed in greater numbers to help improve quality control and production techniques. More maintenance workers will be hired to keep the industry's growing amount of machinery in working order. In contrast, machine molding and coremaking will be substituted for hand processes, and will limit the need for additional hand molders and hand coremakers. Improved molding techniques, such as quick set molding in which the mold hardens quickly and without baking in an oven, also will limit employment of molders. As more machinery for materials handling is introduced, employment of laborers and other unskilled workers may decline.

Earnings and Working Conditions

Production workers in foundries have higher average earnings than those in manufacturing as a whole. In 1974, production workers in iron and steel foundries averaged $5.05 an hour, and those in nonferrous foundries averaged $4.48. By comparison, production workers in all manufacturing industries averaged $4.40 an hour.

Working conditions in foundries have improved in recent years. Many foundries have changed plant layouts and installed modern ventilating systems to reduce heat, fumes, and smoke. Although the injury rate in foundries is higher than the average for manufacturing, employers and unions are attempting to reduce injuries by promoting safety training.

Foundry workers belong to many unions, including the International Molders' and Allied Workers' Union; the United Steelworkers of America; and the International Union of Electrical, Radio and Machine Workers. Many patternmakers are members of the Pattern Makers' League of North America.

Sources of Additional Information

Further information about work opportunities in foundry occupations may be obtained from local foundries, the local office of the State employment service, the nearest office of the State apprenticeship agency or the Bureau of Apprenticeship and Training, U.S. Department of Labor. Information also is available from the following organizations:

American Foundrymen's Society, Golf and Wolf Rds., Des Plaines, Ill. 60016.

Cast Metals Federation, Cast Metals Federation Building, 20611 Center Ridge Rd., Rocky River, Ohio 44116.

Foundry Educational Foundation, 1138 Terminal Tower, Cleveland, Ohio 44113.

International Molders' and Allied Workers' Union, 1225 E. McMillan St., Cincinnati, Ohio 45206.

OCCUPATIONS IN THE INDUSTRIAL CHEMICAL INDUSTRY

Industrial chemical products are the raw materials for all kinds of everyday items, from nylon stockings to automobile tires. Chemicals also are used to treat drinking water, to propel rockets, and to make steel, glass, explosives, and thousands of other items. The discovery of nylon, plastics, and other new products has helped the industrial chemical industry become one of the Nation's most important.

Making these many, very different kinds of products requires a large number of workers with many different skills. About 550,000 people in many different occupations worked in the industrial chemical industry in 1974. Training varies from a few days on the job for some plantworkers to college degrees for engineers and chemists.

Nature of the Industry

The industry produces organic and inorganic chemicals, plastics, and man-made rubber and fibers. Unlike drugs, paints, and other chemical products sold directly to consumers, industrial chemicals are used by other industries to make their own products.

Chemical products are made from coal, petroleum, limestone, mineral ores, and many other raw materials. Since these materials usually go through several chemical changes, the finished products are vastly different from the original ingredients. Some plastics, for example, are made from natural gas.

In a modern chemical plant, automatic equipment controls the dissolving, heating, cooling, mixing, filtering, and drying processes that convert raw materials to finished products. This equipment regulates the combination of ingredients, flow of materials, and the temperature, pressure, and process time. Materials also are moved automatically from one part of the plant to another by conveyors or through pipes. Because of this automatic equipment, relatively few workers can produce tons of chemicals in one continuous operation.

About two-thirds of the 3,000 industrial chemical plants in the United States have fewer than 50 workers. Over half of the industry's employees, however, are concentrated in large plants with more than 500 workers.

Chemical plants are usually close to manufacturing centers or near the sources of raw material. Many plants that produce chemicals from petroleum, for example, are near the oil fields of Texas and Louisiana. Although industrial chemical workers are employed in almost every state, about half of them work in Tennessee, New Jersey, Texas, Virginia, West Virginia, Ohio, and South Carolina.

Occupations in the Industry

Workers with many different skills and levels of education work in the industrial chemical industry. Research scientists, engineers, and technicians develop products and design equipment and production processes. Administrators, professionals, and clerical workers handle financial and business matters, keep records, and advertise and sell chemical products. Other employees are in processing, maintenance, and other plant jobs.

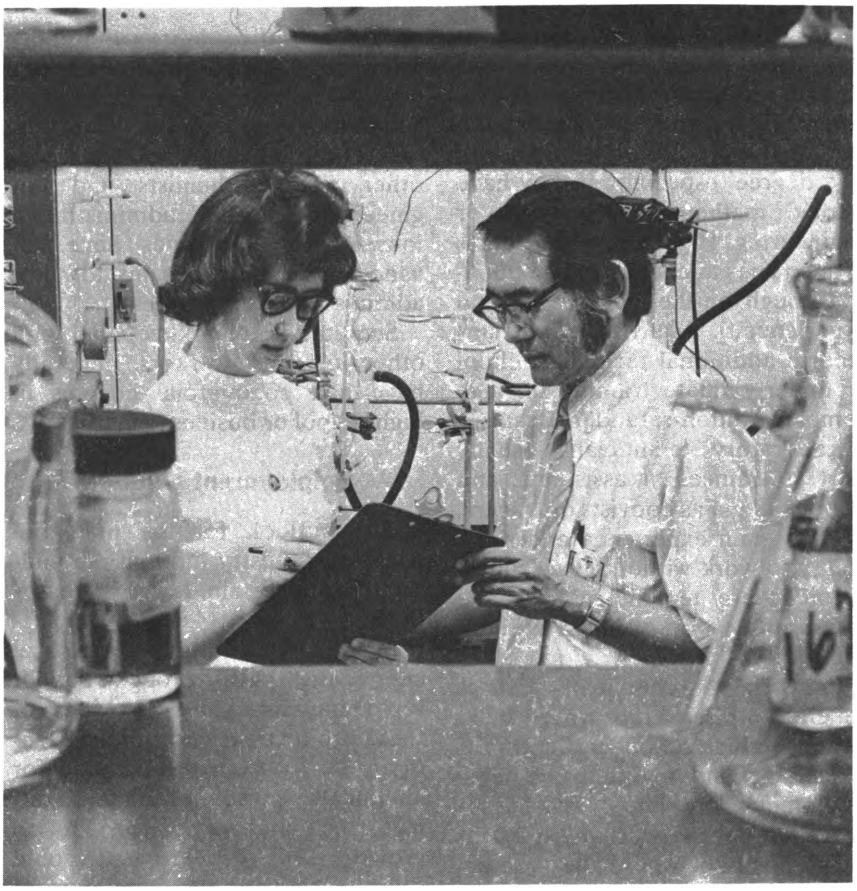
Scientific and Technical Occupations. The industrial chemical industry is one of the Nation's major employers of scientific and technical workers; 1 out of 5 of its employees is a scientist, engineer, or technician. Many work in research and testing laboratories. An even larger number are administrators or production supervisors. Because the sale of chemical products frequently requires a technical background, scientists and engineers sometimes work as sales representatives.

Chemists are the largest and one of the most important group of scientists in the industry. Through basic and applied research, chemists learn about the properties of chemicals in order to find new and improved products and production methods. Their efforts have led to the discovery of plastics, nylon, and many other items.

Chemists also work in activities other than research and development. A large number supervise plantworkers or analyze and test chemical samples to insure the quality of the final product. Others are administrators, marketing experts, chemical salesworkers, and technical writers.

Engineers are another important group of industrial chemical professionals. Using their knowledge of both chemistry and engineering, chemical engineers convert laboratory processes into large-scale production methods. They design chemical plants and processing equipment and sometimes supervise construction and operation. Chemical engineers also fill sales, customer service, market research, plant management, and technical writing jobs.

Mechanical engineers design power and heating equipment. They also work with chemical engineers to design processing equipment and supervise its installation,



One out of five chemical workers is a scientist, engineer, or technician.

operation, and maintenance. Electrical engineers design electric and electronic instruments and control devices, and facilities for generating and distributing electric power.

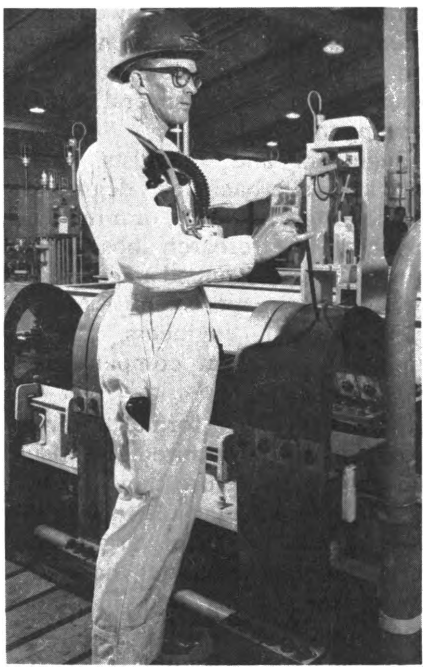
Many technical workers assist scientists and engineers. Laboratory technicians conduct tests and record the results in charts, graphs, and reports which are used by chemists and chemical engineers. Their work may range from simple routine tests to complicated analyses. Drafters provide engineers with specifications and detailed drawings of chemical equipment.

Plant Occupations. About 3 out of every 5 industrial chemical workers operate or maintain equipment or do other plant jobs.

Skilled *chemical operators* (D.O.T. 558.885 and 559.782) and their helpers are the largest group of plantworkers. They set dials, valves, and other controls on automatic equipment to insure that the right temperature, pressure, and amounts of materials are used. As chemicals are processed, operators read instruments that measure pressure, flow of materials, and other conditions. They also use instruments to test chemicals or send chemical samples to the testing laboratory. Operators keep records of instrument readings and test results and report equipment breakdowns. Chemical operators are sometimes called filterers, mixers, or some other title, depending on the kinds of equipment they operate.

To keep production processes running smoothly, instruments must give accurate measurements and equipment must withstand corrosion, damaging chemicals, high temperatures, and pressure. Many skilled maintenance workers are needed to keep this equipment in good condition. Pipefitters and boilermakers lay out, install, and repair pipes, vats, and pressure tanks; maintenance machinists make and repair metal parts for machinery; electricians maintain and repair wiring, motors, and other electrical equipment; and instrument repairers install and service instruments and control devices. In some chemical plants one worker may do several of these jobs. Plantworkers also are needed to drive trucks, keep inventory of stock and tools, load and unload trucks, ships, and railroad cars, keep the plant and office clean, and do many other kinds of work.

Administrative, Clerical, and Related Occupations. About 1 out of 5 industrial chemical workers holds an administrative, clerical, or other nonscientific white-collar job. High-level managers generally are



Chemical operator checks production process.

trained in chemistry or chemical engineering. These executives decide what products to manufacture, where to build plants, and how to handle the company's finances. Executives depend on specialized workers including accountants, sales representatives, lawyers, industrial and public relations workers, market researchers, computer programmers, and personnel and advertising workers. Many secretaries, typists, payroll and shipping clerks, and other clerical employees work in offices and plants.

(Individual statements elsewhere in the *Handbook* give detailed discussions of many scientific, technical, maintenance, and other occupations found in the industrial chemical industry, as well as in other industries.)

Training, Other Qualifications, and Advancement

Jobs in the industrial chemical industry require from a few days of on-the-job training to many years of preparation. Some plant workers can learn their jobs in a day or two. Scientists, engineers, technicians, and chemical operators, on the other hand, spend several years learning their skills.

Engineers and scientists must have at least a bachelor's degree in engineering, chemistry, or a related science. Most research jobs, however, require advanced degrees or specialized experience. Many scientists and engineers attend graduate courses at company expense.

Some firms have formal training programs for newly hired scientists and engineers. Before they are assigned to a particular job, these employees work briefly in various departments to learn about the company's overall operation. In other firms, junior scientists and engineers are assigned immediately to a specific job.

Technicians qualify for their jobs in many ways. Graduates of technical institutes, junior colleges, or vocational technical schools have the best opportunities. Companies also hire students who have completed part of the requirements for a college degree, especially if they have studied mathematics, science, or engineering. High school graduates with courses in chemistry can qualify through on-the-job training and experience. Many technicians receive additional technical school or undergraduate training through company tuition-refund programs.

Laboratory technicians usually start as trainees or assistants, and drafters begin as copyists or tracers. As they gain experience and show ability to work without close supervision, these technicians advance from routine work to more difficult and responsible jobs.

Industrial chemical firms generally hire and train inexperienced high school graduates for processing and maintenance jobs. Equipment operators and other processing workers usually start out in a labor pool where they are assigned jobs such as filling barrels or moving materials. Workers may be transferred from the labor pool to fill vacancies in one of the processing departments. As they gain experience they move to more skilled processing jobs. Thus, a worker may advance from laborer to chemical operator helper, and then to chemical operator. Skilled processing workers are rarely recruited from other plants.

Most maintenance workers are trained on the job. Chemical companies often have formal maintenance training programs, including some classroom instruction, which may last from a few months to several years. Instrument repairers sometimes attend training programs offered by instrument manufacturers. Maintenance workers and trainees are encouraged to take job-related courses at local vocational or technical schools. Their employers may pay part or all of the tuition.

Administrative jobs are usually filled by people with college degrees in business administration, accounting, economics, statistics, marketing, industrial relations, and other fields. Chemists and engineers also hold administrative jobs. Some companies have advanced training programs for new administrative employees.

Secretaries, bookkeepers, and other clerical workers generally have had commercial courses in high school or business school.

Employment Outlook

The outlook for the industrial chemical industry through the mid-1980's is uncertain. Large increases in the price of petroleum, which is the raw material for many industrial chemicals, have brought about rapid increases in the prices of these products. Higher prices eventually may curtail the demand for chemicals, subsequently moderating the industry's production growth. This development could sharply reduce the employment growth that otherwise would occur. However, even if employment does not grow, the industry will still need many new workers to replace employees who retire, die, or transfer to other industries. Job openings from deaths and retirements alone will average several thousand a year.

Although the composition of employment in the industry is expected to change, with more administrative and technical workers needed to handle the increasingly complex production processes, most job openings will continue to be for production workers since they are the largest group of employees.

Earnings and Working Conditions

Production workers in the industrial chemical industry have relatively high earnings because a large

proportion of them are in skilled jobs. In 1974 they averaged $5.05 an hour, compared to $4.40 an hour for production workers in all manufacturing.

National wage data are not available for individual occupations in the industrial chemicals industry. However, in 1974 hourly wages in a few union-management contracts were as follows:

	Hourly rates
Instrument repairers	$4.13–6.00
Laboratory technicians	3.93–5.89
Chemical operators	4.13–5.86
Pipefitters, boilermakers, and sheet-metal workers	4.13–5.86

Because chemical plants usually operate around the clock—three shifts a day, 7 days a week—processing workers often work the second or third shift, usually for extra pay. Shift assignments are usually rotated, so an individual may work days 1 week and nights the next. Maintenance workers usually work only the day shift.

Most industrial chemical jobs, except those for laborers or material handlers, are not strenuous. Equipment operators are on their feet most of the time. Some workers must climb stairs or ladders to considerable heights, or work outdoors in all kinds of weather. Workers may be exposed to dust, disagreeable odors, or high temperatures, although most plants have ventilating or air-conditioning systems.

Many chemicals are dangerous to touch or breathe. However, the industrial chemical industry has one of the better safety records in manufacturing. Protective clothing, eyeglasses, showers, and eye baths near hazardous work stations and other safety measures help prevent serious injuries.

Many production workers in the industrial chemical industry belong to labor unions, including the International Chemical Workers Union; Oil, Chemical, and Atomic Workers International Union; and the United Steelworkers of America.

Sources of Additional Information

Further information on careers in the industry may be obtained from employment offices of industrial chemical companies, locals of the unions mentioned above, and from:

American Chemical Society, 1155 16th St. NW., Washington, D.C. 20036.

Manufacturing Chemists' Association, Inc., 1825 Connecticut Ave. NW., Washington, D.C. 20009.

OCCUPATIONS IN THE IRON AND STEEL INDUSTRY

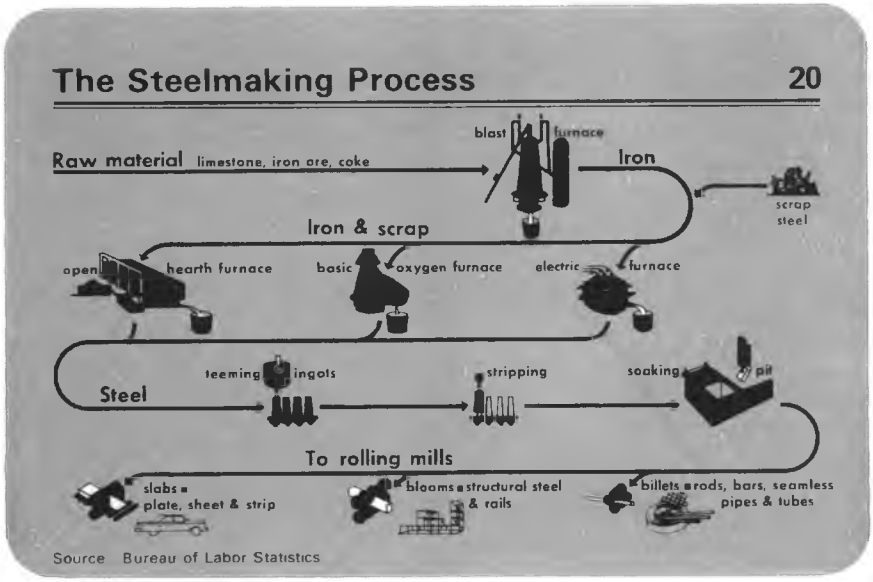
Steel is the backbone of any industrialized economy. Few products in daily use have not been made from steel or processed by machinery made of steel. In 1974, the United States produced about one-fifth of the world's steel output.

About 610,000 wage and salary workers were on the payrolls of the iron and steel industry's more than 940 plants in 1974. Employees work in a broad range of jobs that require a wide variety of skills. Many of these jobs are found only in iron and steelmaking.

The iron and steel industry, as discussed in this chapter, consists of blast furnaces, steelmaking furnaces, and finishing mills. The mining and processing of raw materials used to make steel and the fabrication of steel are not described. (Employment opportunities in foundry, forging, and machining occupations are discussed elsewhere in the *Handbook*.)

Blast furnaces make iron from iron ore, coke, and limestone. Steelmaking furnaces refine the iron into steel. Primary rolling mills and continous casting operations shape the steel into basic products called billets, blooms, and slabs, which other rolling mills refine into sheets, plates, bars, strips, and various other semifinished products. Many mills also produce finished items, such as pipe and wire. Most semifinished steel products, however, are shipped to plants of other industries.

The leading steel-consuming industries manufacture automobiles, construction materials, machinery and machine tools, containers, and household appliances. Steel sheets are made into automobile bodies, appliances, and furniture. Steel bars are used to make parts for machinery and to reinforce concrete in building and highway construction. Steelplates become parts of ships, bridges, railroad cars, and storage tanks. Strip steel is used to make pots and pans, razor blades, toys, and many other items.



Individual plants in the iron and steel industry typically employ a large number of workers. About 80 percent of the industry's employees work in plants which have more than 2,500 employees. A few plants have more than 20,000. Many plants, however, have fewer than 100 employees.

Iron and steel plants are located mainly in the northern and eastern parts of the United States. About 7 out of 10 of the industry's workers are employed in five States—Pennsylvania, Ohio, Indiana, Illinois, and New York. Nearly 3 out of 10 are employed in Pennsylvania alone.

The heart of U.S. steel manufacturing is a triangular area, about 250 miles on a side, marked off by Johnstown, Pa., Buffalo, N.Y., and Detroit, Mich. Included in this area are major steel producing centers such as Pittsburgh, Pa., and Cleveland and Youngstown, Ohio. Large plants also are located on the south shore of Lake Michigan near Chicago. The Nation's three largest steel plants are located at Indiana Harbor and Gary, Ind., and Sparrows Point, Md. (near Baltimore). Much of the steelmaking in the South is in the vicinity of Birmingham, Ala., and Houston, Tex. In California there are plants at Fontana and near San Francisco. Other steelmaking facilities are located at Pueblo, Colo. and Provo, Utah.

Occupations in the Industry

Workers in the iron and steel industry hold more than 2,000 different types of jobs. Many are directly engaged in making iron and steel and converting it into

semifinished and finished products. Others maintain the vast amount of machinery used in the industry, operate cranes and other equipment that move raw materials and steel products about the plants, or perform other kinds of production jobs. In addition, many workers are needed to do clerical, sales, professional, technical, administrative, and supervisory work.

Processing Occupations. The majority of the workers in the industry are employed in the many processing operations involved in converting iron ore into steel and then into semifinished and finished steel products. Following are brief descriptions of the major steelmaking and finishing operations and some of the occupations connected with them.

Blast furnaces. The blast furnace, a large steel cylinder lined with heat-resistant brick, is used to make molten iron from iron ore. A mixture of ore, coke, and limestone (called a "charge") is fed into the top of the furnace. Hot air blown in the bottom from giant stoves causes the coke to burn, producing intense heat. At these high temperatures gas from the burning coke reacts with the oxygen in the ore, freeing the iron.

The iron, now molten, trickles down through the burning coke and collects in a pool at the bottom of the furnace. At the same time, the intense heat causes the limestone to combine with other impurities in the ore and with coke ash to form "slag," a byproduct that is often used for making cement and insulating materials. The slag also trickles down through the coke and floats on top of the heavier molten iron. Molten iron is removed from the furnace every 3 or 4 hours; slag may be removed more frequently.

A blast furnace operates continuously, 24 hours a day, 7 days a week, unless it is shut down for repairs or for other reasons. A single furnace may produce up to 7,500 tons of iron in a 24-hour period.

The raw materials used in blast furnaces are transferred from stockyards by *larry operators* (D.O.T. 919.883). These workers position their larry cars under storage bins where they are filled with coke, limestone, or iron ore. After driving on tracks to the furnace, the operators position their cars over an open grate. Pulling a lever, they dump the materials through the grate and into a hopper. *Scale car operators* (D.O.T. 921.883) drive other larry cars on tracks in tunnels underneath the hoppers. Positioning their car under one of these bins, they fill it with raw material, weigh the loaded car, and then unload the material into skip cars where the ore, limestone, or coke is automatically carried to the top of the blast furnace and dumped. In stockhouses without automatic controls a *skip car operator* (D.O.T. 921.883) uses electric and pneumatic controls to operate these cars. Scale car operators must keep records of what they put in the furnace, and must know what is in the furnace at any time. *Stove tenders* (D.O.T. 512.782) operate the stoves which heat air for the blast furnace. They regulate valves to control the heat of the stoves and the flow of air to the furnace.

Blowers (D.O.T. 519.132) oversee the operation of one or more blast furnaces and are responsible for the quantity and quality of the iron produced. They coordinate the addition of raw materials by stockhouse workers with the furnace operation and supervise *keepers* (D.O.T. 502.884) and their *helpers* (D.O.T. 502.887) in removing (tapping) the iron and slag from the furnace. If the iron is not forming correctly in the furnace, they may have the stove tenders change the temperature and flow of air into the furnace.

When the blower has determined that the iron is ready to be removed, the keeper and a helper drill through the clay that is plugging a taphole above the molten iron, allowing the slag to flow down a sand-lined channel into waiting ladles. Helpers open gates to divert the slag into other ladles when the first one is filled. After removing the slag the keeper drills through a lower taphole which allows the iron to flow down another channel into hot metal cars. In some furnaces only the lower taphole is used. The slag flows out after the iron and is diverted by the keeper to the slag channel. To close the furnace the keeper uses a "mud gun" to shoot clay into the tapholes. The keeper and helpers use sledges and tongs to remove solidified iron and slag from the channels and shovels to line the channels with special heat resistant sand.

Some iron is made into finished products such as automobile engine blocks and plumbing pipes. Most of it, however, is used to make steel. Because steel is stronger than iron and can be hammered and bent without breaking, it can be used for many more products.

Steel furnaces. Steel is made by refining iron to remove some of the carbon and impurities and adding alloying agents such as silicon and manganese. This is done in several types of furnaces: basic oxygen, open hearth, and electric.

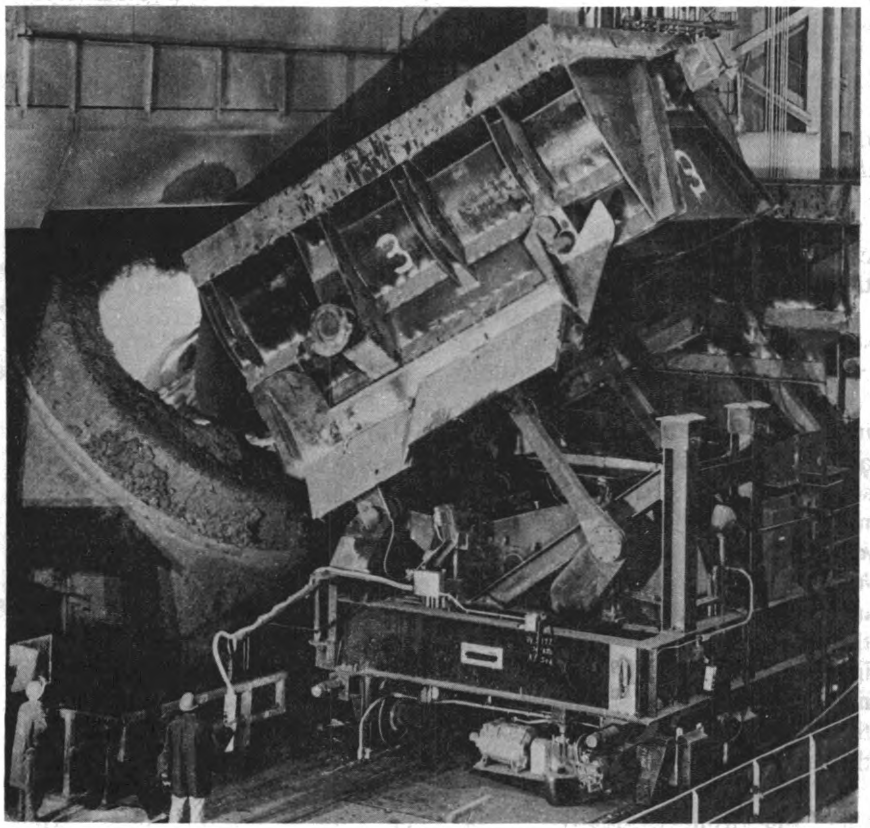
More than half of all domestic steel is made in basic oxygen furnaces (BOF's) and about a quarter in open hearth furnaces. Both produce similar kinds of steel, but BOF's do the job faster and are expected to replace many of the open hearths now in operation. Although electric furnaces also produce regular steel like that made by BOF's and open hearths, they can also produce high quality steel such as tool and stainless steel.

A *melter* (D.O.T. 512.132) supervises workers at a steel furnace. Melters receive information on the characteristics of the raw materials they will be using and the type and

quality of steel they are expected to produce. The melter makes the steel to the desired specifications by varying the proportions of iron, scrap steel, and limestone in the furnace, and by adding small amounts of other materials such as manganese, silicon, copper, or other alloy additives. The procedure followed depends on the furnace used.

A basic oxygen furnace (BOF) is a giant, pear-shaped steel container lined with refractory material. The *furnace operator* (D.O.T. 512.782), under the direction of the melter, controls this steelmaking process. To begin the operation, the furnace operator's first assistant uses controls to tilt the furnace to receive the charge of steel scrap and molten iron. A *scrap crane operator* (D.O.T. 921.883) adds scrap steel and is followed by a *charging crane operator* (D.O.T. 921.883) who adds the molten iron made by the blast furnace. After the assistant rights the furnace, the furnace operator, who works in a pulpit, uses levers and buttons to lower the oxygen lance, a pipe which blows oxygen into the furnace at supersonic speeds. Operators also control the addition of lime, which reacts with impurities in the iron to form slag, and the addition of any alloys which are required to give the steel the desired properties. If the chemical reactions become too violent, the furnace may overheat, causing slag and iron to splash out the top. Thus, furnace operators must pay close attention to conditions in the furnace, regulate the oxygen flow and, if the furnace does overheat, direct the rocking of the furnace to cool it.

By observing the various instruments in the control room, the furnace operator knows when the steel has almost the correct composition. The first assistant then tilts the furnace while the second assistant and helpers, working from behind a heat shield, use a long-handled spoon to take a sample. The sample is sent up to the lab where metallurgists determine how close the steel is to the product desired. Based on this information, the furnace operator determines how much longer and at what temperature the furnace should operate. When the furnace operator has determined that the steel is of the correct composition, the first assistant tilts the furnace towards a waiting ladle. The steel flows through a taphole halfway up the furnace and into the ladle. The second assistant and helpers may add alloys to the ladle while the steel is poured. By continually tilting the furnace at a steeper angle the first assistant can keep the slag above the taphole, preventing it from flowing into the ladle. Eventually, the slag is poured into the slag pot. The assistants and helpers then use handtools to clean out the tap hole and furnace lip.



A scrap crane operator loads a B.O.F. with scrap metal.

An open hearth furnace resembles a large, rectangular, shallow pan. The melter at this furnace supervises a *first helper* (D.O.T. 512.782) who in turn directs the activities of a *second helper* (D.O.T. 502.884) and a *third helper* (D.O.T. 519.887). To begin the operation, a *charging-machine operator* (D.O.T. 512.883), working in a pulpit, uses a long-armed charging machine to dump boxes of limestone and scrap steel inside the furnace door. The first helper operates controls to open and close the door, and regulates the flow of hot air from brick stoves to the furnace. After determining that the material has reached the correct temperature, the first helper signals a crane operator who pours molten iron from a ladle into a movable spout located at a door of the furnace. The first helper continues to operate controls to bring the furnace up to the best temperature for the steelmaking reactions.

After taking a sample of the molten metal and determining that it

has the correct composition, the first helper directs the other helpers in tapping the furnace. Using an explosive charge, the second helper opens the taphole, which is located at the lowest part of the furnace. While the metal flows into the ladle, the second and third helpers shovel alloying materials, which they had previously weighed and wheeled to the furnace, into the ladle. The lighter slag flows out after the steel and overflows into a slag pot. After the furnace has been emptied, the first helper examines the interior and supervises the other helpers in repairing any damage to the floor or walls.

The electric arc furnace is the most common electric furnace. To load it, the roof is usually swung aside by the *furnace operator* (D.O.T. 512.782). A crane operator adds lime, scrap steel, and in some cases enriched iron pellets to the furnace. Molten iron is seldom used in these furnaces. After closing the roof, the furnace operator uses controls to lower electrodes to within a few inches of the metal. Other controls are used to regulate the current flowing through the electrodes. The current arcs from an electrode to the metal and then back to a neighboring electrode, melting the steel. By regulating the current, the operator can control the temperature much more accurately than operators of BOF's and open hearths, to produce very high quality steels.

To remove the slag, the furnace operator uses levers to tilt the furnace slightly while an assistant uses a long pole to stir the slag. This helps the slag flow out of a spout located above the molten steel. When the furnace has been righted, alloys can be added through the roof, after which the operator tilts the furnace in the opposite direction to pour the steel into a ladle.

Molten steel usually is solidified into large blocks called "ingots." A *ladle crane operator* (D.O.T. 921.883) controls an overhead crane which picks up the ladle of molten steel and moves it over a long row of ingot molds resting on flatbottom cars. The *steel pourer* (D.O.T. 514.884) operates a stopper at the bottom of the ladle to let the steel flow into these molds. As soon as the steel has solidified sufficiently, an *ingot stripper* (D.O.T. 921.883) operates an overhead crane, which removes the molds from the ingots.

Furnace workers take sample of molten steel for laboratory analysis.

Rolling and finishing. The three principal methods of shaping steel are rolling, casting, and forging. About three-fourths of all steel products are shaped by the rolling process. In this method, heated steel ingots are squeezed into longer and flatter shapes between two massive cylinders or "rolls." Before ingots of steel are rolled, they are heated to the temperature specified by plant metallurgists. The heating is done in large furnaces called "soaking pits," located in the plant floor. A *soaking pit crane operator* (D.O.T. 921.883) maneuvers an overhead crane to lift the ingots from small railcars and place them in the soaking pit. A *heater* (D.O.T. 613.782) and *helper* (D.O.T. 613.885) control the soaking pit operation. They adjust controls to maintain the correct temperature in each pit, and by watching dials and observing the color of the metal, they determine when the ingot is ready for rolling. When the ingots are hot enough the crane operator places them on an ingot buggy, which carries them to the first rolling mill, sometimes called a "primary" mill. Here, the ingots are rolled into smaller, more easily handled shapes called blooms and slabs. Blooms are generally between 6 and 12 inches wide and 6

and 12 inches thick. Slabs are much wider and thinner than blooms.

The rolling of ingots into blooms and slabs is a similar operation; in fact some rolling mills can do both. The ingot moves along on a roller conveyer to a machine which resembles a giant clothes wringer. A "two-high" rolling mill has two grooved rolls which revolve in opposite directions. The rolls grip the approaching ingot and pull it between them, squeezing it thinner and longer. When the ingot has made one such pass the rolls are reversed, and the ingot is fed back through them. Throughout the rolling operation, the ingot is periodically turned 90 degrees by mechanical devices called "manipulators," and passed between the rolls again so that all sides are rolled. This operation is repeated until the ingot is reduced to a slab or bloom of the desired size. It is then ready to be cut to specified lengths.

A *roller* (D.O.T. 613.782), the worker in charge of the mill, works in a glass-enclosed control booth, located above or beside the conveyer line. This employee's duties, which appear to consist principally of moving levers and pushing buttons, look relatively simple. However, the quality of the product and the speed with which the ingot is rolled depend upon the roller's skill. The roller regulates the opening between the rolls after each pass. If the opening is set too wide, more passes will be needed to get the required shape, and production will be slowed. If the opening is too narrow, the rolls or gears may be damaged. Long experience and a knowledge of steel characteristics are required for a worker to become a roller. A *manipulator operator* (D.O.T. 613.782) sits in the booth beside the roller and operates controls which position the ingot correctly before each pass.

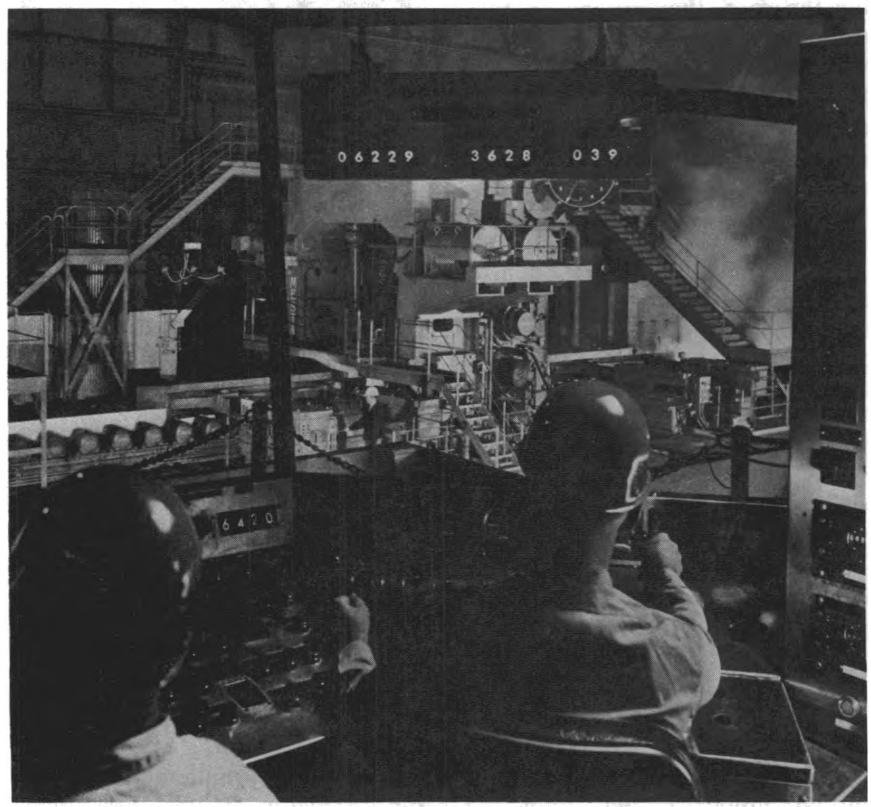
Upon leaving the rolling mill, the red-hot slab or bloom moves along a conveyer to a place where a *shear operator* (D.O.T. 615.782) controls a heavy hydraulic shear which cuts the steel into desired lengths.

In a rolling mill that has automatic controls, a rolling mill attendant is given a card that has been punched with a series of holes. The holes represent coded directions as to how the ingot is to be rolled. The attendant inserts the card into a card "reader" and presses a button to start the automatic rolling sequence. When this process is used, the roller's job is shifted from operating the controls to directing and coordinating the rolling process.

Of increasing use in steel shaping is the continuous casting process, which eliminates the necessity of producing large ingots that in turn must be reheated and then put through huge blooming and slabbing mills. In the continuous casting process, molten steel is poured into a water-cooled mold having the profile of the desired product shape, such as slab or bloom. The steel cools and solidifies along the bottom and lower sides of the mold. Passing down through a chamber, the steel is further cooled by a water spray. Pinch rolls control its descent and support its weight, and the molded slab or bloom of steel is cut into lengths as it emerges from the rolls.

After the steel is rolled or cast into primary shapes, most of it is put through semifinishing and finishing operations. Slabs, for example, can be reduced and shaped into plates and sheets. Blooms can be made into rods which in turn can be reduced to wire.

To make sheets, a slab is first heated in a furnace similar to the soaking pits, described earlier, and then run through a hot strip mill. The hot strip mill is a continuous series of pairs of rolls, similar to the two at the primary mill. As the slab moves through each pair of rolls it



Remote control enables rollers to work outside the vicinity of the rolling process

becomes thinner and longer. Edge guides control its width. After passing through the last pair of rolls, the sheet is wound into a coil. If the customer prefers a thinner sheet or an improved surface, the product may be cold rolled in another mill.

Having obtained information on the characteristics of the sheet desired, the roller at the hot strip mill refers to a printed guide to determine the necessary gauge between each pair of rolls, and the speed at which the slab should travel. Working in a pulpit, the roller uses controls to set the gauge on the last series of rolls, while the *speed operator* (D.O.T. 613.782) controls the speed of the sheet being rolled. Unless problems develop, the job of these two workers is repetitive. However, if the sheet should begin to buckle between rolls, due to the steel's composition or temperature, these two employees must readjust the gauge and speed in an attempt to avoid damage to the sheet.

Under the direction of the roller, a *rougher* (D.O.T. 613.782) and assistant use handtools to adjust the gauge and edge guides for the first series of rolls (called the roughing mill). A *rougher pulpit operator* (D.O.T. 613.782), following the rougher's instructions, signals the furnace crew for additional slabs and uses hand controls to operate guides to position the slab at the start of the run.

Wire and pipe are made from blooms. First the bloom is rolled into a billet (a bloom with a smaller cross section). To make wire, the billet is rolled into an even thinner product called a rod.

A *wire drawer* (D.O.T. 614.782) operates equipment that pulls the steel rod through a die. The die has a tapered hole, one end of which is smaller than the rod. As the rod passes through the hole, it is made thinner and longer and becomes wire.

A *piercer-machine operator* (D.O.T. 613.885) controls machinery that makes seamless pipe from solid billets of steel. The operator passes a heated billet between two barrel-shaped rolls which spin the billet and force an end of it against a sharp plug or "mandrel." The mandrel smooths the inside wall of the billet and makes the diameter of the hole uniform.

Maintenance, Transportation, and Plant Service Occupations. Large numbers of workers are required in steel plants to support processing activities. Some maintain and repair machinery and equipment, while others operate the equipment which provides power, steam, and water.

Machinists and machine tool operators make and repair metal parts for production equipment. Diemakers use machine tools to form dies, such as those used to make wire. *Roll turners* (D.O.T. 613.780) use lathes, grinders, and other machine tools to refinish the steel rolls used in the rolling mills.

Millwrights overhaul machinery and repair and replace defective parts. Electricians install wiring and fixtures and hook up electrically operated equipment. Electrical repairers (motor inspectors) keep wiring, motors, switches, and other electrical equipment in good operating condition.

Electronic repairers install and maintain the increasing number of electronic devices and systems used in steel manufacturing plants. Typically, this equipment includes communication systems such as closed-circuit television; electronic computing and data recording systems; and measuring, processing, and control devices such as X-ray measuring or inspection equipment.

Bricklayers repair and rebuild the brickwork in furnaces, soaking pits, ladles, and coke ovens, as well as mill buildings and offices. Pipefitters lay out, install, and repair piping that is used to carry the large amounts of liquids and gases used in steelmaking. Boilermakers test, repair, and rebuild heating units, storage tanks, stationary boilers, and condensers. Locomotive engineers and other train crew members operate trains that transport materials and products in the vast yards of iron and steel plants. Other skilled workers operate the various boilers, turbines, and switchboards in factory powerplants.

Other types of maintenance and service workers include carpenters, oilers, painters, instrument repairers, scale mechanics, welders, loaders, riggers, janitors, and guards. Many laborers are employed to load and unload materials and do a variety of cleanup jobs.

Administrative, Clerical, and Technical Occupations. Professional, administrative, clerical, and salesworkers consitute about one-fifth of the industry's total employment. Of these, the majority are clerical workers, such as secretaries, stenographers, typists, accounting clerks, and general office clerks.

Engineers, scientists, and technicians make up a substantial proportion of the industry's white-collar employment. Several thousand of these workers perform research and development work to improve existing iron and steel products and processes, and to develop new ones.

Among the technical specialists employed in steelmaking are mechanical engineers, whose principal work is the design, construction, and operation of mill machinery and material handling equipment. Metallurgists and metallurgical engineers work in laboratories and production departments where they have the important task of specifying, controlling, and testing the quality of the steel during its manufacture. Civil engineers are engaged in the layout, construction, and maintenance of steel plants, and the equipment used for heat, light, and transportation. Electrical engineers design, lay out, and su-

pervise the operation of electrical facilities that provide power for steel mill operation.

Chemists analyze the chemical properties of steel and raw materials in laboratories. Laboratory technicians do routine testing and assist chemists and engineers. Drafters prepare working plans and detailed drawings required in plant construction and maintenance.

Among the employees in administrative, managerial, and supervisory occupations are office managers, labor relations and personnel managers, purchasing agents, plant managers, and industrial engineers. Working with these personnel are several thousand professional workers, including accountants, nurses, lawyers, economists, statisticians, and mathematicians. The industry also employs several thousand salesworkers.

(Detailed discussions of professional, technical, mechanical, and other occupations found in the iron and steel industry, as well as in many other industries, are given elsewhere in the *Handbook.*)

Training, Other Qualifications, and Advancement

New workers in processing operations usually are hired as unskilled laborers. Openings in higher rated jobs usually are filled by promoting workers from lower grade jobs. Length of service with the company is the major factor considered when selecting workers for promotion. Promotions to first level supervisory positions, such as blower and melter, differ among companies. Some firms determine these promotions solely on seniority while others base them on ability to do the job.

Training for processing occupations is done almost entirely on the job. Workers move to operations requiring progressively greater skill as they acquire experience. A crane operator, for example, first is taught how to operate relatively simple cranes, and then advances through several steps to cranes much more difficult to run, such as the hot-metal crane.

Workers in the various operating units usually advance along fairly well-defined lines of promotion within their departments. For example, to become a blast furnace blower, a worker generally starts as a laborer, advancing to second helper, first helper, keeper and finally blower. At a basic oxygen furnace a worker may begin by doing general cleanup work and then advance to furnace hand, second assistant, first assistant, furnace operator and eventually to melter. A possible line of job advancement for a roller in a finishing mill might be assistant rougher, rougher pulpit operator, rougher, speed operator and finish roller. Workers can be trained for skilled jobs, such as blower, melter, and roller, which are among the highest rated steelmaking jobs, in a minimum of 4 or 5 years, but they may have to wait 25 or 30 years before openings occur.

To help them advance in their work, many employees take part-time courses in subjects such as chemistry, physics, and metallurgy. Steel companies sometimes provide this training—often within the plant. Other workers take evening courses in high schools, trade schools, or universities or enroll in correspondence courses.

Although many maintenance workers start as helpers and pick up their skills from experienced workers, apprenticeship is the best way to learn a maintenance trade. Apprenticeship programs usually last 3 or 4 years and consist mainly of shop training in various aspects of the particular jobs. In addition, classroom instruction in related technical subjects usually is given, either in the plant or in local vocational schools.

Steelmaking companies have different qualifications for apprentice applicants. Generally, employers require applicants to have the equivalent of a high school or vocational school education. In most cases, the minimum age for applicants is 18 years. Some companies give aptitude and other types of tests to applicants to determine their suitability for the trades. Apprentices generally are chosen from among qualified workers already employed in the plant.

The minimum requirement for engineering and scientific jobs usually is a bachelor's degree with an appropriate major. Practically all the larger companies have formal training programs for college-trained technical workers. In these programs, trainees work for brief periods in various operating and maintenance divisions to get a broad picture of steelmaking operations before they are assigned to a particular department. In other companies, the newly hired scientist or engineer is assigned directly to a specific research, operating, maintenance, administrative, or sales unit. Engineering graduates frequently are hired for saleswork and many of the executives in the industry have engineering backgrounds. Engineering graduates, as well as graduates of business administration and liberal arts colleges, are employed in sales, accounting, and labor-management relations, as well as in managerial positions.

