For example, those making women's suits, coats, and skirts averaged $83.15 a week in early 1967, whereas those producing men's work clothing averaged $57.44 a week. Earnings of apparel workers also vary by occupation and geographical area. For example, average hourly earnings of cutters and pressers in almost all areas are higher than those of sewing machine operators; and average hourly earnings generally are lower in the South than in the Middle Atlantic States. The following tabulation gives estimated average hourly earnings for selected occupations and geographical areas in one segment of the apparel industry in March 1966:

	Estimated average hourly earnings		
Women's and misses' dresses	*Wilkes-Barre-Hazleton*	*Los Angeles-Long Beach*	*New York City*
All production workers	$1.89	$2.15	$2.73
Cutters and markers (almost all men)	2.79	3.28	3.55
Pressers, hand (women)	2.61	2.22	2.91
Pressers, hand (men)	3.17	2.94	5.08
Sewers, hand (almost all women)	1.67	1.86	2.12
Sewing machine operators, section system (almost all women)	1.92	1.93	2.41
Sewing machine operators, single hand (tailor) system (almost all women)	.....	2.27	2.81

Because most production workers in this industry are paid on the basis of the number of pieces they produce, their total earnings depend upon speed as well as skill. Sewing machine operators, hand sewers, and pressers generally are paid on a piecework basis. Cutters are paid either piecework rates or hourly wages, depending upon the practice in the area or shop in which they work. Most of the other workers, including tailors, patternmakers, graders, inspectors, and work distributors, are paid by the hour or week.

In most metropolitan areas, the bulk of apparel employees work in shops that have union contracts. New employees in plants which have these agreements are required to join the union after 30 days of employment. These agreements deal with such subjects as wages; hours of work; vacation and holiday pay; seniority; health, insurance, and pension plans; and other employment matters. Among the unions to which apparel workers belong are the Amalgamated Clothing Workers of America (ACWA), International Ladies' Garment Workers' Union (ILGWU), and United Garment Workers of America (UGW). The ILGWU sponsors vacation resorts for union members and their families. Both the ACWA and the ILGWU operate health centers for garment workers in major producing areas.

Workers in the apparel industry can expect to lose very little work time as a result of strikes or other work stoppages because the industry has had many years of peaceful labor-management relations. However, workers making certain types of garments may have layoffs of several weeks during slack seasons. Generally, such layoffs occur more often in plants making seasonal garments, such as women's coats and suits, than in plants producing standardized garments, such as pajamas and men's shirts, which are worn all year long. In many plants, the available work during slack periods is divided so that workers can be assured of at least some earnings. Also, more and more firms are diversifying the types of apparel they make, which reduces seasonal employment declines.

Old buildings, whose surroundings and facilities may frequently leave much to be desired, continue to house most apparel establishments, especially those in metropolitan areas. Newly constructed plants usually have ample space, good lighting, and air conditioning. Some of the new plants have cafeterias, and health clinics with a registered nurse on duty.

Most sewing jobs are performed while sitting and are not physically strenuous. The working pace is rapid because workers' earnings depend on their production. In addition, many tasks are extremely monotonous. Serious accidents among sewers are rare, although a sewer may occasionally pierce a finger with a needle. On the other hand, pressing may be strenuous work and involves working with hot steam.

Working conditions in cutting and designing rooms are pleasant. In manufacturing establishments, designing and cutting are often performed in a separate area away from the main sewing and pressing operations. Jobs in designing and cutting operations are more interesting and less monotonous than most other apparel jobs. Moreover, since accuracy and skill as well as individual talent and judgment are valued more than speed in these jobs, the work pace is less rapid.

Where To Go for More Information

Information relating to 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 the State capital.

Information concerning apprenticeships may be obtained from the Apprenticeship Council of the State Labor Department or the local office of the U.S. Employment Service. Some local Employment Service offices give tests to determine hand-eye coordination, which is important for many apparel industry jobs.

Information of a general nature may be obtained from the following sources:

Amalgamated Clothing Workers of America,
15 Union Square, New York, N.Y. 10003.

American Apparel Manufacturers Association, Inc.,
2000 K St. NW., Washington, D.C. 20006.

Associated Fur Manufacturers, Inc.,
101 West 30th St., New York, N.Y. 10001.

Clothing Manufacturers Association of U.S.A.,
135 West 50th St., New York, N.Y. 10001.

National Outerwear and Sportswear Association, Inc.,
347 Fifth Ave., New York, N.Y. 10016.

International Ladies' Garment Workers' Union,
1710 Broadway, New York, N.Y. 10019.

United Garment Workers of America,
31 Union Square, New York, N.Y. 10003.

OCCUPATIONS IN THE ATOMIC ENERGY FIELD

In early 1967, about 175,000 workers had jobs in a variety of atomic energy activities. Large numbers of these workers were employed in research and development work. Others were engaged in activities such as the manufacture of nuclear weapons and other defense materials, the design and manufacture of nuclear reactors, and the production of nuclear fuels. The majority of atomic energy workers are scientists, engineers, technicians, or craftsmen. Employment opportunities for these workers will continue to be especially favorable through the 1970's.

Applications of Atomic Energy

Atomic energy is a source of enormous heat and radiation that can be used in many ways for peaceful as well as military purposes. Peaceful applications of atomic energy 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 force.

One of the most significant uses of atomic energy is in the production of commercial electricity, using nuclear reactors as the heat source. (See chart 49.) Steam produced by such reactors is now generating electricity for several communities. In recent years these reactors have become more competitive with systems using fossil fuels, such as coal and oil, and it is anticipated that many more nuclear facilities will be built. Since reactors are an efficient source of thermal energy, they also can be used to evaporate large quantities of sea water to produce fresh water—a process known as desalting. Plans are already being developed to build a combination power generation and desalting plant.

Nuclear reactors provide power for naval and commercial ships. By virtually eliminating the need for refueling, nuclear propulsion greatly extends the range and mobility of our naval forces. Research towards developing nuclear propulsion for space vehicles hold excellent promise for extending the range of space flights by eliminating the need to carry great quantities of conventional fuel.

Although existing reactors generate tremendous amounts of power from a small amount of uranium, research is continuing in an effort to develop even more efficient reactors. Still further in the future, we can hope to generate power through controlled fusion. Fusion occurs naturally on the sun, and scientists already have produced uncontrolled fusion in the hydrogen bomb, but have not yet been able to produce a controlled fusion reaction on a relatively small scale. Research also is being conducted in the "Plowshare" program to develop peaceful uses for nuclear explosives. The program has many potential applications in such areas as gas and oil recovery, mining operations, and in excavation of harbors, canals, and mountain passes.

Another significant application of atomic energy is in the use of radioisotopes which decay or disintegrate spontaneously, emitting radiation that can be detected by special instruments. Radioisotopes are very valuable as research tools in agriculture, medicine, and industry and for use in industrial inspection and control devices.

Nuclear radiation also has tremendous potential as an aid in the preservation of food. One of the major causes of food spoilage is the activity of micro-organisms. When food is treated with radiation, these organisms are killed, and the spoilage process is greatly inhibited. This treatment makes possible the long term storage of certain foods without refrigeration, and extends the time for marketing certain perishable refrigerated items such as fresh fruits and fish.

How Atomic Energy Is Produced

Atomic energy, or more accurately nuclear energy, may be produced through several processes, the two most important of which are fission and fusion. In fission, the nucleus of a heavy atom is split, releasing energy in the form of heat and radiation, and producing two lighter elements or more. In fusion, energy is released by combining the nuclei of two light atoms. The detonation of atomic bombs is an application of the explosive release of enormous amounts of atomic energy. Nonweapon applications require that release of this energy be carefully controlled and regulated so that it proceeds at a manageable rate.

Controlled fission is the essential feature of a nuclear reactor. The reactor, being a furnace, requires fuel to operate. The principal source material for reactor fuel is uranium, which in its natural state contains less than 1 percent of readily fissionable material, uranium U–235. Although natural uranium is used as reactor fuel, a more concentrated and enriched fuel can be produced and used by increasing the proportion of U–235 isotopes through a process called gaseous diffusion. U–235 occurs naturally and undergoes fission readily, but two manmade fissionable materials, plutonium and uranium U–235, also can be used as reactor fuel.

Fissionable fuel is placed in the nuclear reactor with certain other elements. Under proper conditions, the fuel will sustain a "chain reaction"—the continuous fissioning (or splitting) of the nuclei of atoms—resulting in the release of energy in the form of heat and radiation. When the fissionable atoms in the fuel split, they release neutrons (so-called "atomic bullets") which cause other fissionable atoms to split. These, in turn, release additional neutrons which similarly split more atoms. The level of the chain reaction is carefully controlled, usually by inserting special neutron-absorbing rods into the fuel chamber, or "core," of the reactor. In this way, the rate of the fission reaction and of the energy produced can be regulated or stopped completely.

Thus, harnessed atomic energy is produced in a nuclear reactor in the form of heat and radiation. However, if reactors are to be used for power, the heat must be removed from the reactor and put to work. This is done by converting the heat to electricity through the use of conventional equipment. The major difference between nuclear and conventional thermal electric power stations is that the heat needed to generate steam to drive turbines comes from a nuclear reactor rather than from a conventional steam-generating boiler fueled with coal, gas, or oil.

During the fission process, nuclear radiation is released. This radiation, identifiable only by sensitive instruments, can be ruinous to equipment and highly dangerous to personnel. Therefore, special materials, resistant to damage by radiation, are used in reactors and great care is taken to protect personnel.

Nature of the Atomic Energy Field

Many different kinds of research and industrial activities are required for the production and application of nuclear energy. Included in the various processes is 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 radioactive wastes; the processing and packaging of radioisotopes; the production of nuclear weapons; and research and development work.

These activities are performed in plants in several different industries, as well as in laboratories and other types of facilities. Much of this work, such as ore mining and milling, manufacture of heat transfer equipment, and construction of facilities, differs little from similar nonatomic energy work. Other activities, such as manufacture of the fuels needed to run reactors, are unique to the atomic energy field.

The Federal Government supports most of the basic atomic energy activities. The U.S. Atomic Energy Commission (AEC) directs the Federal Government's atomic energy program and regulates the use of nuclear materials by private organizations. The operation of AEC-owned facilities, including laboratories, uranium processing plants, nuclear reactors, and weapon manufacturing plants, is contracted out to private organizations. More than half of all workers in the atomic energy field are employed in these facilities. In their own installations, private firms are engaged in many types of atomic energy activity, except development and production of military weapons and certain nuclear fuel-processing operations.

A large amount of research and development work is done in the atomic energy field. Much of this work is carried on by the AEC-owned laboratories and by university and college laboratories, other nonprofit institutions, and industrial organizations under Commission contracts.

Occupations in the Atomic Energy Field

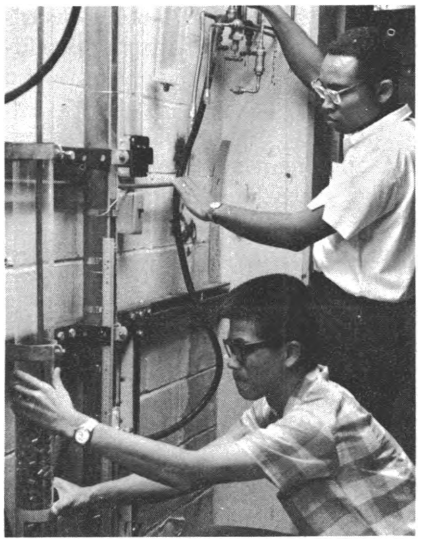
Engineers, scientists, technicians, and craftsmen account for a higher proportion of total employment in this field than in most other fields, largely because of the importance of research and development. Office personnel in administrative and clerical jobs represent another large group. Most of the remaining employment consists of semiskilled and unskilled workers in production work, and plant protection and other service workers.

Although many engineers in the atomic energy field are highly trained in nuclear technology, engineers in all major engineering fields are employed. Mechanical engineering is the largest single engineering occupation, but large numbers of electrical and electronics, chemical, reactor, civil, and metallurgical engineers also are employed. Many of these engineers do research and development work, while others are engaged in designing nuclear reactors, nuclear instruments, and other equipment used in the atomic energy field, and in the operation of production plants.

A large number of scientists are employed by research laboratories and other organizations engaged in atomic energy work to perform basic and applied nuclear research. Physicists and chemists predominate, but many types of scientists are included, such as mathematicians, metallurgists, biological scientists, and health physicists.

A large number of technicians are employed to assist engineers and scientists in research and development work and in the designing and testing of equipment and materials. These workers include draftsmen; electronics, instrument, chemical, and other engineering and physical science technicians; and radiation monitors.

The atomic energy field employs many highly skilled workers to fabricate special parts and equipment for use in experimental and pilot work and to maintain the considerable amount of complex equipment and



Nuclear engineers adjust equipment used in reprocessing nuclear fuels.

machinery. Maintenance mechanics (e.g., machinery repairmen and millwrights) and all-round machinists are employed extensively in most atomic energy activities, as are electricians, plumbers, pipefitters, and other craftsmen and chemical process operators.

Activities in the Atomic Energy Field

A brief description of some important atomic energy activities and the types of workers employed in them follows.

Uranium Mining. The 4,000 miners and supporting personnel employed in uranium mines in early 1967 had jobs similar to those in the mining of other metallic ores. Their jobs are largely concentrated in the Colorado Plateau area of the Far West, in the States of New Mexico, Wyoming, Utah, Colorado, and Arizona. A relatively few mines account for the bulk of production and employment. Most workers in uranium mines are in production jobs, such as miner and driller in underground mines, and truck-driver, bulldozer operator, and machine loader in open pit mines. A small proportion of the employees in uranium mining are in professional jobs, such as mining engineer and 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 2,000 workers in early 1967.

These mills employ skilled machinery repairmen, millwrights, pipefitters, carpenters, electricians, and chemical process operators. A small proportion of the employees in milling operations are scientists and engineers.

Uranium Refining and Enriching. Milled uranium is chemically processed to remove impurities and then 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 early 1967, uranium refining and enriching plants employed about 7,500 workers.

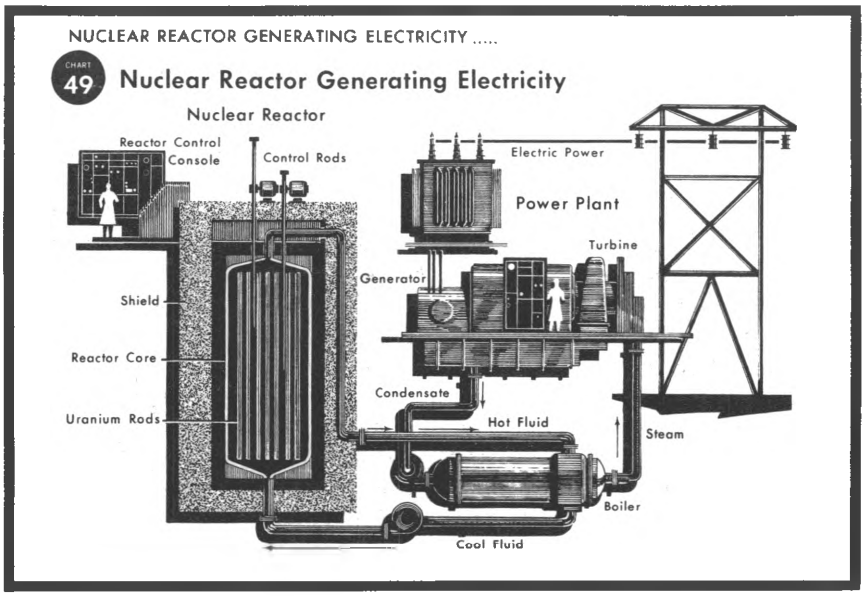
Maintenance craftsmen, particularly in the highly automated uranium enriching plants, account for a large proportion of skilled workers. Large numbers of chemical process operators are also employed. Chemical engineers and chemists accounted for almost half of the engineers and scientists. Many of the technicians worked in chemical analytical laboratories associated with production processes.