Completion of a business course in high school, junior college, or business school is preferred for entry into most of the office occupations. Office jobs requiring special knowledge of the steel industry generally are filled by promoting personnel already employed in the industry.

Employment Outlook

Employment in the iron and steel industry is not expected to change significantly in the long run (1974-85). Nevertheless, many workers

will be hired to replace those who retire, die, or transfer to other fields. The total number hired may fluctuate from year to year because the industry is sensitive to changes in business conditions and defense needs.

Production of iron and steel is expected to increase moderately as population and business growth create a demand for more automobiles, household appliances, industrial machinery, and other products that require large amounts of these metals. Because of laborsaving technology, however, employment is not expected to keep pace with increases in production. Giant blast furnaces are being built that make more iron per worker than the smaller furnaces they are replacing. Open hearth furnaces will continue to be replaced with more efficient basic oxygen furnaces, increasing the amount of steel produced per worker. Older primary rolling mills will be replaced by continuous casters, which use fewer employees to produce slabs, billets, and blooms. Greater use of computers to control plant equipment, as in hot finishing mills, and to process business records also will increase efficiency.

Employment trends will differ among occupations. The number of engineers, metallurgists, laboratory technicians, and other technical workers will increase as the industry's research and development programs expand. Employment of computer programmers and operators also will increase. More maintenance workers will be needed to maintain the increasingly complex machinery used by steel mills. Employment in processing occupations, on the other hand, is expected to decline slightly as more efficient plant machinery and equipment are introduced.

Earnings and Working Conditions

Earnings of production workers in iron and steelmaking are among the highest in manufacturing. In 1974, they averaged $6.25 an hour, while production workers in manufacturing as a whole averaged $4.40. To show how earnings vary by occupation and department, wage rates for employees in some of the principal occupations are presented in table 1. However, most steelworkers are paid on an incentive basis—that is, the more they produce the more they earn—and often earn more than the table would indicate.

Basic straight-time hourly earnings [1] of workers in selected occupations in basic iron and steel establishments, mid-1974

	Hourly earnings
Blast furnaces:	
Larry operators	$5.10
Keepers	5.50
Basic oxygen furnaces:	
Second assistants	5.20
Furnace operators	6.40
Open hearth furnaces:	
Charging machine operators	5.70
Furnace operators	6.50
Bloom, slab, and billet mills:	
Soaking pit crane operators	5.60
Rollers	6.80
Continuous hot-strip mills:	
Roughers	5.70
Rollers	7.30
Maintenance:	
Bricklayers	5.80
Millwrights	5.70

[1] Excludes premium pay for overtime and for work on weekends, holidays, and late shifts.

Most plantworkers in the iron and steel industry are members of the United Steelworkers of America. Agreements between steel companies and the union include some of the most liberal benefits in industry. Most workers receive vacation pay ranging from 1 to 4 weeks, depending on length of service. A worker in the top 50 percent of a seniority list receives a 13-week vacation every 5 years; the remaining workers receive 3 extra weeks of vacation once in a 5-year period. Professional and executive personnel in some companies receive similar benefits.

Workers may retire on company-paid pensions after 30 years of service, regardless of age. Employees having 2 years of more of service are eligible to receive supplemental unemployment benefits for up to 52 weeks. Other benefits include health and life insurance, and education and scholarship assistance.

Working conditions vary by department. Maintenance shops generally are clean and cool. Rolling mills and furnaces are hot and noisy. Many plants, however, have developed methods to reduce job discomfort. The use of remote control, for example, enables some employees, such as furnace operators, to work outside the immediate vicinity of processing operations. In other instances, the cabs in which the workers sit while operating mechanical equipment, such as cranes, may be air-conditioned. Because certain processes are continuous, many employees are on night shifts or work on weekends.

Sources of Additional Information

For additional information about careers in the iron and steel industry, contact:

American Iron and Steel Institute, 1000 16th St. NW., Washington, D.C. 20036.

United Steelworkers of America, 1500 Commonwealth Building, Pittsburgh, Pa. 15222.

OCCUPATIONS IN LOGGING AND LUMBER MILLS

Young people who have a high school education and a love for the outdoors and wildlife may find rewarding careers in the logging and lumber industry. Logging camps and sawmills provide many job opportunities in the South and Pacific Northwest, the Nation's major timber-producing regions. Because the building and furnishing of homes, hospitals, schools, stores, and most other structures depend upon lumber and wood products, thousands of job openings will be available each year through the mid-1980's.

Nature and Location of the Industry

In 1974, nearly 85,000 wage and salary workers were employed in logging to help harvest trees and remove them from forests. A much larger number—about 220,000—worked in sawmills and planing mills where logs are converted into lumber. In addition, about 50,000 workers were self-employed, most of them in logging.

This statement deals with activities and jobs involved in cutting and removing timber from forests and in the processing of logs into rough and finished lumber. It excludes the manufacture of paper, plywood, veneer, and other wood products such as furniture and boxes. Occupations in paper manufacturing are discussed in a separate statement elsewhere in the *Handbook*.

Lumber production has followed the same basic process for many years. A stand of timber is harvested in the forest, moved to a central location or "landing" accessible to transportation, and then carried by truck or rail to a mill for processing. Logging crews typically consist of from 5 to 15 workers. Several crews, each working at a different location, may be needed to supply logs for a single mill. The crew moves through the forest as one area after another is harvested. Years ago these workers lived in camps close to the cutting site. With better roads, almost all can now live at home and commute to work.

In the sawmill, logs are debarked, rough-sawn into various widths and lengths, and then seasoned (dried) so the wood will not warp. A small amount of rough lumber is sold without further processing, but the rest must be sent to a planing mill before it goes to market. In this mill, rough boards are finished to give them a smooth surface. Boards also are made into flooring, siding, moulding, and other forms of building trim. Since logs cost more to ship than lumber, sawmills usually are located near tree harvesting areas. Some of these mills are small, portable operations that can be moved about from week to week as the harvest progresses, but the large ones are permanent. Planing mills may be near sawmills or hundreds of miles away. About three-fourths of all mills employ fewer than 20 workers, but some have more than 100.

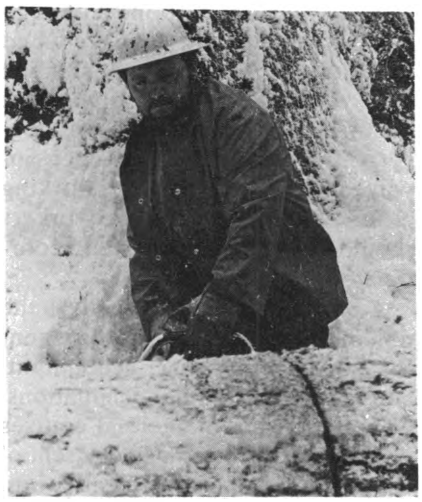
Although some logging and lumber mill workers are employed in nearly every State, seven States account for about half of the industry's employment: Oregon, Washington, California, Alabama, North Carolina, Arkansas, and Georgia.

Logging

Before a stand of timber is harvested, a *forester* (D.O.T. 040.081) decides which trees to cut. Foresters also map the cutting areas, plan and supervise the cutting, and plant seedlings to replace the trees that were removed. *Timber cruisers* (D.O.T. 449.287) estimate the amount and grade of standing timber and help foresters make maps. Heavy equipment operators build access roads and trails to the cutting and loading areas so that they can be reached by logging crews.

The initial harvesting task—"falling and bucking"—is the process of cutting the tree down and further cutting (bucking) it into logs for easier handling. *Fallers* (D.O.T. 940.884), working singly or in pairs, use powersaws to cut down trees marked by the forester. Expert fallers can usually drop a tree in the exact spot where they want it, making sure other trees are not injured in the process. As soon as the tree is down, *buckers* (D.O.T. 940.884) saw the limbs off and saw the trunk into logs.

The next task—"skidding"—is a method of removing logs from the cutting area. A choker (steel cable) is noosed around the log by *choker setters* (D.O.T. 942.887) and then attached to a tractor which drags or "skids" the log to the landing. A *rigging slinger* (D.O.T. 942.884) supervises and assists choker setters and tractor drivers. In rough terrain in the West, where logs must be moved up or down steep slopes or across ravines, the "highlead" method is used instead of tractor skidding. This method is somewhat like a fishing rod and reel. Steel cables run from a diesel-powered winch (reel) through pulleys at the top of a large steel tower (rod) and down to the cutting area which may be hundreds of feet away from the tower. Choker setters noose the end of the cable around a log and a *yarder engineer* (D.O.T. 942.782) operates the winch to pull the log into the landing. Experiments are



Logging worker uses chain saw to divide tree trunk into logs.

now being made with heavy duty helicopters. Hovering above a logging site, the helicopters can lift and move logs weighing several tons. Balloons also are being tried.

After logs reach the landing, they are loaded on a truck trailer and hauled to a mill. A *loader engineer* (D.O.T. 921.883) operates a machine that picks up logs and places them on the trailer. A *second loader* (D.O.T. 949.884) directs the positioning of logs on the trailer. Although trucks usually are used, logs are sometimes carried by railroad cars.

Sawmills and Planing Mills. At the sawmill incoming logs are stacked on the ground (cold decking) or dumped into a pond to await cutting. Water storage protects the logs from splitting, insect damage, and fire. Cold decking, on the other hand, permits greater storage volume per acre, and some hardwoods such as oak must be stored this way because they will sink in water. *Scalers* (D.O.T. 941.488) measure logs and look for defects, such as knots and splits, to estimate the amount and quality of lumber available. *Pond workers* (D.O.T. 921.886) wearing spiked boots walk about on the logs in the pond and use long poles to sort them so that all of one kind or size go into the mill together.

A *bull-chain operator* (D.O.T. 921.885) controls a conveyor that pulls logs up a chute into the sawmill. A *barker operator* (D.O.T 533.782) operates machinery to remove bark and foreign matter that could damage saws. One kind of machine has rough metal bars or knives that rub or chip the bark away. Another kind tears it off with the high pressure force of water. The removed bark may be processed into garden mulch or burned to produce heat and steam for the sawmill.

As a log enters the sawing area, a *deck worker* (D.O.T. 667.887) rolls it onto a platform called a "carriage," and a *block setter* (D.O.T. 667.885) aligns the log and locks it into position. The carriage, which moves back and forth on rails, carries the log into the teeth of a large bandsaw, and each time it passes the saw a board is sliced off. This operation is controlled by a *head sawyer* (D.O.T. 667.782), who is one of the most experienced workers in the mill. The quantity of lumber obtained from logs depends largely on the head sawyer's skill and knowledge.

After leaving the carriage, the lumber moves to an edger saw, consisting of two or more circular blades. Operated by a *pony edger* (D.O.T. 667.782), the edging machinery cuts the lumber to the desired width. For example, the production run may be cutting boards to a 4-inch width. Next, a *trimmer saw operator* (D.O.T. 667.782), using a series of circular cross-cut saws, cuts the lumber to various lengths, such as 8, 10, or 12 feet.

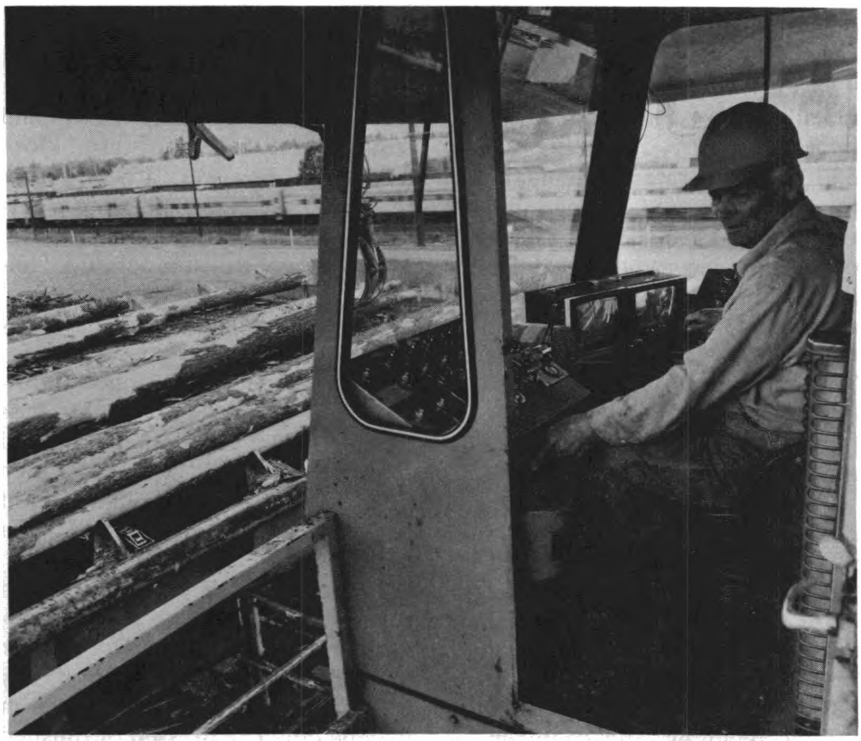
When all sawing is completed, a conveyor system moves the rough lumber into a sorting shed, where *graders* (D.O.T. 669.587) examine each board and determine its grade. After grading, *sorters* (D.O.T. 922.887) pull and stack the lumber according to type, grade, and dimension.

At this stage, the lumber is still green and must be seasoned so that it will not shrink or warp. It may be stacked outdoors where the sun and wind will remove moisture. More frequently, however, it is placed in a specially heated building (dry-kiln). *Dry-kiln operators* (D.O.T. 563.381) control temperature, humidity, and ventilation in kilns.

Some seasoned lumber is ready for use without further processing, primarily in the construction industry. Most of the lumber must pass through a mill before being shipped to market. In this mill, the rough dried lumber is run through a set of rotating knives controlled by a *planer operator* (D.O.T. 665.782). Some knife heads produce smooth surfaces, while others tongue-and-groove the boards for flooring or paneling. Similarly, a wide variety of moulding or other building trim may be cut. The dressed or finished lumber is usually graded again before storage or shipment by a *planer mill grader* (D.O.T. 669.587).

In addition to occupations described in the logging and milling processes, many other occupations require a broad range of training and skills. Maintenance mechanics install and repair saws and related machinery. Saw filers sharpen and repair saws, and electricians maintain and repair wiring, motors, and other electrical equipment. Truckdrivers transport logs to the mills and deliver the finished lumber products to wholesalers.

Many workers are employed in clerical, sales, and administrative occupations. For example, many firms employ office managers, purchasing agents, personnel managers, salesworkers, office clerks, stenographers and typists, bookkeepers, and business machine operators. Also, the industry employs professional and technical workers, such as civil and industrial engineers, drafters and surveyors, and accountants. (Detailed discussions of professional, technical, and mechanical occupations, found not



Mechanized equipment in modern sawmills reduces need for hand labor.

only in logging and milling but in other industries as well, are given elsewhere in the *Handbook* in sections covering individual occupations.)

Training, Other Qualifications, and Advancement

Most loggers and millhands get their first jobs without previous training. Employers prefer high school graduates, but applicants with less education frequently are hired: Entry level jobs usually can be learned in a few weeks by observing and helping experienced workers. A beginner on a logging crew may start by helping choker setters or buckers. In the mill, a beginner may be assigned to a labor pool to do odd jobs, such as stacking and sorting lumber. As workers gain experience, and as vacancies occur, they can advance to higher paying jobs. A choker setter who has an aptitude for operating machinery, for example, may become a truck or tractor driver, or a yarder engineer. Millhands also can learn various kinds of machine operating jobs, such as bull-chain operator and pony edger.

Mechanics, electricians, and others who repair and maintain the industry's equipment are trained on the job under the guidance of supervisors and experienced workers. In some firms, this training is supplemented by classroom instruction. Maintenance trainees frequently are selected from workers already employed in mills or logging crews. Many firms, however, will hire inexperienced people who have mechanical aptitude. Generally, it takes a trainee 3 to 4 years to become skilled in one of the maintenance jobs.

Workers who have leadership ability and years of experience can advance to supervisory positions in mills and logging crews. As in other industries, however, opportunities for promotion are limited because relatively few of these positions exist.

Loggers and millhands must be in good physical condition. Although modern equipment has reduced some of the heavy labor, stamina and agility are still important qualifications, particularly for loggers. Because of the danger involved in operating and working around heavy machinery, workers should be alert and well coordinated.

A bachelor's degree usually is the minimum educational requirement for forester, engineer, accountant, and other professional occupations. Completion of commercial courses in high school or business school usually is adequate for entry into clerical occupations, such as secretary, typist, and bookkeeper.

Employment Outlook

Employment in logging and lumber mills is expected to decline through the mid-1980's despite increases in wood production to meet the Nation's population and industrial growth. Laborsaving machinery will make it possible to harvest and process more lumber with fewer employees. Nevertheless, several thousand new workers will be needed each year to replace those who retire, die, or leave the industry for other reasons. The number of job openings may fluctuate from year to year, however, because the demand for lumber is sensitive to changes in construction activity.

Employment in logging camps and mills will decline over the long run as more modern equipment and techniques are adopted. A tree shear, for example, which has a scissor-like pair of blades, can cut down a tree four times as fast as a saw. As more of these shears come into use, fewer logging workers will be required. Sawmills and planing mills may reduce employment requirements by installing new machinery and improving plant layouts. In the kiln area, for example, a stacking machine operated by

Logging	Hourly rates	
	South	West Coast
Deck workers	$2.30	$4.40
Pond workers	2.55	4.40
Sorters	2.25	4.40
Trimmers	2.35	4.60
Checker setters	2.45	4.75
Block setters	2.50	4.85
Pony edgers	2.45	4.95
Lumber stackers	2.25	4.95
Truckdrivers	2.50	5.00
Planer operators	3.30	5.20
Graders, planed lumber	2.70	5.35
Tractor drivers, skidding	2.70	5.55
Head-saw operators, circular saw	3.40	6.00
Head-saw operators, band saw	4.45	6.40
Fallers and buckers, power	2.85	7.95

two or three people can replace six who stack by hand.

Although employment in the industry as a whole is declining, certain occupations will grow. Additional mechanics, for example, will be needed to maintain the growing stock of logging equipment, trucks, and mill machinery. More foresters will find jobs in this industry as forest replanting and conservation programs receive greater attention. Mechanical and electrical engineers will be in greater demand as the industry's production methods become more complex. As in the past, however, most of the industry's job openings will be for logging and millworkers; because they make up a very large proportion of the industry's total employment, replacement needs are high.

Summer jobs sometimes are available for high school students 17 years of age or older. These jobs are unskilled and include such tasks as working on a survey crew, helping haul logs to landings, clearing brush, and fighting forest fires.

Earnings and Working Conditions

In 1974, production workers in sawmills and planning mills averaged $3.79. In comparison, production workers in manufacturing industries as a whole averaged $4.40 an hour.

Wage rates in logging vary considerably by occupation, size of firm, machines and equipment used and, above all, by geographic area. Estimated average hourly rates for selected occupations in West Coast and Southern logging operations and mills in 1974 are shown in the accompanying tabulation.

Most logging jobs are outdoors. The forest may be wet, muddy, and hot, with annoying insects during the summer; conversely, working conditions may be difficult and time lost because of snow, sleet, and low temperature during the winter. Sawmills and planing mills may be noisy and dusty, and uncomfortably warm during the summer. Moreover, work at logging sites and in mills is more hazardous than in most manufacturing plants. For many persons, however, the opportunity to work and live in forest regions away from crowded cities more than offsets these disadvantages.

The major unions in this industry are the International Woodworkers of America and the United Brotherhood of Carpenters and Joiners of America, both AFL—CIO affiliates. A large proportion of the industry's production workers on the West Coast are covered by union-management contracts. On the other hand, relatively few of those in the South were covered.

Sources of Additional Information

For further information about job opportunities and working conditions, contact:

International Woodworkers of America, 1622 N. Lombard St., Portland, Oreg. 97217.

Wood Industry Careers, National Forest Products Association, 1619 Mass. Ave. NW., Washington, D.C. 20036.

MOTOR VEHICLE AND EQUIPMENT MANUFACTURING OCCUPATIONS

The automobile industry employs more workers than any other single manufacturing industry. Moreover, it is a major consumer of steel, rubber, plate glass, and other basic materials. Many businesses, including repair shops, gas stations, highway construction, and truck and bus transportation facilities, have been created because of motor vehicles.

To build the more than 10 million vehicles produced in 1974, the automobile industry employed 860,000 workers. In addition to workers discussed in this chapter, thousands of persons work in other industries that produce automobile glass, automotive stampings, lighting systems, storage batteries, tires, and many other components.

Like other large industries, the automobile industry employs people with widely different levels and types of education and training. Job requirements vary from a college degree for engineers and other professional and technical workers to a few hours of on-the-job training for some assemblers, materials handlers, and custodians.

Nature and Location of the Industry

The automobile industry is able to produce millions of vehicles because of mass production of standardized parts and assembly line manufacturing. Parts plants make thousands of interchangeable parts. At the assembly plants workers put these parts together to build a complete vehicle. New cars are driven off the assembly line at the rate of about one a minute.

The industry has about 3,000 plants, ranging from small parts plants with only a few workers to huge assembly plants that employ several thousand. About 85 percent of the industry's employees work in plants with 500 workers or more.

Over two-thirds of the automobile industry's employees work in the Great Lakes region, including Michigan, Ohio, Indiana, Illinois, Wisconsin, and western New York. Michigan alone has almost 40 percent of the total, with half of these workers in the Detroit metropolitan area. Other important automobile industry centers in the Great Lakes area are Flint and Lansing, Michigan; Cleveland and Warren, Ohio; Indianapolis and Ft. Wayne, Indiana; Buffalo, New York; and Chicago, Illinois.

Major automobile manufacturing centers are also found in other parts of the country, including Los Angeles, San Francisco, Kansas City, St. Louis, Atlanta, and Philadelphia.

How Automobiles are Made

There are three stages in making an automobile: designing, engineering, and testing; production of parts and subassemblies; and final assembly. (Although the rest of this statement discusses only automobiles, the information also applies to trucks, buses, and other motor vehicles.)

Designing, Engineering, and Testing. About 2 to 3 years of designing, engineering, and testing precede the actual production of a new car.

First, executives decide what kind of car to produce—a sports car, compact, or luxury car—and approve basic specifications for the car's size and cost. Stylists design the car's body and interior. From the stylists' sketches and drawings, skilled model makers make scale and full-size clay and fiberglass models of the car. The models are used to refine the styling, to evaluate safety features, and finally to make master dies for producing the car. Engineers design the car's engine, transmission, suspension, and other parts. Their designs must meet safety and pollution control standards, as well as pass cost, fuel economy, and performance tests. They work with physicists, chemists, metallurgists, and other scientists on research to develop new parts, stronger and lighter metal alloys, new ways to use plastic and fiberglass, and thousands of other improvements. Engineers also work with drafters who draw up blueprints and specifications.

Each new design and improvement is thoroughly tested in the laboratory and on the road. Engines are run thousands of miles under nearly all driving conditions. Safety features are tested in the laboratory and in actual crashes. Components that fail must be redesigned before the car can be produced.

Production of Parts. Once the car is finally designed and tested, the thousands of parts that are needed to assemble complete vehicles must be produced. Parts are made from a variety of materials, including steel, copper, aluminum, glass, rubber, plastic, and fabric.

Several different methods are used to make metal parts. The casting process is used for bulky parts such as engine blocks. Axles and other parts that must withstand great stress are forged. Body panels are stamped out of sheet metal by huge presses. Some parts are machined to exact dimensions. Some parts are made entirely by machine. These metalworking

processes are explained more fully under plant occupations.

Other parts are produced by a variety of manufacturing processes. Plastic and glass parts are molded and cut, seat cushions are sewn, and many parts are painted. Parts are also assembled into units or "subassemblies," such as complete transmissions.

Throughout production many inspections and tests are made to ensure that the assembled car will meet quality and safety standards.

Final Assembly. After many months of designing, testing, and producing parts, the car is finally assembled. Workers attach the parts and subassemblies in the right order as a conveyor carries the chassis along the assembly line. Axles are attached; the engine and transmission are mounted; body panels are welded together, painted, and joined to the chassis; instrument panels and seats are installed. Near the end of the line, hubcaps, mirrors, and other finishing touches are added. Gasoline is pumped into the fuel tank, headlights and wheels are aligned, and the car is inspected and driven off the line. The whole final assembly process may take as little as 90 minutes.

Assembling hundreds of cars a day requires expert timing and coordination. Parts and subassemblies are delivered according to production schedules arranged months in advance. They are fed continually to workers from storage areas along the assembly line. Instructions for the color and special equipment for each car are transmitted along the line. This system allows cars of different colors and types to follow each other on the assembly line—a blue sedan may follow a red station wagon. Inspections are made at many assembly stations to make sure the car is put together correctly.

Occupations in the Industry

The automobile industry employs workers in hundreds of occupations. Semiskilled plant workers, including assemblers and inspectors, make up about one-half of all employees. An additional one-quarter are supervisors, machinists, tool and die makers, mechanics, and other skilled craftworkers. Clerical workers make up another one-tenth of the total. The rest are professionals, technicians, salesworkers, managers, guards, and unskilled workers.

Some of the important occupations are described briefly below. Detailed discussions of many of the professional, technical, craft, and plant jobs may be found elsewhere in the *Handbook*.

Professional and Technical Occupations. The modern automobile is the product of the research, design, and development work of thousands of engineers, chemists, drafters, and other professional and technical workers.

Over 30,000 engineers worked in the automobile industry in 1974. Most of them were mechanical, electrical, or industrial engineers. Mechanical engineers design improvements for engines, transmissions, and other working parts. Electrical engineers design the car's electrical system, especially the ignition system and accessories. Industrial engineers concentrate on plant layout, work standards, scheduling, and other production problems. The industry also employs metallurgical, civil, chemical, and ceramic engineers.

The industry employed over 3,000 mathematicians, physicists, chemists, and other physical scientists in 1974. Most of them work on research and development projects such as finding ways to reduce fuel consumption and air pollution and studying the behavior of metals under certain conditions. Mathematicians and statisticians design quality control systems and work with research scientists and engineers. Some scientists supervise technical phases of production. Metallurgists, for example, supervise melting and heating operations in the casting and forging departments.

Drafters are the largest group of technical workers. They work closely with engineers and stylists to draft blueprints and specifications for each part of the car. Engineering aides, laboratory assistants, and thousands of other technicians also assist engineers and scientists.

Administrative, Clerical, and Related Occupations. Executives decide what kind of vehicles to produce, what prices to charge, where to build plants, and whether to manufacture or buy certain parts. They are assisted by lawyers, market analysts, economists, statisticians, industrial relations experts and other professionals, who may also supervise plant or office staffs. Purchasing agents, personnel managers, and other administrative workers direct special phases of the company's business.

Secretaries, bookkeepers, shipping clerks, keypunch and business machine operators, typists, and other clerical employees work in the industry's plants and offices.

Plant Occupations. About three-fourths of the automobile industry's employees work in the plant. Most of them make parts or work on the assembly line. Others service and repair machinery and equipment.

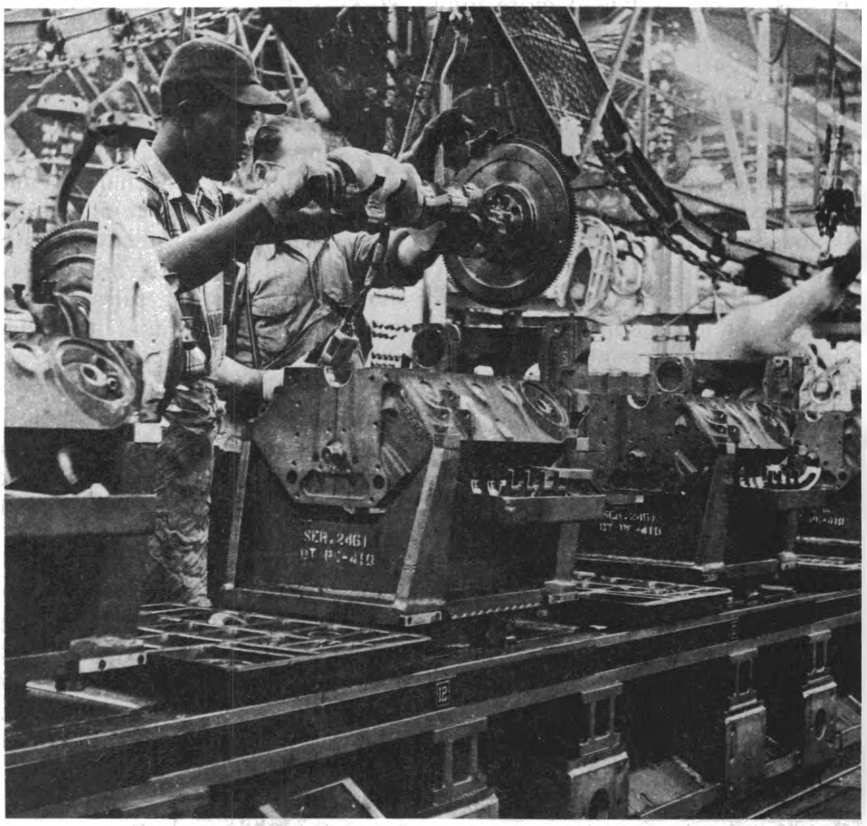
Foundry Occupations. Engine blocks and many other parts are "cast" or molded from melted metal. Patternmakers, coremakers, and machine molders make sand molds which have a hollow space inside in the shape of the part. Workers called melters and pourers melt the metal in electric furnaces, or cupolas, and pour it into the mold. After it cools and hardens into the shape of the part, shakeout workers remove the casting from the mold.

Forging Occupations. Axles, driveshafts, and other forged parts are made by pounding metal into dies. Workers called heaters heat the metal in a furnace and place it in a forging die. Hammerers then use a drophammer to pound the metal into the shape of the die. Other forge shop workers clean, finish, heattreat, and inspect forged parts.

Machining and other Metalworking Occupations. Most rough cast, forged, and some stamped parts must be machined to exact dimensions before they can be used. Machine tool operators, representing one of the industry's largest metal working occupations, run machine tools that cut or grind away excess metal from rough parts. Most operators use only one kind of machine tool and are called lathe operators, milling machine operators, or some other special title. Operators on some machines make simple tool changes and gauge machined areas of the parts.

Some machine tools are automatic and can be linked together to do a series of machining operations. A rough engine block, for example, can be moved through hundreds of automatic drilling, cutting, and grinding operations with little or no manual labor. Some of the inspection is also automatic. Workers must monitor a control panel to spot interruptions and breakdowns.

Assembly Occupations. The largest group of workers in the automobile industry are the *assemblers* (D.O.T. 806.887). They put together small parts to make subassemblies, and put subassemblies together to build a complete vehicle. Each assembler has a specific job to do as the vehicle passes a work station. For example, one worker mounts a tire and the next worker tightens the nuts with a power wrench. Most assembly jobs are repetitive and require limited skills. However, they do require good coordination, and may be strenuous.



Assemblers install crank shaft into cylinder block.

Finishing Occupations. "Finishing" includes painting, polishing, upholstering, and other operations that protect the car's surface and add to the car's comfort and appearance. *Electroplaters* (D.O.T. 500.885) coat bumpers, grills, hubcaps, and trim with chrome. *Metal finishers* (D.O.T. 705.884) file and polish rough metal surfaces in preparation for painting. *Sprayers* (D.O.T. 741.887) apply primers and paint with power spray guns. *Polishers* (D.O.T. 705.884) polish finished surfaces by hand or with a power buffing wheel.

Several different kinds of workers combine their skills to make the car's upholstery. Working from a pattern, *cutters* (D.O.T. 781.884) cut fabric or leather with hand or electric shears. *Sewing machine operators* (D.O.T. 787.782) sew the pieces together into seat covers or headliners. *Cushion builders* (D.O.T. 780.884) fasten springs, padding, and foam rubber to the seats and other upholstered areas and install the covers.

Inspection Occupations. (D.O.T. 806.281, .283, .381, .382, .387, .684, and .687). Throughout the manufacture and assembly of a new car, inspectors inspect certain parts for defects. They inspect raw materials, examine parts during manufacturing, check the quality and uniformity of subassemblies, and test-drive the new car. Inspectors need various skills, depending on the part of process they inspect. Many of them use micrometers, gauges, and testing instruments and read blueprints and specifications.

Other Plant Occupations. Many

other workers help keep the plant operating by delivering materials and parts, repairing equipment, and cleaning and guarding the plant.

Assembly line production requires an elaborate materials handling and delivery system. Materials handlers load and unload raw materials and parts from trucks, ships, and railroad cars. Overhead crane operators move heavy machinery and raw steel. Power truck operators move parts and materials about the plant. Checkers, stock chasers, and stock clerks make sure parts and tools are delivered to the assembly line at the right time. They receive and distribute materials and keep records of shipments.

A large staff of workers set up the plant's equipment and keep it in good condition. Skilled maintenance mechanics and electricians service and repair complex mechanical hydraulic, electrical, and electronic equipment. Millwrights move and install heavy machinery. Plumbers and pipefitters lay out, install, and repair piping, valves, pumps, and compressors. Carpenters, stationary engineers, and sheet-metal workers also work in automobile plants.

The industry also employs many protective and custodial workers, including guards, janitors, and porters.

Training, Other Qualifications, and Advancement

Engineers and scientists must have at least a bachelor's degree with an appropriate major. Advanced degrees or specialized experience are sometimes required for research and development jobs. About a dozen colleges offer undergraduate or graduate courses in automotive engineering, and many companies have training programs in automotive specialties for engineers and scientists. Most companies also offer grants, loans, or tuition refund plans to their employees for advanced study. Engineers and scientists may become supervisors of research or production units, and sometimes enter administrative or executive positions.

Most automotive stylists are graduates of art institutes or have bachelor's degrees in industrial design. They should have a background in practical applications, such as model building, as well as in design theory and techniques.

Most engineering aides, laboratory assistants, drafters, and other technicians in the automobile industry are graduates of technical institutes or junior colleges. Others are trained on the job, at company schools, or at company expense at local technical schools or junior colleges. Technicians sometimes advance to engineering jobs through experience and study toward an engineering degree.

Although a college education is not always required, administrative jobs are usually filled by people with degrees in business administration, engineering, marketing, accounting, industrial relations, and similar fields. Some companies offer advanced training in these specialties.

For semiskilled jobs, the industry seeks people who can do routine work at a steady pace. Most assembly jobs can be learned in a few hours, and the less skilled machine operating jobs can be learned in a few weeks. Plant workers should be in good health and have good coordination and ability to do mechanical work.

Tool and die makers, patternmakers, electricians, and some other craftworkers in the automobile industry need at least 4 years of training. Although many persons learn their skills by working with experienced craftworkers, apprenticeship training is the best way to learn a skilled trade. Automobile manufacturers, working with labor unions, offer apprenticeships in many crafts.

Applicants for apprenticeship usually must be high school, trade, or vocational school graduates, or have equivalent training. Training should include mathematics, science, mechanical drawing, and shop courses. Apprentices must pass physical examinations, mechanical aptitude tests, and other qualifying tests.

Apprenticeship includes both classroom and on-the-job instruction. Shop math, blueprint reading, shop theory, and such special subjects as electronics and hydraulics are studied in the classroom. In the shop, apprentices learn the techniques of their trade and how to use tools and machinery.

Supervisors usually are selected from workers already employed in the firm, especially if they have completed an apprenticeship and have considerable experience. Newly promoted supervisors usually go through a special training program.

Employment Outlook

Employment in the automobile industry is not expected to increase significantly through 1985. Nevertheless, thousands of workers will be hired in this large industry each year to replace those who retire, die, or transfer to other industries. The total number hired will fluctuate from year to year because the industry is sensitive to changes in general business conditions, consumer preferences, availability of credit, and defense activity.

The production of motor vehicles is expected to increase during the next decade as population and income increase. Because of labor-saving technology, however, employment in the industry will not keep pace with production. Automobile companies will use more automated and computerized equipment for machining, assembling, and inspecting. A recent example is the versatile "industrial

robot" which can be programmed to weld body panels, feed parts into machine tools, and do a variety of other tasks. Also, new or modernized plants will have the latest conveyor equipment for moving parts and materials.

Some of the industry's increased efficiency, however, will be offset by other developments. More workers will be needed to design, test, and build cars with improved safety, exhaust control, and fuel consumption features.

Changes in the kinds of vehicles built and how they are produced will affect the type as well as the number of workers employed in the automobile industry. More engineers, scientists, technicians, and other professionals will be employed to meet the industry's research and development needs, especially to design new engines, exhaust systems, and safety equipment. The use of computers will increase the need for systems analysts and programmers, but will limit employment growth in many clerical occupations.

The employment of skilled workers, as a group, may decline, mainly because fewer machinists and tool and diemakers will be needed as more efficient processes are introduced. Some skilled occupations will grow, including electricians, millwrights, pipefitters, and machine repairers. Overall, the number of semiskilled workers will decline slightly.

Earnings and Working Conditions

Production workers in the automobile industry are among the highest paid in manufacturing. In 1974 they averaged $5.90 an hour, compared to $4.40 an hour for production workers in all manufacturing industries.

Besides wages and salaries, automobile workers receive a wide range of fringe benefits. They are paid one and one-half times their normal wage for working more than 8 hours a day or 40 hours a week, or for working on Saturday. They receive premiums for working late shifts, and double the normal wage for Sundays and holidays. Most workers get paid vacations (or payment instead of vacations) and 12 paid holidays a year. Most companies provide annual wage increases, plus automatic increases when the cost of living rises. Life, accident, and health insurance are provided, also.

A great majority of the industry's workers are covered by company-paid retirement plans. Retirement pay varies with length of service. Many plans provide for retirement at age 55, or after 30 years of service regardless of age.

Most wage workers and some salaried employees receive supplemental unemployment benefit plans, paid for entirely by their employers. These plans provide pay during layoffs and also provide short-workweek benefits when workers are required to work less than a full week. During layoff, provisions are included for life, accident, and health insurance; survivor income benefits; relocation allowances; and separation payments for those laid off 12 continuous months or more.

Most production maintenance workers in assembly plants, and a majority in parts plants, belong to the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America. In some parts plants, the International Union, Allied Industrial Workers of America is the bargaining agent. Other workers belong to the International Association of Machinists and Aerospace Workers; the Pattern Maker's League of North America; the International Molders' and Allied Workers' Union of North America; the Metal Polishers Buffers, Platers, and Helpers International Union; the International Union, United Plant Guard Workers of America (Ind.); the International Brotherhood of Electrical Workers; the International Union of Electrical, Radio, and Machine Workers; and the International Die Sinkers' Conference (Ind.).

Most automobile industry employees work in plants that are relatively clean and free of dust, smoke, and fumes. Some work areas, however, are hot, noisy, and filled with dust and fumes. These conditions have been greatly improved by the introduction of better ventilation and noise control systems.

Sources of Additional Information

Information on employment and training opportunities in the automobile industry can be obtained from local offices of the State employment service; employment offices of automobile firms; locals of the unions listed above; and from:

International Union, United Automobile, Aerospace and Agricultural Implement Workers of America. 8000 East Jefferson Ave., Detroit, Mich. 48214.

Motor Vehicle Manufacturers Association of the U.S., Inc., 320 New Center Building, Detroit, Mich. 48202.

Information on careers in automotive engineering and a list of schools offering automotive engineering courses are available from:

Society of Automotive Engineers, 2 Pennsylvania Plaza, New York, N.Y. 10001.

OFFICE MACHINE AND COMPUTER MANUFACTURING OCCUPATIONS

During the last decade, employment in the office machine and computer industry grew much faster than employment in manufacturing as a whole. Growth was spearheaded by a rapid expansion in the production of computers. For many years, the industry's chief products were typewriters, adding machines, calculators, and other conventional office machines. Today, plants that make computers account for more than half of the industry's production.

Nature and Location of the Industry

In 1974, the office machine and computer manufacturing industry employed 294,000 workers in approximately 1,000 plants. About 7 out of every 10 of them worked in plants that produced computer equipment, the remainder in plants that produced conventional office machines and scales and other weighing devices.

Computer equipment manufacturing plants employed about 210,000 workers in 1974. These plants manufacture general purpose computers as well as those used for special applications, such as space exploration and missiles. They also manufacture related equipment such as machines that read magnetic numbers on bank checks. In addition to computers and related equipment, plants may furnish "software" (computer programs and operating systems). Thousands of people whose employment is not included in this chapter are employed outside manufacturing plants by firms that specialize in software or that rent or lease computers and provide related services.

In 1974, more than 80,000 people were employed in factories that produced conventional office machines and scales. Of this total, nearly half produced desk calculators, cash registers, coin and ticket counters, and adding, accounting, and voting machines; the rest produced typewriters, industrial and household scales and miscellaneous office machines, including items as diverse as postage meters and dictating machines.

Large plants account for most of the employment in office machine and computer manufacturing. A majority of the industry's employees are in plants that have 1,000 or more employees; several computer plants have more than 5,000 employees.

California, New York, and Minnesota have about two-thirds of computer manufacturing employment, and the following States employ most of the remainder: Massachusetts, Pennsylvania, Arizona, Florida, Texas, North Carolina and Colorado. In New York, the lower Hudson River Valley area has many important computer manufacturing centers: Poughkeepsie, East Fish Kill, and Kingston. Large manufacturing plants also are located in Rochester and Utica, N.Y., and in the Boston, Mass., and Philadelphia, Pa. areas. The leading center in the Midwest is Minneapolis-St. Paul. The Los Angeles and San Diego industrial areas are the most important computer manufacturing centers in the West, followed by Phoenix, Ariz.; and San Jose, Calif.

Most of the conventional business machine manufacturing employment is located in nine States: Ohio, Kentucky, New York, Michigan, California, Illinois, Delaware, New Jersey, and Connecticut. Some of the important manufacturing centers are: Dayton, Toledo, and Euclid, Ohio; the New York-Northeastern New Jersey industrial area; Hartford and Stamford, Conn.; Chicago, Ill.; Detroit, Mich.; and Lexington, Ky.

Occupations in the Industry

A variety of occupations, requiring a broad range of training and skills, are found in plants that make office machines and computers. More than half of the industry's workers are in white-collar jobs (engineering, scientific, technical, administrative, sales, and clerical); the others are in plant jobs (assembly, inspection, maintenance, transportation and service).

White-collar workers represent a significantly larger proportion of total employment in the computer industry than in most other manufacturing industries because of the highly complex nature of computer manufacturing.

Some of the key occupations in the office machine and computer industry are described briefly in the following section. (Detailed discussions of professional, technical, skilled, and other occupations found in this industry, as well as in many others, are given elsewhere in the *Handbook*, in sections covering individual occupations.)

Engineering and Scientific Occupations. Nearly 1 out of every 10 workers in the office machine and computer industry is an engineer or scientist. Most of them work at computer plants.

The largest group of engineers work with electricity or electronics. Most are engaged in research and development, although many work in production. The industry also employs large numbers of mechanical and industrial engineers. Some

mechanical engineers are engaged in product development and tool and equipment design. Others are concerned with the maintenance, layout, and operation of plant equipment. Industrial engineers determine the most effective means of using the basic factors of production-labor, machines, and materials.

Chemists make up the largest group of scientists in office machine and computer manufacturing. Their work is primarily in chemical processing of printed circuits used in computers. Mathematicians make up another large group of scientists. Their work on complex mathematical problems is important in designing computers. Physicists are employed in research and development to work on items such as miniaturized components and circuits. Statisticians work in fields such as quality control and production scheduling.

The industry also employs systems analysts and computer programmers, many of whom have scientific or engineering backgrounds. Systems analysts primarily devise new information processing techniques and improve existing techniques. Programmers design and test computer programs. Some analysts and programmers specialize in scientific and engineering problems, while others process accounting, inventory, sales, and other business data. Systems analysts and programmers may assist sales personnel in determining data processing needs of customers.

Technical Occupations. More than 1 out of every 20 workers in the industry is a technician. Most specialize in electronics and assist engineers and scientists in research and development, testing and inspecting electronic components, and doing complex assembly work. Some electronics technicians specialize in repairing computers. Chemical control technicians prepare solutions used in the etching of circuit boards. Photographic technicians set up cameras and other equipment used in the tracing process to create copper etchings on circuit boards. Drafters prepare drawings from sketches or specifications furnished by engineers. Engineering aids assist engineers by making calculations, sketches, and drawings, and by conducting performance tests on components.

Administrative and Sales Occupations. About 1 out of every 13 workers is an administrator. Included are top executives who manage companies and determine policy decisions and middle managers who direct departments such as advertising and industrial relations. Other administrative employees in staff positions include accountants, lawyers, and market researchers.

Sales personnel hold about 1 out of every 25 jobs in the industry. Those who sell conventional office machines usually work on their own. Computer sales personnel, on the other hand, are assisted by a host of technical experts, such as engineers and systems analysts. Because computers are complex and expensive, computer sales representatives may have to spend several months to complete a sale.

Clerical Occupations. Nearly 1 out every 6 workers in the industry is in a clerical job. Included in this group are secretaries, clerk typists, file clerks, bookkeepers, and business machine operators, as well as computer personnel such as keypunch and computer operators.

Plant Occupations. Nearly half of this industry's employees are plant (blue-collar) workers. Most plant workers are engaged directly in making computers and office machines. They include assemblers, inspectors or testers, machinists, machine tool operators, and their supervisors. Truckdrivers, material handlers, power truck operators, guards, and janitors move materials and perform custodial duties, and plumbers and pipefitters, electricians, carpenters, and other workers maintain production machinery and building facilities.

Assembly Occupations. (D.O.T. 590.885; 692.782; 706.884; 726.781 and .884) Workers who assemble computers and office machines have many different skills, and make up the largest group of plant workers.

Assemblers may put together small parts to make components or components to make sub-assemblies or the finished product. Much of their work is done by hand. Some assemblers do a single operation as components move down the assembly line. The assembly of typewriters, for example, is divided into many simple operations. Each assembler does one job as the typwriter passes the work station. Some assembly jobs are difficult and require great skill, while others are relatively simple. Skilled electronics assemblers, for example, use diagrams as guides to wire complex memory and logic panels for computers.

Machines are used for many assembly operations. Automatic wire-wrapping machines, for example, wire panels and plugboards. Operators feed these machines and remove and inspect finished items.

Electronic technicians usually do the most difficult hand assembly work. In research laboratories, they put together experimental equipment. In plants, they put together complex items that require a knowledge of electronics theory.

Assemblers commonly use screwdrivers, pliers, snippers, and soldering irons and they use special devices to position and hold parts during assembly. Some assemblers use precision equipment to weld connections in circuit assemblies.

Machining Occupations. Most office machine and computer manufacturing plants employ machining

workers who operate power-driven machine tools to produce plastic and metal parts for computers, typewriters, accounting machines, calculators, and other products. Numerical control machine operators tend machines that have been programmed to perform machining operations automatically. Toolmakers construct and repair equipment used to make and assemble parts. Diemakers specialize in metal forms (dies) used in punch and power presses that shape metal parts.

Inspection and Testing Operations. These operations begin when raw materials enter the plant and continue throughout the assembly process. Finished parts and products are tested and inspected thoroughly.

Some inspectors examine individual parts; others inspect components during subassembly; still others inspect completed office machines and computers. Many inspecting jobs require highly skilled workers. On the other hand, relatively unskilled people can run some automatic test equipment. Workers who feed or monitor this equipment are called test-set operators or testing machine operators.

Job titles indicate the work many inspectors do. *Machined parts inspectors* (D.O.T. 609.381) use precision testing instruments to determine whether parts have been machined properly. *Type inspectors* (D.O.T. 706.687) use a magnifying glass to examine typewriter type for defects. *Electronic subassembly inspectors* (D.O.T. 726.384) use microscopes, meters, and various measuring devices to examine circuits and other electronic subassemblies. *Electronic assembly inspectors* (D.O.T. 722.281) use special instruments to test electronic systems such as computer memory units.

In plants that manufacture conventional office machines, final inspection is relatively simple. Inspectors operate the machines, look for defects, and refer malfunctioning machines to repairers. The final inspection or "debugging" of computers, on the other hand, is very complex. Electronic technicians inspect new computers under the supervision of electronic engineers. They use complex equipment to run tests and detailed drawings and instructions to find causes of malfunctions.

Maintenance Occupations. Many maintenance workers with different types of training take care of the industry's production machinery and equipment. Skilled electricians are responsible for the maintenance of electrical equipment. Machine and equipment repairers make mechanical repairs. Maintenance machinists and welders build and repair equipment. Air-conditioning and refrigeration mechanics are employed in plants which are air-conditioned and have special refrigerated and dust-free rooms in order to maintain the equipment. Painters, plumbers, pipefitters, carpenters, and sheet-metal workers, and other building maintenance craft workers also are employed.

Other Plant Occupations. Many truckdrivers are employed to make deliveries to various parts of plants. Laborers load and unload trucks and boxcars and do general clean-up work. Some other plant occupations are boiler operator, stationary engineer, guard, and janitor.

Training, Other Qualifications, and Advancement

A bachelor's degree in engineering or one of the sciences is usually required for engineering and scientific jobs. For research and development work, applicants with advanced degrees generally are preferred. Some companies have training programs designed to give young college graduates a broad picture of manufacturing operations before they are assigned to a particular department. Because of the highly technical nature of computers, many of the industry's executives have backgrounds in engineering or science.

Engineers and scientists, as well as graduates of business administration and liberal arts colleges, are employed as sales workers, programmers, and systems analysts. Most business and liberal arts graduates, however, are employed in accounting, labor-management relations, and other administrative activities.

Technicians qualify for their jobs in a number of ways. Some obtain training in either a public, private, or Armed Forces technical schools. Others have one or more years of scientific or engineering training, but have not completed all of the requirements for a degree. Still other technicians are promoted from lower grade jobs in the plant and some well-qualified technicians may advance to engineering jobs after completing courses in mathematics, engineering, and related subjects.

People who complete commercial courses in high school or business school are preferred in clerical jobs such as stenographer or office machine operator. For computer operators, most firms prefer applicants who have some college or technical training in data processing. With additional training, some computer operators and clerical workers advance to programmer jobs.

In selecting workers for plant jobs, firms generally prefer high school or vocational school graduates, who are then trained through on-the-job instruction and experience that varies from a few days to years. Some plants also conduct classroom training of short duration. Skilled craft workers, such as machinists and tool and die makers, may spend 3 to 4 years in learning their jobs and some firms have formal apprenticeship programs, which include both on-the-job

training and classroom instruction related to the particular craft. Frequently, openings for skilled jobs are filled by qualified young workers already in the plant.

Workers who have little or no previous experience or training are hired for less skilled inspection, assembly, and machining jobs. Applicants may have to pass aptitude tests and demonstrate ability for particular types of work. Most assembly and inspection jobs require good eyesight and color perception, manual dexterity, and patience.

Experienced plant workers have opportunities to advance to jobs with higher pay. Assemblers, for example, can become semiskilled inspectors, and eventually skilled inspectors. Machine tool operators can move to skilled machinist jobs. Craft workers and skilled inspectors can become technicians, after completing courses in company-operated schools, junior colleges, or technical schools. Supervisory jobs are open to well-qualified plant workers who have leadership ability.

Employment Outlook

Employment in this industry is expected to increase much faster than the average for all industries through the mid-1980's. In addition to the job openings that result from employment growth, many openings will arise as experienced workers retire, die, or transfer to jobs in other industries.

Employment growth is expected to be concentrated in plants that produce electronic computer equipment as the demand for computers and related equipment continues to increase. As the economy expands and becomes more complex, computers will become increasingly useful to business, government agencies, and other organizations. Demand also will be stimulated as new uses for computers are developed. Growth in the number of computers will be accompanied by a need for additional computer-related equipment—input and output, storage, and communication devices.

Employment in plants that produce conventional office machines is expected to grow slowly. Most job openings will result from the need to replace experienced workers who retire, die, or transfer to other industries. The demand for most types of office machines is expected to rise rapidly as business and government organizations grow and the volume of paperwork increases. However, technological improvements in production methods are expected to increase output per worker. For example, increasing mechanization of operations formerly done by hand will tend to reduce labor requirements, particularly in plants where products are mass-produced, such as typewriters and calculators.

Some occupational groups in the office machine and computer manufacturing industry are expected to grow faster than others. For example, the number of professional and administrative workers, particularly engineers, scientists, and technicians, is expected to increase more rapidly than the number of plant workers. Demand for these workers will be spurred by continued high levels of research and development expenditures to improve production processes, advance machine capabilities, and broaden the use of computers for numerical controlled manufacturing.

Semiskilled production workers, such as assemblers and inspectors, will continue to account for most of the work force in plant occupations, despite the growing use of automated and mechanized assembly line equipment.

Earnings and Working Conditions

Earnings of plant workers in the office machine and computer industry are higher than the average for other manufacturing industries. In 1974, they averaged $4.64 an hour, compared with $4.40 an hour for plant workers in manufacturing industries as a whole.

National wage data are not available for individual occupations in the office machine and computer industry. However, the following tabulation, based on data obtained from a small number of union contracts, provides an example of the range in hourly wage rates for selcted occupations in 1974:

	Hourly rate ranges
Assemblers	$3.03–4.46
Machinists	3.49–4.93
Inspectors	2.93–4.93
Tool and die makers	3.53–4.90
Electricians	3.34–4.48

Some employees work night shifts and weekends because many plants operate around the clock. Employees working second or third shifts, or more than 8 hours a day or 40 hours a week generally receive extra pay.

Paid vacations and holidays are almost universal in this industry. Most employees receive 1 to 4 weeks of vacation, depending on length of service. They also receive insurance and pension benefits at least partially financed by the employer. Employee stock purchase plans are available in many firms.

In general, the work surroundings in office machine and computer plants are more favorable than those in most other types of factories. Work stations usually are well-lighted and clean, and free from dust, fumes, and loud noises. Many computer factories are relatively new and are located in suburban areas.

Some plant jobs are repetitious, but very few require great physical effort. Fewer and less severe injuries take place in office machine and computer manufacturing than the average for all manufacturing.

Many plant workers are covered

by union contracts. The principal unions in this industry 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; and the International Brotherhood of Electrical Workers.

Sources of Additional Information

For general information on the industry, write:

Computer and Business Equipment Manufacturer's Association, 1828 L. St. NW., Washington, D.C. 20036.

For general information on jobs in the industry, write to:

American Federation of Information Processing Societies, Inc., 210 Summit Ave., Montvale, N.J. 07645.

OCCUPATIONS IN THE PAPER AND ALLIED PRODUCTS INDUSTRIES

In 1974, the paper and allied products industry employed about 700,000 people to produce many different kinds of paper and paperboard products. The industry employs workers in occupations ranging from unskilled to highly specialized technical and professional jobs, many found only in the paper industry.

Nature and Location of the Industry

The paper industry is highly mechanized. Pulp, paper, and many finished paper products are manufactured by machines—some as long as a football field—in a series of nearly automatic operations that require very little handling of materials by workers. Manufacturing plants in the paper industry are engaged in one or more of three different operations: The production of pulp (the basic ingredient of paper) from wood, reused fibers, or other raw materials; the manufacture of paper or paperboard (thick paper) from pulp; or the conversion of rolls or sheets of paper or paperboard into finished products, such as tissue paper, envelopes, and boxes.

The largest group of employees in the industry works in mills that produce pulp, paper, or paperboard. The next largest group works in plants that make boxes and containers; and the remainder work in plants that make a variety of other paper products.

About four-fifths of the industry's employees work in factories which employ 100 workers or more.

Workers in this industry are located throughout the country, although about half are employed in eight States: New York, Pennsylvania, Ohio, Illinois, Wisconsin, California, Massachusetts, and New Jersey. Other States having large numbers of paperworkers are Michigan, Georgia, Washington, North Carolina, Alabama, Maine, Texas, and Florida.

Occupations in the Industry

Employees in the paper industry work in a variety of occupations, requiring a broad range of training and skills. Many workers operate and control specialized papermaking, finishing, and converting machines. Some workers install and repair papermaking machinery. Truck drivers make deliveries, and other workers load and unload trucks, railroad cars, and ships.

The industry employs many workers in clerical, sales, and administrative occupations. For example, it employs purchasing agents, personnel managers, sales representatives, office clerks, stenographers, book-keepers, and business machine operators. Also, because of the complex processes and equipment used, the industry employs professional and technical workers, including chemical and mechanical engineers, chemists, laboratory technicians, and pulp and paper testers. (Detailed discussions of professional, technical, and mechanical occupations, found not only in the paper industry but in other industries, are given elsewhere in the *Handbook* in sections covering individual occupations.)

Production Jobs. In 1974, more than three-fourths of all employees in the industry worked in production jobs. The simplified description of papermaking occupations and processes that follows applies to a plant which combines the production of pulp, paper, and finished paper products into one continuous operation. (See accompanying chart.)

After logs are received at the pulpmill, the bark is removed. One machine used for this operation is a large revolving cylinder known as a "drum barker." Logs are fed mechanically into this machine by a semiskilled worker called a *barker operator* (D.O.T. 533.782). The machine cleans bark from the logs by tumbling them against each other and also against the rough inner surface of the drum. Next, pulp fibers in the logs are separated from other substances by a chemical or mechanical process, or both, depending on the type of wood used and the grade of paper desired.

In the mechanical process, pulpwood is held against a fast-revolving grindstone that separates the fibers. In the more commonly used chemical process, pulpwood is carried on conveyor belts to a chipper machine operated by a *chipper* (D.O.T. 668.885). The machine cuts the pulpwood into chips about the size of a quarter. These wood chips are "cooked" with chemicals under high temperature and pressure in a "digester," a kettlelike vat several stories high. Digesters are operated by skilled workers called *digester operators* (D.O.T. 532.782), who determine the amount of chemicals to be used and the cooking temperature and pressure. They also direct the loading of the digester with wood chips and chemicals. By checking an instrument panel, digester operators make certain that proper conditions

are being maintained. When the pulp fibers are removed from the digester, they are washed to remove chemicals, partially cooked chips, and other impurities. These fibers, called pulp, resemble wet, brown cotton.

Many modern plants are today making greater use of continuous digesters (equipment that produces pulp continuously rather than in separate batches). Continuous digesters make it practical to use sawdust in pulp-making, and eliminate the manual starting and stopping of each batch of pulp.

To turn pulp into paper, the pulp is mixed thoroughly with water and further refined in machines operated by skilled workers called *beater engineers* (D.O.T. 530.782). The kind and amount of chemicals and dyes they use and the length of time they "beat" the solution determines the color and strength of the paper.

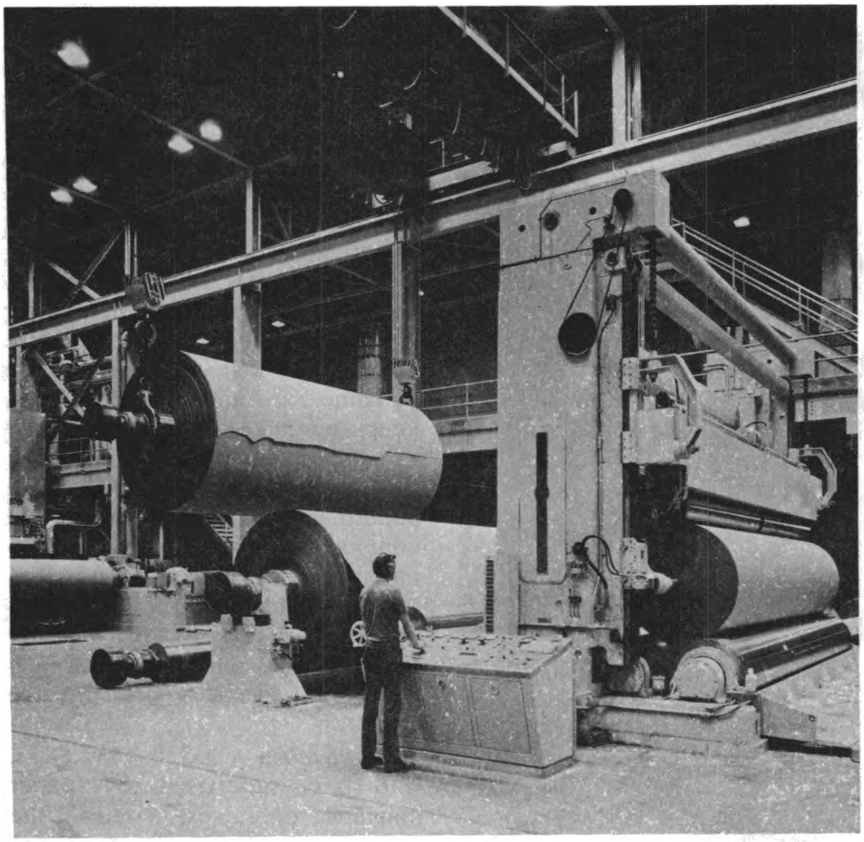
The pulp solution, now more than 99 percent water, is turned into paper or paperboard by machines which are among the largest in American industry. The machines are of two general types. One is the Fourdrinier machine, by far the most commonly used; the other is the cylinder machine used to make particular types of paper, such as building and container board. In the Fourdrinier, the pulp solution pours into a continuously moving and vibrating belt of fine wire screen. As the water drains, millions of pulp fibers adhere to one another, forming a thin wet sheet of paper. After passing through presses that squeeze out more water, the newly formed paper passes through the dryer section of the papermaking machine to evaporate remaining water.

The quality of the paper produced largely depends on the skills of *paper machine operators* (D.O.T. 539.782), who control the "wet-end" of the papermaking machine to form paper of specified thickness, width, and physical strength. They check control-panel instruments to make sure the flow of pulp and the speed of the machine are coordinated. Paper machine operators also determine whether the paper meets required specifications by interpreting laboratory tests or, in some instances, by visually checking or feeling the paper. They supervise the less skilled workers of the machine crew and, with their help, keep the paper moving smoothly through the machine.

Many modern papermills have papermaking machines which use computers and advanced instrumentation to help the operator control the quality of the paper. For example, beta-ray sensors measure the weight of the paper and electromagnetic sensors measure the thickness.

Backtenders (D.O.T. 532.885), who are supervised by paper machine operators, control the pressure and temperature of machinery that dries and finishes the paper and gives it the correct thickness. Backtenders inspect the paper for imperfections, and make sure that it is being wound tightly and uniformly into rolls. They also adjust the machinery that cuts the rolls into smaller rolls and, with the help of assistants, may weigh and wrap the rolls for shipment.

Papermills that produce a fine grade of paper for books, magazines, or stationary usually have finishing departments. Most workers in these departments are either semiskilled or unskilled. One semiskilled worker, the *supercalendar operator* (D.O.T. 534.782), aided by several helpers and by mechanical handling equipment, places huge rolls of paper onto a machine that gives the paper a smooth and glossy finish. The supercalendar operator also inspects the finished paper to make sure that specifications have been met. Another semiskilled worker, the



paper sorter and counter (D.O.T. 649.687), inspects sheets of paper for tears, dirt spots, and wrinkles; counts them; and may fill customer orders.

In converting plants, machines operated by semiskilled or skilled workers convert paper and paperboard into envelopes, napkins, corrugated shipping containers, and other paper products. Occupations in converting plants differ widely, depending largely on the product being manufactured. An example of a semiskilled worker is the *envelope machine operator* (D.O.T. 641.885) who feeds and tends an automatic machine that makes envelopes from either rolls of paper or prepared envelope blanks. One of the few skilled workers in a converting plant is the *printer-slotter operator* (D.O.T. 651.782) who controls a machine that cuts and creases paperboard sheets and prints designs or lettering on them.

Converting plants employ thousands of workers to print designs and lettering on bags, labels, wallpaper, and other paper products. Among these are compositors who set type, and press operators who prepare and operate printing presses.

Maintenance Jobs. The paper industry employs many skilled maintenance workers to care for its complex machinery and electrical equipment. *Millwrights* install and repair machinery. They also take apart and reassemble machines when they are moved about the plant. *Instrument repairers* install and service instruments that measure and control the flow of pulp, paper, water, steam, and chemical additives.

Other important maintenance employees include *electricians*, who repair wiring, motors, control panels, and switches; *maintenance machinists*, who make replacement parts for mechanical equipment; and *pipefitters*, who lay out, install, and repair pipes.

Stationary engineers are employed to operate and maintain powerplants, steam engines, boilers, air compressors, and turbines.

Professional and Technical Occupations. The complexity of pulp and paper manufacturing requires thousands of workers who have engineering, chemical, or other technical training. Approximately 15,000 scientists and engineers and 5,000 technicians were employed by the paper industry in 1974.

Many chemists are employed to control the quality of the product by supervising the testing of pulp and paper. In research laboratories, chemists study the influence of various chemicals on pulp and paper. In addition, some chemists and engineers are employed as sales representatives, supervisors of plantworkers, or as administrators in positions which require technical knowledge.

Chemical and *mechanical engineers* transform new pulp and papermaking techniques into practical production methods. Some chemical engineers supervise the production process. *Electrical engineers* supervise the operation of power-generating and distributing equipment and instruments.

Packaging engineers design containers and packages and supervise their production. A few box manufacturers also employ artists who develop letterings, designs, and colors for containers.

Foresters manage large areas of timberland and assist in the wood-buying operations of pulp and paper companies. They map forest areas, plan and supervise the harvesting, and seed or plant new trees to assure continuous production of timber.

Systems analysts and *computer programmers* are becoming increasingly important to this industry due to the greater use of computerized

controls in the production process. They analyze business and production problems and convert them to a form suitable for solution by computer.

Frequent tests are performed during the manufacture of pulp or paper to determine whether size, weight, strength, color, and other properties meet standards. Some testing is done by machine operators, but in many mills *testing technicians* are employed. These technicians, who have job titles such as laboratory technician, pulp tester, and chemical analyst, also assist engineers and chemists in research and development activities.

Administrative, Clerical and Related Occupations. The paper industry employs many administrative, clerical, and other office personnel. Executives plan and administer company policy. To work effectively, executives require information from a wide variety of personnel, including accountants, sales representatives, lawyers, and personnel in industrial relations, transportation, market research, and other activities. Bookkeepers, secretaries, shipping clerks, and other clerical workers keep records of personnel, payroll, inventories, sales, shipments, and plant maintenance.

Training, Other Qualifications, and Advancement

Paper and pulp companies generally hire and train inexperienced workers for production and maintenance occupations. Many companies prefer to hire high school graduates. Inexperienced workers usually start as laborers or helpers and advance along fairly well-defined paths to more skilled jobs.

Some large plants have formal apprenticeship programs for maintenance workers. Under these programs, which usually last 3 to 4 years, people are trained for jobs, such as machinist, electrician, millwright, and pipefitter. Generally, an applicant is given a physical examination, mechanical aptitude tests, and similar qualifying tests. Apprenticeship includes both on-the-job training and classroom instruction related to the occupation. The machinist apprentice, for example, receives classroom instructions in mathematics, blueprint reading, and shop theory.

A bachelor's degree is usually the minimum educational requirement for scientists, engineers, foresters, and other professional occupations. For research work, persons having advanced degrees are preferred. Many engineers and chemists (called *process engineers* and *paper chemists*) have specialized training in paper technology. A list of schools offering such training is available from the American Paper Institute, 260 Madison Ave., New York, N.Y. 10016. Many companies have summer jobs for college students specializing in papermaking, and upon graduation frequently hire them on a permanent basis. Some associations, colleges and individual companies offer scholarships in pulp and papermaking technology.

Some companies have formal training programs for college graduates with engineering or scientific backgrounds. These employees before being assigned to a particular department may work for brief periods in various parts of the plant to gain a broad knowledge of pulp and paper manufacturing. Other firms immediately assign junior chemists or engineers to a specific research, operation, or maintenance unit.

Generally, no specialized education is required for laboratory assistants, testing technicians, or other kinds of technicians. Some employers, however, prefer to hire technical institute or junior college graduates. Beginning technicians start in routine jobs and advance to positions of greater responsibility after they acquire experience and can work with minimum supervision.

Administrative postions usually are filled by people who have college degrees in business administration, marketing, accounting, industrial relations, or other specialized business fields. A knowledge of paper technology is helpful for administrators and sales occupations. This is true especially for sales representatives who give customers technical assistance. Most pulp and paper companies employ clerks, bookkeepers, stenographers, and typists who have had commercial courses in high school or business school.

For production workers, promotion generally is limited to more skilled jobs within a "work area," which may be a department, section, or an operation on one type of machine. These promotions may take years, depending on the availability of jobs. Experience gained within a work area usually is not transferrable; unskilled or semiskilled workers who transfer to jobs outside their seniority-area or to other plants usually must start in entry jobs.

Many plant supervisors are former production workers. In some plants, qualified workers may be promoted directly to supervisory positions. In others, workers are given additional training before they are eligible for promotion. This training often is continued after the worker is promoted—through conferences, special plant training sessions, and courses at universities or trade schools. Most firms provide some financial assistance for employees who take courses outside the plant.

Employment Outlook

Employment in the paper and allied products industry is expected to increase more slowly than the average for all industries through the mid-1980's. Although a significant number of job openings is ex-

pected due to growth, most openings will stem from the need to replace workers who retire, die, or leave their jobs for other reasons. The number of job openings may fluctuate from year to year, however, because the demand for paper is somewhat sensitive to changes in economic conditions.

Paper production is expected to increase over the long run as population and business activity grow and new uses for paper are developed. Employment will grow at a slower rate than production, however, because of the greater use of laborsaving machinery. Most of the employment growth will occur in plants that make finished products such as napkins, envelopes, boxes, and wrapping paper. These plants are not as suited for laborsaving machinery as plants that produce pulp and unfinished paper products.

Occupational groups within the industry are expected to grow at different rates. The number of engineers, scientists, technicians, and maintenance workers is expected to increase faster than other occupational groups in the industry. More scientific and technical personnel will be needed as research and development activities expand, and more maintenance workers will be required to service the more complex machinery. Employment of administrative and clerical workers also is expected to rise at a faster pace than total employment. On the other hand, the number of production workers may decline slightly as more laborsaving machinery is introduced. Nevertheless, replacement needs will create many job openings for production workers.

Earnings and Working Conditions

Production workers in the paper industry had average earnings of $4.50 an hour in 1974. In the same year, production workers in all manufacturing industries averaged $4.40 an hour.

The following tabulation, based on information from a score of union-management contracts in the paper industry, illustrates the approximate range of hourly wage rates for selected production and maintenance occupations in 1974. Local rates within these ranges depend on geographic location, type and size of mill, kinds of machines used, and other factors.

	Hourly rate ranges
Production occupations:	
Paper machine operator...	$4.85–7.99
Backtender.....	4.43–7.54
Head stock preparer (beater engineer).....	4.48–6.13
Digester operator (cook).....	4.61–6.09
Supercalendar operator...	5.07–5.69
Barker operator, drum.....	4.13–4.87
Chipper.....	4.12–4.61
Maintenance occupations:	
Pipefitter.....	4.46–5.88
Electrician.....	4.26–5.88
Machinist.....	4.26–5.88

Most pulp and paper plants operate around the clock—three shifts a day, 7 days a week. Production workers can expect to work on evening or night shifts from time to time. Maintenance workers usually are employed on the regular day shift.

In most plants the standard workweek is 40 hours; in a few it is 36 hours or less. Workers normally have year-round employment because paper production is not subject to seasonal variations.

Most pulp and papermaking jobs do not require strenuous physical effort. However, some employees work in hot, humid, and noisy areas. They also may be exposed to disagreeable odors from chemicals in the papermaking process. The rate of injury in this industry has been about the same as the rate for all manufacturing.

A majority of the production workers are members of trade unions. The largest unions in the industry are the United Papermakers and Paperworkers and the International Brotherhood of Pulp, Sulphite and Paper Mill Workers. Many other workers in the Western States, are represented by the Association of Western Pulp and Paper Workers. Many printing workers belong to the International Printing and Graphic Communications Union. Some maintenance and craft workers belong to various craft unions.

Sources of Additional Information

Further information about job opportunities in this industry is available from local offices of the State employment service and from:

American Paper Institute, 260 Madison Ave., New York, N.Y. 10016.

Fibre Box Association, 224 S. Michigan Ave., Chicago, Ill. 60604.

National Paper Box Manufacturers Association, Inc., 121 N. Broad St., Philadelphia, Pa. 19107.

Paper Industry Management Association, 2570 Devon Ave., Des Plaines, Ill. 60018.

For information on job opportunities for paper and paper products sales representatives, write to:

National Paper Trade Association, Inc., 420 Lexington Ave., New York, N.Y. 10017.

OCCUPATIONS IN THE PETROLEUM REFINING INDUSTRY

The petroleum and natural gas industries provide about three-fourths of the Nation's energy needs. Crude oil products supply the fuels and lubricants used for motor vehicles, locomotives, aircraft, and ships. Oil and gas provide much of the heat for homes, factories, and stores, as well as the fuel for the generation of over one-quarter of our electric power. In addition, basic petroleum compounds are used to manufacture hundreds of everyday products such as synthetic rubber, fertilizers, and plastics.

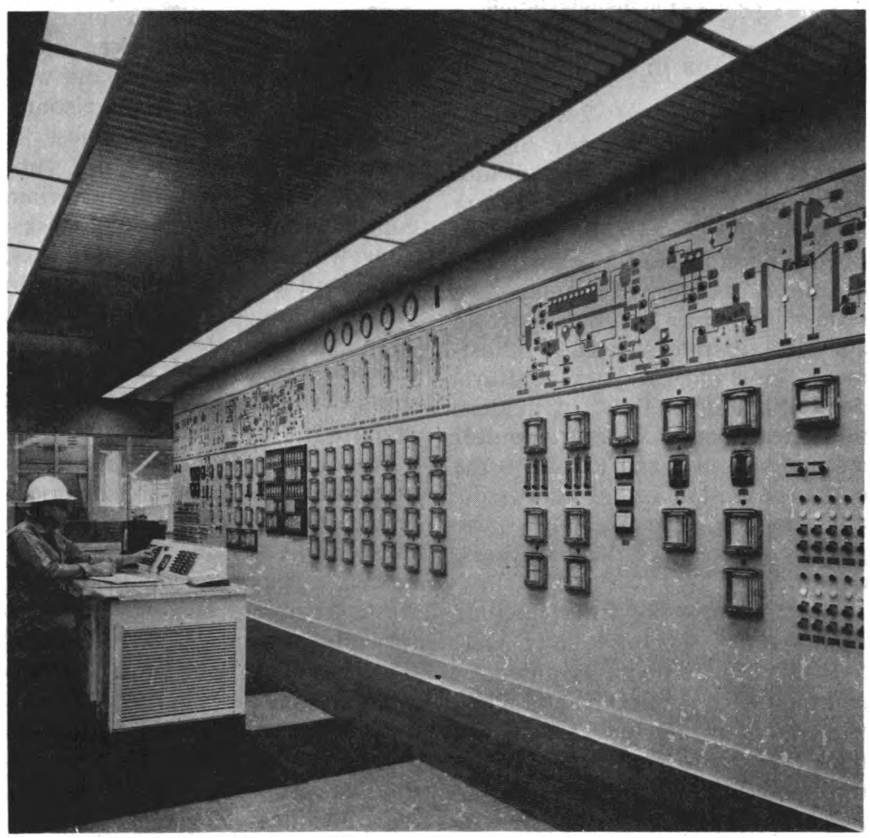
In 1974 about 155,000 workers, who had a wide range of educational backgrounds and skills, were employed in the petroleum refining industry. This industry covers occupations and activities involved in refining oil. Occupations in petroleum and natural gas production and processing are discussed in a separate chapter elsewhere in the *Handbook*.

Nature and Location of the Industry

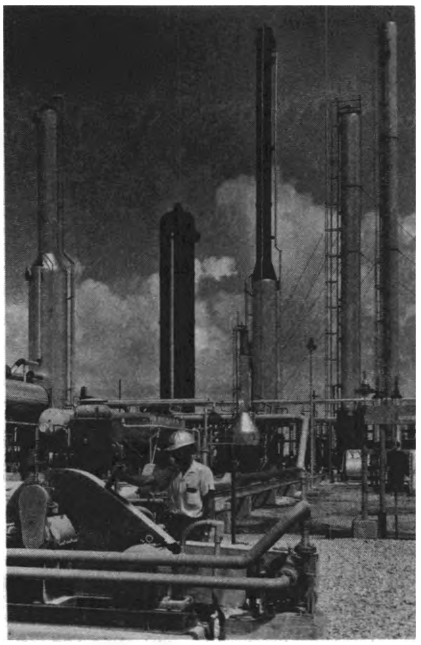
A modern refinery is a complicated plant made up of tanks and towers connected by a maze of pipes and valves. From the time crude oil enters the refinery to the shipment of finished products, the production flow is almost continuous. Operators use instruments including computers to measure and regulate the flow, volume, temperature, and pressure of liquids and gases going through the equipment. Manual handling of materials is virtually eliminated.

The first step in petroleum refining consists of heating crude oil as it flows through a series of pipes in a furnace. The vapors from the heated oil pass into a tower where the various "fractions," or parts, of the oil are condensed. The heaviest parts (for example, heavy fuel oils and asphalt) are drawn off along the bottom of the tower where temperatures are highest; lighter parts (jet fuel and diesel fuel) are drawn off along the middle of the tower; and the lightest (gasoline and gases) are taken off at the top where temperatures are lowest. Further processing by more complicated methods combines or modifies compounds obtained through fractionating. Treating units are used to remove water, sulfur compounds, and other impurities.

About 600 refineries were in operation in 1974. They ranged in size from plants with fewer than three employees to those with several thousand. Although many States have refineries, about 85 percent of the workers were employed in 10 States: Texas, California, Illinois, Pennsylvania, Louisiana, New York, New Jersey, Ohio, Oklahoma, and Indiana. Refineries usually are located near oilfields, industrial centers, or deepwater ports where tankers can dock.



Operator observes central controls for a refinery.



Refinery workers are among the highest paid employees in manufacturing.

Occupations in the Industry

About 1 out of every 2 workers in a refinery is an operator. A key worker in converting crude oil into usable products is the *refinery operator* (D.O.T. 542.280), or chief operator, who is responsible for one or more processing units. The refinery operator, with help from assistant operators, makes adjustments for changes in temperature, pressure, and oil flow. In modern refineries, operators can monitor instruments on panels that show the entire operation of all processing units in the refinery. They also patrol units to check their operating condition.

Other plantworkers may include *still pump operators* (D.O.T. 549.782), also known as pumpers, and their *helpers* (D.O.T. 549.884), who maintain and operate pumps that control all production throughout the refinery; and *treaters* (D.O.T. 549.782), who operate equipment to remove impurities from gasoline, oil, and other products. In automated plants, computers may do the work of pumpers and treaters. Operators monitor the computers to spot potential problem areas, and may make routine checks of the refinery to make sure that valves are operating properly.

Many refineries employ large numbers of maintenance workers to repair, rebuild, replace, and clean equipment. In other plants, maintenance work is contracted to companies outside the petroleum industry. Maintenance workers are needed because high heat, pressure, and corrosion quickly wear out the complex refining equipment. Included are skilled boilermakers, electricians, instrument repairers, machinists, pipefitters, sheetmetal workers, and welders. Helpers and apprentices also are in these trades. Some skilled workers have a primary skill in one craft as well as the ability to handle closely related crafts. For example, a pipefitter also may be a boilermaker and a welder. Maintenance workers who have such combined jobs are sometimes called refinery mechanics.

Plantworkers who do not operate, monitor, or maintain equipment do many other tasks. Some workers drive delivery trucks; some load and unload materials on trucks, trains, or ships; and others keep stock and tool inventory records. The industry also employs service workers such as guards and janitors.

About 12 percent of the workers in petroleum refining are scientists, engineers, and technicians. Among these are chemists, chemical engineers, mechanical engineers, waste treatment engineers, laboratory technicians, and drafters. Chemists and laboratory technicians control the quality of petroleum products by making tests and analyses to determine chemical and physical properties. Some chemists and chemical engineers develop and improve products and processes. Laboratory technicians assist chemists in research projects or do routine testing and sample taking. Some engineers design chemical processing equipment and plant layout, and others supervise refining processes. Waste treatment engineers and technicians supervise and improve treatment and disposal of refinery waste waters and gases. Drafters prepare plans and drawings needed in refinery construction and maintenance.

Refining companies employ many administrative, clerical, and other white-collar personnel. Administrative workers include managers, accountants, purchasing agents, lawyers, computer programmers, computer analysts, and personnel and training specialists. Typists, secretaries, bookkeepers, keypunch operators, and business machine operators assist administrative workers. (Detailed discussions of professional, technical, mechanical, and other occupations found not only in petroleum refining but also in other industries are presented elsewhere in the *Handbook*.)

Training, Other Qualifications, and Advancement

New plantworkers usually begin as aides in a labor pool where they move materials, pack cartons, fill barrels, and do maintenance work. They may be transferred to the processing department or maintenance shop when a vacancy occurs. Aptitude testing and interviewing frequently are used in selecting applicants for plant jobs.

Workers newly assigned to a processing department learn to operate equipment under experienced operators. Formal training courses frequently are given in plant operation.

A supervisor trains inexperienced workers in the maintenance shop. Some refineries have classroom instruction related to particular work. After 3 or 4 years, a person may advance from helper to skilled craft worker in one of the maintenance crafts. Some large refineries train

workers in several crafts. For example, a qualified instrument repairer may be given electrician or machinist training.

For scientists and engineers, a bachelor's degree in an appropriate field usually is the minimum educational requirement. Advanced degrees are preferred for research work.

For most laboratory assistant jobs, 2-year technical school training is required. Laboratory assistants begin in routine jobs and advance to positions of greater responsibility as they acquire experience and learn to work without close supervision. Inexperienced drafters begin as copyists or tracers and can advance to more skilled drafting jobs.

Administrative positions generally are filled by people who have college degrees in science and engineering, accounting, business, industrial relations, or other specialized fields. For positions as clerks, bookkeepers, secretaries, and typists, most refineries employ persons who have had commercial courses in high school or business school. For occupations associated with computers, educational requirements range from a high school level for keypunch operators to a college degree in the physical science field for analysts.

Employment Outlook

Employment in petroleum refining is expected to show little change through the mid-1980's. Refinery output is expected to increase to meet the Nation's growing demand for petroleum products, but automated, computerized plants, increased refining capacity, and improved refining techniques should make it possible for the industry to increase production without increasing employment significantly. Nevertheless, thousands of job openings will result from the need to replace workers who retire, die, or transfer to other occupations.

Most jobs will be for operators, maintenance workers, administrators, and technicians. More maintenance workers, such as electricians, pipefitters, and instrument repairers, will be needed to take care of the increasing amount of automated equipment and complex control instruments.

Earnings and Working Conditions

Refinery workers are among the highest paid employees in manufacturing. In 1974 production workers in petroleum refining averaged $5.96 an hour, compared with an average of $4.40 an hour for production workers in manufacturing industries as a whole. Refinery workers have better-than-average earnings because a large proportion are skilled.

Entry salaries for chemical engineers in the petroleum refining industry were among the highest in American industry, according to a survey conducted by the College Placement Council in 1974. The average monthly salary for chemists who had a bachelor's degree and no experience was $966, and for chemical engineers $1,177.

Because petroleum is refined around the clock, operators may be assigned to any one of the three shifts, or they may be rotated on various shifts. Some operators work weekends and get days off during the week. Employees usually receive additional pay for shift work. Most maintenance workers are on duty during the day.

Most refinery jobs require only moderate physical effort. A few workers, however, have to open and close heavy valves and climb stairs and ladders to considerable heights. Others may work in hot places or may be exposed to unpleasant odors. Refineries are relatively safe. The injury frequency rate has been less than half the rate for manufacturing as a whole.

Many refinery workers are union members and belong to the Oil, Chemical and Atomic Workers International Union. Some refinery workers are members of AFL-CIO craft unions or of various independent unions.

Sources of Additional Information

More information on job opportunities in the petroleum refining industry may be obtained from the personnel offices of individual oil companies. General information on jobs in the industry is available from:

National Petroleum Refiners Association, 1725 DeSales St. NW., Washington, D.C. 20036.

OCCUPATIONS IN THE PRINTING AND PUBLISHING INDUSTRY

Printing is both an art and one of our chief means of communication. In 1974, the printing and publishing industry employed about 1.1 million workers. Government agencies and private firms that do their own printing, such as banks and insurance companies, also employed thousands of printing workers.

Nature and Location of the Industry

Included in the industry are the printing and publishing of newspapers, magazines, books, and advertising matter; the production of business forms, greeting cards, and gift wrappings; commercial or job printing; bookbinding; and typesetting, photoengraving, platemaking, and other printing services, primarily for printing establishments.

In 1974, the largest division in terms of employment was newspaper printing and publishing, with over 380,000 employees. Most daily and many weekly newspapers throughout the Nation do their own printing. Although some major newspapers have more than 2,000 employees, many have fewer than 20.

Commercial printing shops, the second largest division of the industry, employed about 362,000 workers. These shops produce a variety of materials, including advertising matter, business cards, calendars, catalogs, labels, maps, and pamphlets. They also print limited-run newspapers, books, and magazines. Many commercial shops have several hundred workers, but employment is concentrated in smaller shops.

Printing jobs are found throughout the country. Almost every town has at least one printing shop, frequently, a small newspaper plant that also may do other printing. However, about one-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 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 newspaper employment, however, is found outside these centers because of the great number of small local newspapers.

Printing Methods

Printing is a means of transferring ink impressions of words and pictures to paper, metal, or other materials. A plate of metal, rubber, or plastic is prepared so that part of it can be covered with ink. The ink is then transferred to a sheet of paper or other material that is pressed against the plate.

In relief printing, the letters and images are raised from the rest of the printing plate. Ink is rolled over the raised surface and then paper is pressed against it. In gravure printing, the image is etched into the surface of a cylinder. The whole surface is covered with ink and then wiped off; ink is left only in the sunken or etched areas. When paper is pressed against the surface, the ink is lifted out and appears on the paper. 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 plate's image areas are coated with a substance to make the greasy printing ink stick to the plate and then moistened with water so that only the image areas take up the ink. The inked image is transferred from the plate to a rubber blanket and then to the paper.

Screen printing is a method in which inks or other materials such as paint and varnish are forced through a stencil mounted on a finely woven screen. The shape of the stencil openings determines the design to be printed. This process may be applied to a variety of surfaces such as paper, glass, metal, plastic, and textiles.

Printing Occupations

Production of printed materials requires workers in a wide variety of occupations. Printing craft workers represent a large segment of these employees. They usually specialize in one area of printing operations: Type composition, photography, platemaking, presswork, or binding. Their training generally is confined to only one of the basic printing methods—letterpress, lithography, or gravure. Some of the principal printing crafts are briefly described below. Detailed information on these crafts is presented in the section on printing occupations, elsewhere in the *Handbook*.

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 1974, about 40 percent of all printing craft workers—165,000—were employed in composing room occupations. This group includes *compositors* (D.O.T. 973.381) who set type by hand or machine; *typesetter perforator operators* (D.O.T. 208.588) who punch tapes used to operate some typesetting machines; *make-up arrangers* (D.O.T. 973.381) who assemble type in shallow trays called "galleys" and make trial copy of this type; and *proofreaders* (D.O.T. 209.688) who check the trial copy with the original copy for errors.

Electrotypers and stereotypers (D.O.T. 974.381 and 975.782) make duplicate pressplates 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.

Photoengravers (D.O.T. 971.381) 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 nonprinting spaces, as do the letters and the accompanying type. Similarly, *gravure photoengravers* (D.O.T. 971.381), a specialized type of photoengravers, make gravure cylinders in which the image is etched below the surface for use in reproducing pictures and type.

The actual printing operation is performed in the pressroom. *Printing press operators* (D.O.T. 651.782, .885 and .886) prepare type forms and pressplates for final printing and tend the presses while they are in operation. Small commercial shops generally have small and relatively simple presses that often are fed paper by hand. At the other extreme are the enormous presses used by the larger newspaper, magazine, and book printing plants. They automatically print the paper and cut, assemble, and fold the pages. These machines are operated by crews of press operators assisted by less skilled workers.

Lithography (offset printing) is growing in importance. Practically all items printed by other processes also can be produced by lithography. It is a process of photographing the matter to be printed, making a printing plate from the photograph and pressing the inked plate against a rubber blanket which in turn presses it onto the paper. Several operations are involved in lithography, and each is performed by a specialized group of workers. The main group of lithographic workers are *camera operators* (D.O.T. 972.382), *artists and letterers* (D.O.T. 971.281), *strippers* (D.O.T. 971.381), *platemakers* (D.O.T. 972.381), and *press operators* (D.O.T. 651.885).

Because of the increasingly complex and highly mechanized printing equipment in use today, technically trained people are needed in all areas of printing management and production. For example, an increasing number of *production technicians* (D.O.T. 019.281) are employed to see that the standards for each printing job are met.

Many printed items, such as books, magazines, pamphlets, and calendars, must be folded, sewed, stapled, or bound after they leave the printing shops. Much of this work is done by skilled bookbinders. In many binderies, however, the work is done mostly by semiskilled assemblers.

Besides printing craft workers, the industry employs people in a variety of other occupations. Many mailroom workers are employed in newspapers and magazine plants to 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 tying machines. Many large printing firms employ mechanics and machinists to repair and adjust typesetting machines, printing presses, and other equipment.

Printing firms employ a great many people as executives, sales representatives, accountants, engineers, computer programers, stenographers, clerks, and laborers. Newspapers and other publishers employ a considerable number of reporters, editors, and photographers. These occupations are discussed elsewhere in the *Handbook*.

Training and Other Qualifications

Many training authorities recommend apprenticeship as the best way to learn printing trades. A substantial number of people, however, learn these trades by working as helpers or through a combination of work experience and schooling. Apprentices often are chosen from among people already employed in various unskilled jobs in printing plants.