Reactor Manufacturing. More than 14,000 workers were employed in early 1967 in the design and manufacture of nuclear reactors and unique reactor components. Reactor manufacturers do extensive research and development work on reactors and auxiliary equipment, design the reactor, and generally fabricate some of the intricate components, such as fuel elements, control rods, and reactor cores.

More than half of the employees in firms that design and manufacture reactors are scientists, engineers, and technicians. Engineers alone represent about one quarter of the employment, with mechanical engineers and reactor engineers, who are specialists in reactor technology, predominating. Among scientists, the largest group of workers are physicists, but many chemists, mathematicians, and metallurgists also are employed. Assisting these engineers and scientists are many draftsmen, engineering aids, and physical science technicians.

Skilled workers are employed by reactor manufacturers in experimental, production, and maintenance work. All-round machinists account for a large proportion of these craftsmen. Other craftsmen such as sheet metal workers, instrument makers, machinery repairmen, instrument repairmen, and electricians also are employed. Reactor manufacturers employ nuclear reactor operators to operate experimental and test reactors.

Reactor Operation and Maintenance. About 1,000 workers were engaged in the operation and maintenance of nuclear reactors producing commercial electricity in early 1967. Principal types of occupations found in the operation of a nuclear power station are mechanical engineer, electrical and electronics engineer, instrument technician, electronics technician, radiation monitor, reactor operator, and other power plant operators and attendants. Among the employees needed to maintain and repair reactors are machinery repairmen, instrument repairmen, electricians, and pipefitters.



Research and Development Facilities. A number of research and development laboratories and other research facilities are owned by the Atomic Energy Commission and are operated for the AEC by universities and industrial concerns. These facilities are major centers for basic and applied nuclear research in the physical, engineering, and life sciences and in the development of nuclear reactors and other nuclear equipment. In early 1967, these facilities employed about 50,000 workers. More than half of the employees in AEC research and development facilities are engineers, scientists, and supporting technicians. Among the engineers and scientists are physicists, mechanical engineers, electrical and electronics engineers, chemists and chemical engineers, mathematicians, reactor engineers, metallurgists and metallurgical engineers, biological scientists, and health physicists. Assisting scientists and engineers are many physical science and engineering aids; draftsmen; electronics, instrument, and biological technicians; and radiation monitors.

Administrative and clerical workers together account for a large proportion of employment. The skilled worker group includes large numbers of all-round machinists, electricians, machinery repairmen, and millwrights, as well as substantial numbers of tool and diemakers, instrument makers, and pipefitters. Nuclear reactor operators are employed to operate research and test reactors and many service workers are employed in plant protection and security operations.

Although most nuclear energy research is performed in AEC research and development facilities, additional research is performed in the privately owned research laboratories of educational institutions, other nonprofit institutions, and industrial concerns. Like the AEC facilities, these laboratories employ a large proportion of workers in scientific, engineering, and other technical jobs.

Production of Nuclear Weapons and Other Defense Materials. Approximately 30,000 workers were employed in early 1967 in establishments producing nuclear weapons and weapon components, plutonium, and other defense materials.

About 1 out of every 4 workers in these defense production facilities is a skilled worker in a production or maintenance job. Included among these skilled workers are large numbers of machinery repairmen and millwrights, chemical process operators, all-round machinists, electricians, instrument repairmen, pipefitters, tool and diemakers, and instrument makers.

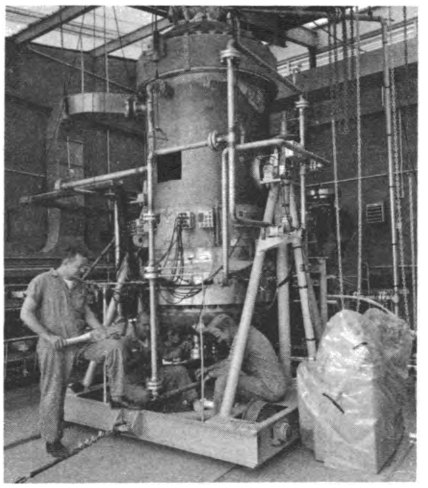
Among the large number of scientists and engineers employed at these facilities are many chemists, physicists, and mechanical, chemical, and electrical and electronics engineers. Many engineering and physical science aids, draftsmen, radiation monitors, and electronics technicians are employed to assist scientists and engineers.

Other Atomic Energy Activities. About 1,500 workers were employed in early 1967 to produce special materials such as beryllium, zirconium, and hafnium for use in reactors.

About 5,500 workers were employed by companies that manufacture reactor control instruments, radiation detection and monitoring devices, and other instruments for the atomic energy field. Production of these instruments involves work similar to that in instrument manufacturing in general. Engineers and technicians represent a substantial proportion of employment in this field.

About 1,000 persons were employed in companies which specialize in the manufacture of particle accelerators or their specialized components. These machines enable scientists to study the structure and properties of the elementary particles that make up the nucleus of an atom. Workers employed in the design and manufacture of these machines include electrical and electronics engineers, mechanical engineers, physicists, draftsmen, electronics technicians, and machinists.

Other workers in the atomic energy field are engaged in such activities as processing and packaging radioisotopes, manufacturing radiography units and radiation gages, packaging and disposing of radioactive wastes, and industrial radiography.



Instrument technicians make connections on test reactor.

Government Employment. The Atomic Energy Commission, which directs the Federal Government's atomic energy program, employed about 7,400 workers in its headquarters and field offices in early 1967. Over 1,300 engineers and scientists were employed by the Commission, including personnel in nearly every major engineering and scientific occupation. Since the AEC is primarily an administrative and regulatory agency, approximately two-thirds of Commission employees are in administrative and other professional positions or in clerical jobs. This proportion of administrative and clerical personnel is much larger than in most other activities in the atomic energy field.

In addition to those employed by the Atomic Energy Commission, a few thousand government employees are engaged in atomic energy work in other Federal agencies and in regulatory and promotional activities of State and local governments. Their responsibilities involve atomic energy research and application, and establishment of radiation health and safety measures.

Unique Atomic Energy Occupations. Most of the occupations discussed in the preceding sections are similar to those found in other industrial activities, although 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 are unique in that they require training in the handling and use of radioactive materials or radiation-producing equipment, are discussed briefly in the following sections.

Health physicists (also called radiological physicists) are concerned with the problem of radiation safety for workers in atomic energy installations and for people in surrounding communities. They are responsible for protecting individuals and property from the hazards of radiation by detecting radiation, and applying safety standards to control exposure to it. In early 1967, more than 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 standards of inspection and determine procedures for protecting employees and eliminating radiological hazards. They supervise the inspection of work areas with potential radiation hazards and prepare instructions covering safe work procedures in these areas.

Health physicists also plan and supervise training programs dealing with radiation hazards and advise others on methods of dealing with such hazards. In some cases, they are employed on research projects dealing with the effects of human exposure to radiation and may develop procedures to be followed in using radioactive materials.

Radiation monitors (also called health-physics technicians) generally work under the supervision of health physicists. An estimated 2,000 radiation monitors were employed in the atomic energy field in early 1967. They use special instruments to monitor (check) work areas, tools, and equipment to detect radioactive contamination. Soil, water, and air samples are taken frequently to determine radiation levels. Monitors may also collect and analyze radiation detectors worn by workers, such as film badges and pocket detection chambers.

Radiation monitors inform their supervisors when a worker's exposure to radiation or the level of radiation in a work area approaches specified maximum permissible limits and they recommend work stoppage in potentially unsafe areas. They calculate the amount of time that personnel may work in contaminated areas, considering maximum radiation exposure limits and the radiation level in the area. Monitors may also give instructions in radiation safety procedures and prescribe special clothing requirements and other safety precautions for workers entering radiation zones.

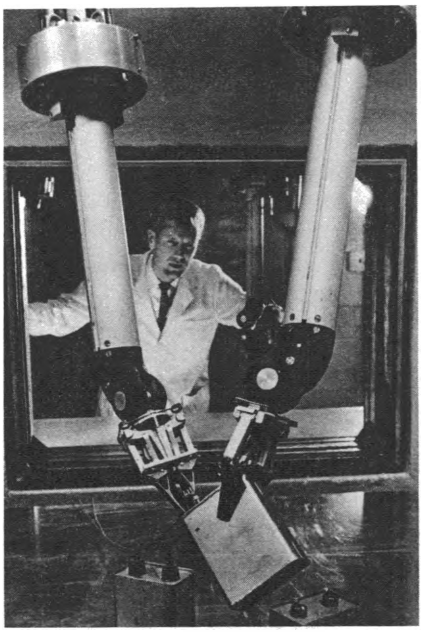
A nuclear reactor operator's job in a nuclear power station is similar to a boiler operator's job in a conventional power station; however, the controls he operates are somewhat different. In addition, reactor operators may assist in the loading and unloading of reactor cores. Nuclear reactor operators who work with research and test reactors check reactor control panels and adjust controls to maintain specified operating conditions within the reactor, such as power and radiation levels. More than 1,000 persons were employed as nuclear reactor operators in early 1967.

Accelerator operators set up and coordinate the operation of particle accelerators. They adjust machine controls to accelerate electrically charged particles, in accordance with instructions from the scientist in charge of the experiment, and set up target materials which are to be bombarded by the accelerated particles.

They also may assist in the maintenance of equipment.

An estimated 7,000 *radiographers* were employed in early 1967. These workers take radiographs of metal castings, welds, and other objects by adjusting the controls of an X-ray machine or by exposing a source of radioactivity to the object to be radiographed. They select the proper type of radiation source and film to use and apply standard mathematical formulas to determine exposure distance and time. While taking radiographs, they use radiation detection instruments to monitor the work area for potential radiation hazards. Radiographers may also remove and develop the film or plate and assist in its analysis.

Hot-cell technicians operate remote-controlled equipment to test radioactive materials that are placed in hot cells—rooms that are 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, these technicians perform standard chemical and metallurgical operations with radioactive materials. Hot-cell technicians may also enter the cell wearing protective clothing to set up experiments or to decontaminate the cell and equipment. *Decontamination men* have the primary duty of decontaminating equipment, plant areas, and materials exposed to radioactive contaminants. They use radiation-detection instruments to locate the contamination; eliminate it by the use of special equipment; detergents, and chemicals; and then verify the effectiveness of the decontamination measures. *Waste-treatment operators* operate heat exchange units, pumps, compressors, and other equipment to decontaminate and dispose of radioactive waste liquids. *Waste-disposal men* seal contaminated wastes in concrete containers and transport the containers to a burial ground or arrange for sea burial. *Radioisotope-production operators* use remote control manipulators and other equipment to prepare radioisotopes for shipping and to perform chemical analyses to ensure that radioisotopes conform to specifications.



Hot-cell technician manipulates "master-slave."

Training, Other Qualifications, and Advancement

Training and educational requirements and advancement opportunities for most workers in atomic energy activities are generally similar to those for comparable jobs in other fields and are discussed elsewhere in the *Handbook* under the specific occupation. However, specialized training is required for many workers because the atomic energy field is a relatively new field of work, requires rigorous work standards in both its research and production activities, and has unique health and safety problems.

Engineers and scientists at all levels of professional training are employed in the atomic energy field. Many of them have had advanced training, particularly those engaged in research, development, and design work. Of the scientists and engineers employed in research and development by major AEC contractors in 1966, about one-fourth had a Ph. D. degree. The proportion of engineers with Ph. D. degrees is smaller than the proportion of scientists with such degrees. However, graduate training is preferred for an increasing number of engineering jobs, and training in nuclear engineering is available almost exclusively at the graduate level.

Specialized knowledge of nuclear energy is essential for most scientific and engineering positions in the atomic energy field. This specialized training may be obtained by taking work at a university or sometimes by on-the-job training.

Colleges and universities have expanded their facilities and curriculums to provide training in nuclear energy. Engineers and scientists who plan to specialize in the atomic energy field generally take graduate work in nuclear energy, although introductory or background courses may be taken at the undergraduate level. 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.

Craftsmen in some atomic energy jobs need more training than most craftsmen in comparable nonatomic jobs. High skill requirements are often needed because of the extreme 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 metals costing more than $1,000 a foot. Welding may also have to meet higher reliability standards than in most nonatomic fields. Craftsmen in the atomic energy field generally obtain the required special skills through on-the-job training. Many AEC installations also have apprentice training programs to develop craft skills.

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 is often required for teaching and research positions.

To qualify for on-the-job training as a radiation monitor, a high school education with courses in mathematics, physics, and chemistry is usually sufficient. Radiation monitors must become familiar with characteristics of radiation, maximum permissible radiation exposure levels, and methods of calculating exposure periods. They must also learn how to calibrate the instruments they use.

Nuclear power reactor operators need a basic understanding of reactor theory and a working knowledge of reactor controls. Most operator trainees have a high school education. Trainees usually are selected from conventional power plant personnel having experience as operators of boiler, turbine or electrical machinery. Preference is sometimes given to those who have completed courses in science and engineering at the college level. Workers who operate the controls of private nuclear reactors must be licensed by the AEC. To qualify for a license, the trainee must pass an operating test, a written test given by the AEC, and a medical examination.

To qualify for on-the-job training as an accelerator operator, a high school education that includes courses in mathematics and physics usually is required. Accelerator operators receive several months of on-the-job training covering operating, repair, and safety procedures. To qualify for on-the-job training as a radiographer, a high school education, including courses in mathematics, chemistry, and physics usually is sufficient.

High school graduates with some mechanical experience usually can qualify for on-the-job training as hot-cell technicians and decontamination men. They may be given in-plant training lasting several months. For the job of radioisotope-production operator, a high school education, with courses in chemistry, is usually required. High school graduates can qualify as waste-treatment operators, but experience in reading electronic instruments or in a chemical laboratory is desirable. High school graduates can also qualify for employment as waste-disposal men. They receive on-the-job training in the operation of equipment and the avoidance of radiation hazards.

Other workers in the atomic energy field also need special training because of the presence of potential radiation hazards. Employees who work in the vicinity of such hazards are always 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 have a security clearance. This is a finding based on an investigation of a person's character, loyalty, and associations.

The Atomic Energy Commission, 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. The AEC also offers graduate fellowships in specialized nuclear fields.

A large number of fellowships—about 480—were awarded for the 1965–66 academic year. The prerequisite for consideration for a fellowship is a bachelor's degree in engineering or physical science.

Fellowships in health physics provide for 9 months' training at a university, followed by 3 months' training at a Commission laboratory. Approximately 60 such fellowships are available each year to students with bachelor's degrees in biology, chemistry, engineering, or physics. About 10 additional fellowships are available for advanced training in health physics leading to a doctorate.

Additional educational and training opportunities are offered in cooperative programs arranged by AEC laboratories with colleges and universities. Temporary employment at AEC-owned laboratories is available to faculty members and students. Engineering undergraduates may work at laboratories and other Commission facilities on a rotation basis with classroom studies, and graduate students may do their thesis work at AEC laboratories.

Many Commission contractors provide employees with training at their own plants or at nearby colleges and universities.

Employment Outlook

Total employment in the atomic energy field is expected to increase moderately during the remainder of the 1960's. Over the 1970's, however, overall employment is likely to grow more rapidly as commercial activities in atomic energy expand, and as new applications of this energy form are developed.

Many factors point to a long-term expansion in this field. Increasing expenditures for atomic energy research and development should lead to further employment growth in research and development laboratories; the use of nuclear reactors in electric power generating stations is becoming increasingly widespread; and the use of reactors in conjunction with power generation to desalt sea water is also expected to increase. Growth in the use of nuclear reactors for propulsion of naval and maritime ships is anticipated, although progress in this area may not be as rapid as in power generation. Expansion is also expected in the "Plowshare" program to develop peaceful uses for nuclear explosives, in programs to further develop radioisotope technology, and in the use of nuclear power in space.