Printing apprenticeships usually last from 4 to 6 years, depending on the occupation and shop or area practices. The apprenticeship programs cover all phases of a particular trade and generally include classroom or correspondence study in related technical subjects, as well as on-the-job training. Apprenticeship applicants generally must be at least 18 years of age and pass an aptitude test and a physical examination. Applicants who qualify may be put on a waiting list if there are no immediate apprenticeship job openings.

Most employers prefer applicants to have 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.

Most printing crafts require people with good eyesight, about average physical strength, and a high degree of manual dexterity. Alertness, patience, and the ability to work with others also are necessary. The ability to distinguish colors is important in areas of printing where color is used. An artistic sense also is an asset since the finished product should be pleasing in balance and design.

About 4,000 schools—high schools, vocational schools, technical institutes, and colleges—offer courses in printing technology. These courses may help a person to be selected for apprenticeships or other job openings in the printing and publishing industry.

Administrative jobs are usually filled by upgrading experienced people. Many owners and production managers of printing firms have come from the ranks of printing craft workers. In recent years, however, more firms are filling administrative positions with people who have college degrees in business administration, marketing, accounting, industrial relations, or other specialized business fields. Most firms hire clerks, bookkeepers, stenographers, and typists who have completed commercial courses in high school or business school.

Some computer programmers in the printing industry have technical school training; others learn their skills on the job. Also, many compositors and typesetters are being taught computer programming skills, and the International Typographic Union has established a training center for this purpose.

Employment Outlook

Employment in the printing and publishing industry is expected to grow more slowly than the average for all industries through the mid-1980's. Most job openings will occur from the need to replace experienced workers who retire, die, or transfer to other industries.

The volume of printed materials is expected to increase rapidly because of population growth, the increasingly high literacy level of the population, and the trend to greater use of printed materials for information, packaging, and various industrial and commercial purposes. Employment will grow at a slower rate than the volume of printing, however, because of laborsaving technological changes in printing methods.

Occupational groups in the industry are expected to increase at different rates. Employment of technical, maintenance, and clerical workers will increase at a faster pace than total employment. Employment growth will vary among the printing crafts. The number of lithographic craft workers, for example, is expected to increase because of the growing use of lithography. On the other hand, since lithography does not require photoengraving, employment of photoengravers is expected to decline. The trend to computerization of typesetting operations will reduce the need for some machine operators in composing rooms while creating a demand for more computer programmers. More mechanics will be hired to maintain the industry's increasingly complex machinery.

Earnings and Working Conditions

Earnings of production workers in the printing and publishing industry are among the highest in manufacturing. In 1974, they averaged $4.96 an hour, while those in manufacturing industries as a whole averaged $4.40.

The accompaying tabulation shows the average estimated union minimum hourly rates for selected printing occupations in 1974 based on a survey of 69 large cities. These are the minimum basic rates for daywork, and do not include overtime, other special payments, or bonuses.

Most printing craft workers who are covered by union contracts work fewer than 40 hours a week. Some contracts specify a standard workweek of less than 35 hours, but most fall within a 35 to 37-1/2 hour range. Time and a half generally is paid for overtime. Work on Sundays and holidays is paid for at time and one-half or double-time rates in most commercial printing firms. In newspaper plants, however, the 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 generally are from 40 to 50 percent of the basic rate for skilled workers in the shop. Wages are increased periodically, usually every 6 months, until the apprentice reaches the skilled rate.

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. Among these are the Graphic Arts Union, International the International Printing and Graphic Communication's Union America, the International Typographical Union, and the International Mailers Union.

Sources of Additional Information

Details about employment opportunities and apprenticeships

	Average minimum hourly rate, 1974	
	Newspaper	*Book and job shops*
Bookbinders	—	$6.63
Compositors:		
Hand	$6.86	7.11
Machine operators	6.97	6.97
Electrotypers	—	6.22
Photoengravers	7.27	—
Press operators	6.74	—
Press (cylinder) operators	—	6.73
Press (platen) operators	—	5.86
Stereotypers	6.69	6.78

may be obtained from local employers, such as newspapers and printing shops, local offices of the unions mentioned above, or the local office of State employment services. Some State employment service offices screen applicants and give aptitude tests.

For general information on the industry, write to:

American Newspaper Publishers Association, 11600 Sunrise Valley Dr., Reston, Va. 20041.

American Photoplatemakers Association, 166 W. Van Buren St., Chicago, Ill. 60604.

Graphic Arts Technical Foundation, 4615 Forbes Ave., Pittsburgh, Pa. 15213.

Gravure Technical Institute, 60 E. 42 St., New York, N.Y. 10020.

International Typographical Union, P.O. Box 157, Colorado Springs, Colo. 80901.

Printing Industries of America, Inc., 1730 N. Lynn St., Arlington, Va. 22201.

(See the section on Printing Occupations elsewhere in the *Handbook* for names of labor organizations and trade associations that can provide more information on specific printing trades.)

TRANSPORTATION, COMMUNICATIONS, AND PUBLIC UTILITIES

The transportation, communications, and public utility industries produce most of the energy that powers, heats, and lights our factories and homes. The transportation industry moves goods and people by air, rail, water, and highway; the communications industry provides communications systems such as telephones and radio and TV broadcasting. Other public utilities supply the Nation with electricity, gas, and sanitation services.

Transportation, communications, and public utility firms are semipublic in character. Some State and local governments operate their own transit lines or electric companies as well as other types of utilities. Privately owned transportation and public utility firms are regulated closely by commissions or by other public authorities to make sure they operate in the public interest.

In 1974, almost 4.7 million people worked in the transportation, communications, and public utility industry division. In addition, more than one-half million persons held jobs with State and local governments in publicly owned transit and utility systems. Almost half of the workers in this industry division worked in two major industry groups: communications employing 1.2 million workers ; and motor freight transportation and warehousing (including local and long-distance trucking); employing over 1 million workers.

Electric, gas, and sanitary services companies employed nearly 750,000 workers and railroads over 580,000. Other industries employing a significant number of workers were air transportation and local and interurban passenger transit. The remaining workers were employed by firms that provide water and pipeline transportation and transportation services.

As shown in the accompanying tabulation, blue-collar workers (craft workers, operatives, and laborers) made up three-fifths of total employment in the transportation, communications, and public utility industries in 1974. Operatives alone accounted for about one-fourth of the total. Most of these semiskilled workers are truck, bus, and taxi drivers, and railroad brake operators. Craft workers made up nearly one-fourth of the total. Among the occupations in this group are airplane mechanic, motor vehicle mechanic, telephone line installer, locomotive engineer, and the supervisors of blue-collar workers. A relatively small fraction of the industry's employees were laborers, such as material handlers and truckdrivers' helpers.

Nearly two-fifths of the industry's employees were white-collar workers (professional, managerial, clerical, and sales). Most of the white-collar workers were in clerical occupations such as telephone operator, ticket agent, secretary, and bookkeeper. These industries employed about an equal number of managerial workers and professional and technical workers. Many of the professional and technical workers are in the communications industry, where, in addition to large numbers of engineers and technicians, many actors, entertainers, and writers are employed.

Major occupational group	*Percent of workers*
All workers	100
Professional, technical, and kindred workers	7
Managers and administrators	8
Clerical and kindred workers	23
Salesworkers	1
Craft and kindred workers	23
Operatives	26
Service workers	3
Laborers	9

Employment in the transportation, communications, and public utility industries is expected to increase more slowly than the average for all industries through the mid-1980's. In addition to openings resulting from growth of the industries, many thousands of jobs will be available each year because of the need to replace workers who die, retire, or transfer to other industries.

Employment growth in individual industries will vary. Rising population and business expansion will stimulate employment growth in air transportation and in trucking. On the other hand, little employment change is expected in local and interurban passenger transportation (buses, taxis, and subways). The longrun decline in railroad employment is expected to continue, but at a decreasing rate.

Employment in communications is expected to grow at about the same rate as the average for all in-

dustries through the mid-1980's. Although demand for the industry's services will increase rapidly, advances in technology are expected to limit employment growth, particularly in telephone communications. Computers and other electronic equipment are expected to be applied increasingly to work previously done by wage earners. Employment in electric and gas utilities also will be affected strongly by advancing technology and will grow more slowly than increases in output.

The statements that follow cover major industries in the transportation, communications, and public utility fields. More detailed information about particular occupations in these fields appears elsewhere in the *Handbook*.

CIVIL AVIATION

The rapid development of air transportation has increased the mobility of the population and has created many thousands of job opportunities in the civil aviation industry. In 1974 over 450,000 people were employed in a variety of interesting and responsible occupations in this industry.

Characteristics of the Industry

Many different organizations and activities are involved in civil aviation. The most familiar are airlines that provide transportation for passengers and cargo. Airlines account for more than three times as much intercity passenger travel as buses and railroads combined.

The civil aviation industry includes other kinds of flying activities. For example, many businesses transport executives in company planes and some firms use their own planes for crop dusting, inspecting pipelines, and other activities. The government-licensed shops which repair and inspect smaller airplanes also are included in the industry.

The Federal Aviation Administration (FAA) and the Civil Aeronautics Board (CAB)—both part of the Federal Government—regulate the civil aviation industy. The FAA develops air safety regulations, coordinates flights, operates ground navigation equipment, and licenses personnel such as pilots and aircraft mechanics. The CAB makes policy on airline rates and routes.

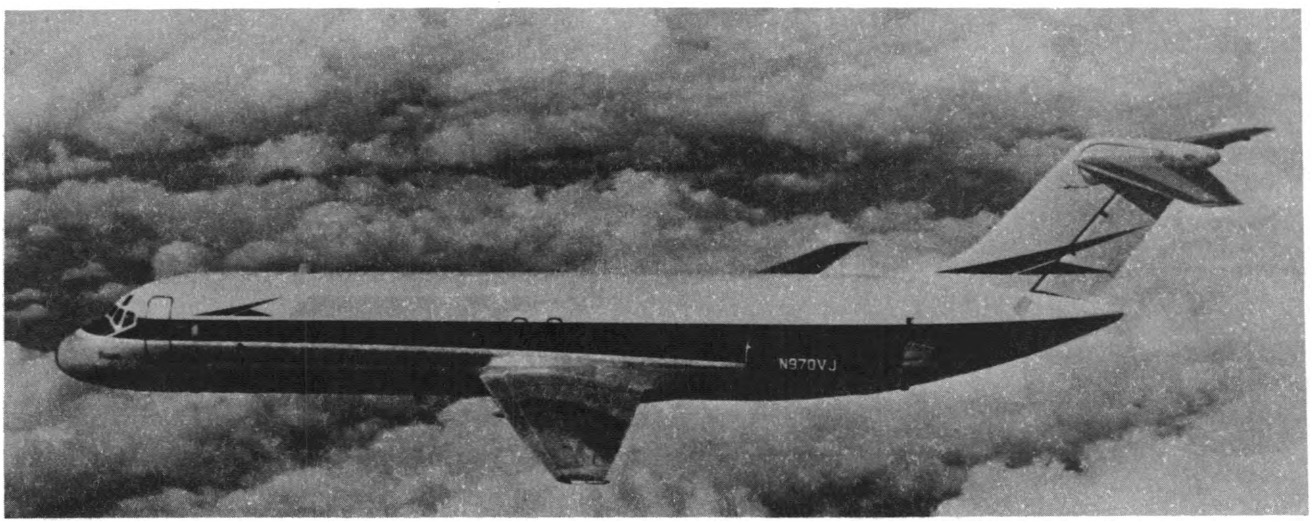
In 1974, about 325,000 employees worked for airlines. Most of the remaining civil aviation employees worked for firms that operate airplanes to transport executives and for firms that rent, service, or repair aircraft. The rest worked for the Federal Government; in 1974, the FAA employed about 56,000 people, the CAB less than 1,000.

About half of all airline employees work at airports near New York, Miami, Los Angeles, San Francisco, Chicago, Atlanta, and Dallas, the cities where major airlines are based. Others work at airports scattered throughout the country. Most other civil aviation employees work at airports near large cities.

Civil Aviation Occupations

About four-fifths of all civil aviation employees work in ground occupations. Many of these are mechanics and aircraft maintenance personnel who refuel, clean, inspect, and repair the planes between flights. Other large groups make reservations and sell tickets for the airline companies. Some are air traffic controllers and flight service specialists for the FAA. Other groundworkers include cargo and freight handlers, dispatchers, and clerical, administrative, and professional personnel.

Flight crewmembers make up the remaining one-fifth of civil aviation employment. They include the pilots who fly the planes and the flight attendants who assist passengers. Detailed discussions of most of the principal occupations in civil aviation are presented elsewhere in the *Handbook* in the section on Air Transportation Occupations.



Training, Other Qualifications, and Advancement

Jobs are available to persons with a wide variety of training and backgrounds. Although some jobs require previous training and may require certificates from the FAA Others can be learned on the job.

Pilots usually have an air transport or commerical pilot's license from the FAA when they begin work. They also must have an instrument license to fly when the weather is bad. As a rule new airline pilots begin as flight engineers.

Interested persons may obtain pilot training from military or civilian flying schools. Physical requirements are high. With or without glasses, they must have 20/20 vision, good hearing, and no physical handicaps that prevent quick reactions. In addition, airlines generally require 2 years of college and prefer college graduates. Before qualified pilots can fly as a flight engineer, they must obtain a flight engineer's license from the FAA.

Although most flight attendants are women, airlines permit men and women to compete equally for available jobs. Applicants must be in excellent health, and those who have some college and have experience in dealing with the public are preferred. Applicants are trained for their jobs at company schools.

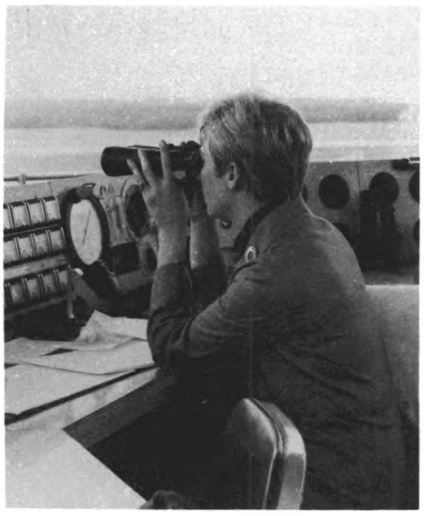
When hiring airplane mechanic trainees or apprentices, employers prefer high school or trade school graduates who are in good physical condition. Experience in automotive repairs or other mechanical work also is helpful. Most mechanics remain in the maintenance field, but they may advance to head mechanics, inspectors, and in a few cases, to supervisory and executive positions. Some jobs require aircraft mechanics to be certified by the FAA as an airframe mechanic, a powerplant mechanic, or both.

New reservation, ticket, and passenger agents are trained by the company. A good speaking voice and a pleasant personality are necessary, because such personnel deal directly with the public. A high school education is required.

Air traffic controllers are selected through the competitive Federal Civil Service System. Applicants must pass a rigid physical examination and a written test. The FAA trains new workers on the job and at the FAA Academy. All workers must be certified by FAA examiners before they can work as controllers. Controllers can advance to chief controller and to higher management jobs in air traffic control.

Completion of commercial courses in high school or business school is usually adequate for entry into general clerical occupations such as secretary or typist. However, additional on-the-job training is needed for specialized clerical occupations such as bookkeeper.

Administrative and sales positions are usually filled by college graduates who have majored in business administration, marketing, accounting, industrial relations, or transportation. Some companies have management training programs for college graduates in which trainees work for brief periods in various departments to get a broad picture of air transportation operations before they are assigned to a particular department.



At airport, air traffic controllers keep airplanes that are flying nearby safely separated.

Employment Outlook

The total number of workers in civil aviation occupations is expected to increase about as fast as the average for all occupations through the mid-1980's. Besides the job openings from employment growth, many openings will arise as experienced workers retire, die, or transfer to other fields of work. However, job opportunities may vary from year to year because the demand for air travel fluctuates with ups and downs in the economy.

Airline employment is expected to increase as passenger and cargo traffic grow in response to increases in population, income, and business activity. Employment in other civil aviation activities is expected to rise as more aircraft are purchased for business, agricultural, fire fighting, and recreational purposes.

Employment trends will differ among occupations. The number of reservation, ticket, and passenger

Reservation agents give information about flights and make reservations over the telephone.

agents, for example, is expected to grow rapidly as more people travel by air. On the other hand, the number of air traffic controllers is expected to grow only moderately because new equipment will permit each controller to direct more planes.

Earnings and Working Conditions

Airline employees earned an average of $16,200 a year in 1974, about twice the average for all nonsupervisory workers in private industry, except farming. Among the major occupations, salaries ranged from $700 a month for new reservation agents to $5,800 a month for experienced airline captains. As an additional benefit, airline employees and their immediate families are entitled to a limited amount of reduced-fare transportation with their own and most other airlines.

Airlines operate flights at all hours of the day and night. Personnel in some occupations, therefore, often have irregular hours or work schedules. For example, flight personnel may be away from home bases about one-third of the time or more. When they are away from home, the airlines provide hotel accommodations.

Ground personnel, such as ticket agents and mechanics, usually work a 5-day 40-hour week. Their working hours, however, often include nights, weekends, or holidays. Ground personnel generally receive extra pay for overtime work or an equal amount of time off.

Sources of Additional Information

For information about job opportunities in a particular airline, write to the personnel manager of the company. Addresses of companies are available from the Air Transport Association of America, 1709 New York Ave. NW., Washington, D.C. 20006.

For information about FAA-approved schools that offer training for airplane mechanics, pilots, or other technical occupations in aviation, write to the Research and Inquiry Division, Office of Information Service AIS-230, Federal Aviation Administration, Washington, D.C. 20591.

OCCUPATIONS IN THE ELECTRIC POWER INDUSTRY

Electricity has become so much a part of our daily lives that most people take it for granted. But just imagine not being able to ride the elevator to your apartment and instead having to walk up all those flights of stairs' Or think about having no lights, television set, or radio in your home' Today, it would be difficult to get used to living without electricity.

Bringing electricity into our homes and places of work and recreation is not as simple as just turning on a switch. There are thousands of employees working in the electric power industry to make all this possible.

Nature and Location of the Industry

The delivery of electricity to users at the instant they need it is the unique feature of the electric power systems. Electricity cannot be stored efficiently but must be used as it is produced. Because a customer can begin or increase the use of electric power at any time by merely flicking a switch, an electric utility system must have sufficient capacity to meet peak consumer needs at any time.

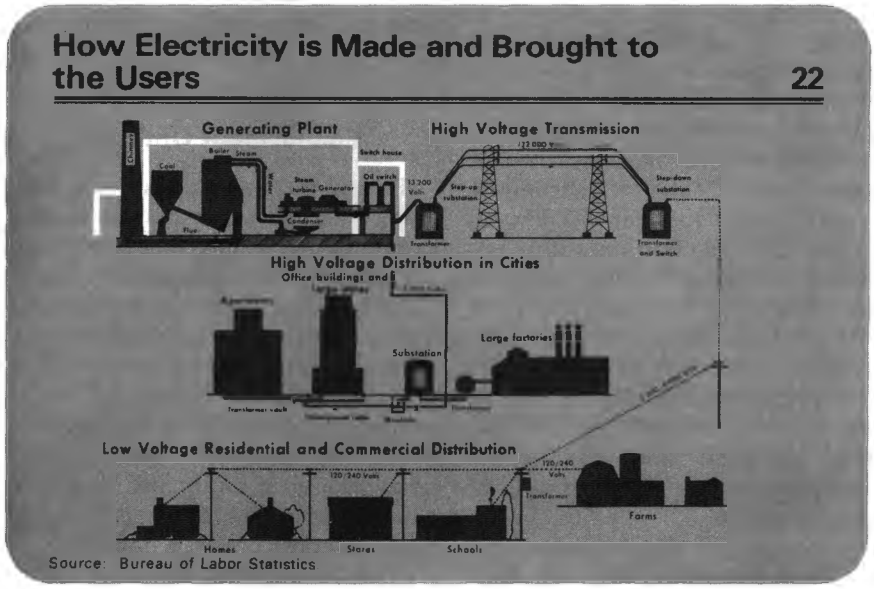
An electric utility system includes powerplants that generate electric power, substations that increase or decrease the voltage, and vast networks of transmission and distribution lines. Electric utilities range from large systems serving broad regional areas to small power companies serving individual communities. Most electric utilities are investor-owned (private) or owned by cooperatives; others are owned by cities, counties, and public utility districts, as well as by the Federal Government. While some utilities generate, transmit, and distribute only electricity, others distribute both electricity and gas. This chapter is concerned with employment relating only to the production and distribution of electric power.

Producing and distributing large quantities of electrical energy involves many processes and activities. The accompanying chart shows how electric energy is generated, and how it travels from the generating station to the users.

The first step in providing electrical energy occurs in a generating station or plant, where huge generators convert mechanical energy into electricity. Electricity is produced primarily in steam-powered generating plants which use coal, gas, oil, or nuclear energy for fuel. In addition, a considerable amount of electricity is produced in hydroelectric generating stations which use water power to operate the turbines. Still other generators, primarily for use in standby service or to provide electricity for special purposes, are powered by diesel engines or gas turbines.

After electricity is generated, it passes through a "switchyard," where the voltage is increased so that the electricity may travel long distances without excessive loss of power. The electricity passes onto transmission lines that carry it from the generating plant to substations, where the voltage is decreased and passed on to the distribution networks serving individual customers. Transmission lines tie together the generating stations of a single system and also the power facilities of several systems. In this way, power can be interchanged among several utility systems to meet varying demands.

In 1974, 550,000 people worked in the electric power industry. Most of them, 465,000, worked in investor-owned utilities and cooperatives and 80,000 worked in Federal



and municipal government utilities. A few large manufacturing establishments, which produce electric power for their own use, also employ electric power workers.

Since electricity reaches almost every locality, jobs in this industry are found throughout the country. Although hydroelectric power projects have created jobs in relatively isolated areas, most utility jobs are still found in heavily populated urban areas.

Electric Utility Occupations. Many different types of workers are required in the electric power industry. About 40 percent of the industry's employees work in occupations related to the generation, transmission, and distribution of electricity, and in customer service occupations. (These occupations are discussed in detail later in this chapter.) The industry also employs large numbers of workers in engineering, scientific, administrative, sales, clerical, and maintenance occupations. A brief discussion on these occupations is given below. Further information can be found in statements covering individual occupations elsewhere in the *Handbook*.

Engineering and Scientific Occupations. Engineers plan generating plant construction and additions, interconnections of complex power systems, and installations of new transmission and distribution systems and equipment. They supervise construction, develop improved operating methods, and test the efficiency of the many types of electrical equipment. In planning modern power systems, engineers help select plantsites, types of fuel, and types of plants. Engineers also help industrial and commercial customers make the best use of electric power.

Administrative and Clerical Occupations. Because of the enormous amount of recordkeeping required, electric utilities employ many administrative and clerical personnel. Large numbers of stenographers, typists, bookkeepers, office machine operators, file clerks, accounting and auditing clerks, and cashiers are employed. These workers keep records of the services rendered by the company, make up bills for customers, and prepare a variety of statements and statistical reports. An increasing amount of this work in the larger offices now is being performed by computers. This generally results in more clerical work being done either by fewer or by the same number of employees. The use of this equipment also creates a need for programmers and computer operators. Administrative employees include accountants, personnel officers, purchasing agents, and lawyers.

Maintenance Occupations. A considerable number of workers test, maintain, and repair equipment. The duties of these skilled craft workers are similar to those of maintenance workers in other industries. Among the more important skilled workers are electricians, instrument repairers, maintenance mechanics, machinists, pipefitters, welders, dispatchers, and boilermakers.

Employment Outlook

Employment in the electric power industry is expected to increase about as fast as the average for all industries through the mid-1980's. The greater use of electric power in industrial processes, growth of commercial centers, and population growth will all contribute to an increased demand for electricity. However, due to the growing use of automatic controls, employment will not increase as fast as electric power production.

Trends in growth will differ from one occupation to another in the industry. The need for scientific, engineering, and technical employees is expected to increase sharply as construction of power generating plants increases and as research into developing more efficient energy usage to combat shortages and higher prices of fossil fuels becomes necessary. Much of this increase in employment will be in the development and construction of new nuclear power facilities.

In many other occupations in this industry, only slight increases in employment are expected. Larger, more efficient powerplants will limit growth of employment of powerplant employees. The increased use of electronic data processing equipment for billing and recordkeeping will restrict growth in some clerical jobs. In occupations which will experience little or no growth, most job openings will result from the need to replace workers who die, retire, or leave the electric power industry for other reasons.

People hired by electric power companies should have relatively secure jobs. Even during downturns in the economy, these companies seldom lay off employees.

Earnings and Working Conditions

Earnings in the electric utility industry are relatively high. In 1974, nonsupervisory employees in private electric power companies averaged $5.55 an hour. By comparison, the average for all nonsupervisory workers in private industry, except farming was $4.22 an hour.

Because supplying electricity is a 24-hour, 7-day-a-week activity, some employees work evenings, nights, and weekends, usually on rotating shifts. Most union contracts with electric utilities provide a higher rate of pay for evening and nightwork than the basic day rate.

Overtime work is often required,

especially during emergencies such as floods, hurricanes, or storms. During an "emergency callout," which is a short-notice request to report for work during nonscheduled hours, the worker generally is guaranteed a minimum of 3 or 4 hours' pay at 1-1/2 times the basic hourly rate. Travel time to and from the job is counted as worktime.

In addition to these provisions which affect pay, electric utilities provide other employee benefits. Generally, annual vacations are granted to workers according to length of service. A typical contract or employee benefit program provides for a 1-week vacation for 6 months to 1 year of service, 2 weeks for 1 to 10 years, and 3 weeks for 10 to 20 years. Some contracts and programs provide for 4 weeks after 18 years, for 5 weeks after 25 years, and 6 weeks after 30 years. The number of paid holidays ranges from 6 to 12 a year. Nearly all companies have benefit plans for their employees. A typical program provides life, hospitalization, and surgical insurance and paid sick leave. Retirement pension plans supplement Federal social security payments and generally are paid for in full or in part by the employer.

Because of the dangers of electrocution and other hazards, electric utilities and unions have made intensive efforts to enforce safe working practices. This has resulted in an injury rate lower than in most manufacturing industries. However, some occupations, especially those on linecrews, are more subject to accidents than others.

Many nonsupervisory electric utility workers in production, transmission, and distribution departments are union members. The bargaining representative for most of these workers is either the International Brotherhood of Electrical Workers or the Utility Workers Union of America. Independent unions represent some utility workers.

Sources of Additional Information

Information about jobs in the electric power industry is available from local electric utility companies, from industry trade associations, or from the local offices of unions that represent electric utility workers. Additional information also may be obtained from:

Edison Electric Institute, 90 Park Ave., New York, N.Y. 10016.

International Brotherhood of Electrical Workers, 1125 15th St. NW., Washington, D.C. 20005.

Utility Workers' Union of America, 1875 Connecticut Ave. NW., Washington, D.C. 20006.

POWERPLANT OCCUPATIONS

Nature of the Work

Operators are keyworkers in a powerplant. They include four basic classes—boiler, turbine, auxiliary equipment, and switchboard. These operators observe, control, and keep records of the operation of various kinds of powerplant equipment. They make sure that the equipment functions efficiently and detect any trouble that arises. In many new steamplants, including nuclear, these jobs are combined; operators and their assistants are known as steam operators, powerplant operators, or central control room operators.

Of increasing importance are the maintenance personnel, including electrical, instrument, and mechanical repairers. Other powerplant workers include helpers and cleaners, and the custodial staff, including janitors and guards. In steam generating plants using coal for fuel, coal handlers are employed. In hydroelectric plants, gate tenders open and close the headgates that control the flow of water to turbines. Supervision of powerplant operations is handled by chief engineers called operations supervisors, and by their assistants, watch engineers (called shift supervisors).

Boiler operators (D.O.T. 950.782)—employed only where steam generates electricity—regulate the supplies of fuel, air, and water in the boilers and maintain proper steam pressure to turn the turbines. Pressure is measured by gauges, meters, and other instruments mounted on panel boards. One employee may operate one or more boilers.

Turbine operators (D.O.T. 952.138) control the operation of steam or water-powered turbines that drive the generators. In small plants, they also may operate auxiliary equipment or a switchboard. Since modern steam turbines and generators operate at extremely high speeds, pressures, and temperatures, the operator must give close attention to the pressure gauges, thermometers, and other instruments showing the operations of the turbo-generator unit. Turbine operators record the information shown by these instruments and check the oil pressure at bearings, the speed of the turbines, and the circulation and amount of cooling water in the condensers that change the steam back into water. They also are responsible for starting and shutting down the turbines and generators, as directed by the switchboard operator in the control room. Other workers, such as helpers and junior operators, assist the turbine operators.

Auxiliary equipment operators (D.O.T. 952.782) check and record the readings of instruments that indicate the operating condition of pumps, fans, blowers, condensers, evaporators, water conditioners, compressors, and coal pulverizers. Since auxiliary equipment may occasionally break down, these operators must be able to detect trouble quickly, and sometimes make minor repairs. In small plants which do not employ auxiliary equipment

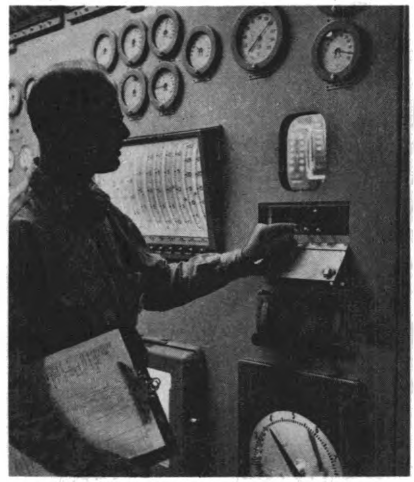
operators, these duties are performed by turbine operators.

Switchboard operators (D.O.T. 952.782) control the amount of electric power flowing from generators to outgoing powerlines by watching instrument panels and by operating switchboards. Switches control the movement of electricity through the generating station circuits and onto the transmission lines. Instruments mounted on panelboards show the power demands on the station at any instant, the powerload on each line leaving the station, the amount of current being produced by each generator, and the voltage.

The operators use switches to distribute the power demands among the generators, to combine the current from two or more generators, and to regulate the flow of the electricity onto various powerlines. When power requirements change, they order generators started or stopped and, at the proper time, connect them to the power circuits in the station or disconnect them. In doing this, they follow telephone orders from the load dispatcher who directs the flow of current throughout the system.

Switchboard operators and their assistants also check their instruments frequently to see that electricity is moving through and out of the powerplant properly, and that correct voltage is being maintained. Among their other duties, they keep records of all switching operations and of load conditions on generators, lines, and transformers. They obtain this information by making regular meter readings.

Control room operator (D.O.T. 950.782). In most powerplants constructed in recent years, the operation of boilers, turbines, auxiliary equipment, and the switching required for balancing generator output has been centralized in a single control room. Here, central control room operators or powerplant operators regulate all the generating equipment, which in older plants requires specialists such as boiler and turbine operators. Control room operators have several assistants who patrol the plant and check the equipment. Operators report to the plant superintendent or a watch engineer when equipment is not operating properly.



Control room worker checks and records instrument readings.

Watch engineers or shift supervisors (D.O.T. 950.131) oversee the employees who operate and maintain boilers, turbines, generators, transformers, and other machinery and equipment. Watch engineers are supervised by a chief engineer or a plant superintendent who is in charge of the entire plant.

Generally, a nuclear-powered plant requires about the same kind and number of employees as a steam-generating plant powered by coal. However, nuclear plants employ a few additional employees such as health and safety specialists.

Training, Other Qualifications, and Advancement

New powerplant workers generally begin at the bottom of the ladder—usually on cleanup jobs. Such work gives beginners an opportunity to become familiar with the equipment and the operations of a powerplant. They advance to the more responsible job of helper, as openings occur. Formal apprenticeships in these jobs are rare. Applicants generally are required to have a high school or vocational school education.

It takes from 1 to 3 years to become qualified as an auxiliary equipment operator and from 4 to 8 years to become a boiler operator, turbine operator, or switchboard operator. A person learning to be an auxiliary equipment operator progresses from helper to junior operator to operator. A boiler operator generally spends from 2 to 6 months as a laborer before being promoted to the job of helper. Depending on openings and the worker's aptitude, the helper may advance to junior boiler operator and eventually to boiler operator, or transfer to the maintenance department and work up to boiler repairer. Turbine operators advance from the ranks of auxiliary equipment operators and are often selected from other plants.

In many States and large cities, employees who operate equipment in powerplants must be licensed by local or State agencies. While licensing requirements often vary from place to place, the National Institute for the Uniform Licensing of Power Engineers (NIULPE) is attempting to standardize these requirements.

Some powerplant workers employed in atomic-powered electric plants must have special training to work with nuclear fuel, in addition to the knowledge and skills required for conventional steam-generated electric power. All control room operators, assistant control room operators, and some operators of high pressure auxiliary equipment in nuclear powerplants must be licensed by the Nuclear Regulatory Commission.

Where a system has a number of generating plants of different size, operators usually first get experience in the smaller stations and

then are promoted to jobs in the larger stations as vacancies occur.

New workers in the switchboard operators section begin as helpers, advance to junior operators, and then to switchboard operators. Some utility companies promote substation operators to switchboard operating jobs. The duties of both classes of operators have much in common. Switchboard operators can advance to work in the load dispatcher's office.

Watch engineers are selected from among experienced powerplant operators. At least 5 to 10 years of experience as a first-class operator are usually required to qualify for a watch engineer's job.

Employment Outlook

Employment of powerplant operators is expected to increase more slowly than the average for all occupations through the mid-1980's, even though the production of electrical energy will increase at a rapid rate. Although some new jobs will become available, most job openings will occur because of the need to replace workers who retire, die, or leave the industry for other work. People hired by electric power companies are likely to have relatively secure jobs. Even during downturns in the economy these companies seldom lay off employees.

Because of the increased demand for electric power, it will be necessary to build and operate many new generating stations. The use of larger and more efficient equipment, however, will result in a great increase in capacity and production without a corresponding increase in the number of powerplant operators. For example, it takes only one turbine operator to control a turbogenerator regardless of the generator's size. Also, automatic equipment makes it possible for one boiler operator to control several boilers from a central control room.

Earnings and Working Conditions

The earnings of powerplant workers vary by occupation and locality. The following tabulation shows estimated average hourly earnings for selected powerplant occupations in privately owned utilities in 1974.

	Average hourly earnings
Auxiliary equipment operator	$4.80
Boiler operator	6.30
Control room operator	7.00
Switchboard operator:	
Switchboard operator, Class A	6.40
Switchboard operator, Class B	5.95
Turbine operator	6.15
Watch engineer	7.35

A powerplant is typically well-lighted and ventilated, clean, and orderly, but there is some noise from the equipment.

Switchboard operators in the control room often sit at the panel boards, but boiler and turbine operators are almost constantly on their feet. The work of powerplant operators generally is not physically strenuous, particularly in the new powerplants. Since generating stations operate 24 hours a day, 7 days a week, some powerplant employees must work nights and weekends, usually on rotating shifts.

Sources of Additional Information

For information concerning licensing of powerplant employees, contact State and local occupational licensing agencies in your area or write to:

National Institute for Uniform Licensing of Power Engineers, 176 W. Adam St., Suite 1914, Chicago, Ill. 60603.

TRANSMISSION AND DISTRIBUTION OCCUPATIONS

Nature of the Work

One-fourth of the workers in the electric power industry are in transmission and distribution jobs. The principal workers in these jobs are those who control the flow of electricity—load dispatchers and substation operators—and employees who construct and maintain powerlines—line installers and repairers, cable splicers, troubleshooters, ground helpers, and laborers. Line installers and repairers make up the largest single occupation in the industry.

Load dispatchers (D.O.T. 950.168), also called system operators or power dispatchers, control the flow of electricity throughout the area served by the utility. The load dispatcher's room is the nerve center of the entire utility system. From this location, the load dispatcher controls the plant equipment used to generate electricity and directs its flow. Dispatchers telephone instructions to the switchboard operators at the generating plants and the substations, telling them when additional boilers and generators are to be started or stopped so that power production will be in balance with power needs.

The load dispatcher must anticipate demands for electric power so that the system will be prepared to meet them. Power demands on utility systems may change from hour to hour. A sudden afternoon rainstorm may cause a million lights to be switched on in a matter of minutes.

Dispatchers also direct the handling of any emergency situation, such as transformer or transmission line failure, and route current around the affected area. They also may be in charge of interconnections with other systems and direct-

ing transfers of current between systems as the need arises.

The load dispatcher's source of information for the entire transmission system is the pilot board. This board, which dominates the load dispatcher's room, is a complete map of the utility's transmission system. It enables the dispatcher to determine, at a glance, the conditions that exist at any point in the system. Lights may show the positions of switches which control generating equipment and transmission circuits, as well as high voltage connections with substations and large industrial customers. The board also may have several recording instruments which make a graphic record of operations for future analysis and study.

Substation operators (D.O.T. 952.782) generally are responsible for the operation of the substation. Under orders from the load dispatcher, they direct the flow of current out of the station by means of a switchboard. Ammeters, voltmeters, and other types of instruments on the switchboard register the amount of electric power flowing through each line. The flow of electricity from the incoming to the outgoing lines is controlled by circuit breakers. The substation operators connect or break the flow of current by manipulating switchboard levers that control the circuit breakers. In some substations, where alternating current is changed to direct current to meet the needs of special users, the operator controls converters which perform the change.

In addition to switching duties, substation operators check the operating condition of all equipment to make sure that it is working properly. They supervise the activities of the other substation employees on the same shift. In smaller substations, the operator may be the only employee.

Some utilities employ a mobile operator who drives from one automatic station to another, inspecting powerlines, operating controls, and assisting customers' electricians in large commercial or government installations. Since this job requires a considerable degree of independent judgment, the mobile operator is usually more experienced than the substation operator.

Line installers and repairers (D.O.T. 821.381) construct and maintain the network of powerlines that carries electricity from generating plants to consumers. Their work consists of installations, equipment replacements, repairs, and routine maintenance. When wires, cables, or poles break, it means an emergency call for a linecrew. Line repairers splice or replace broken wires and cables and replace broken insulators or other damaged equipment. Most installers and repairers now work from "bucket" trucks with pneumatic lifts that take them to the top of the pole at the touch of a lever. In some power companies, linecrew employees specialize in particular types of work. Those in one crew may work on new construction only, and others may do only repair work.

Trouble shooters (D.O.T. 821.281) are experienced line installers and repairers who are assigned to special crews that handle emergency calls. They move from one job to another, as ordered by a central service office which receives reports of line trouble. Often troubleshooters receive their orders by direct radio communications with the central service office.

These workers must have a thorough knowledge of the company's transmission and distribution

Line installers and repairers construct electric powerlines.

network. They first locate and report the source of trouble and then attempt to restore service by making the necessary repairs. Depending on the nature and extent of the problem, troubleshooters may restore service, or simply disconnect and remove the damaged equipment. They must be familiar with all the circuits and switching points so that they can safely disconnect live circuits.

Ground helpers (D.O.T. 821.887) dig poleholes and help line installers and repairers erect the poles or towers which carry the distribution lines. Line installers bolt crossarms to the poles and bolt or clamp insulators in place on the crossarms. Ground helpers then help the installers raise the wires and cables and install them on the poles by attaching them to the insulators. In addition, with assistance from ground helpers, line installers attach a wide variety of equipment to the poles, such as lightning arrestors, transformers, and switches.

Cable splicers (D.O.T. 829.381) install and repair insulated cables on utility poles and towers, as well as those buried underground or those installed in underground conduits. When cables are installed, the cable splicers pull the cable through the conduit and then join the cables at connecting points in the transmission and distribution systems. At each connection in the cable, they wrap insulation around the wiring. They splice the conductors leading away from each junction of the main cable, insulate the splices, and connect the cable sheathing. Most of the physical work in placing new cables or replacing old ones is done by laborers.

Cable splicers spend most of their time repairing and maintaining cables and changing the layout of the cable systems. They must know the arrangement of the wiring systems, where the circuits are connected, and where they lead to and come from. When making repairs, they must make sure that the conductors do not become mixed up between the substation and the customer's premises. Cable splicers also periodically check insulation on cables to make sure it is in good condition.

Training, Other Qualifications, and Advancement

Load dispatchers are selected from experienced switchboard operators and from operators of large substations. Usually, 7 to 10 years of experience as a senior switchboard or substation operator are required for promotion to load dispatcher. To qualify for this job, an applicant must have knowledge of the entire utility system.

Substation operators generally begin as assistant or junior operators. Advancement to the job of operator in a large substation requires from 3 to 7 years of on-the-job training. About 4 years of on-the-job training are needed to qualify as a skilled line installer and repairer. Some companies have formal apprenticeship programs for line employees. Apprenticeship programs combine on-the-job training with classroom instruction in blueprint reading, elementary electrical theory, electrical codes, and methods of transmitting electrical energy.

Apprentices usually begin training by helping ground helpers set poles in place and by passing tools and equipment up to line installers and repairers. After about 6 months, apprentices begin to do simple linework under close supervision, and progress to more difficult work as they gain experience. The training of line installers and repairers who learn their skills on the job generally is similar to the apprenticeship program; it usually takes about the same length of time, but does not involve classroom instruction. A line installer and repairer may advance to troubleshooter after several years of experience.

Candidates for linework should be strong and in good physical condition since work involving climbing poles and lifting lines and equipment is strenuous. They also must have steady nerves and good balance to work at the top of the poles and to avoid the hazards of live wires and falls.

Most cable splicers get their training on the job, usually taking about 4 years to become fully qualified. Workers begin as helpers and then are promoted to assistant or junior splicers. In these jobs, they are assigned more difficult tasks as their knowledge of the work increases.

Employment Outlook

Several thousand job opportunities are expected to be available in transmission and distribution occupations through the mid-1980's. Most of these opportunities will occur because of the need to replace experienced workers who retire, die, or transfer to other fields of work. Workers hired by electric power companies are likely to have relatively secure jobs. Even during downturns in the economy, these companies seldom lay off employees.

Some increase in the employment of transmission and distribution workers is expected, although employment trends will differ among the various occupations in this category. In spite of the need to construct and maintain a rapidly growing number of transmission and distribution lines, the number of line installers and repairers and troubleshooters is expected to increase only slightly because of the use of more mechanized equipment. A limited increase in the number of cable splicers is expected because of the growing use of underground lines in suburban areas. The need for regular substation operators, however, will be reduced substantially, since the introduction of improved and more

automatic equipment makes it possible to operate more substations by remote control. At the same time, more mobile substation operators will probably be required.

Earnings and Working Conditions

Wages for transmission and distribution workers vary by occupation and geographic location. The following tabulation shows estimated average hourly earnings for major transmission and distribution occupations in privately owned utilities in 1974.

	Average hourly earnings
Ground helper	$4.55
Line installer and repairer	6.75
Load dispatcher	7.10
Substation operator	6.05
Trouble shooter	7.75

Load dispatchers and substation operators generally work indoors in pleasant surroundings. Line installers and repairers, troubleshooters, and ground helpers work outdoors. In emergencies, they may work in all kinds of weather. Cable splicers do most of their work in manholes beneath city streets—often in cramped quarters. Safety standards developed over the years by utility companies, with the cooperation of labor unions, have greatly reduced the hazards of these jobs.

CUSTOMER SERVICE OCCUPATIONS

Nature of the Work

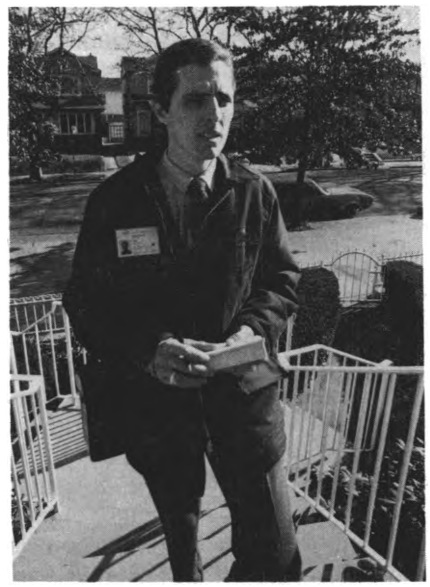
Workers in customer service occupations include people who install, test, and repair meters; meter readers; company agents in rural areas; and appliance repairers.

Electric meter repairers (D.O.T. 729.281) are the most skilled workers in this group. They install, test, maintain, and repair meters on customers' premises. Some repairers can handle all types of meters, including the more complicated ones used in industrial plants and other places where large quantities of electric power are used. Others specialize in repairing the simpler kinds, like those in homes. Often, some of the large systems require specialists, such as *meter installers* (D.O.T. 821.381) and *meter testers* (D.O.T. 729.281). Installers put in and take out meters. Testers specialize in testing the small meters used in homes and some of the more complicated ones used by commercial and industrial customers.

Meter readers (D.O.T. 239.588) go to customers' premises to check meters which register the amount of electric energy used. They record the amount of electricity used in a specific period so that each customer can be charged for the correct amount. They also watch for, and report, any tampering with meters.