Employment opportunities are expected to rise significantly for workers who design and manufacture nuclear power reactors and instruments, and who process and package radioisotopes. As more nuclear reactors are built and put into operation, employ-

ment will further increase both in the operation and maintenance of reactors, and in such related activities as the fabrication and reprocessing of reactor fuel elements and the disposal of radioactive wastes. Employment in mining, milling, refining, and enrichment of uranium will increase as the demand for nuclear fuel increases. As the use of nuclear power becomes more widespread, there will also be an increase in employment of regulatory workers in both the Atomic Energy Commission and in State agencies to insure safe use of atomic energy. Expansion in these areas of atomic energy will create very good employment opportunities for trained professional and technical workers and for skilled craftsmen.

In addition to the employment opportunities created by expansion in atomic energy activities, other job openings will occur because of the need to replace workers who retire, die, or transfer to other industries.

Earnings and Working Conditions

In early 1967, blue-collar workers employed by contractors at AEC laboratories and other installations had average straight-time hourly earnings of $3.48, while blue-collar workers in all manufacturing industries had average earnings of $2.78 an hour.

Professional workers employed at AEC installations averaged $12,380 a year in base pay in early 1967, and other white-collar workers (largely clerical and other office personnel) averaged $6,600 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 facilities construction are generally similar to those in comparable nonatomic energy activities, except for radiation safety precautions. Nearly 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. In other atomic energy activities, in which the major proportion of workers in the field are employed, working conditions generally are very good. Buildings and plants are well lighted and ventilated. Equipment, tools, and machines are modern and sometimes the most advanced of their type. Only a small proportion of employees in the atomic energy field actually work in areas where direct radiation hazard dangers exist. In some cases, plants are located in remote areas.

Extensive safeguards ensure the health and safety of workers, and the AEC and its contractors have maintained an excellent safety record. The AEC regulates the possession and use of radioactive materials, and AEC personnel inspect nuclear facilities to insure compliance with the AEC's health and safety requirements. Constant efforts are being made to provide better safety standards and regulations.

Most plant hourly paid workers belong to unions that represent their particular craft or industry.

Where To Go for More Information

Additional information about the atomic energy field may be obtained from:

U.S. Atomic Energy Commission,
Washington, D.C. 20545.

OCCUPATIONS IN THE BAKING INDUSTRY

The baking industry is one of the largest food-processing employers in the United States. Occupations in baking establishments provide steady, year-round employment to several hundred thousand workers throughout the country.

The industry employs workers to make bakery products, wrap and pack these products, and to deliver them to stores, homes, and restaurants. It also employs mechanics to maintain and repair the large amounts of machinery used in modern bakeries. Additional mechanics are employed to serve the fleets of delivery trucks. The industry employs many managers and sales specialists to direct operations and clerical workers to perform the regular office duties.

Nature and Location of the Industry

In early 1967, the baking industry employed 280,000 workers in about 5,000 establishments. About 85 percent of these workers were employed in establishments that produced perishable baked goods such as bread, rolls, pies, cakes, and doughnuts. The remaining workers were employed in establishments that produced "dry" baked goods such as cookies, crackers, pretzels, and ice cream cones. Baking establishments include large wholesale bakeries that sell to retail stores, restaurants, hotels, and other large customers; home service bakeries that deliver their products directly to the customers' homes; bakeries owned and operated by grocery chains; and the central baking establishments of companies operating several retail bake shops.

In addition to the baking establishments described above, over 14,000 single-shop retail bakeries employed about 100,000 men and women including shop owners. Although some retail bakeshops employed 20 individuals or more, the average shop employed about 5 or 6. Many of the actual baking operations in these retail establishments are done by hand rather than machine, and therefore, retail bakeries offer many opportunities to the skilled baking craftsman which are not available in the large industrial-type establishments.

Most establishments producing perishable baked goods are relatively small because they serve only their local area. However, an increasing number serve markets up to 200 miles away, and a few serve even wider areas. In contrast, bakeries that produce dry baked goods generally are large establishments that distribute their products regionally or nationally. The average number of employees in these bakeries is about 120 in contrast to about 50 in bakeries producing perishable products.

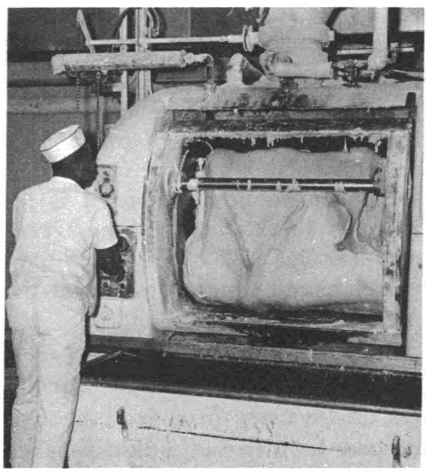
Almost every community in the United States has at least one bakery. However, half of all industrial bakeries and the same proportion of the industry's employees are in the following seven States: New York, Pennsylvania, California, Illinois, Ohio, New Jersey, and Massachusetts.

Occupations in the Baking Industry

Nearly 60 percent of the employees in the baking industry perform the actual baking operations, receive and store raw materials, maintain and repair machinery and other baking equipment, wrap or pack products for delivery, or keep the bakeries sanitary. About every fifth employee delivers the industry's products. Most of these employees work as driver-salesmen, selling to retail stores or directly to customers in their homes. Other drivers with no sales duties are employed to deliver bakery products to distribution centers, hotels, restaurants, and stores. The remainder of the work force is employed in administrative, professional, technical, and clerical jobs.

About 1 of every 5 industrial bakery workers is a woman. Most of them are employed as secretaries, typists, bookkeepers, and in other office jobs. Some are employed in production jobs, such as slicing machine operator, wrapping machine operator, or pie and cake packer; very few women are bakers.

Production Occupations. The principal baking processes consist of blending, sifting, mixing, proofing, baking, and wrapping and packing. Since bread is the primary product of the baking industry, the following descriptions of occupations relate principally to the production of bread. With some variations, depending on the product and the amount of mechanization in the bakery, these are the occupations in any industrial bakery.



Dough mixer operator prepares to release batch of dough into trough.

In general, production workers load and unload machines, watch the operation of the machines, and inspect the output. *Mixers* (D.O.T. 520.885) weigh ingredients and combine them in blending machines. By means of instruments, they carefully control timing and temperature in order to produce a uniform, well-blended dough. The dough is sent to a "proofing" room where the warm temperature produces a fermenting process which causes the dough to rise. When the dough has risen, it is poured into another blending machine, and additional flour, liquids, sugar, salt, and shortening are added and mixed. The dough then goes through another fermenting process before it is shaped into loaves or rolls. *Dividermen* (D.O.T. 526.-782) operate machines which divide the dough according to the weight of the loaf to be produced. The pieces of dough are rolled into balls which are dusted with flour in a rounding machine. *Dough molders* or *molding machine operators* (D.O.T. 520.885) operate machines which press all the air bubbles from the dough and form it into loaves or rolls. "Continuous mixing," an automatic process that is being used increasingly, eliminates many of the steps described above. When fancy shaped bread or rolls are made, *bench hands* (D.O.T. 520.-884) knead and form the dough by hand into various shapes and place the pieces of dough in the pans. The pans containing the machine- and hand-shaped dough go to the final proofing room where the dough rises for about an hour before it is removed and placed in the oven. *Ovenmen* (D.O.T. 526.885) adjust temperature and timing devices on the ovens.

In small bakeries, *all-round bakers* (D.O.T. 526.781), assisted by helpers, usually carry through all the steps needed to turn out finished baked products. Large bakeries employ all-round bakers as working foremen in charge of one operation or more. These workers supervise the men and machines in their department 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. They may assist all-round bakers and specialized bakery workers. They have job titles such as dough mixer helper, bench hand helper, and ovenman helper. Helpers also perform such jobs as greasing pans, removing bread from pans, pushing troughs and racks, and washing pans.

After baked foods 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 into the machines and watch the slicing and wrapping operations. They adjust the machines and keep them supplied with plastic bags, paper, and labels. The wrapped loaves leave the machines and travel along a conveyor belt to the shipping platform.

Many bakery employees work in icing departments where they give the finishing touches to cakes, pastries, and other sweet goods. *Icing mixers* (D.O.T. 520.885) prepare cake icings and fillings, following special formulas of the bakery. They weigh and measure ingredients and mix them by machine. They also prepare cooked fillings for pies, tarts, and other pastries.

In small plants, icing mixers may also spread icing on cakes and cookies. *Hand icers* (D.O.T. 524.-

Baker adjusts automatic depanning machine.

884) are skilled craftsmen 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 employ many workers in their storage, warehousing, and shipping departments. Receiving and stock clerks check and keep records of incoming supplies and ingredients, and deliver them to various departments. Packers and checkers make up orders of bakery products for delivery by driver-salesmen.

Maintenance Occupations. Baking firms employ skilled maintenance workers such as machinists, electricians, and stationary engineers and their helpers to keep machinery and equipment in good condition. Large plants, which are usually highly mechanized, employ many of these workers. In addition, since many baking firms have fleets of trucks, many truck mechanics are employed for maintenance.

Sales and Driving Occupations. The selling and delivery of finished baked foods to grocers, restaurants, hotels, homes, and other customers provide jobs for many thousands of workers. Some of these workers sell baked goods, some drive trucks, and many do both.

Driver-salesmen, also called routemen (D.O.T. 292.358), work for either wholesale bakeries or home-service bakeries. They deliver baked foods to grocery stores or to homes along their assigned routes and collect payment for delivered products. A major part of their job is to try to increase customers' orders and to gain new customers on their routes. Wholesale driver-salesmen arrange their baked products on shelves or display racks in grocery stores. At some busy stores, they may restock the shelves several times a day. Home-service driver-salesmen make deliveries directly to customers' homes. Driver-salesmen return to the bakery at the end of each day to make a report of the day's transactions. They turn in money collected from their customers and return unsold baked goods. They make a list of the items that they think grocers or housewives on their routes will buy the next day. These estimates, assembled from driver-salesmen on all routes, serve as guides for production managers in making up production schedules for the next morning.

A large bakery may employ several route supervisors, each in charge of 6 to 10 driver-salesmen. In a smaller bakery, one route supervisor may be in charge of all salesmen. When a salesman is absent, the supervisor may take over the route until the salesman returns or is replaced. Route supervisors also train new driver-salesmen.

Chain grocery store bakeries and multioutlet retail bakeries generally employ truckdrivers rather than driver-salesmen. These employees drive large vans, delivering baked foods to each of their company's stores. Truckdrivers for chainstore bakeries deliver wrapped bread and other bakery products to loading platforms of the stores. Stock clerks then arrange the display of baked goods in the stores. In bakeries which operate their own retail bakery outlets, the truckdrivers wheel the unwrapped baked foods in enclosed metal racks from the van to each store. Sales clerks then arrange the display of these freshly baked foods.

Administrative, Clerical, and Professional and Technical Occupations. Administrators in large baking firms and proprietors of small firms coordinate all baking activities from the purchase of raw materials to the production and delivery of baked products. In large baking firms, activities are divided into separate departments or functions and supervised by plant managers, comptrollers, sales managers, and other executives. Other administrative employees may specialize in such fields as accounting, purchasing, advertising, and personnel and industrial relations. Business offices of bakeries employ many types of clerical workers, including bookkeepers, cashiers, clerks, business machine operators, stenographers, typists, and switchboard operators. A large proportion of these office workers are women. Some large baking companies have laboratories and test kitchens where chemists, home economists, and their assistants test ingredients and prepare formulas and recipes for bread and other baked items. (Detailed discussions 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 of on-the-job training to several years of training and experience. For example, some bakery workers, such as slicing machine operators, can be trained on the job in a few days. Skilled workers, such as all-round bakers and baking specialists, require at least 3 or 4 years of training. Professional personnel and some administrative workers must have a college degree or equivalent experience in their particular specialty.

Most inexperienced production workers in the baking industry are hired as helpers (utility workers). They may be assigned such tasks as washing and greasing pans, carrying ingredients to mixing machines, pushing troughs of dough to the proofing room, and otherwise assisting bakers. By working alongside skilled bakers, helpers are able to acquire baking skills.

Some bakeries train their bakers through formal apprenticeship pro-

grams. Apprentices generally are selected from among the helpers. Employers usually require that apprentice applicants be between 18 and 26 years of age, have a high school or vocational school education, and show an interest in baking. Apprenticeship programs last 3 or 4 years. They include on-the-job training in all baking operations and classroom instruction in related subjects.

Some workers acquire baking skills by taking courses in vocational school or by learning the trade in the Armed Forces. Such training may not qualify a young man as a skilled baker, but it may help him to become an apprentice and perhaps shorten his apprenticeship period.

Bakers may be promoted to such jobs as working foreman or department foreman. 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.

Good health is important for a young man or woman planning to enter a baking occupation. For anyone handling food, most States require a health certificate indicating that the worker is free from communicable diseases. Good health is necessary also because of irregular working hours and the extremes in temperatures found in bakeries.

Some bakeries have apprenticeship programs for maintenance jobs such as machinists, electricians, and mechanics. Other plants hire inexperienced workers as mechanics' helpers, who gain experience and know-how while working with skilled mechanics. Some bakeries hire only skilled maintenance men.

For jobs as driver-salesmen or truckdrivers, baking firms generally hire inexperienced young men with a high school education. These workers often begin as stock clerks, packers, or checkers, and may be promoted to driving jobs as vacancies occur. Some young men take summer and part-time jobs as driver-helpers to gain experience. Applicants for these jobs must be able to get a commercial driving permit (chauffeur's license). Large baking companies often give tests to their applicants to determine whether they are safe drivers. A pleasant appearance and the ability to get along well with people are preferred qualifications for the new worker who wants to sell as well as drive. New driver-salesmen may be given classroom instruction in sales, display, and delivery procedures. Most training, however, is given on the job by route supervisors. Driver-salesmen may be promoted to route supervisor and sales manager.

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 baking craftsmen, and some begin their careers in sales occupations. In recent years, large baking firms have required their new administrative workers to have a college degree in one of the administrative fields, such as marketing, accounting, labor relations, personnel, or advertising. Several colleges offer courses in baking science and management; one college offers a 4-year course in this field.

Young women who have completed a commercial course in high school, junior college, or a business school usually are preferred for the secretarial, stenographic, and other office jobs.

Employment Outlook

Several thousand job openings are expected to occur in the baking industry each year during the rest of the 1960's and over the 1970 decade because of the need to replace workers who retire, die, or transfer to other fields of work. Retirements and deaths alone should provide about 6,000 job openings each year.

The demand for bakery products is expected to rise moderately during this period in response to increases in population. However, because of increasing efficiency in production, employment in the industry is expected to decline slowly. Even so, employment in some occupations is expected to increase. For example, more truckdrivers will be needed as suburban developments increase and sales territories expand. Additional maintenance workers will be needed to keep machinery and other equipment in operating order as bakeries become more mechanized. Some increase may occur in the number of clerical workers as a result of additional recordkeeping requirements. However, the anticipated increases in these occupations will be more than offset by the continuing decline in the number of production workers resulting from the installation of mechanized processing and materials handling equipment, and improvements in the methods of processing baked goods. Pneumatic conveyors, for example, greatly increase efficiency in materials handling operations, and the "continuous mix" process eliminates dough mixing and proofing operations. In addition, the freezing of baked goods for storage until ready for sale permits bakeries to prepare a week's requirements at one time rather than small batches daily.

Earnings and Working Conditions

Earnings of production workers in the perishable bakery products industry averaged $105.86 a week, or $2.64 an hour, in late 1966. The rates were slightly lower in biscuit and cracker bakeries. Wage rates tend to be higher in the West and North than in the South or Southwest.

According to union-management contracts covering employees in 25 wholesale bakeries producing bread and related products, ranges for minimum hourly rates in major oc-

cupations in mid-1966 were as follows:

Baking foremen and all-round bakers	$2.88–$4.04
Mixers (dough or icing)	2.43– 3.88
Ovenmen	2.43– 3.88
Molders and dividers and molding and dividing machine operators	2.28– 3.88
Benchmen	2.43– 3.79
Utilitymen (general helpers)	2.13– 3.28
Wrapping machine operators	2.28– 3.02
Porters and cleaners	1.92– 2.73

Some plant employees work night shifts and weekends because baking is done around the clock in many plants. Workers receive from 7 to 23 cents an hour extra pay for night-work. However, the night shift is being eliminated in some bakeries because the increasing use of freezing processes makes it possible to prepare baked goods in advance and store them until needed. Most plant workers are on a 40-hour workweek, although some work 35 or 37½ hours and others 44 or 48 hours regularly. For those who work a 35- or 37½-hour week, time and a half is paid for work beyond their regular schedule. For all others, time and a half is paid for all work over 40 hours.

Driver-salesmen are usually paid a guaranteed minimum salary plus a percentage of their dollar sales. According to limited information available in late 1966 on baking firms in 13 Eastern States, driver-salesmen for both wholesale and home-service bakeries had minimum weekly salaries of from $70 to $118. By selling more baked products to their customers and by increasing the number of customers on their routes, driver-salesmen can increase their earnings considerably. Companies generally pay for uniforms and their maintenance.

Truckdrivers for baking plants are paid by the hour. Hourly rates and hours worked vary from city to city. In mid-1965 (the latest year for which this information is available), the minimum wage rates and maximum hours a week before overtime rates prevail, provided by union-management contracts for truckdrivers of bakeries producing bread, cakes, pies, etc. in 11 selected cities were as follows:

	Minimum wage rate	*Hours per week*
Atlanta, Ga	$2.695	45
Birmingham, Ala	2.43	47
Cleveland, Ohio	3.33	40
Dallas, Tex	2.59	45
Detroit, Mich. (bread)	3.10	40
Houston, Tex	2.645	45
Little Rock, Ark	2.43	46
New York, N.Y. (cake and pastry)	3.225	40
Oklahoma City, Okla	2.465	45
Pittsburgh, Pa. (bread)	2.545	44
Oakland, Calif. (transport and chainstore)	3.95–4.20	40

Home-service driver-salesmen and truckdrivers work mostly out of doors. Wholesale driver-salesmen spend much of their time arranging bakery goods on grocers' display shelves. Many jobs in baking plants involve some strenuous physical work, despite the considerable mechanization of baking processes. Work near ovens may be hot.

Paid vacations for employees are almost universal in industrial baking firms. Vacation periods range from 1 to 4 weeks, according to length of service. Paid holidays range from 5 to 11 days, depending on the locality. Most baking firms have adopted some type of insurance or pension arrangement for their employees, such as life insurance, health insurance programs, or retirement pension plans. A large number of employees are covered by joint union-industry health and welfare plans, and pension systems which are paid for entirely by employer contributions.

Most plant workers and drivers belong to a labor union. Bakers, baking specialists, and other plant workers have been organized by the American Bakery and Confectionery Workers' International Union or the Bakery and Confectionery Workers' International Union of America (Ind.). Driver-salesmen and transport drivers are generally members of the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.). Some maintenance men are members of craft unions such as the International Association of Machinists and Aerospace Workers and the International Union of Operating Engineers.

Where To Go for More Information

Information on local job openings in the baking industry may be obtained directly from bakeries in the community.

High school students—or adults interested in evening courses—may obtain information on courses relating to baking by writing to the Director of Vocational Education or to the Superintendent of Schools in their local community, or to the State Director of Vocational Education in the Department of Education in the State capital.

General information on job opportunities in the baking industry and on requirements for entering accredited schools which offer courses or degrees in baking science and technology may be obtained by writing to:

American Bakers Association,
1700 Pennsylvania Ave. NW.,
Washington, D.C. 20006.

ELECTRONICS MANUFACTURING

The science of electronics has contributed greatly to the spectacular achievements of the age in which we live. Electronic instruments guide unmanned missiles for our Nation's defense and control the flights of our astronauts as they rocket into outer space. Other electronic instruments make it possible for man to see, hear, and communicate over vast distances. Electronic devices direct, control, and test production processes in industries such as steel, petroleum, and chemicals. Electronic data-processing equipment enables business and Government to handle tons of paper work with great accuracy and speed. Hospitals use electronic instruments to perform laboratory tests and to check body functions. Television and radio sets inform and entertain, while other electronic devices help protect homes against fire and other hazards. Indications are that electronics will play an even greater role in the future.

In early 1967, an estimated 1.1 million workers were engaged in manufacturing electronic products. During the late 1960's and throughout the 1970's, a rapid increase in employment is anticipated. Job opportunities are expected to be particularly favorable in plants producing industrial-commercial electronic equipment, output of which is expected to grow more rapidly than other electronic products.

Nature and Location of Electronics Manufacturing

Before World War II, the principal electronic products were radios, broadcasting equipment, other receiving and transmitting equipment, and electron tubes. With the rapid development of new electronic products during and after that war, the broader term "electronics manufacturing" or "electronics industry" came into general use.

The heart of every electronic product is a circuit or system that includes electron tubes, semiconductors, and other electronic devices which regulate, control, or direct the flow of small, active particles of negative electricity (electrons) through the circuit. Because of their unique functions, electronic devices are finding many applications.

Electronic products may be grouped into four major categories: (1) Military and space equipment, (2) industrial and commercial products, (3) consumer products, and (4) components. In 1966, military and space products accounted for about half of total electronic shipments. Industrial and commercial equipment and consumer products accounted for about one-fourth each; components produced as replacement parts were only a small percentage of total shipments. (Components produced as original equipment for end products are included in the shipments value of the end products.)

Military and space products include electronic guidance and telemetering systems for missiles and spacecraft; radar and other detection devices; automatic communications and computing systems; gyroscopes and other navigational equipment; and fire controls (such as air-to-air target seeking and detonating equipment). Some important commercial and industrial electronic products are computers; commercial radio and television broadcasting equipment; commercial and private aircraft communications and navigational apparatus; and industrial testing, measuring, and production control equipment. Principal consumer products include television sets, radios, phonographs, tape recorders, and hearing aids. Electronic components fall into three broad classifications: tubes, semiconductors, and "other components." Tubes include receiving tubes, power tubes, television picture tubes, and special purpose tubes. Principal semiconductor devices are transistors, diodes, rectifiers, and microelectronic devices, which include combinations of miniaturized semiconductors. "Other components" include such items as capacitors, resistors, transformers, relays, connectors, and electronic switches.

Of the estimated 1.1 million workers employed in electronics manufacturing establishments in early 1967, about three-fifths—640,000—were in plants producing end products. About 325,000 of these workers produced military and space equipment; 170,000 industrial and commercial products; and 145,000 consumer items. The remaining 440,000 workers were in plants making electronic components.

Electronics manufacturing plants are located in nearly every State, but the majority of electronics manufacturing workers in early 1967 were employed in seven States: California, New York, New Jersey, Illinois, Massachusetts, Pennsylvania, and Indiana. Metropolitan areas with large numbers of electronics manufacturing workers included Chicago, Los Angeles, New York, Philadelphia, Newark, Boston, Baltimore, and Indianapolis.

In addition to the employees in electronics manufacturing plants, over 75,000 electronics workers were employed in the Federal Government, universities, and nonprofit research centers, in such activities as research, development, and the

negotiation and administration of contracts.

How Electronic Products Are Made

Many plants manufacturing electronic products specialize in one type of end product, such as television sets, radios, or electronic computers; or one type of component, such as television picture tubes, power tubes, or semiconductors. In plants which produce several types of end products or components, each type is generally made in a separate department.

Subassemblies, such as tuners and record changers, are often made in plants specializing in these products. Research and development activities are performed in establishments specializing in such work, or in separate departments of manufacturing plants.

A large proportion of workers in plants manufacturing end products are engaged in assembly operations. Inspecting and testing of subassemblies and end products are also important activities. Some end-product plants have fabricating and processing departments in which workers do machining, sheet-metal work, and cleaning and coating of metals, such as painting and plating; and plastic molding.

In assembling radios, television sets, and other end products produced in large quantities, major subassemblies, such as circuit boards or panels, transformers, tuners, tubes, and speakers are attached mainly by hand onto a chassis. A moving conveyor is often used to transport the chassis from one work station to another. Assembled units are placed into metal, plastic, or wooden cabinets. Where complex electronic products are made in small lots, as in the case of scientific and research devices and of electronic equipment used in space exploration, one or two workers may assemble a complete unit by hand.

Semiautomatic and automatic machinery are being used more and more to perform processing and assembly operations in end-equipment plants, particularly where products are mass-produced. For example, in the manufacture of circuit boards, many plants use automatic punch presses to make holes in thin sheets of plastic (one or both sides of which is coated with a thin layer of copper) so that components can be attached. Machines are used to etch electrical circuits, which replace wires, on the circuit boards. Machines also position components into the proper holes in the circuit boards. Mechanical devices bend the wires or metal "ears" on the bottom of the components, locking them into place on the board. Wire leads on the components are commonly soldered to the etched circuits in one continuous operation (called "dip" or "wave" soldering).

Parts used in end products are usually brought to the assembly line by hand truck since most electronic parts are not bulky. They may be loose in boxes, fed from hoppers (receptacles for parts), or held in special containers or jigs. During assembly operations, components and subassemblies are inspected and tested to locate faulty parts or connections or other defects.

In components manufacturing plants, most assembly work is done by machine. Some types of components are usually assembled by hand, such as experimental parts, special purpose tubes, and extremely tiny semiconductors used in military and space equipment. Electronic components are inspected and tested many times, beginning with visual inspection of raw materials as they enter the plant and continuing through all stages of manufacture.

Electronics Manufacturing Occupations

A wide variety of occupations, requiring a broad range of training and skills, is found in plants manufacturing electronic products. About half the workers in electronics manufacturing are in plant jobs (production, maintenance, transportation, and service); the rest are in white-collar jobs (engineering, scientific, finance, administrative, clerical, and sales).

The proportions of plant and white-collar workers differ from one establishment to another, depending mainly on the products being manufactured. For example, the proportion of plant workers is generally higher in establishments producing consumer products than in establishments manufacturing military and space products.

More than two-fifths of the workers employed in electronics manufacturing plants are women. In some plants, particularly those producing electron tubes and semiconductors, women account for half or more of total employment. Most women are employed as semiskilled plant workers, chiefly as assemblers, inspectors, and testers, and as office workers. However, opportunities for women exist in nearly all types of jobs in electronics.

Professional and Technical Occupations. A large proportion of electronics manufacturing workers are in engineering, scientific, and other technical jobs. Engineers and scientists alone represent about 1 out of 7 electronics workers. Generally, they account for a much larger proportion of employment in plants making military and space equipment than in those producing other types of electronic products.

The largest group of engineers is electrical or electronics engineers. They are generally employed in research and development, although many work in production operations as design engineers or as test methods and quality control engineers. Electronics engineers also work as field engineers, sales engineers, or engineering liaison men.

Substantial numbers of mechanical engineers and industrial engineers are also employed in electronics manufacturing plants. Mechanical engineers work as design engineers in product development and in tool and equipment design. They work also as

plant engineers—chiefly concerned with the maintenance layout, and operation of plant equipment. Most industrial engineers work as production engineers or as efficiency, methods, or time-study engineers. Other engineers employed in electronics manufacturing include chemical, metallurgical, and ceramic engineers.

Physicists make up the largest group of scientists in electronics manufacturing. Most of them do research and development work in connection with such products as microwave tubes and microminiaturized components and circuits. Microminiaturization refers to the development of extremely tiny, light-weight electronic devices which consume very small amounts of power. Many scientists in electronics manufacturing are chemists and metallurgists, employed mainly in research work and in materials testing. Mathematicians and statisticians work with engineers and scientists on complex mathematical and statistical problems, especially in the design of military and space equipment and computers. Statisticians are also employed in the fields of quality control, production scheduling, and sales analysis and planning. Industrial designers work on the design of electronic products and the equipment used to manufacture them.

Technicians—such as electronics technicians, draftsmen, engineering aids, laboratory technicians, and mathematical assistants represent a large group of electronics manufacturing workers, roughly 1 out of 11.

Many electronics technicians are engaged in research and development work, helping engineers in the design and construction of experimental models. They are also employed by manufacturers to work on electronic equipment in customers' establishments. Other electronics technicians work in highly technical inspecting, testing, and assembly jobs in the engineering laboratories of firms manufacturing electronic products.

Research technician analyzes quality of materials for electronic components.

Draftsmen are usually employed in engineering departments to prepare drawings from sketches or specifications furnished by engineers. Manufacturers of military and space equipment generally employ a higher proportion of draftsmen than do manufacturers of other types of electronic products.

Engineering aids are another important group of technicians. They assist engineers by making calculations, sketches, and drawings, and by conducting performance tests on components and systems. Laboratory technicians help physicists, chemists, and engineers by performing such duties as setting up apparatus and assisting in laboratory analyses and experiments. Some laboratory technicians may themselves conduct analyses and experiments, usually of a standardized, routine nature. Mathematical assistants help to solve mathematical problems, following procedures outlined by mathematicians. They also operate test equipment used in the development of electronic computers.

Technical writers work closely with engineers, particularly in plants making military-space and industrial-commercial products and in establishments doing research and development work. They prepare training and technical manuals describing the operation and maintenance of electronic equipment. They also prepare catalogs, product literature, and project reports and proposals. Specifications writers compile lists of required measurements and materials. 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 plants are in administrative or other office jobs. Administrative workers include purchasing agents, sales executives, personnel workers, advertising personnel and marketing research specialists. Clerks, secretaries, stenographers, typists, and business machine operators, many of whom are women, are among the thousands of other office workers employed by electronics manufacturing firms. A small but growing proportion of these office workers operate electronic computers and auxiliary equipment. Most of these computers are used to process office records, including payroll, production, costs, sales, and inventory data.

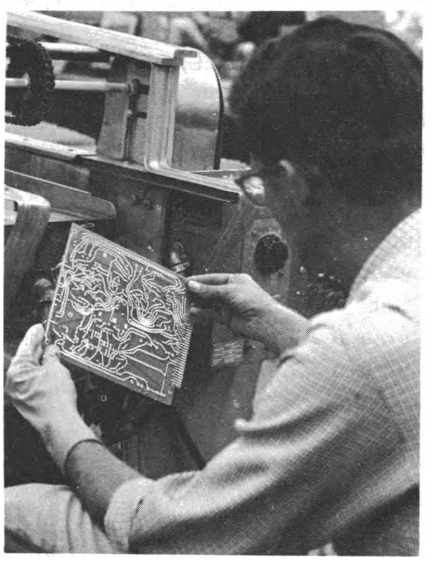
Plant Occupations. About half of electronics manufacturing employees work in assembly, inspecting and testing, machining, fabricating, processing, maintenance, and other plant operations. The proportion of workers in each of these operations differs among electronics plants depending largely on whether end products or components are produced, and the types manufactured. For example, the proportion of assemblers is higher in plants making components and consumer end products than in plants producing military space equipment, and industrial-commercial products. The proportion of machining and fabricating workers is higher among

manufacturers of military space equipment and industrial-commercial products than among manufacturers of other types of products.

Assembly occupations (D.O.T. 729.884; 720.884; 726.781 and .884). Assemblers make up the largest group of electronics plant workers. Both end-product and component manufacturing firms employ assemblers with many different skills. However, most assemblers are semiskilled workers.

Most end products are assembled mainly by hand, with small handtools, soldering irons, and light welding devices. Assemblers use diagrams, models, and color-coded parts and wires to help them in their work. Some assembly work is done by following instructions presented on color slides and tape recordings. Color slides flash a picture of an assembly sequence on a viewing screen while the assembler listens to recorded directions.