District representatives usually serve as company agents in outlying districts which are too small to justify more specialized workers. They collect overdue bills; make minor repairs; and read, connect, and disconnect meters. They receive and send service complaints and reports of line trouble to a central office.

Appliance repairers are discussed in a separate chapter elsewhere in the *Handbook*.



Meter readers go to customer's homes to record electricity used.

Training, Other Qualifications, and Advancement

Meter repairers begin their jobs as helpers in the meter testing and repair departments. Persons entering this field should have a basic knowledge of electricity. About 4 years of on-the-job training are required to become a fully qualified meter repairer. Some companies have formal apprenticeship programs in which the trainee progresses according to a specific plan.

Inexperienced workers can qualify as meter readers after a few weeks of training. Beginners accompany the experienced meter reader on the rounds until they have learned the job.

The duties of district representatives are learned on the job. An important qualification for this occupation is the ability to deal tactfully with the public in handling service complaints and collecting overdue bills.

Employment Outlook

Employment in customer service occupations is expected to show little change through the mid-1980's. The need for meter readers will be limited because of the trend toward less frequent readings. Moreover, automatic meter reading may become more common, and new meters will require less maintenance. However, some job openings for meter repairers and

meter readers will occur each year to replace workers who retire, die, or transfer to other fields of work. People hired by electric power companies are likely to have relatively secure jobs. Even during downturns in the economy, these companies seldom lay off employees.

Earnings and Working Conditions

The earnings of customer service workers vary according to the type of job they have and the section of the country in which they work. The following tabulation shows estimated average hourly earnings for major customer service jobs in privately owned utilities in 1974.

	Average hourly earnings
District representative	$6.90
Meter repairer A	6.15
Meter repairer B	5.45
Meter reader	4.90

OCCUPATIONS IN THE MERCHANT MARINE INDUSTRY

In 1974, the merchant marine industry employed about 50,000 people in a variety of occupations that require different levels of skill and education. Many of these jobs are found only in the merchant marine industry.

Nature and Location of the Industry

The merchant marine consists mainly of private firms that carry foreign and domestic commerce aboard oceangoing vessels. In late 1974, nearly all of the 578 ships in the active fleet were privately owned. The small number of government-owned ships in the merchant marine are operated by the Navy's Military Sealift Command (MSC) and have civilian seafaring personnel.

Nearly three-fifths of the ships in our merchant fleet are freighters. These include general cargo ships and special vessels, such as roll-on-roll-off container ships. About two-fifths of the ships are tankers that carry liquid products, such as oil, mostly between the Nation's Gulf and Atlantic Coast ports. Several ships are combination passenger-cargo carriers.

Many ships operate on a regular schedule to specific ports. Others sail for any port promising cargo. The size of a crew depends on the type of vessel. Cargo ships and tankers have crews varying from 26 to 65 persons; passenger ships may have crews of 300 or more.

Most shoreside employees in the industry work in the country's major port cities, and most officers and sailors have home bases in these cities. The Nation's largest port is New York. Other major Atlantic ports are Boston, Philadelphia, Baltimore, Norfolk, Charleston, Savannah, Tampa, and Jacksonville. Gulf ports that handle large volumes of cargo include New Orleans, Houston, and Galveston. Shipping on the West Coast is concentrated in the areas of San Francisco, Los Angeles, Seattle, and Portland.

Occupations in the Industry

More than half of the merchant marine industry's employees are officers and sailors who make up ship crews. Most of the industry's shoreside employees are dockworkers who load and unload ships. A small number of workers have administrative and clerical jobs.

Ship Crews. The *captain* (D.O.T. 197.168) or master, has complete authority and responsibility for the ship's operation, including discipline, order, and the safety of the crew, passengers, and cargo. Under the supervision of the captain, the work aboard ship is divided among the deck, engine, and steward departments.

Deck officers (D.O.T. 197.133), under orders from the captain, direct the navigation of the ship and the maintenance of the deck and hull. *Boatswains* (D.O.T. 911.131) supervise deck crews and see that deck officers' orders are carried out. *Able seamen* (D.O.T. 911.887) steer the ship and report sightings to the deck officer. *Ordinary*

Deck officer uses sextant to determine ship's position.

seamen (D.O.T. 911.887), the entry rating in the deck department, do general maintenance work such as chipping rust, painting, and splicing and coiling ropes. *Deck utility hands* (D.O.T. 911. 884) and *ship's carpenters* (D.O.T.860.281) also are employed to maintain the ship's deck and hull.

Marine engineers (D.O.T. 197.136) are responsible for starting, stopping, and controlling the speed of the main engines and the operation of all other machinery aboard ship. They also direct sailors, such as oilers and wipers, in the lubrication and maintenance of engines, pumps, and other equipment. *Oilers* (D.O.T. 911.884) lubricate moving parts of mechanical equipment. *Wipers* (D.O.T. 699.887) keep the engineroom and machinery clean. *Firers-watertenders* (D.O.T. 951.885) regulate fuel gauges and the amount of water in the boilers. The ship's *electrician* (D.O.T. 825.281) repairs and maintains electrical equipment, such as generators and motors.

The *chief steward* (D.O.T. 350.138) supervises the preparation of meals and the upkeep of living quarters aboard ship. The *chief cook* (D.O.T.315.131) and assistant cooks prepare meals. *Utility hands* (D.O.T. 318.887) carry food supplies from the storeroom, prepare vegetables, and wash cooking utensils. *Mess attendants* (D.O.T. 350.878) set tables, serve meals, wash dishes, and care for living quarters.

Most ships employ *radio officers* (D.O.T. 193.282), who keep contact with the shore and other ships and maintain the radio equipment. Some cargo ships and all passenger vessels carry *pursers* (D.O.T. 197.168), who prepare the necessary papers to allow ships to enter or leave port.

Occupations aboard ship are discussed in detail elsewhere in the *Handbook* in the statements on merchant marine officers and merchant marine sailors.

Engineering officer records pressure gage readings in engine room.

Dock Workers. Many workers are needed to load and unload ships. Terminal managers are responsible for hiring dockworkers called *stevedores* (D.O.T. 911.883). Gang bosses supervise crews of stevedores who load and unload ships and move cargo in and out of warehouses. Some operate materials handling equipment, such as lift trucks and cranes. Stevedores also position and fasten hose lines to the ship's tanks when loading or unloading liquid cargo, such as chemicals and oil.

Clerical Occupations. The merchant marine industry employs workers in general clerical jobs, such as payroll clerk, secretary, and typist. Other clerical workers have specialized jobs. *Billing clerks* (D.O.T. 219.388) type invoices that list items shipped and dates of shipment. *Clerks and dispatchers, pilot station*, (D.O.T. 219.368) keep records of ships entering ports. *Manifest clerks* (D.O.T. 911.368) compile and type the ship's manifest (a list of passengers and cargo) for use at customhouses or terminals. *Receipt and report clerks* (D.O.T. 911.388) prepare reports on labor and equipment costs for loading and unloading cargoes.

Administrative and Professional Occupations. The merchant marine industry employs a small number of administrative and other office personnel. Executives plan and administer company policy. The industry also employs accountants, lawyers, and labor relations and personnel workers. Some *marine architects* (D.O.T. 001.081) are

employed to oversee the construction and repair of ships.

Training, Other Qualifications, and Advancement

Inexperienced workers may be hired as stevedores to load and unload cargo. Applicants must be in good physical condition. A high school education is preferred but not required. Under the guidance of experienced workers, stevedores can learn their jobs in a few weeks. As vacancies occur, they can advance to jobs such as lift truck operator and crane operator. Workers who have supervisory ability may become gang bosses.

No educational requirements are established for jobs aboard ship, but a good education is an advantage. Formal training for officers is conducted at the U.S. Merchant Marine Academy, at five State merchant marine academies, and through programs operated by trade unions. Unions also conduct training programs to upgrade the ratings of sailors.

To obtain an officer's license, a candidate must be a U.S. citizen, physically fit, and pass a written examination administered by the U.S. Coast Guard. Sailors also must obtain licenses (merchant mariner's document) from the Coast Guard. Applicants are required to pass a physical examination and present proof that they have a job offer aboard a U.S. merchant vessel.

Persons who are considering a career at sea must be able to live and work with others as a team. Although peace-time service is relaxed, they must adjust to some military-like discipline that is essential because of the nature of shipboard life.

Most general clerical occupations, such as secretary or bookkeeper, usually require the completion of basic commercial courses in high school or business school. Additional on-the-job training is necessary for specialized clerical occupations, such as manifest clerk and receipt and report clerk.

Administrative positions usually are filled by college graduates who have degrees in business administration, marketing, accounting, industrial relations, or other specialized fields. A knowledge of the merchant marine industry is helpful. Marine architects must be licensed professionals. Requirements for licensing are set by the individual States and generally include graduation from an accredited professional school followed by 3 years of practical experience in an architect's office.

Employment Outlook

Employment in the merchant marine industry is expected to decline through the mid-1980's. Nevertheless, some openings will arise each year from the need to replace experienced workers who retire, die, or transfer to other fields.

Because of substantially higher shipbuilding and labor costs, our merchant fleet finds it difficult to compete in the world shipping market. To insure that our country has a merchant fleet operating in regular or essential trade routes, the Government subsidizes many ships. In 1970, the Government also passed a law which would subsidize the construction of 30 new ships annually over a 10-year period and to improve tax incentives for firms to buy new ships. Despite this support, the size of our merchant fleet probably will not grow significantly, since the number of ships to be built is expected to only slightly exceed the number of older vessels taken out of service.

Little or no change in the employment of ship's officers is expected over the long run. Employment of sailors, on the other hand, is expected to decline because new ships are equipped with laborsaving innovations, such as automated enginerooms, which reduce the need for these workers.

Employment trends also will vary among shoreside occupations. The greater use of containerized cargo ships and improvements in materials handling equipment will reduce the need for stevedores. Employment in administrative and clerical occupations, on the othe hand, is not expected to change significantly.

Earnings and Working Conditions

Stevedores working along the Atlantic and Gulf Coasts earned $6.80 an hour in 1974, and those on the Pacific Coast earned $6.50 an hour. Stevedores also earn extra pay for handling hazardous cargo.

Earnings aboard ships are relatively high; most officers earned a base pay of about $1,350 a month in 1974. Sailors who have advanced a rung or two in rating could receive a base pay of nearly $700 a month. In addition, both officers' and sailors' earnings are supplemented by premium pay for overtime or for assuming extra responsibilities. On the average, additional payments for assuming extra work or responsibility add about 50 percent to base pay. Shipboard workers also receive free meals and lodging while at sea.

Since ship's crewmembers and stevedores are subject to occasional layoff, however, their annual earnings usually are not as high as the hourly rates and monthly salaries would imply.

Most shoreside workers in the industry work a 5-day, 40-hour week. The workweek for people aboard ships is considerably different. Most officers and sailors are required to stand watch, working split shifts around the clock. Generally, they work two 4-hour shifts during every 24-hour period and have 8 hours off between each shift. Other officers and sailors are on duty 8 hours a day, Monday through Friday.

The merchant marine industry provides excellent fringe benefits. Most employers provide paid vacations and holidays. Vacations for sailors and officers range from 90 to 180 days a year. Many firms also provide other benefits such as life, health, and accident insurance. Officers and sailors may retire on full pension after 20 years of service, regardless of age. Stevedores are eligible for pension at age 65.

Working and living conditions aboard ship have improved over the years. Mechanization has reduced the physical demands, and newer vessels have private rooms, air-conditioning, television, and better recreational facilities. However, life aboard ship is confining, and since voyages last several weeks or months, officers and sailors are away from their homes and families much of the time. Some tire of the lengthy separations and choose shoreside employment. However, for many people, the spirit and adventure of the sea, good wages, and fringe benefits more than compensate for the disadvantages.

The duties aboard ship are hazardous compared with other industries. At sea, there is always the possibility of injury from falls or the danger of fire, collision, or sinking. Most shoreside jobs are not hazardous, but stevedores may do heavy lifting and risk injury from falling boxes and other freight when loading and unloading ships.

Most employees are union members. All stevedores are represented by either the International Longshoremen's Association or the International Longshoremen's and Warehousemen's Union. Most officers aboard ships are represented by the International Organization of Masters, Mates and Pilots; and the National Marine Engineers Beneficial Association. Sailors are members of the National Maritime Union of America and the Seafarers' Union.

Sources of Additional Information

For general information about jobs in the merchant marine, write to:

Office of Maritime Manpower, Maritime Administration, U.S. Department of Commerce, Washington, D.C. 20235.

Information about job openings and wages aboard ships can be obtained from local maritime unions. If such a union is not listed in the local telephone directory, contact:

National Maritime Union of America, 36 Seventh Ave., New York, N.Y. 10011.

Seafarers' International Union of North America, 675 Fourth Ave., Brooklyn, N.Y. 11232.

National Marine Engineers, Beneficial Association, 17 Battery Pl., New York, N.Y. 10004.

Further information about stevedore jobs is available from:

International Longshoremen's Association (AFL-CIO), 17 Battery Pl., New York, N.Y. 10004.

International Longshoremen's and Warehousemen's Union (AFLCIO), 150 Golden Gate Ave., San Francisco, Calif. 94102.

OCCUPATIONS IN RADIO AND TELEVISION BROADCASTING

The glamor and excitement of radio and television make broadcasting careers attractive to many people. In 1974 about 120,000 full-time and 30,000 part-time workers were employed in broadcasting; slightly more than half were in radio and the rest were in television. In addition, several thousand freelance performers, such as writers, performers, and musicians, work on a contract basis for stations, networks, and other producers. Several thousand other employees work for independent producers in activities closely related to broadcasting, such as the preparation of filmed and taped programs and commercials.

Broadcasting stations offer a variety of interesting jobs in all parts of the country. Opportunities for entry jobs are best at stations in small communities, although the highest paying jobs are in large cities, especially those with national network stations.

Nature and Location of the Industry

In 1974 about 7,000 commercial radio stations and 700 commercial television stations were in operation in the United States.

Most commercial radio broadcasting stations are small, independent businesses. The average station employs about 11 full-time and 4 part-time workers. Television stations are generally larger, and average about 75 full-time and 10 part-time employees.

Commercial radio stations are served by nine nationwide networks and a large number of regional networks. Stations can affiliate with networks by agreeing to broadcast their programs on a regular basis. The seven national radio networks employed approximately 2,500 workers in 1974.

Most television stations depend on 1 of 3 national television networks for programs that would be too expensive for individual stations to originate—for example, sports events, such as baseball games, or newscasts of national and international significance. These networks, in turn, can offer national coverage to sponsors. As many as 200 stations across the country may carry a network television show. In 1974 the three national networks employed about 18,000 workers, or almost 3 of every 10 staff employees in commercial television. Most network programs originate in New York City or Los Angeles.

In addition to commercial broadcasting stations, there were about 700 educational radio stations (mainly FM) and 220 educational television stations in 1974. These stations are operated principally by educational agencies such as State commissions, local boards of education, colleges and universities, and special community public television organizations. Educational stations employed more than

Announcers read prepared news reports on the air.

8,000 full-time and over 3,000 part-time workers in 1974.

There were also about 3,150 cable TV systems (CATV) employing about 9,500 workers in 1974.

Broadcasting Occupations

About half of all employees in the broadcasting industry hold professional and technical jobs, such as staff announcers, news persons, writers, or broadcast technicians. Clerical and sales workers make up an additional one-fourth, and managerial personnel make up about one-seventh. Many of the remaining employees are craft workers, such as electricians and carpenters.

Jobs vary greatly between small and large stations. In small stations, the station manager, who frequently is the owner, may act as sales manager, or perhaps as program director, announcer, and copywriter. Announcers in small stations may do their own writing, operate the studio control board, and do sales work. The engineering staff may consist of only one full-time broadcast technician assisted by workers from the other departments. In large radio and television stations, jobs are more specialized and usually confined to 1 of 4 departments: programming, technical, sales, or administrative. The kinds of jobs found in each of these departments are described in the following paragraphs.

Programming Department. Staff employees produce daily and weekly shows, assign personnel to cover special events, and provide general program services such as sound effects and lighting. In addition to these staff employees, freelance performers, writers, singers, and other entertainers are hired for specific broadcasts, a series of broadcasts, or for special assignments.

The size of a station's programming department depends on the extent to which its broadcasts are live, recorded, or received from a network. In a small station, a few people make commercial announcements, read news and sports summaries, select and play recordings, and introduce network programs. In a large station, on the other hand, the program staff may consist of a large number of people in a wide variety of specialized jobs.

Program directors are responsible for the overall program schedules of large stations. They arrange for a combination of programs that will effectively meet the needs of advertisers and at the same time be attractive and interesting to the audience.

Traffic managers prepare daily schedules of programs and keep records of broadcasting time available for advertising. *Continuity directors* are responsible for the writing and editing of all scripts. They may be assisted by *continuity writers*, who prepare announcers' books ("copy") which contain the script and commercials for each program along with their sequence and length.

Directors plan and supervise individual programs or series of programs. They coordinate the shows, select artists and studio personnel, schedule and conduct rehearsals, and direct on-the-air shows. They may be assisted by *associate directors*, who work out detailed schedules and plans, arrange for distribution of scripts and changes in scripts to the cast, and help direct on-the-air shows. Some stations employ *program assistants* to aid directors and associate directors. Assistants help assemble and coordinate the various parts of the show. They arrange for props, makeup service, artwork, and film slides and assist in timing. They cue the performers, using cue cards prepared from scripts.

Community and public affairs directors are a link between the station and schools, churches, citizen groups, and civic organizations. They supervise, write, and host public affairs programs.

In large stations, directors may work under the supervision of a *producer*, who selects scripts, controls finances, and handles other production problems. Many times these functions are combined in the job of *producer-director*.

Announcers are the largest and best known group of program workers. Announcers introduce programs, guests, and musical selections and deliver most of the live commercial messages. In small stations, they also may operate the control board, sell time, and write commercial and news copy. Broadcast announcers are discussed in detail elsewhere in the *Handbook*.

Music is an important part of radio programming. Both small and large stations use recordings and transcriptions to provide musical programs and background music for other shows. Large stations, which have extensive music libraries, sometimes employ *music librarians* to maintain music files and answer requests for any particular selection of music. The networks have specialized personnel who plan and arrange for musical services. *Musical directors* select, arrange, and direct music for programs following general instructions from program directors. They select musicians for live broadcasts and direct them during rehearsals and broadcasts. Musicians are generally hired on a freelance basis.

News gathering and reporting is a key aspect of radio and television programming. *News directors* plan and supervise all news and special events coverage. *Newscasters* broadcast daily news programs and report special news events on the scene. *Newswriters* select and write copy for newscasters to read on the air. In small stations, the jobs of newscaster and newswriter often are combined.

Stations that originate live television shows must have staff members who take care of staging the programs. *Studio supervisors* plan and supervise the setting up of scenery

and props. *Floor managers* plan and direct the performers' positions and movements on the set according to directors' instructions. The jobs of studio supervisor and floor manager often are combined. *Property handlers* set up props, hold cue cards, and do other unskilled chores. *Makeup artists* prepare personnel for broadcasts by applying cosmetics. *Scenic designers* plan and design settings and backgrounds for programs. They select furniture, draperies, pictures, and other props to help convey the desired visual impressions. *Sound effects technicians* operate special equipment to simulate sounds, such as gunfire or rain.

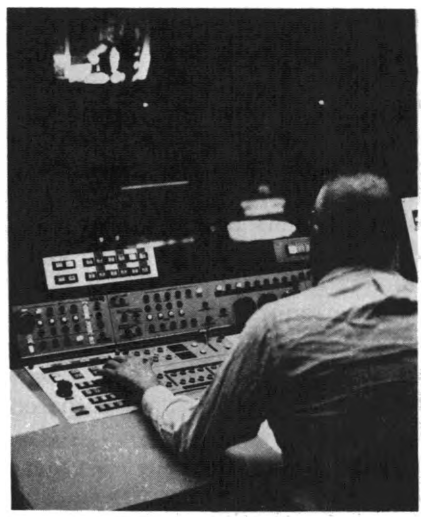
Almost all commercial television programming is recorded either on film or video tape. Broadcast technicians make video tape recordings on electronic equipment that permits instantaneous playback of a performance. Video tape is used to record live shows and to prerecord programs for future broadcasts. Many stations employ specialized staff members to take care of filmed program material. *Film editors* edit and prepare all film for on-the-air presentation. They screen all films received, cut and splice films to insert commercials, and edit locally produced film. *Film librarians* catalogue and maintain files of motion picture film.

Technical Department. Technicians position microphones, adjust levels of sound, keep transmitters operating properly, and move and adjust lights and television cameras to produce clear, well-composed pictures. They also install, maintain, and repair the many types of electrical and electronic equipment required for these operations.

Most stations employ *chief engineers*, who are responsible for all engineering matters, including supervision of technicians. In small stations, they also may work at the control board and repair and maintain equipment. Large stations have engineers who specialize in fields such as sound recording, maintenance, and lighting. Networks employ a few *development engineers* to design and develop new electronic apparatus to meet special problems.

Broadcast technicians have many jobs. For example, they control the operation of the transmitter to keep the level and frequency of broadcast within legal requirements. They also set up, operate, and maintain equipment in the studio and in locations where remote broadcasts are to be made. (Further information on broadcast technicians is given elsewhere in the *Handbook*.)

Sales Department. Sales representatives, the largest group of workers in this department, sell advertising time to sponsors, advertising agencies, and other buyers. They must have a thorough knowledge of the station's operations, programming, and the characteristics of the people in the area it serves. The latter includes population, number of radio and television sets in use, income levels, and consumption patterns. Sales representatives in large stations often work closely with sponsors and advertising agencies. Many stations sell a substantial part of their time, particularly to national advertisers, through independent advertising agencies.



Broadcast technician regulates quality of picture.

Large stations generally have several workers who do only sales work. The sales manager supervises them, and also may handle a few of the largest accounts personally. Some large stations employ statistical clerks and research personnel to help analyze and report market information on the community served.

Business Management. In a very small station, the owner and a secretary may handle all the record-keeping, accounting, purchasing, hiring, and other routine office work. If the size of the station warrants full-time specialists, the business staff may include accountants, publicity specialists, personnel workers, and other professional workers. They are assisted by office workers, such as stenographers, typists, bookkeepers, clerks, and messengers.

Training, Other Qualifications, and Advancement

A high school diploma is the minimum educational requirement for most entry jobs in broadcasting, although for some jobs college training is preferred. A liberal arts education is a good qualification for the beginner because broadcasters need people with knowledge and interests in many areas. Television programming for networks and large independent stations generally requires a college degree and some experience in broadcasting.

Some young people without specialized training or experience get their start in broadcasting in jobs such as clerk, typist, property handler, or assistant to an experienced worker. As these new workers gain knowledge and experience, they have the chance to advance to more

responsible jobs. A few people get started in broadcasting with temporary jobs in the summer when regular workers go on vacation and broadcast schedules of daylight-hours stations are increased.

Technical training in electronics is required for entry jobs in engineering departments. The chief engineer of a television or radio station and any employee who adjusts a broadcast transmitter must have a Federal Communications Commission (FCC) Radiotelephone First Class Operator License. In addition, anyone who operates a radio broadcast transmitter must have at least an FCC Radiotelephone Third Class Operator License. To obtain these licenses, an applicant must pass a series of technical examinations given by the FCC. Small radio stations with only a few employees sometimes prefer to have as many staff members as possible who are legally qualified to operate their transmitters. Because of this, nontechnicians, especially announcers, have a better chance of getting a job in radio if they have a first- or third-class license. A course in electronics at a recognized technical institute is probably the best way to prepare for the FCC test. In addition, high school courses in electronics, mathematics, and physics are often helpful to persons who plan to pursue careers as broadcast technicians.

Entry jobs as announcers in small stations usually do not require specific training or experience, but an applicant must have a good voice, a broad cultural background, and other characteristics that make a dramatic or attractive personality. Courses in speech, English, social science, drama, and electronics are helpful to persons seeking careers as announcers. In addition, college campus radio experience, summer and part-time employment at local stations, and a good knowledge of the commercial industry are all highly regarded as backgrounds. Qualifications for administrative and sales jobs in broadcasting are similar to those required by other employers; a business course program of study in high school or a college degree in business or management is good preparation for such jobs.

Most beginners start out in small stations. Although these stations cannot pay high salaries, they offer opportunities to learn the different phases of broadcasting work because they generally use personnel in combination jobs. For example, an announcer may perform some of the duties of a broadcast technician.

People in the technical department tend to remain in this area of work, where thorough training in electronics is essential. Program employees usually remain in programming work, although sometimes transfers to and from the sales and business departments are made. Transfers are easier between sales and business departments because of their close working relationship; in fact, in the small stations, they are often merged into one department. Although transfers of experienced workers between departments are limited to the extent noted, these distinctions are less important in beginning and top-level jobs. At the higher levels, a station executive may be drawn from top-level personnel of any department.

Many radio and television station managers consider training in a private vocational school to be helpful for people interested in careers in the broadcasting industry. However, before enrolling in any vocational broadcasting school, prospective students should contact employers and broadcasting trade organizations in their area to determine the school's performance in producing suitably trained candidates.

Employment Outlook

Employment in the broadcasting industry is expected to grow faster than the average for all industries through the mid-1980's. Besides the job openings from growth, many openings will result from the need to replace experienced workers who retire, die, or leave the industry for other reasons. Competition will be very keen for entry jobs, especially in the large cities, because of the attraction this field has for young people.

New radio stations are expected to open, particularly in small communities, and will offer opportunities for some additional workers. In existing radio stations, however, technological developments will limit employment growth. For example, automatic programming equipment permits radio stations to provide virtually unattended programming.

The number of educational television stations is expected to increase as private and government groups continue to expand in this area. The growth of educational stations will increase job opportunities, especially in programming, engineering, and station management.

Cable television (CATV) has emerged as a powerful new force in communications, and some additional job opportunities for professional, technical, and maintenance workers will be created as CATV systems increasingly originate and transmit programs. Many of these new jobs will be in small cities where most CATV systems are located to improve television reception in rural areas. By using cables instead of airwaves, CATV can offer customers a larger selection of stations plus many additional programs produced specifically for cable television.

Earnings and Working Conditions

In 1974 earnings of nonsupervisory broadcasting workers averaged $5.02 an hour, nearly one-fifth more than the average for

nonsupervisory workers in private industry, except farming. Salaries range widely among occupations and locations in the broadcasting industry. Employees in large cities generally earn much more than those in the same kinds of jobs in small towns. Wages also tend to be higher in large stations than in small ones, and higher in television than in radio.

Most full-time broadcasting employees have a scheduled 40-hour workweek; employees in many small stations work longer hours. Sales and business employees generally work in the daytime hours common to most office jobs. However, program and engineering employees must work shifts which may include evenings, nights, weekends, and holidays. To meet a broadcast deadline, program and technical employees in the networks may have to work continuously for many hours under great pressure.

Several unions operate in the broadcasting field. They are most active in the network centers and large stations in metropolitan areas. The National Association of Broadcast Employees and Technicians and the International Brotherhood of Electrical Workers both organize all kinds of broadcasting workers, although most of their members are technicians. The International Alliance of Theatrical Stage Employees and Moving Picture Machine Operators organizes various crafts, such as stagehands, sound and lighting technicians, wardrobe attendants, makeup artists, and camera operators. Many announcers and entertainers are members of the American Federation of Television and Radio Artists. The Directors Guild of America, Inc. (Ind.) organizes program directors, associate directors, and stage managers. The Screen Actors Guild, Inc., represents the majority of entertainers who appear on films made for television.

Sources of Additional Information

For general information about careers in radio and television broadcasting, write to:

National Association of Broadcasters, 1771 N St. NW., Washington, D.C. 20036.

For information about college courses in television broadcasting, contact:

Executive Secretary, Broadcasting Education Association, National Association of Broadcasting, 1771 N St. NW., Washington, D.C. 20036.

For general information about careers in public radio and television broadcasting, write to:

Corporation for Public Broadcasting, 888 16th St. NW., Washington, D.C. 20006.

OCCUPATIONS IN THE RAILROAD INDUSTRY

The railroads, with their network of more than 200,000 miles of line reach into all parts of the country. In 1974, they carried over one and a half billion tons of freight and 274 million passengers.

Trains are one of the most efficient methods of transporting large amounts of freight over distances exceeding several hundred miles. Locomotives can pull thousands of tons of cargo using fewer employees and far less fuel than trucks and airplanes.

With 560,000 workers in 1974, the railroads were one of the Nation's largest employers. Railroad workers operate trains, build and repair equipment and facilities, provide services to customers, and collect and account for revenue. In most of these jobs, seniority systems prevail with workers starting at the bottom and working their way up.

Nature and Location of the Industry

The railroad industry is made up of "line-haul" railroad companies that transport freight and passengers, and switching and terminal companies that provide line-haul railroads with services at some large stations and yards.

About 95 percent of all railroad employees work for line-haul companies that handle about 99 percent of the industry's business. The remainder work for switching and terminal companies. Most railroad revenue and employment comes from freight. Passenger service has declined substantially in the past 30 years.

Railroad workers are employed in every State except Hawaii. Large numbers work at terminal points where the railroads have central offices, yards, and maintenance and repair shops. Chicago, the hub of the Nation's railroad network, has more railroad employees than any other area. Many employees also work at the major railroad operations centered near New York, Los Angeles, Philadelphia, Minneapolis, Pittsburgh, and Detroit.

Railroad Occupations

Railroad workers can be divided into four main groups: Operating employees; station and office workers; equipment maintenance workers; and property maintenance workers.

Operating employees make up almost one-third of all railroad workers. This group includes locomotive engineers, conductors, and brake operators. Whether on the road or at terminals and railroad yards, they work together as traincrews. Also included are switchtenders who help conductors and brake operators by throwing track switches in railroad yards and hostlers who fuel, check, and deliver locomotives from the engine house to the crew.

One-fourth of all railroad workers are station and office employees who direct train movements and handle the railroads' business affairs. Professionals such as managers, accountants, statisticians, and systems analysts do administrative and planning work, while clerks keep records, prepare statistics, and handle business transactions such as collecting bills and adjusting claims. Agents manage the business affairs of the railroad station. Telegraphers and telephoners pass on instructions to traincrews and help agents with clerical work.

More than one-fifth of all railroad employees are *equipment maintenance workers*, who service and repair locomotives and cars. This group includes car repairers, machinists, electrical workers, sheet-metal workers, boilermakers, and blacksmiths.

Property maintenance workers, who make up about one-sixth of all railroad employees, build and repair tracks, tunnels, signals, and other railroad property. Track workers repair tracks and roadbeds. Bridge and building workers construct and repair bridges, tunnels, and other structures along the right-of-way. Signal workers install and service the railroads' vast network of signals, including highway crossing protection devices.

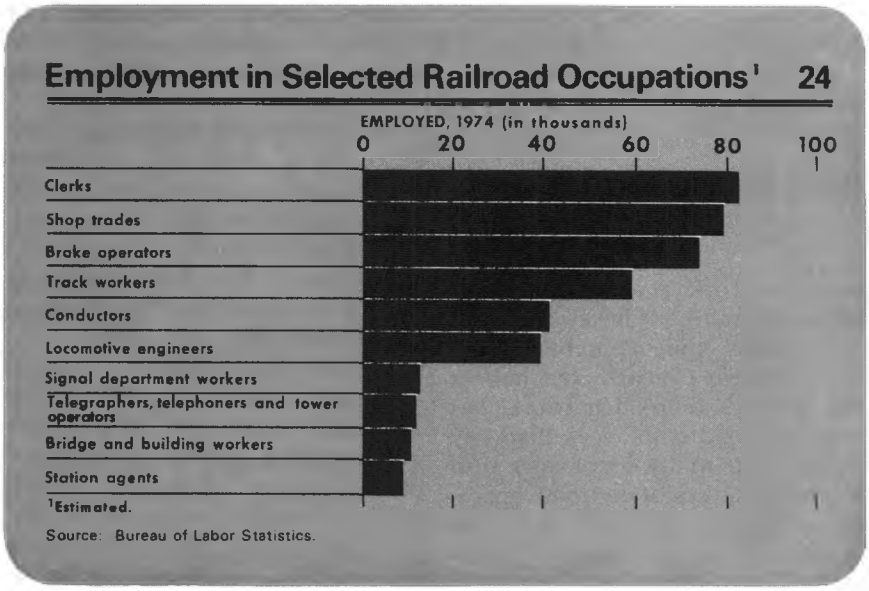
The accompanying chart shows the number of workers in major railroad occupations in 1974. Detailed information about some of these occupations is given elsewhere in the *Handbook*.

Training, Other Qualifications, and Advancement

Most beginning railroad workers are trained on the job by experienced employees. Training for some office and maintenance jobs is available in high schools and vocational schools. Universities and technical schools offer courses in accounting, engineering, traffic management, transportation, and other subjects which are valuable to professional and technical workers.

New employees in some occupations, especially those in operating service jobs such as locomotive engineer, start as "extra board" workers. They substitute for regular workers who are on vacation, ill, or absent for other reasons. They also may be called when railroad traffic increases temporarily or seasonally.

Extra board workers with enough



seniority move to regular assignments as they become available. The length of time on the extra board varies according to the number of available openings. Some workers do not receive regular assignments for many years.

Beginners in shop trades usually are high school graduates with no previous experience, although some shop laborers and helpers are promoted to the trades. Shopworkers serve apprenticeships that last 3 to 4 years, depending on how much previous work experience the apprentice has.

Most applicants for railroad jobs must pass physical examinations. Those interested in traincrew jobs need excellent hearing and eyesight. Color-blind persons are not hired as locomotive engineers or brake operators or for any other jobs that involve interpreting railroad signals.

Railroad workers are promoted on the basis of seniority and ability. Job openings are posted on bulletin boards and workers may bid for them. The worker highest on the seniority list usually gets the job. To be promoted, however, workers may have to qualify by passing written, oral, and practical tests. Advancement in train and engine jobs is along established lines. All conductors, for example, are chosen from qualified brake operators.

Besides determining advancement procedures, seniority also gives workers some choice of working conditions. A telegrapher, for instance, may have to work several years on the night shift at out-of-the-way locations before finally getting a day shift assignment near home.

Employment Outlook

The longrun decline in railroad employment is expected to continue through the mid-1980's, but at a decreasing rate. Nevertheless, thousands of job opportunities will develop each year as the industry replaces some experienced workers who retire, die, or transfer to other fields of work.

Despite an expected increase in freight traffic, railroad employment will decline, mainly as a result of increased worker productivity due to technological innovations. For example, as automatic classification systems are installed in more yards, fewer yard workers will be needed to assemble and disassemble trains. The installation of wayside scanners, which identify cars electronically, will reduce the need for clerical workers.

Most people working in passenger service may eventually work for AMTRAK, the National Railroad Passenger Corporation, created in 1971 to revive passenger service trains. However, it will take years to carry out the AMTRAK program, and it is too early to determine its effect on these jobs.

Earnings and Working Conditions

Nonsupervisory railroad employees averaged $5.68 an hour in 1974, about one-third higher than the average for all nonsupervisory workers in private industry, except farming. Earnings of railroad workers vary widely, however, depending on the occupation. For example, in 1974 average hourly earnings for locomotive engineers in passenger service were $10.55; for freight service brake operators $6.73; for railway clerks, $5.61; and for track gang members, $4.95. Regional wage differences are much less in railroading than in other industries because of nationally negotiated labor contracts.

Most railroad employees work a 5-day, 40-hour week, and receive premium pay for overtime. However, operating employees, station agents, and telegraphers and telephoners often work nights, weekends, and holidays. Extra board workers may be called at any time. Bridge and building workers, signal installers, and track workers may work away from home for days at a time.

Sources of Additional Information

Additional information about occupations in the railroad industry may be obtained from local railroad offices. For general information about the industry, write to:

Association of American Railroads, American Railroads Building, 1920 L St. NW., Washington, D.C. 20036.

OCCUPATIONS IN THE TELEPHONE INDUSTRY

About 600 million local and long distance telephone calls are made daily in the United States and overseas. In 1974, approximately 975,000 employees provided this daily service.

The telephone industry offers steady, year-round employment in many different jobs. Some jobs, such as telephone operator and file clerk, can be learned in a few weeks; others, such as installer and repairer, require many months.

Nature and Location of the Industry

Providing telephone service for the many millions of residential, commercial, and industrial customers is the main work of the Nation's telephone companies. More than 144 million telephones were in use in the United States in 1974.

Telephone jobs are found in almost every community. Most telephone workers, however, work in cities having large concentrations of industrial and business establishments. The nerve center of the local telephone system is the central office that has the switching equipment through which a telephone may be connected with any other telephone. Every call travels from the caller through wires and cables to the cable vault in the central office. Thousands of pairs of wires fan out from the cable vault to a distributing frame where each set of wires is attached to switching equipment. Electromechanical and electronic switching equipment make connections automatically. In a few remaining switchboards and in unusual situations an operator makes the connection.

Some customers make and receive more calls than a single telephone line can handle. For this larger volume of calls, a system somewhat similar to a miniature central office may be installed on the customer's premises. This system is the private branch exchange (PBX), usually found in office buildings, hotels, department stores, and other business firms.

A newer type of service is called CENTREX, in which incoming calls can be dialed to any extension without an operator's assistance, and outgoing and intercom calls can be dialed by the extension users. This equipment can be located either on telephone company premises or on the customer's premises. CENTREX is currently replacing PBX in popularity among business and industrial users which handle a very large volume of calls. However, PBX is still more popular with smaller users.

Other communications services provided by telephone companies include conference equipment installed at a PBX to permit conversations among several telephone users simultaneously; mobile radiotelephones in automobiles, boats, airplanes and trains; and telephones equipped to answer calls automatically and to give and take messages by recordings.

Telephone companies also build and maintain most of the vast network of cables and radio-relay systems for communications services, including those joining the thousands of broadcasting stations all over the Nation. These services are leased to networks and their affiliated stations. Telephone companies also lease data and private wire services to business and government offices.

The Bell System owns about 4 out of 5 of the Nation's domestic telephones. Independent telephone companies own the remainder. There are approximately 1,655 independent telephone companies in the United States. General Telephone and Electronics Corp. in Stamford, Conn., United Utilities, Inc. in Kansas City, and Continental Telephone Corp. in Chantilly, Va. service about 2 out of every 3 telephones owned by independent companies.

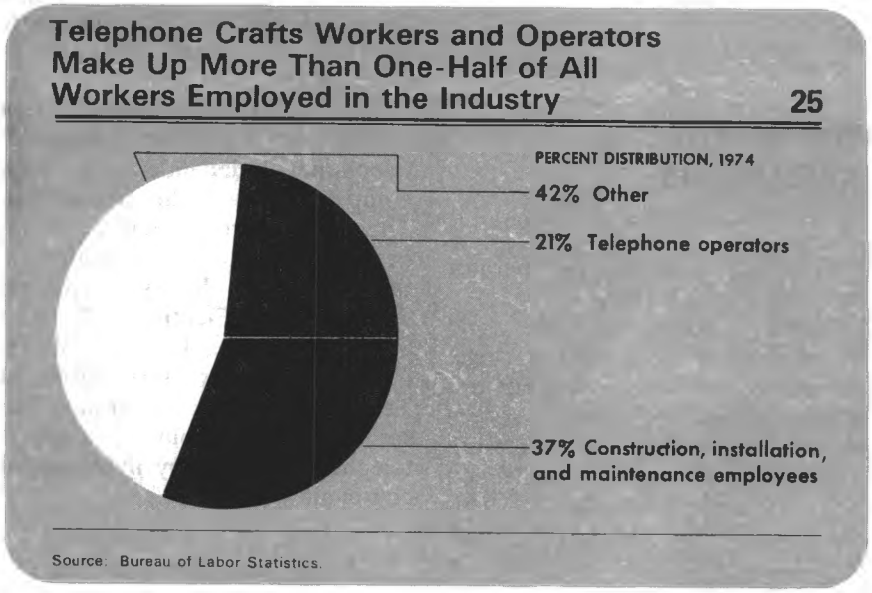
Telephone Occupations

Although the telephone industry requires workers in many different occupations, telephone craft workers and operators make up more than one-half of all workers. (See accompanying chart.)

Telephone craft workers install, repair, and maintain telephones, cables, switching equipment, and message accounting systems. These workers can be grouped by the type of work they perform: construction workers place, splice, and maintain telephone wires and cables; installers and repairers place, maintain, and repair telephones and private branch exchanges (PBX) in homes and offices and other places of business; and central office craft workers test, maintain, and repair equipment in central offices.

Operators make telephone connections; assist customers in specialized services, such as reverse-charge calls; and give telphone information. Detailed discussions of telephone craft occupations and telephone and PBX operators are presented elsewhere in the *Handbook*.

More than one-fifth of all telephone industry employees are clerical workers. They include stenographers, typists, book-



keepers, office machine and computer operators, keypunch operators, cashiers, receptionists, file clerks, accounting and auditing clerks, and payroll clerks. Clerical workers keep records of services, make up and send bills to customers, and prepare statistical and other reports.

About one-tenth of the industry's employees are professional workers. Many of these are scientific and technical personnel such as engineers and drafters. Engineers plan cable and microwave routes, central office and PBX equipment installations, new buildings, the expansion of existing structures, and solve other engineering problems.

Some engineers also engage in research and development of new equipment. Many top managers and administrators have engineering backgrounds. Other professional and technical workers are accountants, personnel and labor relations workers, public relations specialists and publicity writers, computer systems analysts, computer programmers, and lawyers.

Nearly one-tenth of the industry's employees are business and sales representatives who sell new communications services, directory advertising, and handle requests for installing or discontinuing telephone service.

About 3 percent of the industry's workers maintain buildings, offices, and warehouses; operate and service motor vehicles; and do other maintenance jobs in offices and plants. Skilled maintenance workers include stationary engineers, carpenters, painters, electricians, and plumbers. Other workers employed by the telphone industry are janitors, porters, and guards.

Employment Outlook

Telephone industry employment is expected to increase about as fast as the average for all industries through the mid-1980's. In addition to the jobs from employment growth, tens of thousands of openings will arise each year because of the need to replace experienced workers who retire, die, or leave their jobs for other reasons.

Employment will grow primarily because rising population and higher incomes will increase the need for telephone service. Greater demand for transmission of computer-processed data and other information via telephone company lines also will stimulate employment growth. Laborsaving innovations, however, will keep employment from growing as rapidly as telephone service.

Employment of telephone operators is expected to decline slightly. If the trend in the number of telephone companies charging customers for directory assistance calls continues, more people will dial numbers direct and use telephone directories to locate needed numbers, thus reducing the need for operators. Technological innovations will restrict employment growth in some skilled crafts. For example, mechanical improvements, such as pole-lifting equipment and earth-boring tools, will limit employment of line installers by increasing their efficiency. On the other hand, new technology is expected to increase the demand for engineering and technical personnel, especially electrical and electronic engineers and technicians, computer programmers, and systems analysts. Employment in administrative and sales occupations will rise as telephone business increases.

Earnings and Working Conditions

In 1974 earnings for nonsupervisory telephone employees averaged $5.08 an hour. In comparison, nonsupervisory workers in all private industries, except farming, averaged $4.22 an hour.

In early 1974, basic rates ranged from an average of $3.40 an hour for telephone operator trainees to $9.56 for professional and semiprofessional workers.

A telephone employee usually starts at the minimum wage for the particular job. Advancement from the starting rate to the maximum rate generally takes 5 years, but operators and clerical employees of some companies may reach the maximum rate in 4 years.

More than two-thirds of the workers in the industry, mainly telephone operators and craft-

workers, are members of labor unions. The two principal unions representing workers in the telephone industry are the Communications Workers of America and the International Brotherhood of Electrical Workers, but many other employees are members of the 13 independent unions which form the Alliance of Independent Telephone Unions.

Union contracts govern wage rates, wage increases, and the amount of time required to advance from one step to the next for most telephone workers. The contracts also call for extra pay for work beyond the normal 6 to 8 hours a day, or 5 days a week, and for all Sunday and holiday work. Most contracts provide a pay differential for night work.

Overtime work sometimes is required, especially during emergencies, such as floods, hurricanes, or bad storms. During an "emergency call-out," which is a short-notice request to report for work during nonscheduled hours, workers are guaranteed a minimum period of pay at the basic hourly rate. Travel time between jobs is counted as worktime for craft workers under some contracts.

Paid vacations are granted according to length of service. Usually, contracts provide for a 1-week vacation beginning with 6 months of service; 2 weeks for 1 to 7 years; 3 weeks for 8 to 15 years; 4 weeks for 16 to 24 years; and 5 weeks for 25 years and over. Depending on locality, holidays range from 9 to 11 days a year. Most telephone workers are covered by paid sick plans and group insurance which usually provide sickness, accident, and death benefits, and retirement and disability pensions.

The telephone industry has one of the best safety records in American industry. The number of disabling injuries has been well below the average.

Sources of Additional Information

More details about employment opportunities are available from the telephone company in your community or local offices of the unions that represent telephone workers. If no local union is listed in the telephone directory write to:

Alliance of Independent Telephone Unions, P.O. Box 5462, Hamden, Conn. 16518.

Communication Workers of America, 1925 K St. NW., Washington, D.C. 20006.