Precision assemblers install components and subassemblies into end products in which moving parts and mechanisms must operate within clearances measured in thousandths, or even millionths, of an inch. Some of these assembly workers do repair work, experimental and developmental work, and model assembly work. Most precision assemblers are employed in the manufacture of military space and industrial-commercial electronic equipment.



Machine operator checks wave-soldered printed circuit board.

Machines are used in some assembly work on end products. For example, in putting together subassemblies such as circuit boards, automatic machines are often used to position components on the boards and to solder connections. Here the assemblers work as machine operators or loaders.

Most components are assembled by machines, since their assembly involves many separate but simple and repetitive operations. Even some types of miniaturized semiconductors and other components, made with parts small enough to pass through the eye of a needle, are now assembled on highly complex machines. Some of these machines are automatically controlled.

Hand assembly is needed for some components, such as receiving tubes, special purpose tubes, and some types of transistors, diodes, capacitors, and resistors. Hand assemblers may only perform a single operation on these components as they move down the assembly line, but some may completely assemble a particular type of component. Tiny components are often hand-assembled under magnifying lenses or powerful microscopes.

Hand assemblers may sometimes use machines to assist them in performing assembly operations on components. For example, precision welding equipment may be used to weld connections in microminiature components and circuit assemblies. Some circuit assemblies are so small that hundreds of components may be precision welded in a cubic inch of space. Machines may also be used to position and hold component parts during assembly operations.

Hand assemblers are also employed in electronics research laboratories and in the research and development departments of electronics manufacturers. These workers—frequently called electronics technicians—generally do difficult assembly work on small quantities of complex, often experimental, equipment. They may also work on the development of new ways to assemble large quantities of components or subassemblies by machine. Some electronics technicians install subassemblies into complex systems such as those in guided missiles. These hand assemblers usually must know enough electronics theory to understand the operation of the items being assembled.

Most assemblers are women. They are employed mainly as machine operators or tenders and as hand assemblers of items made in large quantities. Men are chiefly employed in experimental assembly work, in model assembly, and in assembly jobs requiring relatively heavy work. Men are also employed in assembly departments as "trouble shooters." These workers analyze end products and subassemblies which have failed routine performance tests, to pinpoint the exact cause of faulty operation.

Machining occupations. Metal machining workers are employed in most electronics manufacturing plants, particularly those making military-space and industrial-commercial products. Machine-tool operators and machinists operate power-driven machine tools to produce metal parts of electronic products. Toolmakers construct and repair jigs and fixtures used in the fabrication and assembly of parts. Diemakers specialize in making metal forms (dies) used in punch and power presses to shape metal parts.

Fabricating occupations. Fabricating workers are employed in many electronics manufacturing plants, but the largest proportion is in establishments producing industrial-commercial products. Among the fabricating workers are sheet-metal workers who make frames, chassis, and cabinets.

Many women are employed as assemblers in the electronics industry.

Glass blowers and *glass lathe operators* (D.O.T. 674.782) are employed chiefly in electronic tube experimentation and development work; in the manufacture of special purpose tubes, which are made in small numbers; and in rebuilding television picture tubes. Other fabricating workers include *punch press operators, blanking machine operators* and *shear operators.*

Some fabricating jobs involve the molding, firing, and glazing of ceramics used as insulating materials in many components. Workers may also operate machines that mold plastic components. In electron tube manufacturing, special fabricating workers are employed. For example, *grid lathe operators* (D.O.T. 725.884) make grids (devices in electronic tubes which control the flow of electrons) by winding fine wire around two heavy parallel wires. Other fabricating workers include spot welders, *coil winders* (D.O.T. 724.781 and .884) and *crystal grinders and finishers* (D.O.T. 726.884).

Processing occupations. A relatively small but important group of electronics manufacturing workers is engaged in processing activities, chiefly in plants producing electronic components. Electroplaters and *tinners* (D.O.T. 501.885) coat many parts with metal. *Anodizers* (D.O.T. 501.782) treat parts in electrolytic and chemical baths to prevent corrosion. *Silk screen operators* (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.

Processing workers also impregnate or coat coils and other electronic components with waxes, oils, or other materials. Some operate machines which encase microminiature components in plastic resin to join and insulate them in circuits, seal out moisture, and reduce chances of connection failure caused by heat and vibration.

Another group of processing workers operate furnaces, ovens, and kilns, used chiefly to harden ceramics, bake on coatings, and eliminate contamination by gases and foreign materials. *Operators of infrared ovens and hydrogen furnace fires* (D.O.T. 590.885) rid tubes of foreign deposits. In tube manufacturing, *exhaust operators* (D.O.T. 725.884) and *sealers* (D.O.T. 692.885) operate gas flame machines which seal the mount (the part of an electronic tube consisting of a Bakelite base and stem) in the tube, clear the tube of impurities, exhaust the gas, and seal the tube.

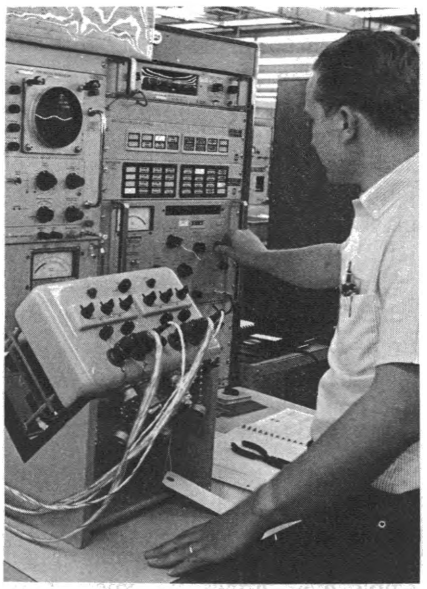
Testing and inspection. Testing and inspection in electronics manufacturing begin when raw materials enter the plants, and continue throughout fabricating operations. Finished components and end products undergo thorough testing and inspection, frequently including operation for a period of time, before shipment.

In end-product manufacturing plants, testers use voltmeters, oscilloscopes, and other test meters to make certain that components, subassem-

blies, and end products conform to specifications. Many of these workers have job titles that indicate the type of work they do, such as analyzer, final tester, tuner tester, and operational tester.

Some testing jobs require technically trained workers who have had several years of experience in electronic testing. These jobs are commonly found in research and development work, where electronics technicians test, adjust, and aline circuits and systems as part of their overall responsibility. These jobs are also found in complex production work, such as the manufacture of missiles and spacecraft.

In component manufacturing plants, components are checked manually by testers using various types of test meters, or routed mechanically through automatic test equipment. Some automatic equipment can check a large number of component characteristics, produce a punched tape of test results and sort the components into batches for shipping. Although many of these workers are simply called component testers, others have job titles which reflect the type of components they test, such as transformer tester, coil tester, and magnetic component tester. Workers who feed or monitor automatic test equipment are often called test-set operators or testing-machine operators.



Inspector tests power supply module.

The work of inspectors in end-product plants varies from checking incoming materials to inspecting subassemblies and final products for flaws in circuit assembly, etching, plating, painting, and labeling. *Electronic assembly inspectors* (D.O.T. 722.281) examine assembled electronic units to make certain that they conform to blueprints and specifications, and check wire routing, electrical connections, and quality of units. Mechanical and precision inspectors check mechanical assemblies and precision parts. Inspectors in end-product plants may use tools such as measuring scales, micrometers, calipers, and magnifying glasses in their work.

Inspectors in component manufacturing plants check incoming raw materials and subassemblies before, during, and after fabricating and processing operations. They may inspect wire leads on diodes for straightness or length, wire winding on coils for evenness or breakage, and completed tubes for loose wires, scratched paint, corrosion, and defective etches and identifying labels. Some inspectors make repairs on defective components.

Tools used by inspectors in components plants may include magnifying lenses, micrometers, calipers, tweezers, and, in some circumstances, microscopes. These inspectors may have job titles that indicate the work they do, such as incoming materials inspector, plating inspector, power tube inspector, coil inspector, machine parts inspector, and precision inspector.

Maintenance occupations. Many maintenance workers with different types of training are employed in electronics manufacturing plants to take care of machinery and equipment. Skilled electricians are responsible for the proper operation of electrical equipment. Machine and equipment repairmen perform mechanical repairs. Hydraulic mechanics specialize in maintaining hydraulic equipment. Maintenance machinists and welders build and repair equipment, jigs, and fixtures. Air-conditioning and refrigeration mechanics are employed in electronics plants which are air-conditioned and have special refrigerated and dust-free rooms. Painters, plumbers, pipefitters, carpenters, sheet-metal workers, and other building maintenance craftsmen are also employed in electronics plants.

Other plant occupations. Parts changer (D.O.T. 729.381) is another important occupation in electronic manufacturing plants. These workers repair assembled electronic products which have been tagged for replacement of defective parts. Women are frequently employed as parts changers.

Many workers are employed in materials movement and handling. These workers include operators of plant trucks and tractors; forklift operators who stack crates and load and unload trucks and boxcars; and truckdrivers who handle transportation outside the plant. Other occupations include boiler operator and stationary engineer.

(Detailed discussions of professional, technical, mechanical, and other occupations found not only in electronics manufacturing plants but also in other industries are given elsewhere in the *Handbook,* in sections covering the individual occupations.)

Training, Other Qualifications, and Advancement

Electronics manufacturing plants employ many engineers, scientists, and technicians, because of the technical nature of plant production operations and the great emphasis on research and development work. Beginning engineering jobs are usually filled by recent graduates of engineering colleges (some with advanced degrees). A small number of workers without college degrees are upgraded to professional engineering classifica-

tions from such occupations as engineering assistant and electronics technician. Workers who become engineers in this way usually have taken advanced electronics courses in night school or under other training programs. To keep up with new developments in their fields and to help them 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 plants have college degrees and many have advanced degrees. Job prospects are usually better for scientists with at least a master's degree than for those with only a bachelor's degree.

Technicians generally need some specialized training to qualify for their jobs. Most electronics technicians have attended either a public, private, or Armed Forces technical school. Some have obtained their training through apprenticeships, usually of 3 or 4 years' duration. Applicants with a high school education, including courses in mathematics and science, are preferred for these apprenticeships. Some workers become electronics technicians by being upgraded from such jobs as tester and experimental assembler, after they have developed required skills on the job and acquired the necessary knowledge in basic electronics theory, mathematics, drafting, and reading of schematic diagrams. This knowledge is usually obtained by taking courses in company-operated classes, night school, junior college, technical school, or by correspondence.

Electronics technicians need color vision, manual dexterity, and good eye-hand coordination. As in the case of other technical workers, they must be able to understand technical publications. Some technicians who do final testing that requires the operation of radio transmitting equipment must hold licenses from the Federal Communications Commission as first- or second-class commercial radiotelephone operators.

Laboratory technicians, engineering and scientific aids, and mathematical assistants frequently have had 1 year or more of college training in a scientific or engineering field, but have not completed course requirements for a degree. In other cases, these workers have been upgraded from jobs as lower grade assistants in engineering laboratories or as high-grade testers in production departments. In hiring lower grade assistants, electronics firms give preference to high school graduates who have completed high school courses in mathematics, physics, and chemistry.

Draftsmen usually enter their trade by taking a course in drafting at a trade or technical school; a few have completed a 3- or 4-year apprenticeship. Some qualify for their jobs under an informal arrangement with their employers which provides for both on-the-job training and part-time schooling. Because many draftsmen must understand the basic principles of electronic circuits to do their work, they should study basic electronic theory and circuits and the reading of electronic schematic diagrams.

Technical writers must have a flair for writing and are usually required to have some technical training. Electronics firms prefer to hire those who have had some technical institute or college training in science or engineering. Some have college engineering degrees. Many have college degrees in English and journalism and have received their technical training on the job and by attending company-operated evening classes. Technical illustrators have usually attended special schools of art or design.

Many tool and die makers, machinists, electricians, pipefitters, carpenters, and other craftsmen in electronics manufacturing learn their trades by completing a 4- or 5-year apprenticeship. Some enter these trades through upgrading from helpers' jobs. Some take courses at vocational schools.

Formal training in electronics is usually not necessary for workers entering plant jobs, but completion of high school is frequently required. Job applicants may have to pass aptitude tests and demonstrate skill for particular types of work. On-the-job training, usually for a short period, is generally provided for workers who have had no previous experience. Assemblers, testers, and inspectors need good vision, good color perception, manual dexterity, and patience.

Requirements for filling administrative and other office jobs are similar to those in other industries. Certain beginning administrative jobs in electronics manufacturing are generally open only to college graduates with degrees in business administration, accounting, or engineering. More and more employers are requiring college training for administrative jobs in advertising, personnel, accounting, and sales. For clerical jobs, employers usually prefer applicants who are high school graduates with special training in stenography, typing, bookkeeping, and office machine operation.

Employment Outlook

Electronics manufacturing will provide tens of thousands of job opportunities annually during the late 1960's and throughout the 1970's. A rapid rate of growth in electronics employment is expected over this period, assuming relatively full employment in the Nation's economy and the high levels of economic activity needed to achieve this goal. In addition to the many thousands of job opportunities resulting from employment growth, large numbers of job openings will result from the need to replace workers who transfer to other fields of work, retire, or die. Retirements and deaths alone will provide an estimated 35,000 job openings annually—about 10,000 for men and 25,000 for women.

Employment in the electronics industry is expected to rise rapidly but the rate of increases will vary by major product category. The most rapid employment growth is expected for industrial-commercial products. Busi-

nessmen are expected to spend increasing amounts for electronic equipment to automate and mechanize data processing and production processes, especially for such items as computers and numerical controls for machine tools. Demand is also expected to grow for navigational, test, educational, and radio communications equipment. Production of electronic equipment for the medical and atomic energy fields will also expand greatly. In addition, many new fields are being explored for applications of electronic devices, including automated highways and railways and water desalinization and purification.

The demand for consumer items is also expected to increase rapidly as population, family formations, and personal spendable incomes rise over the period. The demand for military and space electronic equipment is expected to grow slowly over the period. This projection is based on the assumption that the level of defense expenditures, an important determinant of output in this product category, will return to the pre-Vietnam level during the 1970's. Moreover, it assumes that expenditures for programs to explore outer space and the ocean depths will continue at approximately current levels. If these assumptions should not be realized, employment levels in this sector of the industry will be affected.

The increase in electronics employment in all product categories probably will not be as great as the expansion in output, however, because 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 television and radio sets, and components. However, mechanized manufacturing processes are difficult to adapt to the fabrication of many types of highly complex electronic products.

Although employment in electronics manufacturing is expected to grow rapidly over the period, the rates of growth will vary among occupational groups and individual occupations. For example, the demand for skilled maintenance personnel, particularly instrument repairmen, is expected to rise at a rapid rate, because of the need to maintain and repair the increasing amounts of complex machinery. On the other hand, employment of semiskilled workers is anticipated to rise slowly because of the growing mechanization and automation of assembly line operations.

The overall demand for engineers, scientists, and technicians is expected to increase because of continued high expenditures for research and development, and the continuing trend toward the production of complex equipment. Among professional and technical workers, the greatest demand will be for engineers with advanced degrees, particularly those who have a background in certain specialized fields, including quantum mechanics, solid-state circuitry, product design, and industrial engineering. The demand for engineers possessing selling ability will rise rapidly because the increasing complexity of industrial and commercial equipment will require salesmen with highly technical backgrounds. The demand for mathematicians and physicists will be particularly great because of expanding research in computer and laser technology.

Earnings and Working Conditions

Average hourly and weekly earnings of production workers in electronics manufacturing industries vary considerably by type of product produced. As shown in the following tabulation, production workers in industries making military-space and industrial-commercial products had higher average earnings in mid-1967 than those in industries producing other major types of electronic products.