International Brotherhood of Electrical Workers, 1200 15th St. NW., Washington, D.C. 20005.

United States Independent Telephone Association, 1801 K St. NW., Suite 1201, Washington, D.C. 20006.

OCCUPATIONS IN THE TRUCKING INDUSTRY

In 1974, the trucking industry employed approximately 1.2 million workers—more than the rival rail, air, and pipeline transportation industries combined. It is a major employer of persons not planning to attend college, since nearly 90 percent of its employees are freight handlers, drivers, truck maintenance personnel, or clerical workers, who only require a high school education.

Nature and Location of the Industry

The trucking industry is made up of companies that sell transportation and storage services. Although many trucking companies serve only a single city and its suburbs, and others carry goods only between distant cities, most large trucking firms provide both types of service. Moreover, some firms operate one type of truck and specialize in one type of product. For example, they may carry steel rods on flat trailers or grain in open top vans. In addition, trucking companies may operate as either contract or common carriers. Contract carriers haul commodities of one or a few shippers exclusively; common carriers serve the general public.

Drivers "keep on trucking" in all kinds of weather.

The industry's employment is concentrated in a relatively small number of large companies. Almost half of the industry's workers are employed by less than 10 percent of the companies. On the other hand, a large proportion of companies are small, particularly those which serve a single city. Many companies are owner-operated, and the owner does the driving.

Trucking industry employees work in cities and towns of all sizes and are distributed much the same as the Nation's population.

Occupations in the Industry

About three-fourths of all trucking industry employees have blue-collar jobs, including about 600,000 truckdrivers. Other important blue-collar occupations are material handlers, mechanics, washers and lubricators, and supervisors. Most white-collar employees are clerical workers, such as secretaries and rate clerks, and administrative personnel, such as terminal managers and accountants.

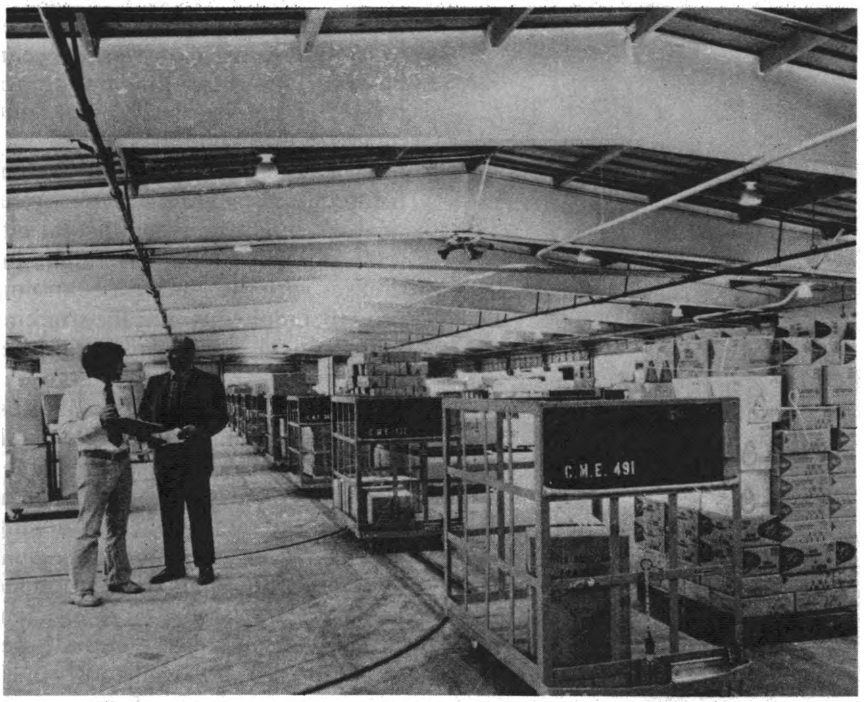
The duties and training requirements of some of the important occupations are described briefly in the following sections.

Truckdriving Occupations. More than half of the industry's employees are drivers. *Long-distance truckdrivers* (D.O.T. 904.883) spend nearly all their working hours driving large trucks or tractor trailers between terminals. Some drivers load and unload their trucks; usually, however, other employees do this work. *Local truckdrivers* (D.O.T. 906.883) operate trucks over short distances, usually within one city and its suburbs. They pick up goods from, and deliver goods to, trucking terminals, businesses, and homes in the area.

Clerical Occupations. About 1 out of every 8 of the industry's employees is a clerical worker. Many have general clerical jobs, such as secretary or clerk-typist, which are common to all industries. Others have specialized jobs. For example, *dispatchers* (D.O.T. 919.168) coordinate the movement of trucks and freight into and out of terminals; make up loads for specific destinations; assign drivers and develop delivery schedules; handle customers' requests for pickup of freight, and provide information on deliveries. *Claims adjusters* (D.O.T. 241.368) handle claims for freight lost or damaged during transit. *Manifest clerks* (D.O.T. 222.488) prepare forms that list details of freight shipments. *Parts-order clerks* (D.O.T. 223.387) supply mechanics with replacement parts for trucks; they also take care of most of the clerical duties needed to maintain a truck repair shop.

Administrative and Related Occupations. More than 1 out of 15 employees is an administrator. Top executives manage companies and make policy decisions. Middle managers supervise the operation of individual departments, terminals, or warehouses. A small number of accountants and lawyers are employed by these companies. The industry also employs sales representatives to solicit freight business.

Material Handling Occupations. About 1 out of 12 employees moves freight into and out of trucks and warehouses. Much of this work is



Assembling loads in advance permits trucks to be loaded quickly.

done by *material handlers* (D.O.T. 929.887) who work in groups of three or four under the direction of a dock supervisor or gang leader. Material handlers load and unload freight with the aid of handtrucks, conveyors, and other devices. Heavy items are moved by *power truck operators* (D.O.T. 922.883) and *crane operators* (D.O.T. 921.280). Gang leaders determine the order in which items will be loaded, so that the cargo is balanced and items to be unloaded first are near the truck's door. *Truckdrivers' helpers* (D.O.T. 905.887) travel with drivers to unload and pick up freight. Occasionally, helpers may do relief driving.

Truck Maintenance Occupations. About 1 out of every 20 employees takes care of the trucks. *Truck mechanics* (D.O.T. 620.281) keep trucks and trailers in good running condition. Much time is spent in preventive maintenance to assure safe operation, to check wear and damage to parts, and to reduce breakdowns. When breakdowns do occur, these workers determine the cause and make the necessary repairs. *Truck mechanic helpers* (D.O.T. 620.884) and apprentices assist experienced mechanics in inspection and repair work. *Truck lubricators* and *washers* (D.O.T. 915.887 and 919.887) clean, lubricate, and refuel trucks, change tires, and do other routine maintenance.

Training, Other Qualifications, and Advancement

Workers in blue-collar occupations usually are hired at the unskilled level, as material handlers, truckdrivers' helpers, lubricators, and washers. No formal training is required for these jobs, but many employers prefer high school school graduates. Applicants must be in good physical condition. New employees work under the guidance of experienced workers and supervisors while learning their jobs; this usually takes no more than a few weeks. As vacancies occur, workers advance to more skilled blue-collar jobs, such as power truck operator and truckdriver. The ability to do the job and length of service with the firm are the primary qualifications for promotion. Material handlers who demonstrate supervisory ability can become gang leaders or dock supervisors.

Qualifications for truckdriving jobs vary and depend on individual employers, the type of truck, and other factors. In most States, drivers must have a chauffeur's license, a commercial driving permit obtained from State motor vehicle departments. The U.S. Department of Transportation establishes minimum qualifications for long-distance drivers. They must be at least 21 years old, be able-bodied, have good hearing, and have at least 20/40 vision with or without glasses. However, many firms will not hire drivers under 25 years of age. Drivers also must be able to read, speak, and write English well enough to complete required reports. Drivers must have good driving records.

People interested in professional driving should take the driver-training courses offered by many high schools. A course in automotive mechanics also is helpful. Private truckdriving training schools offer another opportunity to prepare for a driving job. However, completion of such a course does not assure employment as a driver.

Most truck mechanics learn their skills informally on the job as helpers to experienced mechanics. Others complete formal apprenticeship programs which generally last 4 years and include on-the-job training and related classroom instruction. Unskilled workers, such as lubricators and washers, frequently are promoted to jobs as helpers and apprentices. However, many firms will hire inexperienced people, especially those who have completed courses in automotive mechanics, for helper or apprentice jobs.

Lubricators help keep the trucks in good operating condition.

Completion of commercial courses in high school or in a private business school is usually adequate for entry into general clerical occupations such as secretary or typist. Additional on-the-job training is needed for specialized clerical occupations such as claims adjuster.

Generally, no specialized education is needed for dispatcher jobs. Openings are filled by truckdrivers, claims adjusters, or other workers who know their company's operations and are familiar with State and Federal driving regulations. Candidates may improve their qualifications by taking college or technical school courses in transportation.

Administrative and sales positions frequently are filled by college graduates who have majored in business administration, marketing, accounting, industrial relations, or transportation. Some companies have management training programs for college graduates in which trainees work for brief periods in various departments to get a broad understanding of trucking operations before they are assigned to a particular department. High school graduates may be promoted to administrative and sales positions.

Employment Outlook

Employment in the trucking industry is expected to grow about as fast as the average for all industries through the mid-1980's. In addition to the large number of job openings created by employment growth, thousands more will arise as experienced workers retire, die, or transfer to other fields. The number of jobs may vary from year to year, however, because the amount of freight fluctuates with ups and downs in the economy.

Trucks carry virtually all freight for local distribution and a great deal of freight between distant cities. As the volume of freight increases with the Nation's economic growth, employment in the trucking industry will rise. More employees also will be needed to serve the many factories, warehouses, stores, and homes being built where railroad transportation is not available.

Employment will not increase as fast as the demand for trucking services because technological developments and a continued trend toward larger, more efficient firms will increase output per worker. As a result of these developments, rates of growth will vary among occupations. Employment of material handlers, for example, is expected to increase slowly because of more efficient freight-handling methods—such as conveyors and draglines to move freight in and out of terminals and warehouses. On the other hand, employment of accountants, personnel workers, clerks, and mechanics is expected to increase rapidly as firms increase in size and are able to employ more of these specialists.

Earnings and Working Conditions

In 1974, nonsupervisory workers in the trucking industry averaged $5.79 an hour, compared with $4.22 an hour for their counterparts in all private industry, except farming. Earnings are relatively high in the trucking industry, because highly paid drivers represent a large proportion of employment; many long-distance drivers earn more than $300 a week.

Most employees are paid an hourly rate or a weekly or monthly

salary. However, truckdrivers on the longer runs generally are paid on a mileage basis while driving. For all other worktime, they are paid an hourly rate.

Working conditions vary greatly among occupations in the industry. While drivers may experience nervous strain from maneuvering large trucks in fast-moving traffic, more comfortable seating, power steering, and air-conditioned cabs have reduced physical strain. Long-distance drivers frequently work at night and may spend time away from home; local drivers usually work during the day. Material handlers and truckdrivers' helpers have strenuous jobs, although conveyor systems and other freight handling equipment have reduced some of the heavier lifting and made the work easier and safer. Truck mechanics and other maintenance personnel may have to work in awkward or cramped positions while servicing vehicles, and frequently get dirty because of the grease and oil on the trucks. In addition, most maintenance shops are hot in summer and drafty in the winter. Mechanics occasionally make repairs outdoors when a truck breaks down on the road.

Many large organizations operate around the clock and require some material handling and maintenance personnel to work evenings, nights, and weekends.

A large number of trucking industry employees are members of the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind).

Sources of Additional Information

For general information about career opportunities in the trucking industry, write to:

American Trucking Associations, Inc., 1616 P St. NW., Washington, D.C. 20036.

Information about specific jobs may be available from the personnel departments of local trucking companies or the local office of your State employment service.

WHOLESALE AND RETAIL TRADE

Wholesaling and retailing are the final stages in the transfer of goods from producers to consumers. Wholesalers assemble goods in large lots for distribution to retail stores, industrial firms, and institutions such as schools and hospitals. Retailers sell goods directly to consumers in a variety of ways—in stores, by mail, or through door-to-door selling. A list of the items sold by wholesale and retail businesses would include almost every item produced by industry—automobiles, clothing, food, furniture, and countless others.

In 1974, about 17 million people (not counting an estimated 2 million who were self-employed persons or unpaid family workers) worked in wholesale and retail trade. The largest number of workers—12.7 million or about three-fourths of them were employed in retail trade. The majority of these workers held jobs in department stores, food stores, and restaurants and other eating places. About 4.3 million people worked in wholesale trade.

Workers with a wide range of education, training, and skills hold jobs in wholesale and retail trade. As shown in the accompanying tabulation, 3 out of 5 workers in these industry divisions were white-collar workers (professional, managerial, clerical, and sales). Sales workers, the largest single group, make up more than one-fifth of total industry employment. Managers and proprietors, the second largest group of workers, constitute nearly one-fifth of the industry's work force. Many managers and proprietors own and operate small wholesale houses or retail businesses, such as food stores and gas stations. Clerical workers make up over one-sixth of the work force; many hold jobs as cashiers, especially in supermarkets and other food stores. Other important clerical occupations in retail trade include secretaries, stenographers and typists, office machine operators, and bookkeepers and accounting clerks. Large numbers of shipping and receiving clerks work in both wholesale and retail trade.

Blue-collar workers (craft workers, operatives, and laborers) constitute nearly one-fourth of the industry's jobholders. Many work as mechanics and repairers, gas station attendants, drivers and delivery workers, meat cutters, and materials handlers. Most mechanics work for motor vehicle dealers and gasoline service stations. A large number of meatcutters work in wholesale grocery establishments and in supermarkets and other food stores.

Service workers, employed mostly in retail trade, constitute about 1 out of 6 workers in the industry. Food service workers, such as waitresses and cooks, make up by far the largest concentration of service workers. Other large groups of service workers are janitors, cleaners, and guards.

Major occupational group	*Estimated employment, 1974 (percent distribution)*
All occupational groups...	100
Professional, technical, and kindred workers.....	2
Managers and administrators...	19
Clerical and kindred workers...	17
Salesworkers	22
Craft and kindred workers.....	8
Operatives.....	10
Service workers.....	16
Laborers.....	6

Employment in wholesale and retail trade is expected to increase by about the same rate as the average for all industries through the mid-1980's as sales rise in response to growth in population and income. Due to laborsaving innovations, however, employment is not expected to grow as fast as sales. The use of computers for inventory control and billing, for example, may limit the need for additional clerical workers. Improved methods of handling and storing merchandise will limit the demand for laborers.

The statements that follow discuss job opportunities in restaurants and food stores. More detailed information about occupations that cut across many industries appears elsewhere in the *Handbook*.

OCCUPATIONS IN THE RESTAURANT INDUSTRY

In 1974, the restaurant industry was the fourth largest industry in the country, employing 3.1 million people in establishments ranging from roadside diners to luxurious restaurants. The type of food and service a restaurant offers varies with its size and location, as well as with the kind of customer it seeks to attract. Fast-food restaurants and cafeterias in suburban shopping centers emphasize rapid service and inexpensive meals. Steak houses and pizzerias consider the quality of their specialty most important. Some restaurants cater to customers who wish to eat a leisurely meal in elegant surroundings and their menus often include unusual dishes or "specialties of the house."

Most restaurants are small and have fewer than 10 paid employees; many of these are operated by their owners, who have either no paid help or only one or two part-time workers. An increasing proportion of restaurants, however, are part of a chain operation.

Restaurant jobs are found almost everywhere. Although employment is concentrated in the States with the largest populations and particularly in large cities, even very small communities have luncheonettes and roadside diners.

Restaurant Workers

About three-fourths of all restaurant employees prepare and serve food, and keep cooking and eating areas clean. Waiters and waitresses, and cooks and chefs make up the two largest groups of workers. Others are counter workers, who serve food in cafeterias and fast-food restaurants; bartenders, who mix and serve drinks; dining room attendants, who clear tables, carry dirty dishes back to the kitchen, and sometimes set tables; dishwashers, who wash dishes and help keep the kitchen clean; pantry workers, who prepare salads and certain other dishes; and janitors and porters, who dispose of trash, sweep and mop floors, and keep the restaurant clean. Some of these workers operate mechanical equipment such as dishwashers, floor polishers, and vegetable slicers and peelers. (Detailed information on cooks and chefs, waiters and waitresses, bartenders, food counter workers, and dining room attendants and dishwashers is given elsewhere in the *Handbook*.)

Another large group of restaurant workers—about one-seventh of the total—are managers and proprietors. Many are owners and operators of small restaurants and, in addition to acting as managers, may cook and do other work. Some are salaried employees who manage restaurants for others.

All other restaurant workers combined account for less than one-tenth of total industry employment. Most are clerical workers—cashiers who receive payments and make change for customers; food checkers who total the cost of items selected by cafeteria customers; and bookkeepers, typists, and other office workers. A few restaurants employ dietitians to plan menus, supervise food preparation, and enforce sanitary regulations. Restaurant chains and some large restaurants employ mechanics and other maintenance workers, accountants, advertising or public relations directors, personnel workers, and musicians and other entertainers.

Training, Other Qualifications, and Advancement

The skills and experience needed for restaurant work vary from one occupation to another. Many jobs require no special training or experience, while others require some college or managerial experience. Requirements also vary from one restaurant to another; large or expensive restaurants usually have higher standards than diners or luncheonettes.

Young people who have less than a high school education and no previous experience often can get jobs as kitchen workers, dishwashers, or dining room attendants. Although a high school education is not mandatory, some restaurants hire only those with a diploma or experienced waiters and waitresses, cooks, and bartenders. Special training or many years of experience or both usually are required for chefs' positions.

Newly hired restaurant workers are generally trained on the job. Kitchen workers, for example, may be taught to operate a lettuce-shredder and make salads. Waiters and waitresses are taught to set tables, take orders from customers, and serve food in a courteous and efficient manner. In many restaurants, new employees receive their training under the close supervision of an experienced employee or the manager. Large restaurants and some chain restaurant operations may have more formal programs which often include several days of training sessions for beginners.

Many public and private high schools offer vocational courses for persons interested in restaurant training. Usually included are food preparation and cooking, catering, restaurant management, and other related subjects. Similar training programs are available for a variety

of occupations through restaurant associations and trade unions, technical schools, junior and community colleges, and 4-year colleges. Programs range in length from a few months to 2 years or more.

The Armed Forces are another good source of training and experience in food service work. A number of programs also exist to train handicapped workers for restaurant jobs. Among these are projects to train mentally retarded persons for occupations such as dishwasher and kitchen helper.

When hiring, employers look for applicants who have good health and physical stamina because restaurant workers have to work long hours, often under considerable pressure. Neatness, a pleasant manner, and an even disposition also are important, especially for waiters and waitresses and other employees who meet the public. Restaurants, particularly large chain operations, promote workers who have initiative and ability. Dining room attendants or dishwashers can advance to better paying jobs such as waiter or cook's helper and then through additional training to cook, chef, baker, or bartender. Experience as maitre d'hotel may lead to a position as director of food and beverage services in a large chain organization. Assistant managers, particularly those with college training, may be promoted to manager, and eventually to a top management position.

Employment Outlook

Employment in the restaurant industry is expected to increase faster than the average for all industries through the mid-1980's. In addition to the openings arising from employment growth, thousands of openings are expected each year due to turnover—the need to replace experienced employees who find other jobs or who retire, die, or stop working for other reasons. Turnover is particularly high among part-time workers, many of whom are students.

Most openings will be for waitresses and kitchen helpers—both because of their high replacement needs and because these workers make up a very large proportion of all restaurant employees. Employment opportunities also are expected to be favorable for skilled cooks and salaried restaurant managers. The number of openings in clerical jobs, such as cashier, will be relatively small. A few openings will occur in specialized positions, such as food manager and dietitian.

Population growth, rising personal incomes, and more leisure time will contribute to a growing demand for restaurant services. Also, as an increasing number of wives work, more and more families may find dining out a welcome convenience. Increasing worker productivity, however, will prevent employment from growing as rapidly as demand for restaurant services. Restaurants have become more efficient as fast food service counters have become more popular, and as managers have centralized the purchase of food supplies, introduced self-service, and used precut meats and modern equipment. Many restaurants now use frozen entrees in individual portions which require less time and skill to prepare than fresh foods.

Earnings and Working Conditions

Earnings of restaurant workers depend on the location, size, type, and degree of unionization of the restaurant in which they work. Also, workers in some occupations receive tips in addition to their wages.

In 1974, nonsupervisory workers in the restaurant industry averaged $2.33 an hour (excluding tips). Data from union contracts covering eating and drinking places in several large cities indicate the following range of hourly earnings for individual occupations:

	Hourly rate range [1]
Chefs	$3.00–5.90
Bartenders	2.90–5.40
Cooks	2.60–4.90
Pantry workers	2.16–3.82
Checkers	2.10–3.71
Porters	1.96–3.42
Cashiers	2.10–3.38
Dishwashers	1.31–3.04
Dining room attendants	1.30–3.04
Kitchen helpers	2.19–3.02
Waiters and waitresses	1.20–3.00
Assistant cooks	2.30–2.90
Food counter workers	1.90–2.60

[1] Tips not included.

Salaries of managerial workers differ widely because of differences in duties and responsibilities. Many college graduates who had specialized training in restaurant management received starting salaries ranging from $10,000 to $12,000 annually in 1974. Managerial trainees without this background often started at lower salaries. Many experienced managers earned between $15,000 and $30,000 a year.

In addition to wages, restaurant employees usually get at least one free meal a day, and often are provided with uniforms. Waiters, waitresses, and bartenders also may receive tips.

Most full-time restaurant employees work 30 to 48 hours a week; scheduled hours may include evenings, holidays, and weekends. Many work on split shifts, which means they are on duty for several hours during one meal, take some time off, and then return to work for the next busy period.

Many restaurants have convenient work areas, and are furnished with the latest equipment and laborsaving devices. Others, particularly small restaurants, offer less desirable working conditions. In all restaurants, workers may stand much of the time, have to lift heavy trays and pots, or work near hot ovens or steam tables. Work

hazards include the possibility of burns; cuts from knives and broken glass or china; and slips and falls on wet floors.

The principal union in the restaurant industry is the Hotel and Restaurant Employees and Bartenders International Union (AFL-CIO). The proportion of workers covered by union contracts varies greatly from city to city.

Sources of Additional Information

For additional information about careers in the restaurant industry, write to:

National Institute for the Foodservice Industry, 120 South Riverside Plaza, Chicago, Ill. 60606.

Council on Hotel, Restaurant, and Institutional Education, 1522 K St., NW., Washington, D.C. 20005.

Information on vocational education courses for restaurant work may be obtained from the local director of vocational education, the superintendent of schools in the local community, or the State director of vocational education in the department of education in the State capital.

OCCUPATIONS IN RETAIL FOODSTORES

In the United States, grocery stores and supermarkets are as common as baseballs in summer, and almost always near at hand. But like the tip of an iceberg, the local foodstore is merely a small part of a large body known as the retail foodstore industry. The industry sells most of the food eaten by Americans and employs more than 2.1 million workers.

Jobs in the foodstores vary, and workers range in education and training from high school dropouts to college educated marketing professionals. Jobs in foodstores are especially attractive because employers often provide training and because the opportunities for promotion are good. The large number of opportunities for part-time employment may be of special interest to homemakers and students who do not want full-time jobs.

Nature of the Work

In contrast to restaurants where food is eaten as it is purchased, retail foodstores sell food which is to be eaten away from the store. The industry pioneered in self-service marketing techniques that permit customers to select items from shelves and bring them to check-out stands. Self-service methods reduce the number of employees needed. Therefore the cost of operating a store is lower. As a result, food sold in large self-service foodstores, or supermarkets, is generally less expensive than food sold in small stores.

There are three basic types of food stores: Supermarkets which sell many food items, small grocery stores, and specialty food stores which emphasize a particular type of food, or service, not generally available in a supermarket.

Supermarkets are simply big, self-service grocery stores which sell meat; canned, frozen, or fresh vegetables; baked foods; and other items. Only about 20 percent of all food stores are supermarkets. However, they employ about 60 percent of the industry's workers. Because prices are generally lower than at any other type of foodstore, supermarkets attract customers who make many purchases. When only a loaf of bread or a quart of milk is needed, however, the customer may prefer a nearby neighborhood grocery store or a specialty foodstore.

Small neighborhood grocery stores are the most numerous of all foodstores. Besides a small selection of popular food items, they may feature Spanish, Chinese, or other ethnic foods. Usually, owners personally manage these stores and only employ additional help as needed. Few owners operate more than one store. About 20 percent of the industry's employees work in small grocery stores.

Convenience stores are small grocery stores which specialize in a small variety of food and other items which customers might want in a hurry. They open earlier and close later than large supermarkets, and customers can make purchases quickly. Only 5 percent of the industry's employees work in convenience stores.

Specialty food stores operate in much the same manner as small neighborhood grocery stores. However, they feature only one type of food, such as meat, vegetables, or candy. Most are small and are usually operated by the owner and a few clerks. Approximately 15 percent of the industry's employees work in these stores.

Occupations in the Industry

About 60 percent of foodstore workers are clerks, cashiers, meatcutters, and meatwrappers. Managers and owner-managers make up an additional 25 percent of total employment. The remaining 15 percent are accountants, bookkeepers, truckdrivers, cleaning and other service workers, and laborers.

Clerks in supermarkets are usually called stock or produce clerks. In the grocery department, stock clerks keep shelves filled with merchandise. For example, they may count the cans of soup on the shelves and in the stockroom and decide whether to order more soup from the warehouse. Since storage space is limited, the order should include only as much as might be sold before another delivery from the warehouse will be made.

Stock clerks frequently rearrange food to create an attractive display. They help customers find what they want and perform general clean-up duties. In supermarkets, stock clerks may occasionally operate cash registers or bag groceries.

Produce clerks maintain the displays of fruits and vegetables. Because fruits and vegetables are perishable, clerks use special techniques to keep the stock attractive. Fruits and vegetables are rotated so that the most recently delivered goods are on the bottom of the display. Lettuce and other greens are moistened and chilled to preserve crispness. In addition to caring for the displays, produce clerks help unload delivery trucks, keep the produce department clean, answer customer's questions, and weigh and bag produce.

In large stores which have bakery and delicatessen departments, other clerks work behind counters

selling cakes or lunch meats.

Meatcutters and wrappers order and prepare meats for sale. Since meat is delivered to the store in large pieces, meatcutters use saws and knives to cut the large pieces into roasts, steaks, stew meats, and other meal size portions. After the fat is cut away and bone chips are removed, the meat is placed in plastic trays and is ready to be wrapped.

Meatwrappers use a machine to wrap the package of meat in clear plastic. Then, the wrappers weigh the packages and attach labels which the weighing machine has printed and which identify the type of meat, the weight, the price per pound, and the total price for each package.

At the check-out counter, cashiers ring up the price of each item on the cash register, add sales tax, receive checks or money, make change, and bag purchases.

Cashiers, who are often the only employees customers meet, must be pleasant, courteous, fast, and accurate. Experienced cashiers memorize the prices of hundreds of items, but must detect price changes on cans and boxes. For produce and other items that change price frequently, price lists are used. When not serving customers, cashiers clean counters and restock small convenience items, such as razor blades and candy, displayed near the check-out counter.

Many supermarkets also employ workers to bag and carry groceries from the check-out counter to customers' cars. Cleaning and other service workers polish floors, clean windows, and do other housekeeping jobs. The store manager observes the activities of each department, corrects problems as they arise, and is responsible for all activities and the store's success.

The central administrative offices of supermarket chains employ accountants, bookkeepers, personnel specialists, clerks, secretaries, and other office workers. Chain stores also employ many truckdrivers, stock clerks, and laborers in warehouses.

Training, Other Qualifications, and Advancement

In a large supermarket, a new employee usually begins as a trainee in one of the following occupations: cashier, stock clerk, produce clerk, meatwrapper, or meatcutter. In smaller stores, however, new employees usually are trained as combination cashiers-clerks.

When hiring trainees, employers look for high school graduates who are good at arithmetic and who make a neat appearance. An outgoing personality and the ability to get along with people also are important, particularly for cashiers. Applicants who have less than a high school education may be hired if they qualify in other respects.

New workers learn their jobs mostly by helping and observing experienced employees. A few years may be needed to qualify as a skilled meatcutter, but cashiers and produce clerks generally can learn their jobs in less than 6 months. Jobs as stock clerks and meatwrappers can be learned in even less time.

Before being assigned to a store, cashier trainees may attend a 5-day school operated by a supermarket chain. These courses, which emphasize rapid and accurate operation of cash registers, include instructions for treating customers courteously and for handling complaints. Trainees who pass the examination are assigned to a store to finish their training; those who fail may be hired for other jobs, such as stock or produce clerk.

Some stores have meatcutter apprenticeship programs, which generally last 2 to 3 years, and include classroom instruction as well as on-the-job training.

Foodstores provide ambitious employees with excellent opportunities for advancement in supermarkets, stock clerks frequently move up to better-paying jobs as head clerks or grocery department managers. Produce clerks may advance to jobs produce managers, produce buyer or produce supervisors of several stores. Meatwrappers can learn to be cutters, and then advance to meat department manager. Cashiers and department managers can be promoted to assistant managers and, eventually, managers of a supermarket. Advancement in small foodstores usually is limited, but employees may get all-round experience to start their own small businesses.

Some supermarket employees and managers advance to administrative jobs in their company's central offices. A large number of these jobs, however, are in specialized fields, such as accounting or labor relations, which require college training.

In cooperation with the National Association of Food Chains, Cornell University offers home study courses in management that are designed specifically for food industry employees who wish to improve their chances for advancement. All employees are eligible to take these courses.

Foodstores also have been a growing source of jobs for women. In 1974, about 40 percent of the industry's employees were women, compared with about 30 percent in 1960.

Employment Outlook

The outlook for jobs in the foodstore industry is good. Employment through the mid-1980's is expected to grow about as fast as the average for all industries. In addition, each year thousands of jobs will become available as employees transfer to jobs in other industries, retire, or stop working for other reasons. Many part-time jobs will be available.

As population increases, more food will have to be distributed; this will increase foodstore sales and employment. However, employment is not expected to increase as rapidly as foodstore sales because new equipment will increase employee productivity. For example, computer assisted check-out systems are now being tested as replacements for cash registers. An optical or magnetic scanner transmits the code number of each purchase to a computer that is programmed to record the price of the item, add the tax, and printout a receipt. The computer also keeps track of the store's inventory and places orders with the warehouse when stock is needed. This system would limit growth in the employment of cashiers and stock clerks. Nevertheless, more workers would be hired as additional supermarkets are built to keep up with the expansion of suburbs.

The outlook for part-time jobs as cashiers and stock clerks is very good. Large numbers of the present employees are students who are supplementing their income while attending school. After completing school, many leave for jobs in other industries. Other part-time employees also may work only for short periods. As a result, there are many part-time job opportunities which frequently can lead to full-time jobs.

Earnings and Working Conditions

Earnings of nonsupervisory workers in foodstores are among the highest in retail trade. In 1974, they averaged $3.60 an hour, compared with $3.10 an hour for nonsupervisory workers in retail stores as a whole. Earnings vary considerably by occupation. Based on the limited information available, hourly rates ranged from about $1.60 for clerks with little experience to more than $6.00 for some highly skilled meatcutters. Earnings tend to be highest in large stores in metropolitan areas.

Almost all foodstore employees must be able to stand for several hours at a time. Stock clerks must be capable of lifting boxes or packages which weigh up to 50 pounds. Most foodstore occupations are not hazardous, but meatcutters must be careful when handling knives and using machinery, such as electric saws. Because they frequently work in refrigerated rooms, meatcutters also must be able to tolerate low temperatures (35 to 50 degrees fahrenheit).

Many foodstore employees are union members. Employees in the meat department are represented by the Amalgamated Meat Cutters Union. Other employees in the store belong to the Retail Clerks International Association.

Sources of Additional Information

Details about employment opportunities are available from local foodstores and the local office of the State employment service.

For specific information on the duties and qualifications of cashiers, write to:

National Association of Retail Grocers, 360 North Michigan Ave., Chicago, Ill. 60601.

For information on training and other aspects of the meatcutting trade, contact:

Amalgamated Meat Cutters and Butchers Workmen of North America, 2800 North Sheridan Road, Chicago, Ill. 60657.

FINANCE, INSURANCE, AND REAL ESTATE

Nearly every individual and organization uses services that the finance, insurance, and real estate industry provides. Financial institutions—banks, savings and loan companies, consumer credit organizations, and others—offer services ranging from checking and savings accounts to the handling of stock and bond transactions. Insurance companies provide protection against losses caused by fire, accident, sickness, and death. Real estate firms serve as agents in the sale or rental of buildings and property, and often manage large offices and apartments.

In 1974, over 4.1 million persons worked in the finance, insurance, and real estate field. Finance, the largest sector, employed 1.9 million persons; the next largest, insurance, over 1.4 million workers. The remainder—over 800,000—worked in real estate.

Finance, insurance, and real estate firms are a major source of job opportunities for women, who make up over half of the industry's work force. The proportion of women ranges from about 35 percent in real estate to over 65 percent in banking.

As the accompanying tabulation shows, over 90 percent of the workers in the industry hold white-collar jobs. Clerical workers alone make up 46 percent of the industry's work force. Many clerical workers have jobs that are unique to particular industries, such as bank tellers in financial institutions and claim representatives in insurance companies. Other large clerical occupations include stenographer, typist, secretary, and office machine operator—jobs also found in other industries. Salesworkers constitute 21 percent of the work force. Most of these are insurance and real estate agents and brokers. A relatively small number of the salesworkers sell stocks and bonds.

Major occupational group	*Estimated employment, 1974 (percent distribution)*
All occupational groups	100
Professional, technical, and kindred workers	5
Managers and administrators	20
Clerical and kindred workers	46
Salesworkers	21
Craft and kindred workers	2
Operatives	(1)
Service workers	5
Laborers	1

[1] Less than 0.5 percent.

Managers and officials—bank officers, office managers, and others—make up 20 percent of the industry's work force. Professional and technical workers—such as accountants, computer specialists, and business research analysts—account for another 5 percent.

Employment in the finance, insurance, and real estate industry is expected to increase faster than the average for all industries through the mid-1980's. Over the long run, population, business activity, and personal incomes should continue to rise, creating a need to expand both the types of services offered and the number of establishments engaged in finance, insurance, and real estate. Growth, however, may vary by occupation. For example, the increasing use of data processing should continue to lessen the demand for workers in routine clerical and recordkeeping functions while spurring demand for workers in computer occupations.

OCCUPATIONS IN THE BANKING INDUSTRY

Banks have been described as "department stores of finance" because they offer a variety of services ranging from individual checking accounts to letters of credit for financing world trade. Banks safeguard money and valuables; administer trusts and personal estates; and lend money to business, educational, religious, and other organizations. They lend money to individuals to purchase homes, automobiles, and household items, and to cover unexpected financial needs. Banks continually adapt their services to meet their customers' needs. In recent years, for example, they have offered revolving check credit plans, charge cards, accounting and billing services, and money management counseling.

Banks and Their Workers

Banks employed more than a million workers in 1974; about two-thirds were women. Most bank employees work in commercial banks, where a wide variety of services are offered. Others work in mutual savings banks, which offer a more limited range of services—mainly savings deposit accounts, mortgage loans, safe-deposit rentals, trust management, money orders, travelers' checks, and passbook loans. Still others work in the 12 Federal Reserve Banks (or "bankers' banks") and their 24 branches and in foreign exchange firms, clearing house associations, check cashing agencies, and other organizations doing work closely related to banking. In addition, many people are employed by savings and loan associations, personal credit institutions, and related institutions.

In 1974, commercial banks processed about 25 billion checks and handled an enormous amount of paperwork. The clerical workers who do this job account for nearly two-thirds of all bank employees. Many are tellers or clerks who process the thousands of deposit slips, checks, and other documents which banks handle daily. Banks also employ many secretaries, stenographers, typists, telephone operators, and receptionists.

Bank officers comprise the second largest occupation in the banking industry. Approximately 1 out of 5 employees is an officer—a president, vice president, treasurer, comptroller or other official. Other occupations in the industry account for fewer positions. These include accountants, economists, lawyers, personnel directors, marketing and public relations workers, as well as guards, elevator operators, cleaners, and other service workers.

Three large occupations unique to banking—clerks, tellers, and officers—are described in separate statements elsewhere in the *Handbook*.

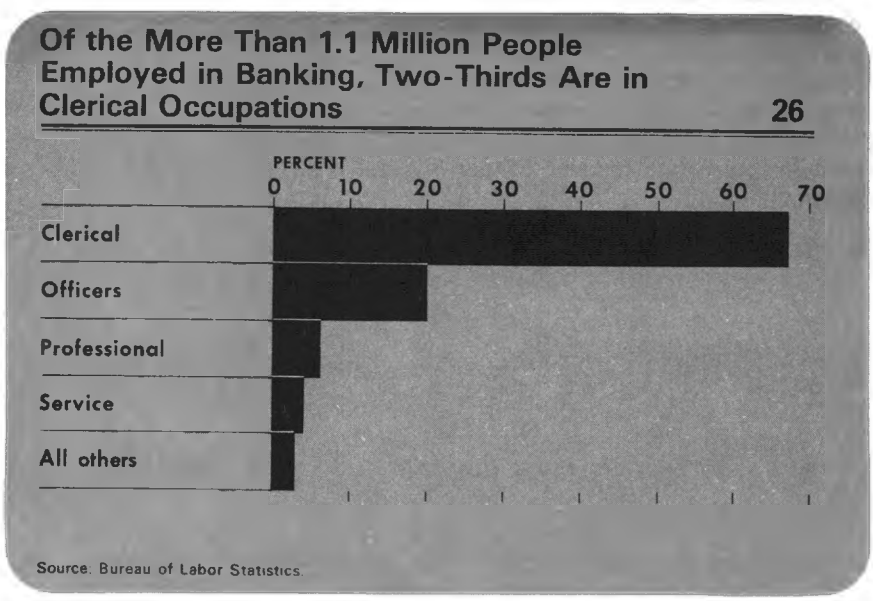
Places of Employment

In 1974, there were more than 40,000 commercial banks and their branches and almost 2,000 mutual savings banks and branches. Bank employment is concentrated in a relatively small number of very large banks. In 1974, for example, almost two-thirds of all commercial bank employees worked in the Nation's 800 largest commercial banks; less than 6 percent were employed by the 6,000 smallest commercial banks.

Most bank employees work in heavily populated States, such as New York, California, Illinois, Pennsylvania, and Texas. New York City, the financial capital of the Nation, has far more bank workers than any other city.

Training

Professional and managerial



bank workers usually have completed college; most clerks have finished high school; guards and building service personnel may have less than a high school education.

Most new employees receive some form of in-service bank training. Banks also provide other opportunities for workers to broaden their knowledge and skills. Many banks encourage employees to take courses at local colleges and universities. In addition, banking associations sponsor a number of programs, sometimes in cooperation with colleges and universities. Many banks pay all or part of the costs for those who successfully complete courses.

Bank workers also can prepare for better jobs by taking courses that the American Institute of Banking offers in many cities throughout the country. The Institute, which has 387 chapters and over 200 study groups, also offers correspondence study and assists local banks in conducting cooperative training programs for various bank positions.

Bank employees should enjoy working with numbers and be able to accept the responsibility of handling large amounts of money. They should present a good image to customers. Often bank officials are encouraged to participate in community activities.

Employment Outlook

Banks should continue to be a major source of job opportunities in office occupations. Banking employment is expected to rise faster than the average for all industries through the mid-1980's. New jobs resulting from employment growth, as well as those that arise as employees retire, die, or stop working for other reasons, are expected to account for tens of thousands of openings each year.

Most openings will be for clerks. In addition, an increasing number of trainee jobs, which may lead to officer positions, will probably become available for college graduates. Many openings for professional and specialized personnel such as accountants and auditors, statisticians, and computer operators also will occur.

Bank facilities and employment will grow as population, sales, and incomes rise, resulting in greater numbers of financial transactions among businesses and individuals. Jobs also will be created as banks continue to improve and expand services such as bank charge cards and the handling of accounts for retail stores. As banks strive to bring these and other services closer to suburban areas, branch banks will grow in number and provide additional employment opportunities.

The continued conversion to electronic data processing may lessen demand for some bank workers, despite the expected increase in bank services. The effect of this development will vary by occupation, as indicated in the statements on specific banking occupations elsewhere in the *Handbook*.

Bank employees can anticipate steadier employment than workers in many other fields, because they are less likely to be laid off during periods of low business activity. Even when a bank is sold or merged, workers seldom lose their jobs. Bank officials usually reduce employment, when necessary, by not replacing employees who leave their jobs.

Earnings and Working Conditions

In addition to salaries, bank workers generally receive liberal fringe benifits. For example, most banks have some type of profit-sharing or bonus plan. In addition, group plans that provide life insurance, hospitalization, surgical benefits, and retirement income are common. Sometimes free checking accounts or safe-deposit boxes also are provided.

The workweek in banks is generally 40 hours or less; in a few localities, a workweek of 35 hours is common. Tellers and some other employees work at least one evening a week when banks remain open for business. Certain check processors and operators of computing equipment may work on evening shifts.

Sources of Additional Information

Local banks and State bankers' associations can furnish specific information about job opportunities in local banking institutions. General information about banking occupations, training opportunities, and the banking industry itself is available from:

American Bankers Association, Bank Personnel Division, 1120 Connecticut Ave. NW., Washington, D.C. 20036.

National Association of Bank Women, Inc., National Office, 111 E. Wacker Dr., Chicago, Ill. 60601

National Bankers Association, 4310 Georgia Ave. NW., Washington, D.C. 20011.

For information about career opportunities as a bank examiner, contact:

Federal Deposit Insurance Corporation, Director of Personnel, 550 17th St. NW., Washington, D.C. 20429.

Information on careers with the Federal Reserve System is available from:

Board of Governors, The Federal Reserve System, Personnel Department, Washington, D.C. 20551 or from the personnel department of the Federal Reserve bank serving each geographic area.

group life insurance protected about 65 million persons; the number of policies was almost double the number 10 years earlier.

OCCUPATIONS IN THE INSURANCE INDUSTRY

The insurance industry offers many employment opportunities both for recent high school and college graduates and for experienced workers.

The 1,800 life and 2,800 property-liability (also called casualty) insurance companies do business in home and regional offices and also in thousands of sales offices throughout the country.

Nature of the Business

There are three major types of insurance: life, property-liability, and health. Some companies specialize in only one type; a growing number of large insurers now offer several lines of insurance. For example, several life carriers can now offer their policyholders protection for their homes and cars; at the same time, major property-liability companies sell life insurance policies. Many insurance companies also offer mutual fund shares and variable annuities as additional investment choices for their customers.

Life insurance companies sell policies that provide benefits to survivors upon the death of the insured. Some life insurance policies also provide policyholders with a steady income when they reach retirement age or if they become disabled; policies may be designed to help provide funds to educate children when they reach college age, or give extra financial protection while the children are young. Life insurance policies also may be used to protect business interests and to guarantee employee benefits. Property-liability insurance provides policyholders with protection against loss or damage to their property, and protects them from financial responsibility for injuries to others or damage to other people's property. It covers hazards such as fire, theft, and windstorm, as well as workers' compensation and other claims. Most life and property liability companies sell accident and health insurance, which helps policyholders pay medical expenses, and may furnish other benefits for an injury or illness.

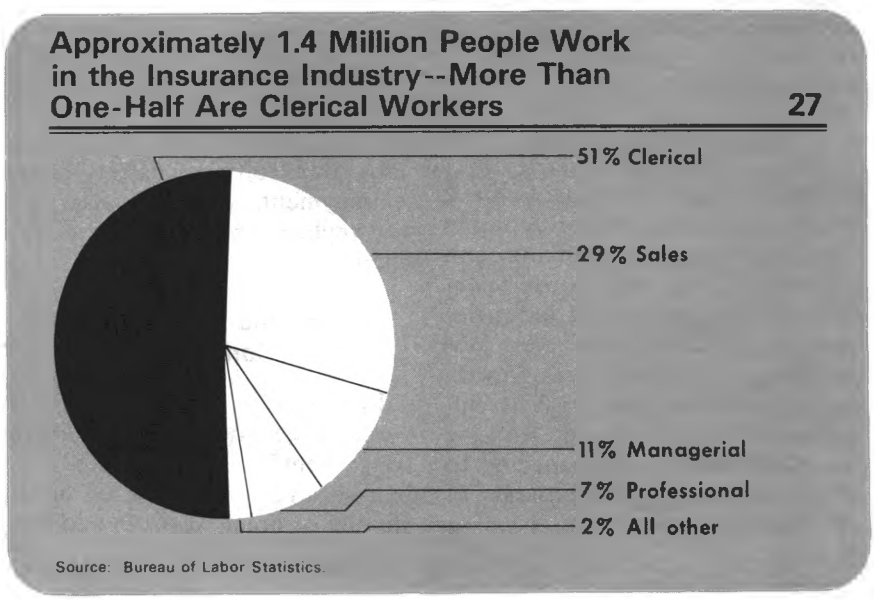
An increasing number of insurance policies cover groups ranging from a few individuals to many thousands. These policies usually are issued to employers for the benefit of their employees. Most common are group life and health plans, although the number of group automobile and homeowner policies is growing rapidly. In 1974,

Insurance Workers

About 1.6 million people worked in the insurance business in 1974. The majority were in clerical and sales jobs. (See accompanying chart.)