Type of product	*Average hourly earnings*	*Average weekly earnings*
All manufacturing industries	$2.82	$114.49
Major electronics manufacturing industries:		
Military-space and industrial-commercial electronics end products	3.03	125.14
Electron tubes	2.61	103.10
Radio and television receiving sets, and phonographs	2.42	92.20
Semiconductors and other components, except tubes	2.36	91.57

Earnings of individual production workers may differ from the averages shown above since such earnings depend not only on the type of plant in which they work but also on factors such as skill level and experience, length of service, geographic location, and amount of overtime.

Electronics workers generally receive premium pay for overtime work and for work on Sundays and holidays. Virtually all plants provide extra pay for evening and night shift work.

Many workers in electronics manufacturing plants receive 2 or 3 weeks' vacation with pay, depending on their length of service, and from 6 to 8 paid holidays a year. Almost all electronics workers are covered by health and life insurance plans; many are covered by pension plans and other fringe benefits.

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. Most plant departments are air conditioned where dust-free conditions or air temperature control is necessary for the manufacture of certain types of electronic equipment. The work in most electronics occupa-

tions is not strenuous. Many assembly line operations are repetitious. Music during working hours, cafeterias, recreational facilities, and social programs are provided for employees by some electronics manufacturing firms.

The frequency of injuries in electronics manufacturing is far below the average in manufacturing as a whole, and injuries are usually less severe.

Many workers in electronics manufacturing are covered by labor-management agreements. The principal unions involved 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.).

Where To Go for More Information

Further information concerning careers in electronics manufacturing can be obtained from the public relations department of individual electronics manufacturing companies and from:

Electronic Industries Association, 2001 Eye St. NW., Washington, D.C. 20006.

OCCUPATIONS IN FOUNDRIES

The metal castings produced by foundry workers are essential parts of thousands of products ranging from automobile engines to cooking utensils. In early 1967, an estimated 400,000 workers were employed in the Nation's foundries and in foundry departments of other metalworking establishments.

Casting is a method of forming metal into a wide range of intricate shapes. To cast metal, a mold is prepared with a cavity in it that has been shaped by a pattern or model of the object to be cast. Metal is then melted and poured into the mold cavity, where it cools and solidifies.

Castings may range in length from a fraction of an inch to many feet. They may weigh anywhere from less than an ounce to many tons. The considerable strength and rigidity of cast objects makes the casting process suitable for producing thousands of items for household and industrial uses. Among these products are machine bases, ship propellers, bearings, industrial valves, water faucets, water mains, engine blocks, dies, gears, motor frames, railroad car wheels, and aircraft and missile components.

Nature and Location of Foundry Work

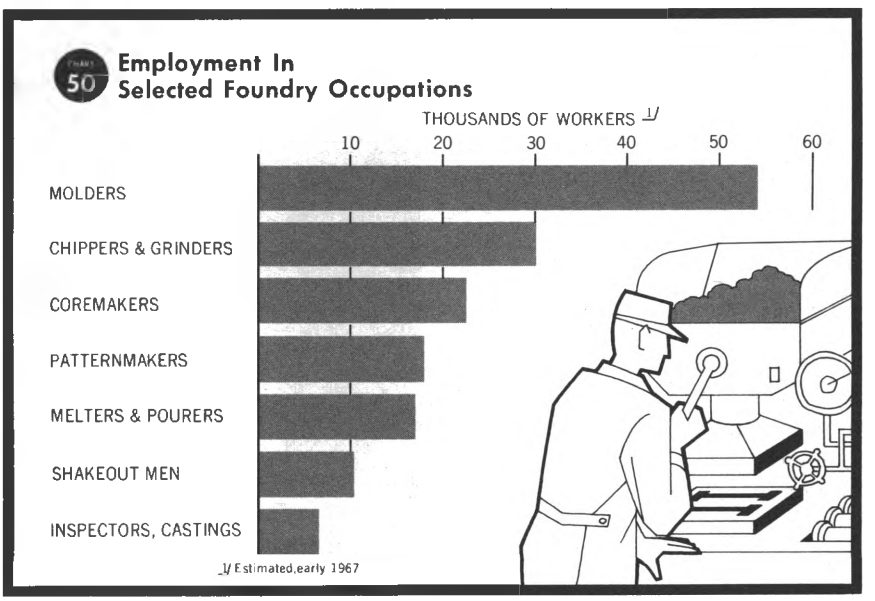
An estimated 240,000 of the foundry industry's workers are employed in ferrous foundries—those that make castings of iron and steel. About three-fifths of these workers are employed in ferrous foundries that produce gray and ductile iron castings; the remainder are employed in malleable iron and steel foundries. About 90,000 workers are employed in nonferrous foundries. Most of this group work in foundries that make brass, bronze, aluminum, magnesium, and zinc castings. Approximately 70,000 foundry workers are employed in foundry departments of other metalworking establishments. Foundries usually specialize in casting a particular metal, since somewhat different methods and equipment are used in melting and in casting the different metals. However, many nonferrous foundries and some ferrous foundries cast several metals. With additional training, foundry workers are capable of transferring from foundries casting one type of metal to foundries casting a different one.

Foundries are usually small establishments. More than 90 percent employ fewer than 250 workers each. However, large foundries with 500 workers or more employ about one-third of all foundry workers. More than two-thirds of the foundry workers are employed in independent shops that sell their castings to other firms. Most of the remaining workers are employed in the foundry departments of plants that use castings in their final products, such as machinery and motor vehicles. Some foundry workers are employed in foundry pattern shops in various metalworking plants, and in shops that make patterns on order.

There are five principal methods of casting, each named for the type of mold used. The most common of these is green-sand molding. In this method, sand composed chiefly of silica, clay, and moisture is packed in a boxlike container, called a flask, around a pattern. After the pattern is withdrawn, molten metal is poured into the mold cavity to form the desired metal shape. Sand molds can be used only once, but the sand is usually reconditioned and reused.

A second method, called permanent molding, employs a metal instead of a sand mold. Metal molds, which can be used many times, are used chiefly for casting nonferrous products. However, some ferrous castings are also produced by this method.

Precision investment casting, a third method (often known as the "lost wax" process), uses ceramic molds. In this method, a wax or plastic pattern is coated with refractory



clay. After the coating hardens, the pattern is melted and drained, leaving a mold cavity into which molten metal is poured. 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. The process is even used more widely to make cores, which form designed cavities in the castings.

Die casting, a fifth process, is done entirely by machines operated by die-casting machine operators. In this method, molten metal under high pressure is forced into dies from which the castings are later automatically ejected, or removed by hand, when the metal solidifies.

Small foundries generally produce small amounts of different kinds of castings for nearby metal fabricating plants. These foundries ordinarily are not highly mechanized. They employ hand and machine molders and coremakers (the key foundry occupations), and a substantial number of unskilled laborers. Many of these foundries produce large castings, and require the skills of floor molders.

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 materials-handling equipment are used in place of hand labor to move materials, molds, and castings. However, proportionately greater numbers of skilled maintenance workers, such as millwrights and electricians, are employed in these foundries to service and repair the large amount of machinery and equipment. Also, these shops employ proportionately fewer skilled molders and coremakers.

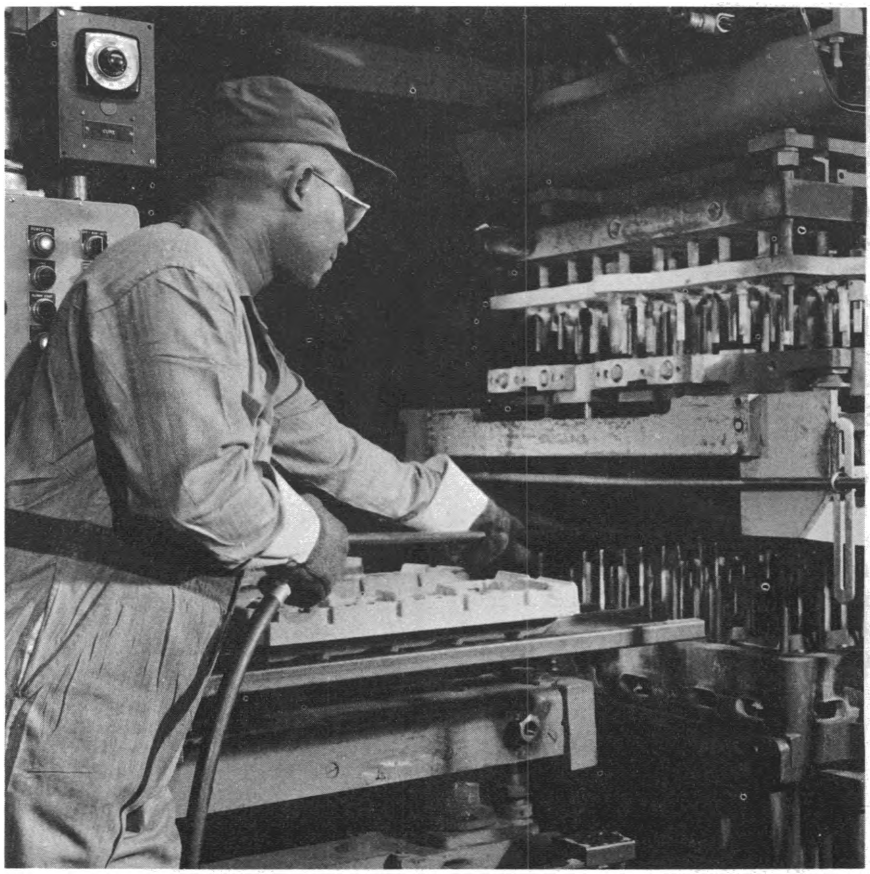
There are foundry jobs in every State and in most large- and medium-size cities in the country. Because foundries usually are located near plants where their castings are used, foundry jobs tend to be concentrated in States where there is considerable metalworking activity; for example, in Michigan, Ohio, Illinois, Pennsylvania, Indiana, and Wisconsin.

Foundry Occupations

More than four-fifths of the approximately 400,000 workers in foundries and foundry departments in early 1967 were employed in plant occupations. More than half of the plant workers were employed in occupations not found in other industries. To illustrate more clearly the duties of these workers, a brief description of the jobs involved in the most common casting process—sand casting—follows:

After the casting is designed, the *patternmaker* makes a wood or metal pattern in the shape of the casting desired. 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, molding 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.*

A coremaker shapes sand, specially prepared by a *sand mixer,* into cores (bodies of sand designed usually to create hollow spaces in castings). Most cores are baked in an oven by a *core-oven tender* (D.O.T. 518.885). Core parts or sections are put together by a *core assembler* (D.O.T. 518.887). After the cores are assembled, they are placed in the molds by *coresetters* (D.O.T. 518.884) or



Machine coremaker tends automatic equipment that produces cores.

molders. Now, the molds are ready for the molten metal to be poured.

A *furnace operator,* or *melter* (D.O.T. 512.782) operates the furnace that melts the metal. The metal is usually poured into molds by a *pourer* (D.O.T. 514.884), although in some small foundries molders may perform this task. When the castings have solidified, they are dumped from the molds by a *shakeout man* (D.O.T. 519.887) and sent to the cleaning and finishing department.

The dirty and rough surfaces of the castings are cleaned and smoothed by blasting or tumbling, and chipping and grinding. A *shotblaster* (D.O.T. 503.887) operates a machine that cleans the castings by blasting them with air mixed with metal shot or grit. The castings may be smoothed by tumbling. In this process, the castings together with an abrasive material, and sometimes water, are placed in a barrel which is rotated. As the barrel turns, the castings tumble against each other, thereby removing sand, burrs, and scale. The man who controls the barrel is called a *tumbler operator* (D.O.T. 599.885). Sandblasters and tumbler operators may also operate a machine which 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 hammers, chisels, and files, to remove excess metal and to finish the castings.

Castings are frequently heat treated in furnaces to improve the physical properties of 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 blueprint specifications.

The estimated number of workers in the principal occupations unique to foundries and foundry departments are shown in chart 50. Detailed discussions of three of these occupations—patternmakers, coremakers, and molders—follow this chapter.

Many foundry workers are employed in occupations that are common to other industries. For example, foundry maintenance mechanics, machinists, carpenters, and millwrights maintain and repair plant and equipment. Crane and derrick operators and truckdrivers move castings and casting materials from place to place. Machine tool operators finish castings in the many foundries that do machine finishing work. Foundries also employ thousands of workers in unskilled jobs, such as guard, janitor, laborer, and helper.

Nearly a fifth 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, stenographers, typists, and accounting clerks.

Foundries also employ substantial numbers of professional and technical workers, such as engineers, and metallurgists. Some of these employees do research; others make designs and layouts of machinery and equipment; control the quality of castings; or supervise plant operations and maintenance. In recent years, increasing numbers of these workers have been hired to sell castings and to assist customers in designing cast parts. Foundry technicians are employed in a variety of functions concerning the control of quality in casting production. 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. In this work they may use X-ray or magnetic apparatus to inspect the internal structure of castings.

Administrative workers employed in foundries include office managers, personnel workers, purchasing agents, plant managers, and other supervisory workers.

(Detailed discussions of professional, technical, mechanical, office, and other occupations found in the foundry industry as well as in many other industries are given in the sections of the *Handbook* covering individual occupations.)

The foundry work force is predominately male, since much of the work connected with the production of castings is strenuous. Women are employed primarily in office jobs, although some are employed in production occupations such as coremaker. Women also assemble wax and plastic patterns in investment casting foundries.

Training, Other Qualifications, and Advancement

Most foundry plant workers start in unskilled jobs, such as laborer or helper. A worker may begin as a laborer and, after receiving informal on-the-job training from a foreman or experienced worker, he may gradually learn how to perform the more skilled jobs. This is the usual practice in training workers for such direct casting process jobs as melter, chipper, and grinder.

Some skilled foundry workers—particularly hand molders, hand coremakers, and patternmakers—learn their jobs through formal apprenticeship. In this type of training, the young worker is given supervised on-the-job training for a period of 4 or 5 years, usually supplemented by classroom instruction. A worker who has completed an apprenticeship program is usually preferred by foundry management because he has a greater working knowledge of all foundry operations and is, therefore, better qualified to fill supervisory jobs.

An increasing number of skilled foundry workers learn their jobs through a combination of trade school and on-the-job training. Beginning workers may attend trade schools that offer training in foundry work before entering a formal apprenticeship program; in some cases, trade school courses may be credited toward completion of formal apprenticeships.

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Employment Outlook

The foundry industry will hire thousands of workers annually through the 1970's, mainly to replace experienced workers who transfer to other fields of work, retire, or die. Because the industry employs a large number of workers, retirements and deaths alone will provide about 9,000 job openings annually.

A substantial increase in foundry production is expected during the decade ahead. Growing population and rising levels of personal disposable income will result in expanded consumer outlays for most products, resulting in greater demand for castings and products that include cast parts. These products include, for example, automobiles, plumbing fixtures, air conditioners, household appliances, and gas and water lines. New machinery, much of which will be made with cast components, will also be needed to produce the increasing quantity of goods needed to satisfy the requirements of an expanding population. In addition, the need for modern transportation systems to transport the output of a growing economy will stimulate the demand for castings used in trucks, buses, railroad cars, ships, and aircraft.

Little or no change is expected in employment in foundries through the 1970's. Continued improvements in casting methods, particularly in machine molding and coremaking, and the increasing use of machinery for materials handling, will result in greater output per foundry worker.

Employment is expected to rise faster in some occupations than in others; in a few occupations, employment may actually decline. For example, scientists, engineers, and other technical personnel are expected to increase more rapidly than other workers as a result of expanding research and development activities. Technicians also will be needed in greater numbers as the foundry industry introduces improved quality control procedures and new production techniques. More maintenance workers and operators of materials moving machines will be needed because of the increasing use of materials-handling equipment and more complex processing equipment. In contrast, the number of hand molders, hand coremakers, and other hand processing workers will show little change, because of the increasing substitution of machine molding and coremaking for hand processes. The number of laborers and other unskilled workers employed in the industry will continue to decline.

Earnings and Working Conditions

Foundry production workers had higher average hourly earnings than production workers in manufacturing as a whole. In early 1967, earnings of production workers in iron and steel foundries averaged $128.78 a week, or $3.03 an hour. In nonferrous foundries, the average was $120.30 a week, or $2.92 an hour. By comparison, production workers in all manufacturing industries had average earnings of $113.02 a week, or $2.77 an hour.

Collective bargaining contracts negotiated between foundry employers and unions generally included provisions for fringe benefits, such as holiday pay, vacation pay, and retirement pensions. Other important benefits often included in such contracts were life, medical, and accident insurance.

Working conditions in foundries have improved in recent years. Many foundries, through the installation of modern ventilating systems, new equipment, and improved plant layout, have reduced the heat, fumes, and smoke that are part of foundry operations. Although the rate of disabling work injuries in foundries is higher than the average for all manufacturing industries, employers and unions attempt to eliminate injuries by promoting safety training and by using protective equipment, such as face shields, metal toe shoes, metal helmets, and safety glasses.

Various labor unions have foundry workers in their membership. Among these unions are the International Molders' and Allied Workers' Union of North America; the United Steelworkers of America; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; and the International Union of Electrical, Radio and Machine Workers. Many patternmakers are members of the Pattern Makers' League of North America.

Where To Go for More Information

For further information about work and/or training opportunities in foundry occupations, inquiries should be directed to 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; and the following organizations:

Foundry Educational Foundation,
1138 Terminal Tower, Cleveland, Ohio 44113.

International Molders' and Allied Workers' Union of North America,
1225 East McMillan St., Cincinnati, Ohio 45206.

National Foundry Association,
9838 Roosevelt Road, P.O. Box 76, Westchester, Ill. 60156.

Non-Ferrous Founders' Society, Inc.,
14600 Detroit Ave., Cleveland, Ohio 44107.

Gray and Ductile Iron Founders' Society, Inc.,
National City—East 6th Bldg., Cleveland, Ohio 44114.

American Foundrymen's Society,
Golf and Wolf Rds., Des Plaines, Ill. 60016.

Malleable Founders' Society,
781 Union Commerce Bldg., Cleveland, Ohio 44114.

Steel Founders' Society of America,
Westview Towers,
21010 Center Ridge Rd., Rocky River, Ohio 44116.

PATTERNMAKERS

Nature of Work

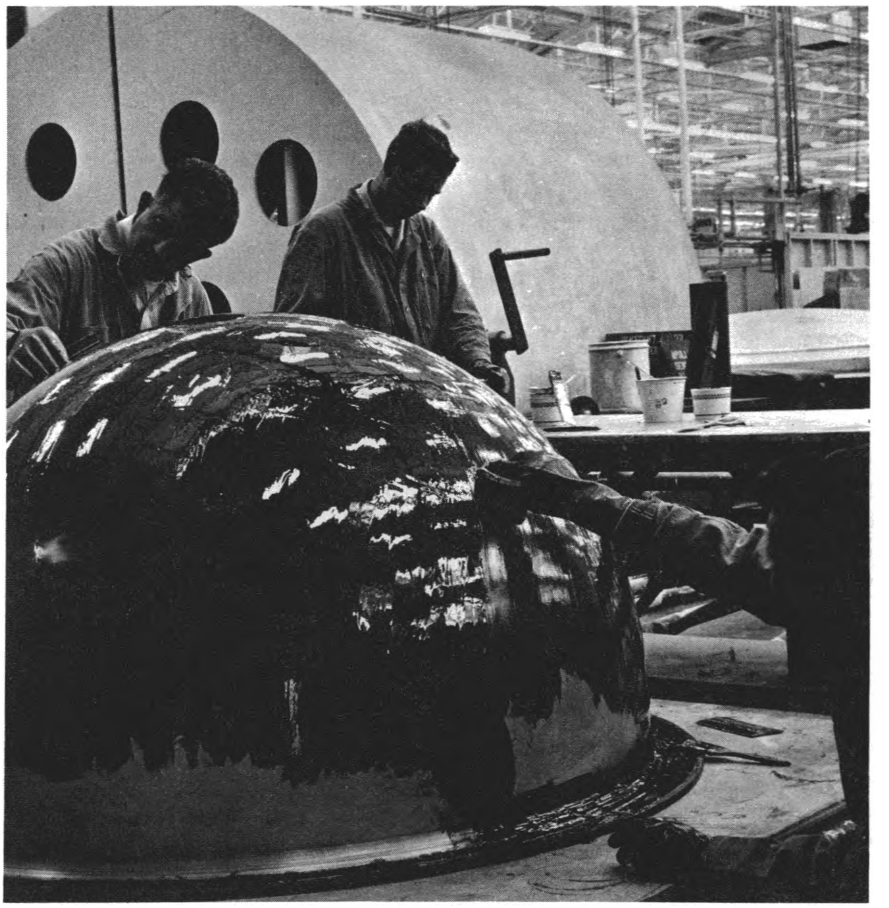
Foundry patternmakers are highly skilled craftsmen who build patterns used in making molds in which foundry castings are formed. Most of the workers in the occupation are *metal patternmakers* (D.O.T. 600.-280); a somewhat smaller number are *wood patternmakers* (D.O.T. 661.-281). In the last decade or so, increasing use has been made of plaster and plastics in patternmaking. Although these materials are used mainly by wood patternmakers, they are also used by metal patternmakers. In addition, a small number of patternmakers work exclusively with plaster and plastics.

Patternmakers work from blueprints prepared by the engineering department or the customer's design engineer. They make a precise pattern for the product, allowing for shrinkage of molten metal used in the casting process and for other factors.

The metal patternmaker prepares patterns from metal stock or from rough castings made from an original wood pattern. To shape and finish the patterns, he uses a variety of metalworking machines, including the engine lathe, drill press, shaper, milling machine, power hacksaw, and grinder, as well as small handtools.

The wood patternmaker selects the appropriate woodstock, lays out the pattern, marks the design for each section on the proper piece of wood, and saws each piece roughly to size. He then shapes the rough pieces into final form, using various woodworking machines, such as circular saws, lathes, planers, bandsaws, and sanders, as well as many small handtools. Finally, he assembles the pattern segments by hand, using glue, screws, and nails. Standardize colors are used to finish the pattern.

A high degree of accuracy is required to make patterns, since any imperfection in the pattern will be reproduced in the castings made from it. Throughout his work, the patternmaker carefully checks each dimension of the pattern, using a variety of measuring instruments such as shrink rules, calipers, micrometers, and gages. Patternmakers also may make core boxes (in much the same manner as patterns are constructed) and repair patterns and core boxes.



Patternmakers cover test tank mold with high-temperature coating.

More than half of the patternmakers work in specially equipped foundry pattern shops in plants making such products as machinery, transportation equipment, and fabricated metal products. Other patternmakers work in plants that make patterns on order, or in pattern shops in independent foundries.

Training and Other Qualifications

Apprenticeship is the principal means of qualifying as a journeyman patternmaker. Because of the high degree of skill and the wide range of knowledge needed for patternmaking, it is difficult to learn the trade informally on the job. In some instances, skilled machinists have been able to transfer to metal patternmaking with additional on-the-job training or experience. Good trade school courses in patternmaking provide useful preparation for the prospective apprentice. Such courses may be credited toward completion of the apprenticeship period. However, these courses do not substitute for apprenticeship or other on-the-job training.

The usual apprenticeship period for patternmaking is 5 years. At least 144 hours of classroom instruction in related technical subjects are normally provided annually. There are separate apprenticeship programs for wood and metal patternmaking.

The patternmaker apprentice begins by helping journeymen in routine duties. Then he makes simple patterns under close supervision, gradually learning to use the various types of machines and handtools. As his training progresses, the work becomes increasingly complex and the supervision more general.

Patternmaking, although not strenuous, requires considerable standing and moving about. A high degree of manual dexterity is especially important because of the precise nature of many hand operations. The ability to visualize objects in three dimensions is also important. Employers generally require patternmaker apprentices to have had at least a high school education.

Employment Outlook

There will be a few thousand job openings for foundry patternmakers, mainly metal patternmakers, during the remainder of this decade and throughout the 1970's. Most job openings will result from the need to replace experienced patternmakers who transfer to other fields of work, retire, or die. Retirements and deaths alone will create several hundred job openings annually.

Employment of foundry patternmakers—who numbered about 18,000 in early 1967—is expected to show little or no growth during the decade ahead, despite the anticipated substantial increase in foundry production. The need for patternmakers will not increase as fast as production, because of the greater use of metal patterns in the production of large numbers of identical castings. Metal patterns can be used many times to make identical molds, thereby reducing the number of individual patterns needed to produce a given number of castings.

Because patternmakers learn either basic metalworking or woodworking skills, they are prepared for employment in related fields when patternmaking employment is not available. Wood patternmakers can qualify for skilled woodworking jobs, such as cabinetmaker, and metal patternmakers can transfer their skills to machining occupations such as machinist or layout man.

Earnings and Working Conditions

Skilled patternmakers generally have higher average straight-time earnings than other skilled foundry workers. However, the earnings of both wood and metal patternmakers depend on the skill requirements of the job, the type of metal poured, and the geographic location of the foundries in which they are employed. Generally, metal patternmakers have higher average hourly earnings than wood patternmakers. In January 1967, average straight-time hourly earnings of wood patternmakers ranged from $3.53 in steel foundries to $4.23 in nonferrous foundries, according to a national survey of wages and fringe benefits for 27 foundry occupations in 55 labor areas, made by the National Foundry Association.

See "Where To Go for More Information" in the introductory section of this chapter.

MOLDERS

Nature of Work

The *molder* prepares a mold which is made of specially prepared sand and which contains a hollow space in the shape of the item to be made. The mold is made by packing and ramming prepared sand around a pattern—a model of the object to be duplicated—in a molding box called a flask. A flask is usually made in two parts which can be separated to allow removal of the pattern by the molder without damaging the mold cavity. Molten metal is poured into the cavity which, when solidified, forms the casting. A molder uses pneumatic-powered rammers and handtools, such as trowels, shovels, and mallets, to handle, compact, and smooth the sand in molds made by hand.

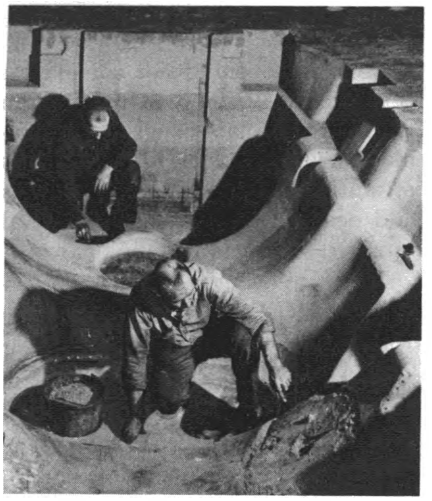
Most of the more than 50,000 workers in this occupation in early 1967 were machine molders; the rest were hand—bench and floor—molders. *Machine molders* (D.O.T. 518.782) operate machines which simplify and speed the making of large quantities of identical sand molds. Machine molders assemble the flask (molding box) and pattern on the machine table, fill the flask with prepared sand, and operate the machine by the properly timed use of its control levers and pedals. Many machine molders are skilled workers who set up and adjust their own machines. Some machine molders are semiskilled workers whose duties are limited to operating machines which are set up for them by more experienced molders or maintenance men.

Bench and floor molders use mainly hand methods to make the sand molds. Molds for small castings are usually made on the workbench by *bench molders* (D.O.T. 518.381); those for large and bulky castings are made on the foundry floor by *floor molders* (D.O.T. 518.381). Skill requirements in this occupation vary considerably. An all-round *hand molder* (journeyman) makes many different kinds of molds. A less skilled molder does more repetitive work, specializing in a few simple types of molds.

Training, Other Qualifications, and Advancement

Completion of a 4-year apprentice training program, or the equivalent in experience, is needed to become a journeyman molder and thus qualify both for all-round hand molding and for the specialized skilled or supervisory jobs. Men with this training are also preferred for some kinds of machine molding.

The molder apprentice works under the close supervision of journeymen who instruct him in the skills of



Hand molders use trowels to finish floor mold.

the craft. About half of the apprentice training is devoted directly to molding. The apprentice begins with a simple job, such as shoveling sand; and gradually takes on more difficult and responsible work, such as ramming molds, withdrawing patterns, and setting cores. He also learns to operate the various types of molding machines. As his training progresses, he makes complete molds, beginning with simple shapes and progressing to those of increasing complexity. This training includes both floorwork and benchwork. In addition, the apprentice may work in other foundry departments to develop all-round knowledge of foundry methods and practice. The apprentice usually receives at least 144 hours of classroom instruction each year in such subjects as shop arithmetic, metallurgy, and shop drawing.

Molders' helpers and less-skilled hand molders frequently learn molding skills informally on the job, and then seek jobs as journeymen. However, this way of learning the trade is often lengthier and less reliable than apprenticeship.

Hand molders who do highly repetitive work usually learn their jobs during a brief training period. "Learners" (either men without previous foundry experience or upgraded foundry helpers) work with a molder engaged in making a particular kind of mold. After 2 to 6 months of this training, the learner is usually competent to make the same mold, or one that is similar, without close supervision.

The more difficult and responsible types of machine molding jobs also require formal or equivalent training. However, most machine molding jobs can be learned in 60 to 90 days of on-the-job training.

An eighth grade education usually is the minimum requirement for apprenticeship. Many employers, however, require additional education up to and including high school graduation for apprenticeship in skilled hand molding or machine molding jobs.

Physical standards for molding jobs are fairly high. The molder stands at his work, moves about a great deal, and must do frequent lifting. The hand molder needs a high degree of manual dexterity and good vision. Since the work is fairly strenuous, very few women are employed as molders.

Employment Outlook

The need to replace molders who transfer to other fields of work, retire, or die will provide most of the job openings for new workers in this trade through the 1970's. Retirements and deaths alone with provide approximately 1,000 openings annually. Several hundred of these openings will be for molding apprentices. There will also be openings each year for workers in entry jobs in machine molding and in the less skilled types of hand molding.

Employment of molders is expected to show little or no growth during the decade ahead, despite the anticipated substantial increase in foundry production. The demand for molders will not increase as fast as foundry production, since the trend is toward more machine molding and less hand molding, and the increasing use of permanent molds and shell molds.

Earnings and Working Conditions

The earnings of molders depend on several factors, including the type of molding work performed—hand or machine; the specific type of hand or machine work performed; the skill requirements of the job; the type of metal poured; and the geographic location of the foundry in which they are employed. In January 1967, the average (median) straight-time hourly earnings of bench molders was $2.87; squeezer-machine molders $2.92; heavy machine molders, $2.87; and floor molders, $3.05, according to a national survey of wages and fringe benefits for 27 foundry occupations in 55 labor areas, made by the National Foundry Association. As shown in the following tabulation of average (mean) straight-time hourly earnings for molding occupations, the highest earnings were received by squeezer-machine molders in nonferrous foundries.

	Type of foundry		
Type of molder	*Gray iron and malleable*	*Steel*	*Nonferrous*
Floor	$2.96	$3.07	$3.06
Bench	2.84	2.76	2.97
Heavy machine	2.74	2.64	2.83
Squeezer machine	2.88	2.77	3.18

See "Where To Go for More Information" in the introductory section of this chapter.