Just over half of all insurance company employees work in clerical and related jobs; this is a much larger proportion than in most other industries. These workers keep records of premium payments, services, and benefits paid to policyholders. Most are secretaries, stenographers, typists, office machine operators, or general office clerks. They do work similar to that of their counterparts in other businesses.

Other clerical workers have positions of greater responsibility that require extensive knowledge of some phase of insurance. They include *claim adjusters* (D.O.T. 241.168) and *claim examiners* (D.O.T. 249.268) who decide whether claims are covered by the policy, see that payment is made,



and, when necessary, investigate the circumstances surrounding the claim. (See the statement on Claim Representatives elsewhere in the *Handbook*.)

Nearly one-third of all insurance employees are salesworkers—chiefly agents and brokers who sell policies to individuals and business firms. *Agents and brokers* (D.O.T. 250.258) usually find their own customers or "prospects," and see that each policy they sell is tailored to meet the individual needs of the policyholder. (See the statement on Insurance Agents and Brokers elsewhere in the *Handbook*.)

About 1 out of 9 insurance workers has a managerial job. Managers of local sales offices often spend part of their time selling. Others, who work in home offices, are in charge of departments such as actuarial calculations, policy issuance, accounting, and investments.

Professionals, employed mainly at home offices, represent about 1 out of 15 insurance workers. These specialists, who work closely with insurance company managers, study insurance risks and coverage problems, analyze investment possibilities, prepare financial reports, and do other professional work. Among them is the *actuary* (D.O.T. 020.188) whose job is unique to the insurance field. Actuaries make studies of the probability of an insured loss and determine premium rates. (See the statement on Actuaries elsewhere in the *Handbook*.) Another specialist is the *underwriter* (D.O.T. 169.188), who evaluates insurance applications to determine the risk involved in issuing a policy. Underwriters decide whether to accept or reject the application; they also determine which premium rate should apply for each policy issued. (See the statement on Underwriters elsewhere in the *Handbook*.)

Other professional employees do essentially the same work in insurance companies as in other businesses. Accountants, for example, analyze insurance company records and financial problems relating to premiums, investments, payments to policyholders, and other aspects of the business. Safety engineers, fire protection engineers, and industrial hygienists in casualty companies work as consultants to industrial and commercial policyholders on matters concerning the health and safety of their employees. (See the statement on Occupational Safety and Health Workers elsewhere in the *Handbook*.) Lawyers interpret the regulations that apply to insurance company operations and handle the settlement of some insurance claims. Investment analysts evaluate real estate mortgages and new issues of bonds and other securities, analyze investments held by their companies, and recommend when to hold, buy, or sell. As more computers are installed to handle office records, an increasing number of programmers, systems analysts, and other data processing specialists are being employed. Many companies also employ editorial, public relations, sales promotion, and advertising specialists.

Insurance companies require the same kinds of custodial and maintenance work as other large organizations. About 1 out of 45 workers in the insurance business performs these duties.

Places of Employment

Many insurance employees work in California, Connecticut, Illinois, Massachusetts, New Jersey, New York, and Texas, where some of the largest insurance companies have home offices. In addition, large numbers are employed in company sales offices, independent agencies, and brokerage firms throughout the country. Almost all sales personnel work out of local offices; most professional and clerical workers, however, are employed in company regional and home offices.

About half of all insurance employees work in life companies and agencies; included in this group are some very large companies with thousands of employees. Property-liability companies, although more numerous than life insurance companies, generally have fewer workers. Many local agencies and sales offices also are small, regardless of the types of insurance handled.

Training, Other Qualifications, and Advancement

Insurance offers job opportunities for people with different educational backgrounds and talents. Some positions require specific college training; others can be filled by workers with limited academic training and few skills.

Graduation from high school or business school is enough training for most beginning clerical jobs. Courses in typing and business math are assets; the ability to operate office machines also is helpful. These and other special skills help beginners advance to more responsible jobs.

Jobs in engineering, accounting, and other professional fields generally require the same kinds of college training here as in other businesses. College-trained people also are preferred for managerial positions, many of which are filled by promotion from within.

In all work requiring contact with the public, employees should have a pleasant disposition and an outgoing personality. Those in frequent contact with policyholders should be able to inspire confidence in their ability to protect the customer's interests. Because insurance companies often encourage their managers and administrative employees to participate in community organizations, they should be people who enjoy working with others in a social situation.

Insurance workers have ample opportunity to continue their education. The Insurance Institute of

America, for example, has home study courses for claim adjusters, claim examiners, underwriters, and salesworkers. The American College of Life Underwriters, the National Association of Life Underwriters, and the Life Underwriter Training Council offer courses that stress the services agents provide to policyholders. Other courses, especially designed to help clerical employees better understand life insurance, relate to the organization and operation of both home and field offices. These are given by the Life Office Management Association, which also provides programs for the development of supervisors and managers.

Employment Outlook

Employment of insurance workers is expected to increase about as fast as the average for all occupations through the mid-1980's as the insurance industry continues to expand. In addition to new jobs that will become available, thousands of openings will occur as employees die, retire, or leave their jobs to seek other work.

The expected increase in employment will result mainly from a growing volume of insurance business. As a larger proportion of the population enters the age group normally associated with family formation, higher incomes, and greater consumer spending, insurance sales should expand. Sales of life insurance will rise as the growing number of young adults attempt to provide a secure future for their families. Property-liability insurance sales should expand as they buy homes, cars, and other items that require insurance protection. More business insurance will be needed as new plants are built, new equipment is installed, and more goods are shipped throughout the country and the world. Furthermore, as the coverage of State workers' compensation laws is broadened, more employers may need this type of insurance protection.

Growth of insurance employment, however, is not expected to keep pace with the expanding volume of business for several reasons. Salesworkers are expected to become more productive as more insurance is sold through group contracts and multiple-line policies (those which cover many different risks formerly covered in separate policies). Although the total number of clerical jobs probably will continue to rise, the increasing use of computers to do routine jobs will lessen the demand for many low-skilled clerical workers. Because the computer can write simple policies, the underwriter occupation may not grow as rapidly as in the past. In addition, State "no-fault" insurance plans should reduce the number and complexity of automobile claims to be adjusted, thus lessening the demand for automobile claim adjusters.

The insurance industry has always been a stable employer and most insurance workers have better prospects of regular employment than workers in many other industries. Business people usually regard property-liability insurance as a necessity, both during economic recession and in boom periods. Individuals who buy insurance try to provide as much basic financial protection as possible, even when their incomes decline.

Earnings and Working Conditions

A 1974 survey of insurance companies, banks, and related businesses revealed a wide range of clerical salaries. Some clerks in beginning routine jobs earned less than $90 a week; experienced clerical employees in more responsible positions earned up to twice that amount.

Differences in clerical salaries reflect variations in specific job duties and differences among insurance companies. Salary levels in different parts of the country also vary; earnings are generally lowest in southern cities and highest in northeastern and western metropolitan areas. (See the chapter on Office Occupations for additional information about earnings of clerical workers.)

Starting salaries for professional workers are generally comparable to those for similar positions in other businesses. According to information available from private surveys of life and property-liability insurance companies, 1974 college graduates started at salaries ranging from $7,500 to $11,000 a year. Specialists with graduate degrees or several years' experience may receive considerably higher starting salaries. Unlike salaried professional workers, agents and brokers earn commissions on the policies they sell. (See the statement on Insurance Agents and Brokers elsewhere in the *Handbook*.) Annual salaries for supervisors in life and property-liability companies ranged from $12,000 to $20,000, depending upon the type of company operation involved.

Except for agents and brokers who sometimes must extend their working hours to meet with prospective clients, insurance company employees worked an average of 37 hours a week in 1974. The number of paid holidays is somewhat greater than in many other industries. Two-week paid vacations generally are granted employees after 1 year of service; in most companies, paid vacations are extended to 3 weeks after 5 years and, in some, to 4 weeks after 10 years. Practically all insurance company workers share in group life and health plans, as well as in retirement pensions.

Sources of Additional Information

General information on employ-

ment opportunities in the insurance business may be obtained from the personnel departments of major insurance companies or from insurance agencies in local communities.

Other information on careers in the insurance field is available from:

Institute of Life Insurance, 277 Park Ave., New York, N.Y. 10017.

Insurance Information Institute, 110 William St., New York. N.Y. 10038.

American Mutual Insurance Alliance, 20 N. Wacker Dr., Chicago, Ill. 60606.

National Association of Insurance Women, 1847 E. 15th St., Tulsa, Okla. 74104.

SERVICE AND MISCELLANEOUS INDUSTRIES

An increasing share of our national wealth is being devoted to services as a result of greater emphasis on amenities such as medical care, education, and recreation. In many ways, this trend reflects the country's goals of a better and fuller life for all its citizens.

In today's job market, the service industries are therefore an important source of employment, for new workers as well as experienced ones, and they offer job opportunities to people with various levels of skills, training, and education.

In 1974, nearly 30 million people worked in service industries. About one-half were wage and salary workers in private firms, 12.3 million more were government employees (mainly in educational and medical services), and 2.2 million were self-employed. The remainder, about 1.4 million, worked in private households.

Educational services, including elementary and secondary schools and institutions of higher education, make up the largest sector of the service industry, and account for over one-fourth of its work force. Hospitals and other establishments that provide health services constitute the next largest sector, and account for nearly one-eighth of the workers. In both these service industries, government workers (mainly local and State) make up a large share of the work force. Other service industries employing many workers are hotels, laundries, private households, business and repair services, and entertainment.

As shown in the accompanying tabulation, white-collar workers (professional, managerial, clerical, and salesworkers) account for over three-fifths of the service industry's employment. The industry employs the highest proportion of professional, technical, and kindred workers of any major industry and these workers account for one-third of the industry's employment. By far the largest concentration of professional personnel is represented by teachers in educational services. Other major employers of professional workers are medical and health services—where doctors, dentists, and nurses constitute a large share of the work force. Many professionals are self-employed. Clerical workers account for 1 out of 5 service industry employees. Most are stenographers, typists, secretaries, and office machine operators. Managers, officials, and proprietors, including health services administrators, make up a relatively small fraction of the industry's employment.

Service workers represent nearly one-third of the industry's employment. Some large service occupations are private household worker, practical nurse, hospital attendant, janitor, waiter or waitress, cook, and protective service worker.

Blue-collar workers, mainly skilled craft workers and semiskilled operatives, constitute only one-ninth of the industry's employment. Many of the craft workers are mechanics in automobile and other repair service industries, or maintenance workers in hotels, schools, and other establishments. Operatives work mainly in laundries, auto repair shops, and other types of repair businesses. Most of the relatively few laborers in this industry work in auto repair shops, on golf courses, and in bowling alleys.

Major occupational group	*Estimated employment, 1974 (percent distribution)*
All occupational groups	100
Professional, technical, and kindred workers	33
Managers and administrators	8
Clerical and kindred workers	20
Salesworkers	1
Craft and kindred workers	5
Operatives	4
Service workers	28
Laborers	2

NOTE: Because of rounding, sum of individual items does not equal total.

Employment in the service industry is expected to increase much faster than the average for all industries through the mid-1980's. The sharp growth in the demand for services is expected to stem from population growth, expanding business activity, and rising personal incomes. The fastest growing parts of the service industry will be hospitals, medical services, and certain firms that provide computer services and laboratory research facilities.

The need for extensive personal contact in the many service functions tends to limit the effect of technological innovations on employment requirements. Although computers may slow the employment growth in some areas—for example, in bookkeeping—technological change is not expected to limit the total demand for

workers in the service industry.

The statements that follow discuss job opportunities in the hotel and laundry and drycleaning industries. More detailed information about services related to occupations that cut across many industries appears elsewhere in the *Handbook*.

HOTEL OCCUPATIONS

Hotels, motels, and resorts provide lodging to suit the needs of every traveler. Some motels offer inexpensive basic services for those who simply want a comfortable place to sleep. Other motels and most hotels cater to persons who desire more luxurious surroundings and offer swimming pools, fine restaurants, and more personalized service. More than 835,000 people, about half of them women, were employed in the industry in 1974.

Some hotel occupations require little or no specialized training. Bellhops, waiters and waitresses, and cleaning workers, for example, usually learn their skills on the job. For many kinds of hotel work, however, demand for persons with special skills or college training is increasing as hotels and motels grow in size, and as chain operations become an ever-larger part of the industry.

This statement describes the jobs usually found in hotels, motels, resorts, and tourist courts. More detailed descriptions of the work of hotel housekeepers, managers, front office clerks, and bellhops are found elsewhere in the *Handbook*.

The Hotel Business

Hotels range in size from those with only a few rooms and employees to huge establishments with more than 1,000 rooms and many hundreds of workers. Many of the motels built in recent years are fairly large and employ many workers, but the economy motels and most older motels have relatively small staffs. Some motels are run entirely by individual owners and their families.

Nearly all hotels and many motels offer a variety of conveniences for their guests, including restaurants, banquet rooms, meeting rooms, swimming pools, and gift shops. Motels usually have simple coffee shops, while hotels often have several restaurants and may offer live entertainment in one of them at night. Hotels and motels in resort areas often have recreational facilities, such as golf courses and tennis courts, in addition to swimming pools. Large hotels also may have newsstands, barber and beauty shops, laundry and valet services, and theater and airline ticket counters.

Hotel Workers

To provide the many services they offer, hotels and motels employ workers in a wide variety of occupations. Housekeeping is a very important part of the business and more than a fourth of all workers are concerned with keeping hotels and motels clean and attractive. The cleaning staff make beds, provide guests with fresh linens and towels, vacuum rooms and halls, and move furniture. Linen room attendants and laundry room workers mark and inspect towels, sheets, and blankets and operate the washing and pressing machines in the hotel laundry. Large hotels and motels usually employ executive housekeepers to supervise these workers and purchase housekeeping supplies. Some hotels also employ managers to supervise laundry operations.

The next largest group of hotel workers are food service personnel. These workers include cooks and chefs, waiters and waitresses, and bartenders who work in the coffee shops and restaurants found in most motels and hotels. Detailed descriptions of their duties are found elsewhere in the *Handbook*.

Hotel managers and assistants are responsible for the profitable operation of their establishments. They determine room rates, oversee restaurant operations, and supervise the hotel or motel staff. In smaller hotels and motels a general manager performs all these tasks, but in large hotels a general manager usually has several assistants, each one responsible for a separate department, such as food service, sales, or personnel.

Nearly all hotels and motels employ clerical workers to take room reservations, bill guests, and furnish information. Most of these workers are front office clerks who greet guests, assign rooms, handle mail, and collect payments. The remainder are bookkeepers, telephone operators, secretaries, and other clerical workers, whose jobs in hotels are much like clerical jobs elsewhere.

Most hotels and some motels employ a uniformed staff to perform services for guests. This staff includes bellhops, who carry baggage and escort guests to their rooms; doorkeepers, who help guests out of their cars or taxis and carry baggage into the hotel lobby; and elevator operators.

In addition, hotels employ many other workers who are also found in other industries. Among these are accountants, personnel workers, entertainers, and recreation workers. Maintenance workers, such as carpenters, electricians, stationary engineers, plumbers, and painters, also work for hotels. Still other workers employed in hotels include detectives, barbers, cosmetologists, valets, and gardeners. Most of these occupations are discussed elsewhere in the *Handbook*.

Employment Outlook

Employment in this industry will expand about as fast as the average for all industries through the mid-1980's as new hotels and motels are built to take advantage of interstate highway or resort locations. In addition to openings resulting from growth, thousands of workers will be needed each year to replace those who retire, die, or transfer to other industries.

Most of the anticipated employment growth will stem from the need to staff new hotels and motels. Employment is expected to increase in both luxury and economy motels as Federal expenditures for highways and other transportation systems stimulate travel. Employment may decline, however, in older hotels, and those unable to modernize are likely to experience low occupancy rates that may force them to reduce costs by eliminating some services and workers. Thousands of temporary jobs will continue to be available each year in resort hotels and motels that are open only part of the year.

Most of the job openings in hotels and motels will be for workers who need little specialized training, such as cleaners, porters, and some dining room employees. Large numbers also will be needed in front office jobs, but opportunities may be limited by the increasing use of computer reservation systems in hotel and motel chains.

Opportunities will be favorable for persons with training or experience as cooks and chefs or as food managers.

Earnings and Working Conditions

Earnings of hotel workers depend on the location, size, and type of the hotel in which they work. Workers in some occupations receive tips in addition to wages that add substantially to their income. Nonsupervisory workers in the hotel industry averaged $2.62 an hour in 1974, excluding tips—about half the average for all nonsupervisory workers in private industry, except farming. About one-half of all hotel workers are covered by Federal and State minimum wage laws; in 1974, workers covered by these laws earned at least $2 an hour.

A 1973 survey of earnings in selected hotel occupations in metropolitan areas indicates that earnings of front office clerks ranged from $2.09 to $3.88 an hour, with an average of $2.56. Bellhops' earnings ranged from $1.99 to $5.71, including tips, with an average of $3 an hour. Tips represent a significant source of income for bellhops, ranging from 23 to 74 percent of their total income.

Salaries of hotel managers and assistants vary greatly, mainly because of differences in duties and responsibilities. Hotel manager trainees who are graduates of specialized college programs start at yearly salaries ranging from $8,000 to $12,000, and are usually given periodic increases for the first year or two. Experienced managers may earn several times as much as beginners; a few, in top jobs, earn $50,000 a year or more. In addition to salary, hotels customarily furnish managers and their families with lodging in the hotel, meals, parking facilities, laundry, and other services.

Since hotels are open round the clock, employees must work on shifts. Fewer employees work at night than during the day and they usually receive additional compensation. Managers and housekeepers who live in the hotel usually have regular work schedules, but they may be called on at any time.

Waiters and waitresses, cooks, pantry workers, dishwashers, and other kitchen workers commonly receive meals; in a few hotels, cleaners, elevator operators, and room clerks also receive meals. Most employees receive 5 to 8 paid holidays a year, paid vacations, and medical benefits.

The Hotel and Restaurant Employees and Bartenders International Union is the major union in the hotel business. Uniformed personnel, such as bellhops and elevator operators, may be members of the Building Service Employees' International Union.

Sources of Additional Information

Information on careers in hotel work may be obtained from:

The Educational Institute of the American Hotel and Motel Association, 1407 S. Harrison Rd., East Lansing, Mich. 48823.

For additional information on hotel training opportunities and a directory of schools and colleges offering courses and scholarships in the hotel field, write to:

Council on Hotel, Restaurant, and Institutional Education, Suite 219, 11 Koger Executive Center, Norfolk, Va. 23502.

Information on housekeeping in hotels is available from:

National Executive Housekeepers Association, Inc., Business and Professional Building, Gallipolis, Ohio 45631.

OCCUPATIONS IN LAUNDRY AND DRYCLEANING PLANTS

In 1974, approximately 430,000 persons were employed by establishments that launder and dryclean garments, household furnishings, and institutional linens and uniforms. These workers were employed throughout the country, but were concentrated in metropolitan areas.

Drycleaning firms and laundries accounted for about three-fourths of the industry's workers. Most of the remainder worked for firms that specialized in renting and cleaning uniforms, towels, diapers, and other linens. A small proportion were employed in valet shops.

More than half of the industry's employment is found in firms that have 20 employees or more. Most firms, however, are owner-operated and have fewer than 10 employees. In 1974, about one-tenth of the industry's workers were self-employed.

Nature of the Work

One way to describe the work done in this industry is to follow an imaginary bundle of clothes from the time it leaves the customer until it is cleaned and returned. (See accompanying chart.) The bundle consists of some men's shirts, a business suit, and bed linens. A *route driver* (D.O.T. 292.358) picks up the bundle and, after leaving a receipt, takes the bundle to the plant.

The owner of the bundle may instead leave it at the plant or drive-up store. In this case, a *counter clerk* (D.O.T. 369.887) makes out a receipt. Either the route driver or the counter clerk sorts the items in the bundle into laundry and drycleaning.

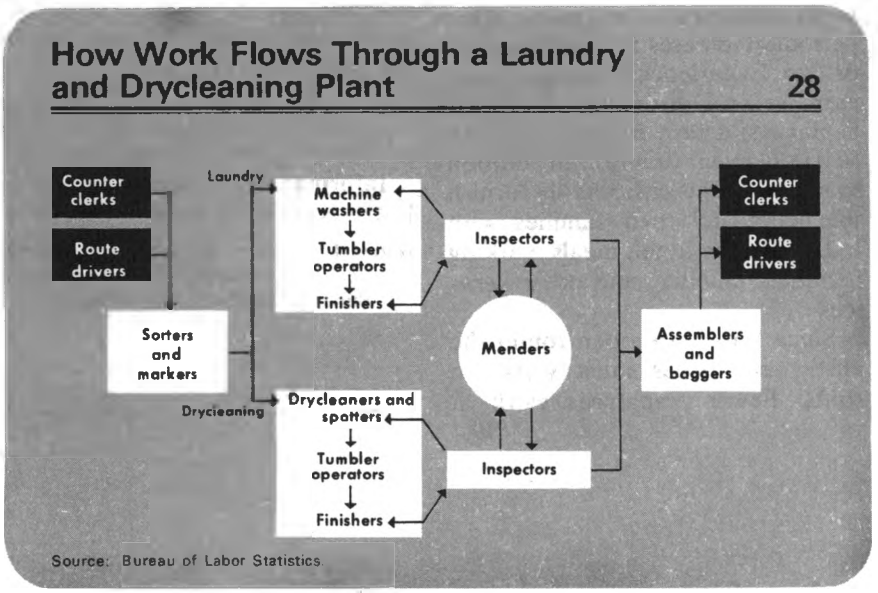
The bundle is turned over to a *marker* (D.O.T. 369.887), who puts an identifying symbol on each item so it may be matched with the customer's receipt at some later time. The marker then sends the shirts and sheets to the washroom and the suit to the drycleaning room.

A *machine washer* (D.O.T. 361.885) puts several hundred pounds of sheets into a huge washing machine. Shirts are loaded into another washer. These machines are controlled automatically, but the machine washer must understand how to operate the controls—water temperature, suds level, time cycles, and the amount of agitation for different fabrics. When the washing cycle is completed, the laundry is transferred to an extractor that removes about half of the water. This stage is similar to the "spin" cycle on a home washer. Conveyors move the laundry to conditioners, dryers, or tumblers where dry, heated air removes some of the remaining moisture.

The sheets go from the drying area to *flatwork finishers* (D.O.T. 363.886), who shake out folds and creases, spread the sheets on moving belts, and feed them into large flatwork ironing machines for ironing and partial folding. When the sheets come out of the machine, other finishers complete the folding and stacking.

Shirts go directly from the extractor to *shirt finishers* (D.O.T. 363.782), who usually work in teams of two or three. One finisher puts the sleeves of the shirt on a "sleever," which has two armlike forms. A second finisher then puts the shirt on a "triple-head" press that irons the front and back simultaneously. In some plants, the first finisher either folds the shirt or places it on a hanger, whichever the customer has indicated. A third finisher may do the folding. In some laundries, one shirt finisher performs all these operations.

The jobs of the *drycleaner* (D.O.T. 362.782) and *machine washer* (D.O.T. 361.885) are



similar, but the cleaning solution for drycleaning is a chemical solvent instead of water, and drycleaning machines generally are smaller than the laundry washers. The drycleaner sorts clothes according to color, fiber content, and fabric construction and selects the proper time cycle for each load. The drycleaner may apply special prespoting solutions to spots and stains before placing the garments in the drycleaning machine. After cleaning, a special machine removes the solvent and then the clothes are dried in a tumbler or hot-air cabinet. The *spotter* (D.O.T. 362.381) will use chemical reagents and steam to remove stubborn stains.

If the clothes are made of a material that sheds wrinkles readily, the finisher places them on hangers and puts them in a steam tunnel or steam cabinet. The steam will remove the wrinkles and help the garment regain its shape.

Some clothes, such as men's suits, are made out of fabrics that require more attention; they are finished differently. A *men's suit finisher* (D.O.T. 363.782) puts the pants on special "topper" and "legger" presses. The jacket is placed on a body form that may have a second part that comes down to press and shape the shoulders and collar of the jacket while the steam is forced from the inside. Final finishing touches are done on a steam-heated pressing head and "buck," a flat surface covered in fabric.

An *inspector* (D.O.T. 369.687) checks finished items to see that the quality standards of the plant have been maintained. Any item in need of recleaning or refinishing may be returned to the appropriate department; occasionally, the inspector works on them instead. Repair work may be forwarded to a *mender* (D.O.T. 782.884), who sews on buttons, mends tears, and resews seams. Finally, *assemblers* (D.O.T. 369.687) collect the linens and shirts by matching the sales invoice with the identification marks. Assemblers or *baggers* (D.O.T. 920.887) may remove tags before putting the items in bags or boxes for storage until called for by the customer or delivered by the route driver.

In addition to workers who are unique to laundry and drycleaning plants, many other workers are found in this industry. The manager or proprietor is responsible for seeing that the work of the plant is performed efficiently. Office workers keep records, handle correspondence, and prepare bills. Sales personnel develop new customers for the plant's services. Mechanics keep equipment and machinery operating properly. Some service workers clean, guard, and otherwise maintain the plant; others plan and serve food to plantworkers. Laborers lift and carry heavy loads to machines. (Discussion of many of these occupations can be found elsewhere in the *Handbook*.)

Training, Other Qualifications, and Advancement

Many workers in this industry get their first jobs without previous training. Persons who have little formal education can get production line jobs in drycleaning plants. Many employers will hire applicants who do not speak English. Basic laundry and drycleaning skills may be learned on the job in a short time. Some jobs, such as folding towels and feeding pillowcases and sheets into a flatwork ironer, may require 1 or 2 days to learn. Some finishing jobs—pants presser, or shirt finisher, for example—may require less than a week's training. Other jobs, such as counter clerk, marker, inspector, and assembler, may require several weeks to learn. Several months or more are needed to train a drycleaner or women's apparel finisher. It may take 6 to 12 months to become a spotter because of the variety of fibers and fabrics, spots and stains, and chemicals used in treating the stains.

Some preemployment training in finishing, drycleaning, and spotting skills is available in vocational high schools and trade schools. Home study courses are available from the International Fabric Care Institute.

Employers look for workers who are dependable and who have physical stamina, manual dexterity, and keen eyesight. Workers must be able to adjust to the repetitive nature of many laundry and drycleaning jobs.

Advancement for most workers in this industry is limited. Many remain permanently in the same job. Nevertheless, employers occasionally send promising employees to technical or managerial training programs or seminars on topics of general interest given by the International Fabriccare Institute at its facility in Joliet, Ill. Some men's suit finishers become skilled enough to do women's apparel finishing. Markers and assemblers interested in finishing work usually are given an opportunity to move up to this job. Finishers also may become inspectors. Supervisors and managers frequently are chosen from experienced employees already in the industry. Some drycleaners and spotters establish their own drycleaning plants.

Employment Outlook

Employment in this industry is expected to decline through the mid-1980's. Laborsaving machinery and more efficient methods of cleaning and finishing laundry will enable the industry to do more work with fewer employees. Nevertheless, thousands of workers will be hired to replace those who retire, die, or transfer to other fields.

Although the industry's total employment is expected to decline, employment trends will differ among occupations. Employment of spotters is expected to decline

because new fibers and finishes make fabrics less stainable. The number of finishers should decrease as machinery does more of the finishing work. On the other hand, more people will be needed in some maintenance occupations to repair the increasing amount of machinery and equipment used by laundry and drycleaning firms. More counter clerks will be required due to growth in the number of retail outlets operated by these firms.

Earnings and Working Conditions

Wage levels in the laundry and drycleaning industry are not high. In 1974, the hourly average wage for nonsupervisory workers in this industry was $2.80 compared to $4.22 for all nonsupervisory workers in private industry, except farming. Earnings are higher for workers in the more highly skilled occupations such as drycleaner, spotter, and machine washer.

Modern laundry and drycleaning plants are clean and well lighted. Because of the heat, hot air, and steam of the cleaning processes, the plant may be hot during the summer months. However, large modern laundries usually have high ceilings—often three stories high—and numerous windows that may be opened for ventilation. Many new, small drycleaning plants are air-conditioned in the office and customer areas and well ventilated in the machinery areas. In addition, new machinery operates with a minimum of noise. Work in laundries and drycleaning plants is less hazardous than in most manufacturing plants.

Sources of Additional Information

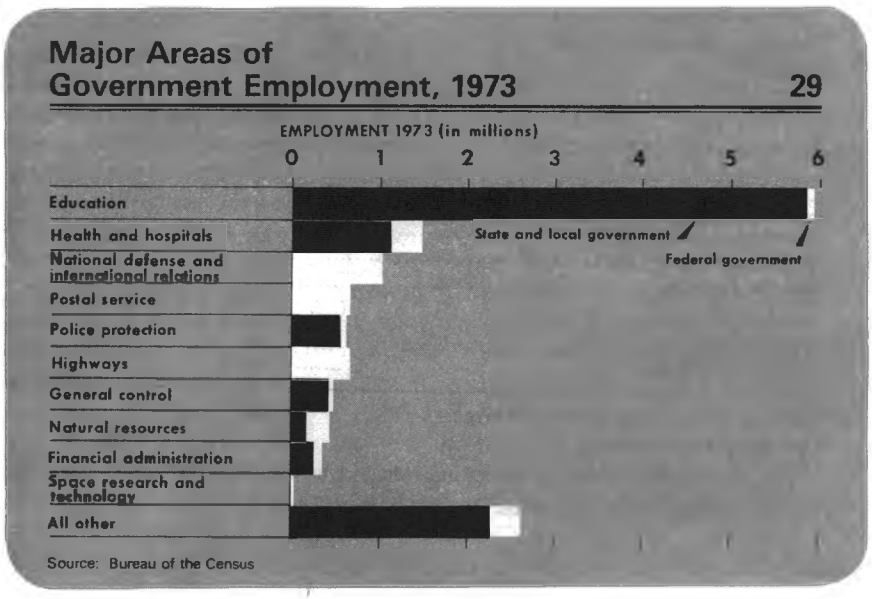
The local office of the State employment service may have additional information on training and employment opportunities in this field.

GOVERNMENT

Government service, one of the Nation's largest fields of employment, provided jobs for over 14.5 million civilian workers in 1974, about 1 out of 6 employed persons in the United States. State or local governments (county, city, town, village, or other local government division) employed nearly four-fifths of these workers. Nearly all of the others worked for the Federal Government in the continental United States. A small number worked for the Federal Government overseas.

Government employees represent a significant portion of each State's work force. They work in large cities, small towns, and even in remote and isolated places such as lighthouses and forest ranger stations.

Continuing the trend begun in the late 1940's, employment in State and local government is expected to grow faster than the average for all industries through the mid-1980's. Federal employment, on the other hand, is expected to grow much more slowly than the average for all industries. Many job opportunities also will arise at all levels of government as workers retire, die, or leave the government service.



Government Activities and Occupations

Two-fifths of all government workers in 1973, or 5.9 million, provided educational services, mostly at the State and local levels in elementary and secondary schools. Besides teachers, others who worked in educational services included administrative and clerical workers, maintenance workers, librarians, dietitians, nurses, and counselors.

About 1.1 million civilian employees in 1973 worked for Federal agencies which are concerned with national defense and international relations. Occupations in this group include administrative and clerical workers, physicians, nurses, teachers, engineers, scientists, technicians, and craft and other manual workers. They work in offices, research laboratories, navy yards, arsenals, and missile launching sites and in hospitals and schools run by the military services.

Another 1.4 million workers provided health services and staffed hospitals, primarily for State and local governments. Many workers also were employed in housing and community development, police and fire protection, social security and public welfare services, transportation and public utilities, financial administration, general administrative functions, and judicial and legislative activities. The majority of these workers also were State and local government employees. All of the 700,000 government workers in postal services and a majority of the 400,000 workers in natural resource fields, such as the National Park and Forest Service, were employed by the Federal Government.

Although the many government activities require a diversified work force having various levels of education, training, and skill, 2 out of 3 government employees are white-collar workers. Among the largest white-collar occupational groups are teachers, administrators, postal clerks, and office workers such as stenographers, typists, and clerks.

Some important service, craft, and manual occupations are aircraft and automotive mechanics, repairers, police, firefighters,

Table 1. Percent distribution of employment in government and private industry by occupation, 1974

Occupation	Government [1]	Private industry
Total	100	100
White-collar workers	67	45
Professional and technical	36	10
Managers and administrators	8	11
Clerical	23	16
Sales	([2])	7
Blue-collar workers	14	39
Craft and related workers	6	15
Transport equipment operatives	3	4
Other equipment operatives	1	15
Nonfarm laborers	4	5
Service workers	19	10
Farm workers	([2])	4

[1] Excludes Federal employment overseas.

[2] Less than 0.5 percent.

NOTE: Because of rounding, sums of individual items may not equal totals.

SOURCE: Bureau of Labor Statistics

truckdrivers, skilled maintenance workers (for example, carpenters, painters, plumbers, and electricians) custodial workers, and laborers.

Because of the special character of many government activities, the occupational distribution of employment is very different from that in private industry, as shown in table 1.

The following chapters discuss opportunities for civilian employment in the major divisions of government and in the various branches of the Armed Forces. A separate chapter gives information on post office occupations.

FEDERAL CIVILIAN GOVERNMENT

Nature and Location of Employment

The Federal Government is the Nation's largest employer; it employed about 2,725,000 civilian workers in all parts of the United States in 1974. In addition, it employed about 60,000 U.S. citizens abroad. Although the headquarters of most Government departments and agencies are in the Washington, D.C. metropolitan area, only 1 out of 9 (about 340,000) Federal employees worked in that area in 1974. Nearly 300,000 worked in California, and more than 100,000 each in New York, Pennsylvania, Texas, and Illinois.

Federal employees work in occupations that represent nearly every kind of job in private employment, as well as some others unique to the Federal Government, such as postal clerk, regulatory inspector, foreign service officer, and Internal Revenue agent. Most Federal employees work for the departments and agencies that make up the executive branch of the government. Some are employed in the legislative and judicial branches.

The executive branch includes the Executive Office of the President, the 11 cabinet departments, and about 80 independent agencies, commissions, and boards. This branch is responsible for activities such as administering Federal laws, handling international relations, conserving natural resources, treating and rehabilitating disabled veterans, delivering the mail, conducting scientific research, maintaining the flow of supplies to the Armed Forces, and administering other programs to promote the health and welfare of the people of the United States.

The Department of Defense, which includes the Departments of the Army, Navy, and Air Force, is the largest agency. It employed over 1 million civilian workers in the United States in 1974. The departments of Agriculture; Health, Education, and Welfare; and Treasury each employed more than 100,000 workers. The two largest independent agencies were the U.S. Postal Service, which employed almost 700,000 workers, and the Veterans Administration, which employed over 200,000.

About 38,000 people worked for the legislative branch of government, which includes the Congress, the Government Printing Office, the General Accounting Office, and the Library of Congress. Almost 10,000 people worked for the judicial branch, which includes the Supreme Court and the other U.S. courts.

White-Collar Occupations. Because of its wide range of responsibilities, the Federal Government employs white-collar workers in a great many occupational fields. Nearly 2 million white-collar workers, including postal workers, worked for the Federal Government in 1974. About 150,000 of these work in engineering and related fields. Included in this total are about 85,000 engineers, representing virtually every branch and specialty of the profession. There also are large numbers of technicians in areas such as engineering, electronics, surveying, and drafting. Nearly two-thirds of all engineers are in the Department of Defense.

Of the 115,000 workers employed in accounting and budgeting work, 34,000 are professional accountants and Internal Revenue agents. Among administrative and managerial occupations in this field are tax technician and budget administrator. There also are large numbers of clerks in specialized accounting work. Accounting workers are employed throughout the Government, particularly in the Department of Defense, the Treasury Department, and the General Accounting Office.

More than 100,000 Federal employees work in hospitals or in medical, dental, and public health activities. Professional occupations in this field include physician, nurse, dietitian, medical technologist, and physical therapist. Among technician and aide jobs are medical technician, medical laboratory aide, and nursing assistant. Employees in this field work primarily in the Veterans Administration; others are in the Defense Department and the Department of Health, Education, and Welfare.

Almost 45,000 biological and agricultural science workers are employed by the Federal Government. Many of these work in forestry and soil conservation activities. Others administer farm assistance programs. The largest number were employed as biology, forest and range fire control , soil conservation , and forestry technicians. Most of these workers are employed by the Departments of Agriculture and Interior.

In the physical sciences, the Federal Government employs professional workers such as physicists, chemists, meteorologists, cartographers, and geologists. Aides and technicians in this field include physical science technician, meteorological technician, and cartographer's technician. Four-fifths of the 42,000 workers in the physical sciences are employed by the Department of Defense; the National Aeronautics and Space Ad-

ministration; and the Departments of Agriculture, Commerce, and Health, Education, and Welfare.

Within the mathematics field are professional mathematicians and statisticians, and mathematics technicians and statistical clerks. There also are a number of administrative positions in the related field of computer programming. Mathematics workers are employed primarily by the Defense Department, the National Aeronautics and Space Administration, and the Departments of Agriculture, Commerce, and Health, Education, and Welfare. Computer related occupations are found in most Federal agencies.

In the field of law there are more than 11,000 employees in professional positions, such as attorney, and others in administrative positions such as claims examiner. There also are many clerical positions that involve claims examining work. Workers in the legal field are employed throughout the Federal Government.

In the social science field there are professional positions for economists throughout the government; psychologists and social workers work primarily for the Veterans Administration; and foreign affairs and international relations specialists for the Department of State. Among social science administrative workers are social insurance administrators in the Department of Health, Education, and Welfare and intelligence specialists for the Department of Defense.

The Federal Government employs about 45,000 persons in investigative and inspection work. Large numbers of these workers are engaged in administrative activities, such as criminal investigation and health and regulatory inspection. Most of these jobs are in the Departments of Defense, Treasury, Justice, and Agriculture.

About 64,000 persons worked in jobs concerned with the purchase, cataloging, storage, and distribution of supplies for the Federal Government. This field includes many managerial and administrative positions such as supply management officer, purchasing officer, and inventory management specialist, as well as large numbers of specialized clerical positions. Most of these jobs are in the Department of Defense.

Nearly 460,000 general clerical workers are employed in all departments and agencies of the Federal Government. Included in this group are office machine operators, secretaries, stenographers, clerk-typists, mail and file clerks, telephone operators, and other related workers. In addition, there are several hundred thousand postal clerks employed by the Federal Government.

Entrance requirements for white-collar jobs vary widely. Entrants into professional occupations must have highly specialized knowledge in a specified field. Occupations typical of this group are attorney, physicist, and engineer.

Entrants into administrative and managerial occupations usually are not required to have knowledge of a specialized field, but rather must indicate that they have potential for future development by having a degree from a 4-year college or by responsible job experience. Entrants usually begin at a trainee level and learn the duties of the job after they are hired. Typical jobs in this group are budget analyst, claims examiner, purchasing officer, administrative assistant, and personnel officer.

Technician, clerical, and aide-assistant jobs have entry level positions that usually are filled by people who have a high school education or the equivalent. For many of these positions, no previous experience or training is required. The entry level position is usually that of trainee. Persons who have junior college or technical school training, or those who have specialized skills, may enter these occupations at higher levels. Jobs typical of this group are engineering technician, supply clerk, clerk-typist, and nursing assistant.

Blue-Collar Occupations. Blue-collar jobs—service, craft, and manual labor—provided employment for more than 544,000 workers in 1974. Most of these workers are in establishments such as naval shipyards, arsenals, air or army depots. Blue-collar workers also work on construction, harbor, flood-control, irrigation, or reclamation projects. The Department of Defense employs about three-fourths of these workers. Others work for the Veterans Administration, U.S. Postal Service, General Services Administration, Department of the Interior, Tennessee Valley Authority, and Department of Agriculture.

The largest single group of blue-collar workers consists of mobile equipment operators and mechanics. These jobs include those of forklift operator, chauffeur, truckdriver, and automobile mechanic. The next largest group of workers are general laborers, who perform a wide variety of manual jobs.

The Federal Government employs many workers in machinery operation and repair occupations, such as boiler and steam plant operator, machinist, machinery repairer, maintenance electrician, electronics equipment repairer, and aircraft mechanic.

Skilled construction workers also are utilized widely throughout the Federal Government in such jobs as carpenter, painter, plumber, steamfitter and pipefitter, and sheetmetal worker. Other important blue-collar occupations include warehouse worker, food service worker, and printer.

Entrance requirements. Persons with previous training in a skilled trade may apply for a position with the Federal Government at the

journeyman level. Those with no previous training may apply for appointment to one of several apprenticeship programs. Applicants are given a written examination and are rated on their potential to learn a skilled trade. The apprenticeship program generally lasts for 4 years with the trainee receiving both classroom and on-the-job training. After completing this training, a person is eligible for a position at the journeyman level. There also are a number of positions which require little or no prior training or experience. These include custodians, maintenance workers, messengers, and many others. (Detailed descriptions of the work duties, qualifications, and training of most white-collar, service, craft, and manual labor jobs mentioned above are provided in other sections of the *Handbook*.)

The Merit System

About 9 out of 10 jobs in the Federal Government in the United States are under the merit system. The Civil Service Act, administered by the U.S. Civil Service Commission, covers 61 percent of all Federal jobs. This act was passed by the Congress to insure that Federal employees are hired on the basis of individual merit and fitness. It provides for competitive examinations and the selection of new employees from among those who make the highest scores. The commission, through its network of 65 Civil Service Commission Area Offices, examines and rates applicants and supplies Federal departments and agencies with names of persons eligible for the jobs to be filled.

Some Federal jobs are exempt from Civil Service requirements, either by law or by action of the Civil Service Commission. However, most of these positions are covered by separate merit systems of other agencies such as the Foreign Service of the Department of State, the Department of Medicine and Surgery of the Veterans Administration, the Federal Bureau of Investigation, the Energy Research and Development Administration, the Nuclear Regulatory Commission, and the Tennessee Valley Authority.

Civil service competitive examinations may be taken by any U.S. citizen. To be eligible for appointment, an applicant must meet minimum age, training, and experience requirements for the particular job. A physical handicap will not in itself bar a person from a position if it does not interfere with his or her performance of the required duties. Examinations vary according to the types of positions for which they are held. Some examinations test the applicant's ability to do the job applied for or his or her ability to learn how to do it. Applicants for jobs that do not require a written test are rated on the basis of the experience and training described in their applications and any supporting evidence required.

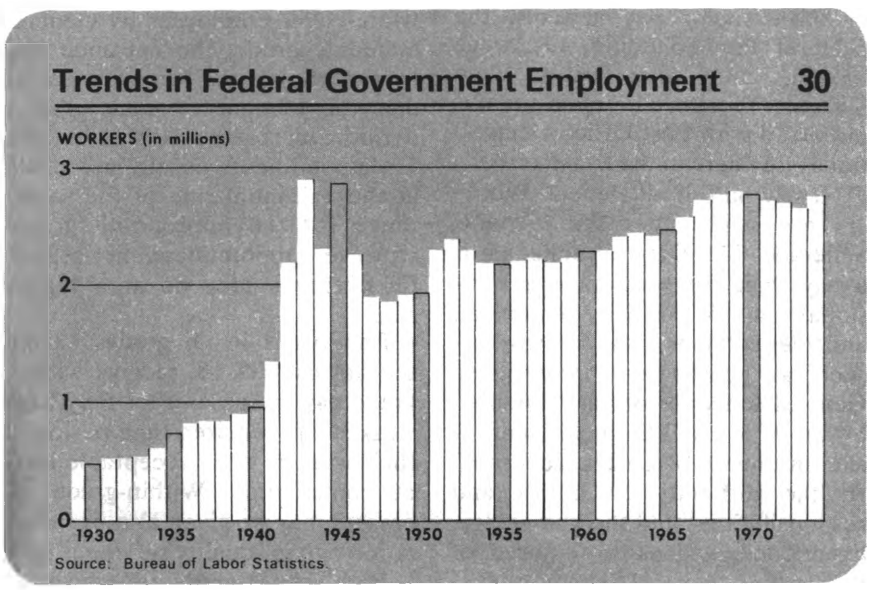
Applicants are notified as to whether they have achieved eligible or ineligible ratings, and the names of eligible applicants are entered on a list in the order of their test scores. When a Federal agency requests names of eligible applicants for a job vacancy, the area office sends the agency the names at the top of the appropriate list; the agency can select any one of the top three. Names of those not selected are restored to the list for consideration for other job openings.

Appointments to civil service jobs are made without regard to an applicant's race, color, religion, national origin, politics, or sex.

Employment Trends and Outlook

Federal employment is expected to grow more slowly than the average for all industries through the mid-1980's, continuing a trend begun in the late 1960's. Although total Federal Government employment is expected to rise somewhat, some Federal agencies will reduce their staffs as some administrative responsibilities will continue to be transferred to State and local governments. In addition, the Department of Defense is expected to reduce the number of its civilian employees.

In addition to some new jobs there will be openings due to the need to replace employees who



transfer out of the Federal service, retire, or die. Thus, many job opportunities will occur in occupations where total employment is relatively stable, as well as in those in which it is rising.

The proportion of Federal workers employed in professional, technical, and administrative jobs has gradually increased in recent years. On the other hand, the proportion employed in clerical and blue-collar jobs has fallen. These trends are expected to continue, reflecting the increasing demand for services of a growing population and the requirements of the country's international programs. These demands are expected to result in rising requirements for professional, administrative, and technical workers. Employment in many clerical and blue-collar occupations, however, will be limited by the Federal Government's increasing use of labor saving electronic data processing and materials handling equipment and the introduction of improved data transmission and communications systems.

Table 1. Distribution of full-time Federal employees under the General Schedule by grade level, March 31, 1974, and salary scale, effective October 13, 1974

General Schedule (GS) Grade	Employees		Salaries		
	Number	Percent	Entrance	Periodic increase	Maximum
Total all grades	1,322,313	100.0			
1	4,317	0.3	$5,294	$176	$6,878
2	36,240	2.7	5,996	200	7,796
3	109,584	8.3	6,764	225	8,789
4	167,377	12.7	7,596	253	9,873
5	176,960	13.4	8,500	283	11,047
6	81,401	6.2	9,473	316	12,317
7	121,387	9.2	10,520	351	13,679
8	26,206	2.0	11,640	388	15,132
9	129,846	9.8	12,841	428	16,693
10	21,837	1.7	14,117	471	18,356
11	141,718	10.7	15,481	516	20,125
12	128,602	9.7	18,463	615	23,998
13	101,496	7.7	21,816	727	28,359
14	46,744	3.5	25,581	853	33,258
15	23,801	1.8	29,818	994	[2] 38,764
16	3,428	.3	34,607	1,154	[2] 43,839
17	1,003	.1	[2] 40,062	1,335	[2] 45,402
18	366	([1])	[2] 46,336	.....	.....

[1] Less than 0.05 percent.

[2] Basic pay limited by section 5308 of title 5 of the United States Code to $36,000 as of the above date.

SOURCE: U.S. Civil Service Commission; preliminary data.

Earnings, Advancement, and Working Conditions

Nearly all Federal civilian employees are paid according to one of three major pay systems; the General Pay Schedule, the wage system, and the Postal Field System. (The Postal Field System is discussed with Post Office Occupations elsewhere in the *Handbook*.)

Nearly half of all Federal Workers are paid under the General Schedule. The General Schedule is a pay scale for workers in professional, administrative, technical, and clerical jobs, and for workers such as guards and messengers. General Schedule jobs are classified by the U.S. Civil Service Commission in one of 18 grades, according to the difficulty of duties and responsibilities, and the knowledge, experience, and skills required of the worker. General Schedule (GS) pay rates are set by Congress and apply nationwide. They are reviewed annually to insure that they remain comparable with salaries in private industry.

The distribution of Federal white-collar employees by General Schedule grade, the entrance and maximum salaries for each grade, and the amount of each grade's periodic increases are listed in table 1. Appointments usually are made at the minimum rate of the salary range for the appropriate grade. However, appointments in hard-to-fill positions may be at a higher rate.

Employees in all grades except the highest, GS-18, receive within-grade pay increases after they have worked the required time period, if their work is at an acceptable level of competence. Within-grade increases may be given also in recognition of high-quality service.

High school graduates who have no related work experience usually start in GS-2 jobs, but some who have special skills begin at grade GS-3. Graduates of 2-year junior colleges and technical schools often can begin at the GS-4 level. Most people appointed to professional and administrative jobs such as psychologist, statistician, economist, writer and editor, budget analyst, accountant, and physicist, can enter at grades GS-5 or GS-7, depending on their academic record. Those who have a master's degree, or the equivalent education or experience, usually enter at the GS-9 or GS-11 level. Advancement to higher grades generally depends upon ability, work performance, and openings in jobs with higher grades.

About one-quarter of the Federal civilian workers are paid according to the coordinated Federal Wage System. Under this system, craft, service, and manual workers are

Table 2. Coordinated Federal Wage System hourly rates [1] for selected occupations and location, January 1, 1975

Location	Labor (heavy)	Electrician	Tool, die, and gauge maker
Atlanta	$3.96	$6.21	$7.17
Boston	4.45	5.98	6.55
Chicago	4.84	6.65	7.43
Denver	3.52	5.83	6.40
Norfolk–Portsmouth–Newport News–Hampton	3.80	5.37	6.04
Houston, Galveston–Texas City	4.09	5.87	6.64
Los Angeles	4.73	6.50	7.25
New Orleans	3.68	5.44	6.19
New York	4.56	6.03	6.67
Pensacola	3.98	6.21	7.17
Philadelphia	4.99	6.05	6.51
Seattle–Everett–Tacoma	5.18	6.49	7.06
San Francisco	5.15	6.97	7.75
St. Louis	4.38	5.84	6.49
Washington, D.C.	4.39	6.24	7.03

[1] Rates are for nonsupervisory workers for the 3rd step of a 5-step pay range.

SOURCE: Bureau of Labor Statistics

paid hourly rates which are established on the basis of "prevailing" rates paid by private employers for similar work in the same locations. As a result, the Federal Government wage rate paid for an occupation varies by locality, as illustrated in table 2.

Federal Government employees work a standard 40-hour week. Employees who are required to work overtime receive premium rates for the additional time or compensatory time off at a later date. Most employees work 8 hours a day and 5 days a week, Monday through Friday, but in some cases, the nature of the work requires a different workweek. Annual earnings for most full-time Federal workers are not affected by seasonal factors.

Federal employees earn 13 days of annual (vacation) leave each year during their first 3 years of service; 20 days each year until the end of 15 years; after 15 years, 26 days each year. Nine paid holidays are observed annually. Workers who are members of military reserve organizations also are granted up to 15 days of paid military leave a year for training purposes. A Federal worker who is laid off is entitled to unemployment compensation similar to that provided for employees in private industry.

Other benefits available to most Federal employees include: a contributory retirement system, optional participation in low-cost group life and health insurance programs which are partly supported by the Government, and training programs to develop maximum job proficiency and help workers achieve their highest potential. These training programs may be conducted in Government facilities or in private educational facilities at Government expense.

Sources of Additional Information

Information on employment opportunities in the Federal Government is available from a number of sources. High school students are often able to get information from their high school guidance counselors. A college placement office is often a good source of such information for college students. Information also may be available from State employment service offices and many U.S. post offices.

Sixty-five area offices operated by the U.S. Civil Service Commission are located in various large cities throughout the country. These offices announce and conduct examinations required for various Federal Government jobs. They evaluate qualifications and refer eligible applicants to employing agencies for their geographic areas. They also provide a complete one-stop information service on local and nationwide job opportunities in the Federal Government service. The area offices also operate a toll-free telephone information service in nearly all States for those unable to visit them. Their telephone numbers are listed in most telephone books under "U.S. Government."

For information about jobs in a specific agency, contact the agency directly.

OCCUPATIONS IN THE POSTAL SERVICE

The U.S. Postal Service handled about 90 billion pieces of mail in 1974, including letters, magazines, and parcels. About 700,000 workers were required to process and deliver this mail. The vast majority of Postal Service jobs are open to workers with 4 years of high school or less. The work is steady, and the pay can range beyond $12,000 a year. Some of the jobs, such as mail carrier, offer a good deal of personal freedom. Other jobs, however, are more closely supervised and more routine.

Nature and Location of the Industry

Most people are familiar with the duties of the mail carrier and the post office window clerk. Yet few are aware of the many different tasks required in processing mail and of the variety of occupations in the Postal Service.

At all hours of the day and night, a steady stream of letters, packages, magazines, and papers moves

through the typical large post office. Mail carriers have collected some of this mail from neighborhood mailboxes; some has been trucked in from surrounding towns or from the airport. When a truck arrives at the post office, mail handlers unload the mail. Postal clerks then sort it according to destination. After being sorted, outgoing mail is loaded into trucks for delivery to the airport or nearby towns. Local mail is left for carriers to deliver the next morning.

To keep buildings and equipment clean and in good working order, the Postal Service employs a variety of service and maintenance workers. Included are janitors, laborers, truck mechanics, electricians, carpenters, and painters. Some workers specialize in repairing machines that process mail.

Postal inspectors audit post offices operations to see that they are run efficiently, that funds are spent properly, and that postal laws and regulations are observed. They also prevent and detect crimes such as theft, forgery, and fraud involving use of the mail.

Postmasters and supervisors are responsible for the day-to-day operation of the post office, for hiring and promoting employees, and for setting up work schedules.

The Postal Service also contracts with private businesses to transport mail. In 1974, there were about 12,500 of these "Star" route contracts. Most " Star" route carriers use trucks to haul mail, but in some remote areas horses or boats are used instead.

Almost 85 percent of all postal workers are in jobs directly related to processing and delivering mail. (See table 1.) This group includes postal clerks, mail carriers, mail handlers, and truckdrivers. (Detailed information on Mail Carriers and Postal Clerks is given elsewhere in the *Handbook*.) Postmasters and supervisors make up nearly 10 percent of total employment, and maintenance workers about 4 percent. The remainder includes such workers as postal inspectors, guards, personnel workers, and secretaries.

The Postal Service operates more than 41,000 installations. Most are post offices, but some serve special purposes, such as handling payroll records or supplying equipment.

Although every community receives mail service, employment is concentrated in large metropolitan areas. Post offices in cities such as New York, Chicago, and Los Angeles employ a great number of workers because they not only process huge amounts of mail for their own populations but also serve as mail processing points for the smaller communities that surround them.

Training, Other Qualifications, and Advancement

An applicant for a Postal Service job must pass an examination and meet minimum age requirements. Generally, the minimum age is 18, but a high school graduate may begin work at 16 if the job is not hazardous and does not require use of a motor vehicle. Many Postal Service jobs do not require formal education or special training. Applicants for these jobs are hired on the basis of their examination scores.

Applicants should apply at the post office where they wish to work and take the entrance examination for the job they want. Examinations for most jobs include a written test. A physical examination is required, as well. Applicants for jobs that require strength and stamina are sometimes given a special test. For example, mail handlers must be able to lift mail sacks weighing up to 70 pounds. The names of applicants who pass the examinations are placed on a list in the order of their scores. Separate eligibility lists are maintained for each post office. Five extra points are added to the score of an honorably discharged veteran, and 10 extra points to the score of a veteran wounded in combat or disabled. Disabled veterans who have a compensable, service-connected disability of 10 percent or more are placed at the top of the eligibility list. When a job opens, the appointing officer chooses one of the top three applicants. Others are left on the list so that they can be considered for future openings.

New employees are trained either on the job by supervisors and other experienced employees or in local training centers. Training ranges from a few days to several months, depending on the job. For example, mail handlers and mechanics' helpers can learn their jobs in a relatively short time. Postal inspectors, on the other hand, need months of training.

Postal workers are classified as casual, part-time flexible, part-time regular, or full-time. Casual workers are hired to help handle the large amounts of mail during the Christmas season and for other short-term assignments. Part-time flexible employees do not have a regular work schedule but replace absent workers or help with extra work loads as the need arises. Part-time regulars have a set work schedule—for example, 4 hours a day. Carriers, clerks, and mail handlers may start as part-time flexible workers and move into full-time jobs according to their seniority as vacancies occur.

Advancement opportunities are available for most postal workers because there is a management commitment to provide career development. Also, employees can get preferred assignments, such as the day shift or a more desirable delivery route, as their seniority increases. When an opening occurs, employees may submit written requests, called "bids," for assignment to the vacancy. The bidder who meets the qualifications and has the most seniority gets the job.

In addition, postal workers can advance to better paying positions

by learning new skills. Training programs are available for low-skilled workers who wish to become technicians or mechanics.

Applicants for supervisory jobs must pass an examination. Additional requirements for promotion may include training or education, a satisfactory work record, and appropriate personal characteristics such as leadership ability. If the leading candidates are equally qualified, length of service also is considered.

Although opportunities for promotion to supervisory positions in smaller post offices are limited, workers may apply for vacancies in a larger post office and thus increase their chances.

Employment Outlook

Employment in the Postal Service is expected to grow more slowly than the average for all industries through the mid-1980's. Mechanization of mail processing and more efficient delivery should allow the Postal Service to handle increasing amounts of mail without corresponding increases in employment. Nevertheless, thousands of job openings will result as workers retire, die, or transfer to other fields.

Earnings and Working Conditions

Postal Service employees are paid under several separate pay schedules depending upon the duties of the job and the knowledge, experience, or skill required. For example, there are separate schedules for production workers, such as clerks and mail handlers; for rural carriers; for postal managers; and for postal executives. In all pay schedules, except that of executives, employees receive periodic "step" increases up to a specified maximum if their job performance is satisfactory. A distribution of employees in levels 1 through 8, with entrance and maximum salaries, is shown in table 1.

Table 1. Employment and salaries in the Postal Service

Grade level	Employment [1]	Salary schedules [2]	
		Entrance	Maximum
Total	449,679		
1	555	$8,692	$10,595
2	2,946	9,111	11,168
3	8,257	9,564	11,786
4	39,920	10,054	12,452
5	352,613	10,586	13,171
6	42,880	11,157	13,962
7	2,132	11,776	14,801
8	376	12,445	15,425

[1] On June 30, 1974; includes nonsupervisory employees in post offices who are paid annual salaries. Does not include rural carriers or part time and casual employees.
[2] In effect in mid-1974; does not include rural carriers.

Most mail handlers are at level 4 and most postal clerks and mail carriers are at level 5.

Full-time employees work an 8-hour day 5 days a week. Both full-time and part-time employees who work more than 8 hours a day or 40 hours a week receive overtime pay of one and one-half times their hourly rates.

In 1974, postal employees earned 13 days of annual leave (vacation) during each of their first 3 years of service, including prior Federal civilian and military service; 20 days each year for 3 to 15 years of service; and 26 days after 15 years. In addition, they earned 13 days of paid sick leave a year regardless of length of service.

Other benefits include retirement and survivorship annuities, free group life insurance, and optional participation in health insurance programs supported in part by the Postal Service.

Most post office buildings are clean and well lighted, but some of the older ones are not. The Postal Service is in the process of replacing and remodeling its outmoded buildings, and conditions are expected to improve.

Most postal workers are members of unions and are covered by a national agreement between the Postal Service and the unions.

Sources of Additional Information

Local post offices and State employment service offices can supply details about entrance examinations and employment opportunities in the Postal Service.

STATE AND LOCAL GOVERNMENTS

State and local governments provide a very large and expanding source of job opportunities in a wide variety of occupational fields. In 1974, over 11.8 million people worked for State and local government agencies; nearly three-fourths of these worked in units of local government, such as counties, municipalities, towns, and school districts.

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Educational services account for the majority of jobs in State and local government. About 5.9 million employees worked in public schools, colleges, or other educational services.

In addition to the nearly 3 million classroom and college teachers, school systems, colleges, and universities also employed administrative personnel, librarians, guidance counselors, nurses, dietitians, clerks, and maintenance workers. Three-fourths of these worked elementary and secondary schools, which are administered largely by local governments. State employment in education is concentrated chiefly at the college, university, and technical school levels.

The next two largest fields of State and local government employment were health services and highway work. The almost 1.4 million workers employed in health and hospital work included physicians, nurses, medical laboratory technicians, and hospital attendants. More than 600,000 people worked in highway activities such as construction and maintenance. Highway workers include civil engineers, surveyors, operators of construction machinery and equipment, truckdrivers, concrete finishers, carpenters, and construction laborers.

General governmental control and financial activities accounted for about 840,000 workers. These included chief executives and their staffs, legislative representatives, and persons employed in the administration of justice, tax enforcement and other financial work, and general administration. These functions require the services of individuals such as lawyers, judges, and other court officials, city managers, property assessors, budget analysts, stenographers, and clerks.

Police and fire protection is another large field of employment. Over 600,000 persons were engaged in police work, including administrative, clerical, and custodial personnel, as well as uniformed and plainclothes police. Local governments employed all of the 300,000 firefighters, many of whom work only part time.

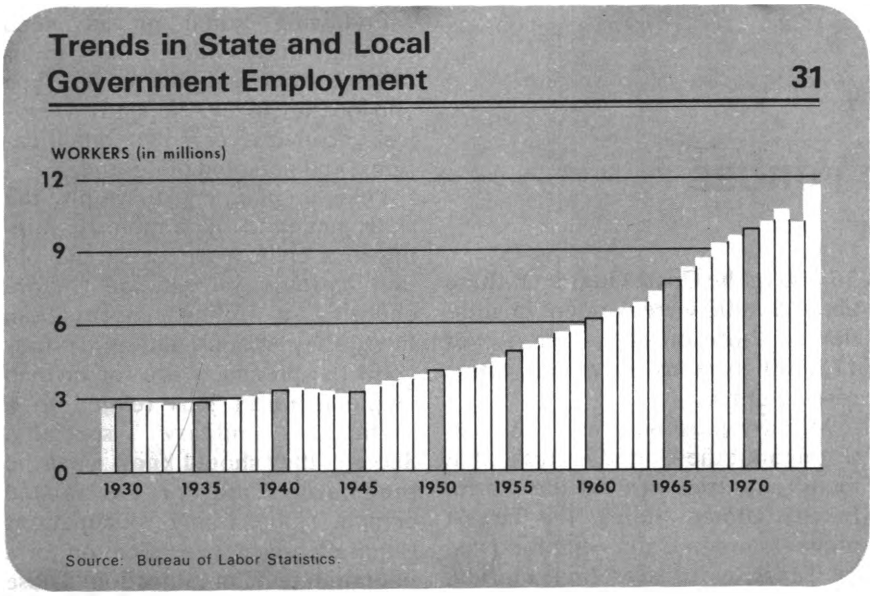
Other State and local government employees work in a wide variety of activities; local utilities (such as water or electricity), transportation, natural resources, public welfare, parks and recreation, sanitation, correction, local libraries, sewage disposal, and housing and urban renewal. These activities require workers in diverse occupations such as economist, electrical engineer, electrician, pipefitter, clerk, forester, and busdriver.

Clerical, administrative, maintenance, and custodial work make up a large portion of employment in most government agencies. Among the workers involved in these activities are clerk-typists, stenographers, secretaries, office managers, fiscal and budget administrators, bookkeepers, accountants, carpenters, painters, plumbers, guards, and janitors. (Detailed discussions of most occupations in State and local governments are given elsewhere in the *Handbook*, in the sections covering the individual occupations.)

Employment Trends and Outlook

The long-range trend in State and local government employment has been steadily upward. (See accompanying chart.) Much of this growth results from the need to provide additional services as population increases and as people move from rural to urban areas. City development has required additional street and highway facilities; police and fire protection; and public health, sanitation, welfare, and other services. Population growth and increasing personal income have generated demand for additional and improved education, housing, health facilities, and other services. Except for elementary and secondary school teachers, State and local government employment is expected to grow faster than the average for all industries through the mid-1980's.

A large State and local work force also will be needed to provide improved public transportation systems, more urban planning and renewal programs, increased police protection, better measures to guard against air and water pollution, and expanded natural resource development programs. In



addition, large numbers of workers will be needed to replace employees who transfer to other fields of work, retire, or die.

Federal-State programs in education, vocational training, medicine, and other fields will increase the needs of local and State governments for professional, administrative, and technical personnel. These will include engineers, scientists, social workers, counselors, teachers, physicians and librarians.

Most positions in State and local governments are filled by residents of the State or locality. Often, however, it is necessary to recruit from outside if shortages of particular skills exist.

Earnings and Working Conditions

Earnings of State and local government employees vary widely, depending upon occupation and locality. Salaries from State to State tend to reflect differences in the general wage level in various localities.

The *Handbook* statement for individual occupations often gives salary information for State and local government employment. Salary information also can be obtained from the appropriate State and local government agencies.

A majority of State and local government positions are filled through some type of formal civil service test, that is, personnel are hired and promoted on the basis of merit. In some areas, groups of employees, such as teachers and police, have separate civil service coverage for their specific groups.

Most State and local government employees are covered by retirement systems or by the Federal Social Security program. They usually work a standard week of 40 hours or less, with overtime pay or compensatory time benefits for additional hours of work.

Sources of Additional Information

Persons interested in working for State or local govenment agencies should contact the appropriate State, county, or city agencies. Offices of local school boards, city clerks, school and college counselors or placement personnel, and local offices of State employment services have additional information.

THE ARMED FORCES

The Armed Forces offer young men and women career opportunities in a range of occupations almost as wide as that found in civilian life. Jobs include clerical and administrative work, skilled construction trades, electrical and electronic occupations, auto repair, and hundreds of other specialties requiring varied amounts of education and training. Each year the Armed Forces give hundreds of thousands of men and women basic and advanced training which can be useful in both military and civilian careers.

Since the Selective Service draft authority was allowed to lapse in 1973, the various branches of the Armed Forces—Army, Air Force, Navy, Marine Corps, and Coast Guard—are being staffed entirely through voluntary enlistments. The military services must compete with civilian employers and offer occupational benefits and training programs which make military service an attractive career alternative. These benefits are explained in more detail later in this statement.

A young person may enlist in any one of a variety of programs that involve different combinations of active and reserve duty. Active duty ranges from 2 to 6 years, with 3- and 4-year enlistments the most common. In general, enlistments for over 4 years are for job specialties which require a considerable amount of advanced technical training.

At the end of 1974, over 2.2 million men and women were on active duty in the Armed Forces: about 780,000 in the Army; 645,000 in the Air Force; 545,000 in the Navy; 190,000 in the Marine Corps; and 36,000 in the Coast Guard. Of these about 50,000 were women. In addition to those on active duty, over 175,000 persons were in active reserve units.

Military personnel are stationed throughout the United States and in many countries around the world. In the United States, the largest numbers are in California, followed by Texas, North Carolina, Florida, Georgia and the Washington, D.C. metropolitan area. Over 500,000 are outside the United States. The majority of these—over 300,000—are stationed in Europe (particularly Germany); large numbers also are in the Western Pacific. In addition, over 200,000 Navy, Marine Corps, and Coast Guard personnel are assigned to ships, installations, and ports in the United States and its outlying areas, and around the world.

Job Training and Education for Enlisted Personnel

The Armed Forces train personnel in hundreds of different types of jobs. Job training available to enlistees depends on the length of their service commitment, their general and technical aptitude, the needs of the service, and personal preferences. Following a basic training period of between 6 and 11 weeks, depending on service branch, a majority of recruits go directly to formal classroom training in a specialty while the remainder receive on-the-job training at their first duty assignment. For those not assigned directly to schools, there is opportunity for formal classroom training following on-the-job training.

Following initial or advanced training, an individual is sent to his or her service assignment. The type and location of duty depend on service vacancies, personal qualifications, and personal preferences.

Persons planning to apply the skills gained through military training to a civilian career should obtain certain information before choosing a military occupation. First, they should determine how good the prospects are for civilian employment in jobs related to a particular military specialty. Second, they should know what the prerequisites are for the related civilian job. Many occupations require licensing, certification, or a minimum level of education. Those interested should find out whether military training is sufficient to enter the field or, if not, what additional training will be required.

Much information on the employment outlook for civilian jobs for which military training helps prepare an individual is given in other *Handbook* statements. Additional information often can be obtained from schools, unions, trade associations and other organizations in the field of interest, or from a school counselor. By looking into this kind of information before choosing a specific military occupation, young people entering the Armed Forces will help insure that the type of training they obtain will fit their career plans.

A list of major job categories for enlisted personnel is presented below.

Administrative Specialists and Clerks
- Personnel
- Administration
- Clerical personnel
- Accounting, finance, and disbursing
- Supply and logistics
- Religious, morale, and welfare
- Information and education
- Communications center operations

Electrical and Mechanical Equipment Repairers
- Aircraft
- Automotive
- Wire communications
- Missiles, mechanical and electrical
- Armament and munitions
- Shipboard propulsion
- Power generating equipment
- Precision equipment
- Aircraft launch equipment
- Other mechanical and electrical equipment

Crafts
- Metalworking
- Construction
- Utilities
- Construction equipment operation
- Lithography
- Industrial gas and fuel production
- Fabric, leather and rubber
- Firefighting and damage control
- Other crafts

Service and Supply Handlers
- Food service
- Motor transport
- Material receipt, storage, and issue
- Military Police
- Personal service
- Auxiliary labor
- Forward area equipment support

Infantry, Gun Crews, and Seamanship Specialists
- Infantry
- Armor and amphibious
- Combat engineering
- Artillery/gunnery, rockets, and missiles
- Combat air crew
- Seamanship

Electronic Equipment Repairers
- Radio/radar
- Fire control systems
- Missile guidance and control
- Sonar equipment
- Nuclear weapons equipment
- ADP computers
- Teletype and cryptographic equipment
- Other electronic equipment

Communications and Intelligence Specialists
- Radio and radio code
- Sonar
- Radar and air traffic control
- Signal intelligence/electronic warfare
- Military intelligence
- Combat operations control

Medical and Dental Specialists
- Medical care
- Technical medical services
- Related medical services
- Dental Care

Other Technical and Allied Specialists
- Photography
- Drafting, surveying, and mapping
- Weather
- Ordnance disposal and diving
- Scientific and engineering aides
- Musicians

A brief description of each category as it relates to civilian jobs follows:

Administrative specialist and clerk jobs are found in most private businesses and government agencies and require the same basic skills as those learned in the military services.

Electrical and mechanical equipment repairers generally are instructed in the basic theories and advanced troubleshooting techniques involved in the operation and repair of equipment. This instruction and training make transfer to a similar civilian job fairly easy in many career fields. In others, some additional civilian training may be needed.

In general, the various *skilled crafts or trades* require some kind of apprenticeship program. In some cases credit is given towards the apprenticeship requirement for skills acquired through military training and experience.

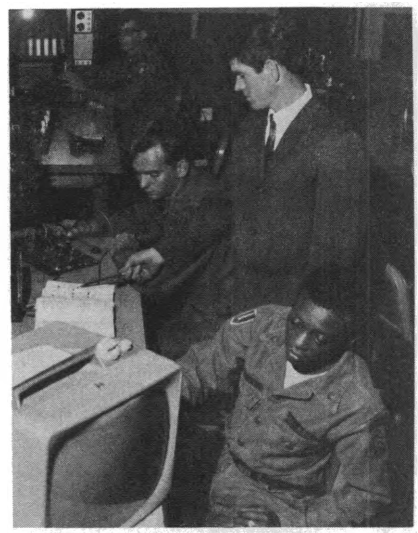
Many of the *service and supply occupations* are identical to those in civilian life. Such military experience is helpful in obtaining similar civilian employment.

On the other hand, many of the jobs in the *infantry, gun crews and seamanship specialist* group are unique to the Armed Forces, having few or no parallels in civilian jobs. However, this work experience may be helpful in developing leadership and supervisory skills which provide a good base for future civilian employment.

Those working as *electronic equipment repairers* generally maintain and repair specialized military equipment. However, most of the training and experience gained can be directly related to civilian occupations such as electronics technician, aircraft instrument mechanic, or radar and radio repairer. The service-trained specialist in this area may need additional training on specialized equipment before gaining journeyman status in civilian employment. Credit is sometimes given in an apprenticeship program for skills acquired in the service. Also, in certain occupations, such as electrician, for example, applicants may be required to show an adequate level of knowledge by passing an examination before a license to practice is issued.

Some of the *communications and intelligence specialist* occupations have civilian counterparts, such as sonar, radar, and radio operators. In general, however, these have a limited civilian demand. Other jobs, such as military intelligence or combat operations control have very few or no parallel civilian occupations.

In recent years, changes in military training and civilian requirements in the *medical and dental* fields have greatly increased civilian employment opportunities for service-trained personnel. An examination is required in most fields to show proficiency. Some of



the civilian occupations in which service-trained men and women can become certified include: physician's assistant; laboratory technician; emergency medical care technician; medical technologist; dental assistant; nurse (most States allow service trained personnel to take the Licensed Practical Nurse Examination; a few, the registered Nurse Examination); and physical therapists.

Other technical and allied specialists include a wide range of jobs, many having direct civilian parallels such as photographer, meteorologist, musician, and others providing skills with limited demand in the civilian sector such as ordnance disposal and diving.

Traditionally, women in the armed services have been limited to jobs in the administrative, clerical, or medical fields. Today, women are eligible and encouraged to enter all military occupational fields except those involving actual combat.

Other Educational Programs

In addition to on-duty training, a variety of programs are available to help military personnel continue their education. A Tuition Assistance program is available at most military installations for active duty personnel who wish to take off-duty courses leading to a bachelor's or advanced degrees. Assistance also is available for schooling ranging from basic subjects through college and technical occupational courses.

Each service branch offers programs for full-time education, providing full pay, allowances, tuition, and related fees. Other programs enable the enlisted man or woman to take college courses and additional military training leading to commissioning as an officer. Courses also are available to help service personnel earn their high school equivalency diploma. In addition, programs are being instituted to permit the application of credit for military training courses towards associate or baccalaureate college degrees from participating institutions.

Officer Training

Officer candidates in the Armed Forces receive training through a wide variety of programs: The Federal Service Academies (Naval, Air Force, Military, and Coast Guard); Reserve Officer Training Corps (ROTC); Officer Candidate School; National Guard (State Officer Candidate School programs); and direct appointment.

The Federal Service Academies provide a 4-year college program leading to a bachelor of science degree. The midshipman or cadet is provided free room and board, tuition, medical care, and a monthly allowance. Graduates may receive regular commissions in all branches of the service and have a 5-year active duty obligation.

To become a candidate for appointment as a midshipman or cadet in the Naval, Air Force, or Military Academy, most applicants obtain a nomination from an authorized nominating source (usually a member of Congress). It is not necessary to know a member of Congress personally to request a nomination. The nominee must

meet certain requirements, which include an academic record of a specified quality, college aptitude test scores above an established minimum, recommendations from teachers or school officials, and passing a medical examination. Appointments are made from eligible nominees according to personal preference of the nominating authority and by a competitive system based on the nominees' qualifications. The dependents of certain veterans may gain admission. Active and reserve service members also may gain admission through applications.

Appointments to the Coast Guard Academy are made on a competitive basis. A nomination is not required.

The Reserve Officer Training Corps (ROTC) Program involves the training of students in over 500 Army, Navy, Marine Corps, and Air Force units at participating colleges and universities throughout the United States. As a part of the school curriculum, ROTC training includes 2 to 5 hours of military instruction a week in addition to regular college courses. Some summer training also is required. Advanced ROTC training, occurring during the junior and senior years, is optional (except under the Navy programs) and students must qualify for admission.

Advanced ROTC students are paid a monthly allowance while attending school and receive additional pay for summer training. Scholarships also are available on a competitive basis. Following graduation, ROTC students fulfill their military obligations by serving as regular or reserve officers for a stipulated period of time.

A commission in the Armed Forces can be earned without ROTC training by those who enlist from civilian life into one of the several Officer Candidate School Programs. The Army, Navy, Air Force, Marine Corps and Coast Guard train selected college graduates to become commissioned officers. The National Guard also has several Officer Candidate Programs for qualified high school graduates.

Many men and women who are trained in medicine or one of the related health sciences may qualify for direct appointment as officers. Financial assistance is available to students enrolled in training in one of these fields. Direct appointments also are available for those qualified to serve in other occupations, such as judge advocate general or chaplain.

The Armed Forces offer a wide variety of flight training programs, many of which lead to a commission. In addition, all services have programs for qualified enlisted personnel to obtain commissions.

Salary, Allowances, Promotion, and Working Conditions

In addition to regular salary, military personnel receive free room and board, medical and dental care, a military clothing allowance, military supermarket and department store shopping privileges, recreational facilities, 30 days of paid vacation a year, and travel opportunity. When room and board are not provided, a living allowance is given. Table 1 gives examples of military pay and allowances.

Active career officers and enlisted personnel also are eligible for retirement benefits after 20 years of service.

The pay grades for enlisted personnel begin at E-1, the lowest, and go to E-9, the highest. The lowest pay grade for commissioned officers is 0-1; the highest, 0-10.

Enlisted personnel will normally be promoted to pay grade E-3 within their first 12 months of service. Further promotions depend on individual merit, but in-grade pay increases are possible on the

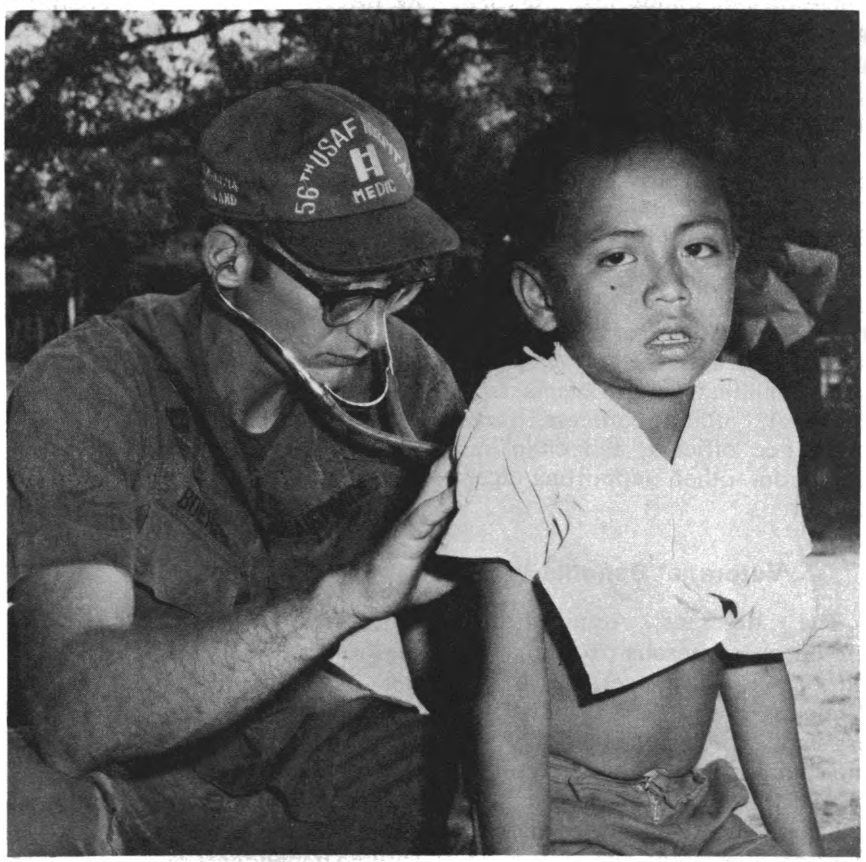


Table 1. Active duty military compensation in 1974 for members of the Armed Forces who are single and have less than 2 years of service

Pay grade	Regular military compensation, total	Basic pay	Quarters allowance	Subsistence allowance
Enlisted members:				
E-1	$5,756	$4,129	$759	$868
E-2	6,278	4,600	810	868
E-3	6,562	4,780	914	868
E-4	6,872	4,971	1,033	868
Commissioned officers:				
O-1	9,594	7,610	1,378	606
O-2	11,128	8,766	1,756	606
O-3	12,669	10,058	2,005	606

SOURCE: Department of Defense.

basis of length of service.

The normal workweek in the Armed Forces is 8 hours a day, 5 or 5 1/2 days a week. Due to the nature of military work, an individual or group may be called upon to work longer hours without additional compensation. With the wide range of jobs found in the service, working conditions vary substantially. Some jobs which are extraordinarily dangerous, or in an undesirable location, provide additional income in the form of a bonus or special payments.

Athletic and other recreational facilities, such as libraries, gymnasiums, tennis courts, golf courses, and movies, are available on most military installations. Service personnel also may get help with personal or financial problems from personal affairs officers, legal assistance officers, and chaplains, and from other supporting agencies.

Veterans' Benefits

The Veterans Administration provides numerous benefits to those who have served in the Armed Forces. The educational assistance program is usually the most important to those considering enlisting.

Veterans who have at least 181 days of continuous active duty are eligible for educational benefits. Each eligible person is entitled to 1 1/2 months of educational assistance for each month of service on active duty, up to a maximum of 36 months. These benefits may be received for education at any approved institution, including public or private elementary, secondary, vocational, correspondence, business, or flight training schools; junior or teachers' colleges; normal schools; colleges or universities; professional, scientific, or technical institutions; and various other institutions that furnish education at the elementary level or above. A member of the service who has not received a secondary school diploma (or an equivalency certificate), and needs to take a remedial or refresher course to prepare for enrollment in an education or training program, may receive such training without having it charged against the benefits earned through military service.

In addition to training in an educational institution, GI Bill benefits are available for apprenticeship or on-the-job training and flight training. The amount of the training assistance allowance depends on the type of program and the number of dependents of the veteran. For full-time education in an approved institution, a veteran with no dependents received $270 a month in January 1975; with one dependent, $321; with two dependents, $366; and $22 for each additional dependent. A veteran with no dependents receiving apprenticeship or on-the-job training was paid $196 for each of the first 6 months; $147 for each of the second 6 months; $98 for each of the third 6 months; and $49 for each additional month; with one dependent, $220, $171, $122, $73; with two dependents, $240, $191, $142, $93; and $10 a month for each additional dependent. Another attractive veterans' benefit available is a guaranteed home, farm, or business loan.

Each of the Armed Forces Reserve Programs offers pay, promotion, training, education and retirement benefits similar to those of the active duty programs.

More detailed or current information on educational benefits, as well as other veterans benefits, is available from the Veterans Administration office located in each State, the District of Columbia, Puerto Rico, and the Philippines.

Other Sources of Information

Each of the military services publishes handbooks and pamphlets that describe entrance requirements, training and advancement opportunities, and other aspects of military careers. These publications are available at all recruiting stations, most State employment service offices, high schools, colleges and public libraries. Individuals may obtain additional information by writing to the addresses below:

U S. Army Recruiting Command, Fort Sheridan, Ill. 60037.

Navy Recruiting Command (Code 40), 4015 Wilson Blvd., Arlington, Va. 22203.

USAF Recruiting Service, Directorate of Recruiting Operations, Randolph Air Force Base, Tex. 78149.

Commandant of the Marine Corps, Code MMRE-7, Headquarters Marine Corps, Washington, D.C. 20380.

Commandant (G-PMR), U.S. Coast Guard, Washington, D.C. 20590.

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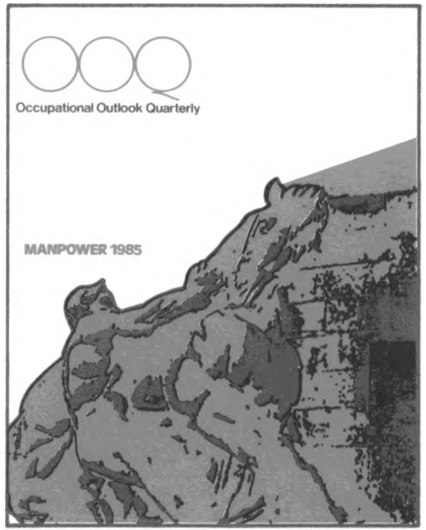

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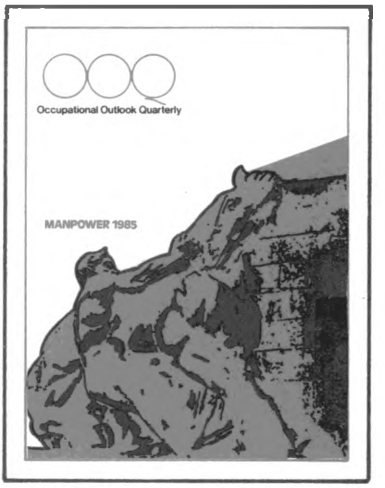

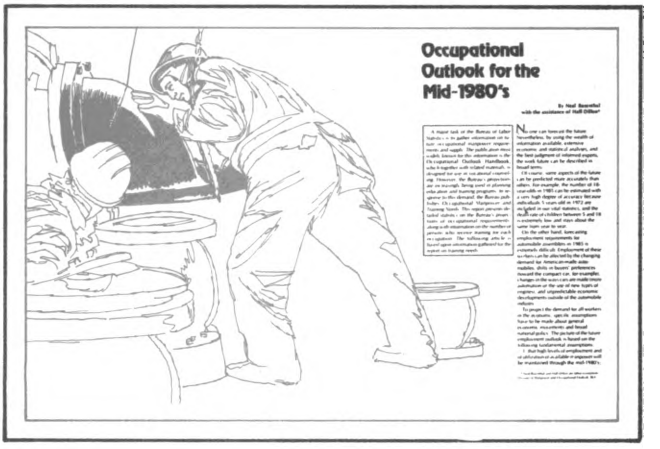

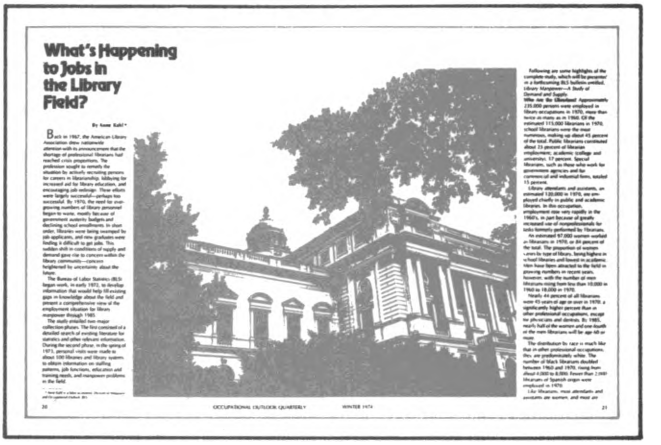

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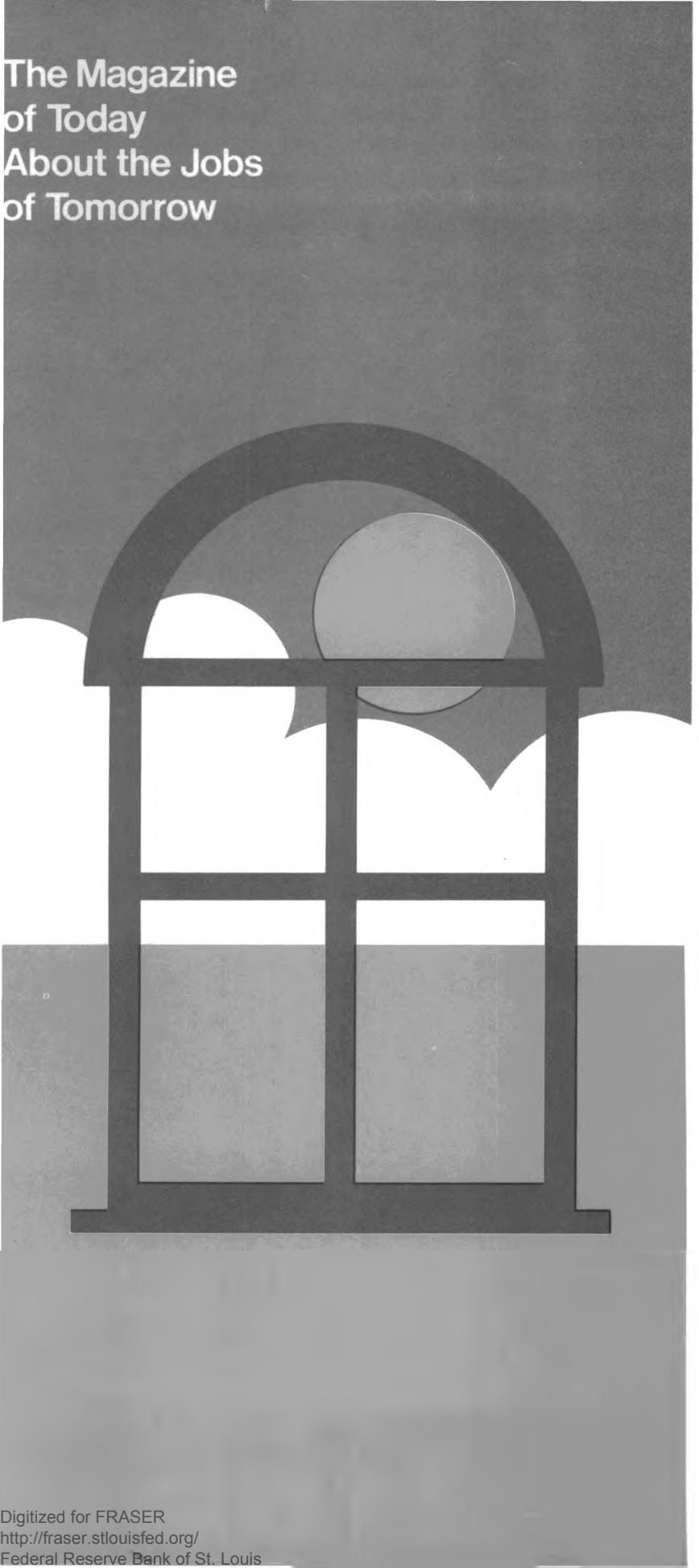

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