COREMAKERS

Nature of Work

Coremakers prepare the "cores" which are placed in molds to form the hollows or holes usually required in metal castings. The poured metal solidifies around the core so that when the core is removed, the desired cavity or contour remains. A core may be made either by hand or machine. In both instances, prepared sand is packed into a core box, a block of wood or metal into which a hollow

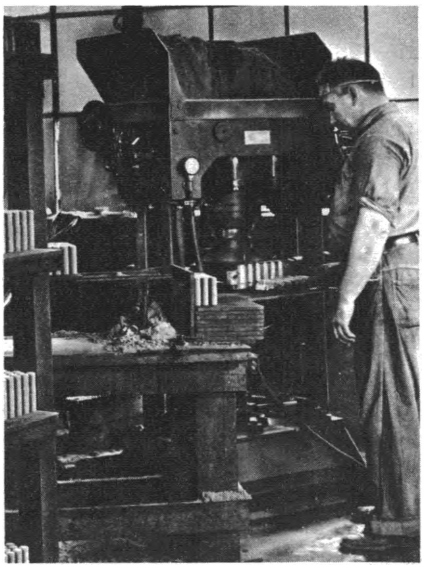
space of the size and shape of the desired core has been cut. After the core has been removed from the core box, it is hardened either by baking or by other drying methods. When hand methods are used to make a core, the coremaker uses mallets and other handtools to pack and ram sand into the core box.

In hand coremaking, small cores are made on the workbench by *bench coremakers* (D.O.T. 518.381) and bulky cores are made on the foundry floor by *floor coremakers* (D.O.T. 518.381). There is a wide range of skill requirements in this occupation. All-round hand coremakers (journeymen) prepare large and intricate cores. The less skilled coremakers make smaller and simpler cores. Their work is highly repetitive because they frequently produce large quantities of identical cores. Many skilled coremakers are employed as supervisors.

Machine coremakers (D.O.T. 518.-885) operate machines which make sand cores by forcing sand into specially shaped hollow forms. Most machine made cores are blown by compressed air. Some machine coremakers are required to set up and adjust their own machines and do finishing operations on the cores. Other coremakers are primarily machine tenders. They are closely supervised and their machines are adjusted for them.

Training, Other Qualifications, and Advancement

Completion of a 4–year apprentice training program or the equivalent in experience is needed to become a skilled hand coremaker. Coremaking apprenticeships are also sometimes required for the more difficult and responsible machine coremaking jobs. Only a brief period of on-the-job training is needed for less skilled hand coremaking and for most machine coremaking jobs. Training in coremaking and molding are often combined in a single apprenticeship.



Coremaker operates machine that forces sand into hollow forms.

The coremaking apprentice works with journeymen coremakers, first helping them in routine duties and then undertaking more advanced work, such as making simple cores, or operating core ovens. As his skill increases, the apprentice makes more complex cores. He acquires experience in benchwork and floorwork and in the operation of coremaking machines used in the plant. On-the-job training is generally supplemented by classroom instruction covering such subjects as arithmetic, shop drawing, and the properties of metals. Hand coremakers with all-round training have opportunities for promotion to supervisory jobs.

An eighth grade education is usually a minimum requirement for coremaking apprentice training; some employers require apprentices to be high school graduates.

Persons without previous foundry experience may be hired directly for the less skilled coremaking jobs, or foundry laborers or helpers may be upgraded to do this work. Physical requirements for light coremaking are not exacting because the work is not very strenuous. Some types of hand coremaking require a high degree of manual dexterity. Women are frequently employed to do light coremaking.

Employment Outlook

Most job openings for coremakers through the 1970's will result from the need to replace experienced coremakers who transfer to other fields of work, retire, or die. Retirements and deaths alone will create several hundred job opening annually.

The employment of coremakers—who numbered about 22,000 in early 1967—is expected to show little or no growth during the decade ahead, despite the anticipated substantial increase in foundry production. The demand for coremakers will not increase as fast as production, because of the growing use of machine-made rather than handmade cores.

Earnings and Working Conditions

The earnings of both hand and machine coremakers depend not only on the skill requirements of the job, but also on the type of metal poured and the geographic location of the foundry in which they are employed. In January 1967, the average (median) straight-time hourly earnings of bench coremakers was $2.87; floor coremakers, $2.97; and machine coremakers $3.05, according to a national survey of wages and fringe benefits for 27 foundry occupations in 55 labor areas, made by the National Foundry Association. As shown in the following tabulation of average (mean) straight-time hourly earnings for coremaking occupations, the highest averages were recorded for bench coremakers in nonferrous foundries:

	Type of foundry		
Occupation	*Gray iron and malleable*	*Steel*	*Nonferrous*
Floor coremaker	$2.78	$2.93	$2.91
Bench coremaker	2.74	2.92	2.99
Machine coremaker	2.96	2.78	2.83

See "Where To Go for More Information" in the introductory section of this chapter.

OCCUPATIONS IN THE INDUSTRIAL CHEMICAL INDUSTRY

The industrial chemical industry has grown, in just a few decades, into one of the great manufacturing industries of our Nation. An important reason for this growth has been the industry's huge expenditures for research and development activities, which have provided many new and improved products for its customers—mainly other manufacturing industries. A wide variety of industrial chemical products contribute to our everyday needs and comforts, e.g., synthetic fibers are used in clothing and rugs, and plastics in dinnerware and furniture. Also, they are essential for the manufacture of missile and space equipment, rocket propulsion fuels, and for other national defense and space materials.

In early 1967, more than 500,000 wage and salary workers were employed in the industrial chemical industry in a wide range of occupations. Job requirements varied from graduate college degrees for some scientists and engineers to a few days of on-the-job training for some plant workers.

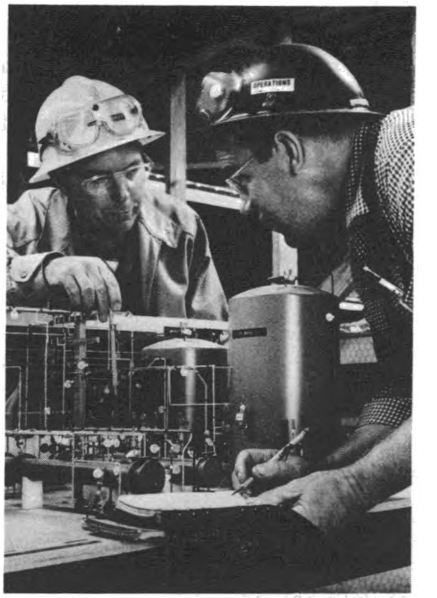
Nature of the Industry

The industrial chemical industry is made up of plants which manufacture industrial inorganic and organic chemicals, plastic materials and synthetic resins, synthetic rubber and synthetic and other man-made fibers, except glass. These chemicals are used mainly by other companies in the chemical industry, and by other manufacturing industries as raw materials or as processing agents to make their own products. Industrial chemicals are unlike other chemical products, such as drugs, soaps, detergents, cosmetics, perfumes, paints, and fertilizers, which are sold directly to the consumer without further processing. The latter are not discussed in this statement.

Industrial chemical plants make organic chemicals from raw materials obtained from the remains of prehistoric life such as coal, petroleum, and natural gas, or from living materials such as agricultural and forest products. Some products of organic chemicals such as synthetic fibers, synthetic rubber, and plastics are well known. Among those less well known to the public are coal tar crudes, benzene, acetone, and formaldehyde. The principal users of organic chemicals include the textile, plastics products, rubber, and food-processing industries.

Inorganic chemicals come from nonliving matter, such as salt, sulfur, mineral ores, and limestone. They are basic materials for making, or helping to make, other chemicals as well as finished products, such as steel, glass, paper, and gasoline. In at least one respect, the manufacture of chemicals differs from the manufacture of most other products—the ingredients which are used to make chemicals undergo reactions which produce compounds vastly different in nature and appearance from those of the original raw materials. For example, by rearranging and combining the molecules of coal, air, and water, the chemists can produce nylon, a product having no similarity to its raw materials.

A modern chemical plant is made up of huge towers, tanks, and buildings linked together by a network of pipes. These structures contain the various types of equipment needed to process raw materials into chemical products. Raw materials go through several processing operations such as drying, heating, cooling, mixing, evaporating, and filtering. Between each operation, the materials, which may be liquid, solid, or gas, are transported by pipes or conveyors. Throughout these operations, automatic control devices regulate the flow of materials, the combination of chemicals, and the temperature, pressure, and time needed for each operation. These control devices make it possible for tons of material to be processed in one continuous operation with very little manual handling of materials.



Production workers study scale model of chemical plant to learn about new processing equipment.

Approximately 2,500 plants in the United States make industrial chemicals. About two-thirds of the plants have fewer than 50 employees each. However, more than one-half of the industrial chemical workers are employed in very large plants of 500 or more employees each. Chemical plants are usually located on the outskirts of industrial centers. Sometimes plants are built near the sources of raw material; for example, plants

which produce chemicals made from petroleum and natural gas are located near the oilfields and refineries of Texas, California, and Louisiana.

Although industrial chemical workers are employed in most States: more than 60 percent of the employees and more than one-half the plants are in the following 10 States; New Jersey, Texas, New York, Tennessee, Virginia, Pennsylvania, Delaware, West Virginia, Michigan, and Ohio.

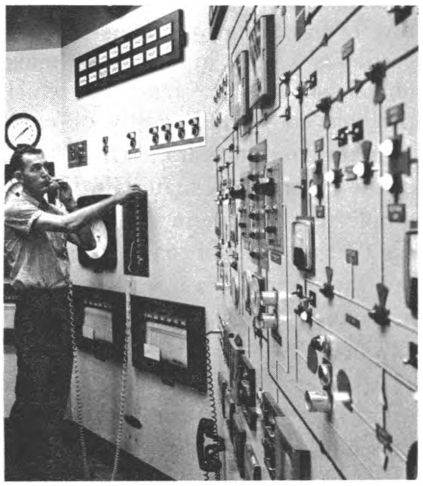
Occupations in the Industry

Workers with many different levels of skills and education are employed in the plants, offices, and laboratories of industrial chemical firms. More than 3 out of every 5 employees are engaged in processing operations, maintenance duties, or other plant-related activities. A large number of scientists, engineers, and other technical personnel are also employed because of the highly technical nature of chemical products and the methods used to produce them. Administrative and professional employees, such as purchasing agents, salesmen, accountants, lawyers, and personnel officers, make up another sizable segment of the industry's work force. In addition, large numbers of clerical workers, such as bookkeepers, stenographers, typists, and office machine operators, are employed.

About 1 out of every 8 workers in the industrial chemical industry is a woman. Most women in this industry work in clerical jobs, although some work in chemical laboratories as research chemists or as laboratory technicians and assistants. In a few industrial chemical plants, women are employed as chemical operators or as packers.

Plant Occupations. Plant workers, who represent more than 3 out of every 5 employees in the industrial chemical industry, can generally be divided into three major occupational groups: Processing workers, who operate the chemical-processing equipment; maintenance workers, who maintain, install, and repair machinery, pipes, and equipment; and other plant workers, such as stock clerks, material handlers, and truckdrivers.

Process equipment operators and their helpers are the largest occupational group in the industrial chemical industry. Many of these operators are highly skilled workers. *Chemical operators* (D.O.T. 558.885 and 559.782) control the various pieces of equipment which convert raw materials into chemical products. Operators are responsible for carrying out instructions given to them by the supervisor in charge. Operators set dials on devices that measure the exact amount of materials to be processed and control temperature, pressure, and flow of materials. They keep a record of operations and report any sign of breakdown of equipment. They may use instruments which measure and test chemicals or they may send samples of chemicals to laboratory technicians in the testing laboratory. They may be assisted by chemical operators of less skill, as well as by helpers. Sometimes chemical operators are classified according to the type of equipment they operate, such as filterer, grinder, or mixer.

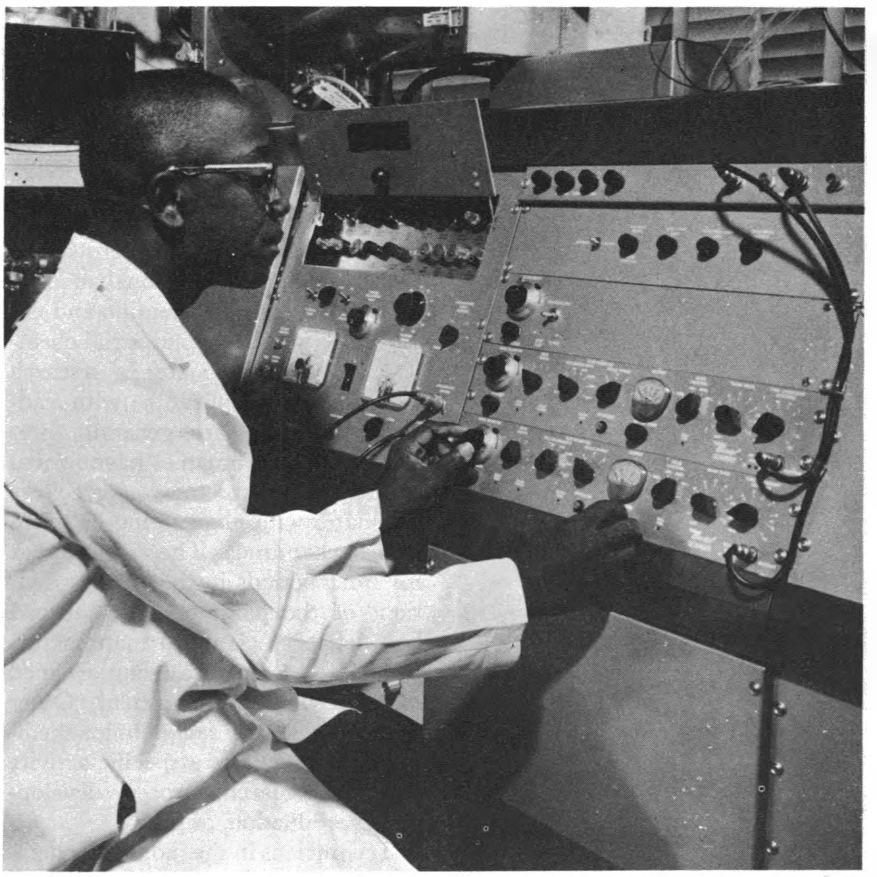


Operator monitors instruments that automatically check and control chemical production.

The industry employs many skilled maintenance workers to prevent interruptions of its highly automated production processes. Maintenance skills are also very important because of the extremes of temperature, pressure, and corrosion to which pipes, vats, and other plant equipment are subjected. Included among maintenance workers are *pipefitters,* who lay out, install, and repair pipes and pipefitting; *maintenance machinists,* who make and repair metal parts for machines and equipment; *electricians,* who maintain and repair wiring, motors, switches, and other electrical equipment; and *instrument repairmen,* who install and repair electrical and electronic instruments and control devices. In some chemical plants, the duties of several maintenance jobs may be combined into a single job and performed by one maintenance man.

Plant workers who do not operate or maintain equipment perform a variety of other tasks in industrial chemical plants. Some drive trucks and tractors to make deliveries to various parts of the plant; some load and unload materials on trucks, trains, or ships; and other workers keep inventory records of stock and tools. The industry also employs custodial workers, such as guards, watchmen, and janitors, whose duties are similar to those of such workers in other industries.

Scientific and Technical Occupations. The industrial chemical industry is one of the Nation's largest employers of scientific and technical personnel. About 1 out of every 6 employees in this industry is in some activity requiring scientific, engineering, or technical training. About 40 percent of these employees work in laboratories, developing new chemical products and new methods of production as well as performing basic research. About one-third are involved in the production of chemicals and in other plant operations. The remaining scientific and technical personnel are in analysis and testing



Chemist uses complex equipment to analyze composition of chemical compounds.

work, and in administrative or sales positions requiring technical background.

Chemists and chemical engineers make up the largest proportion of scientific and technical personnel in the industrial chemical industry. Many *chemists* work in research and development laboratories. A large number work in production departments, analyzing and testing chemicals in order to control their quality during processing. Some chemists are supervisors of plant workers; others are technical salesmen, technical writers, or administrators whose positions require technical knowledge.

Chemical engineers apply their knowledge of both chemistry and engineering to the design, construction, operation, and improvement of chemical equipment and plants. They convert processes developed in a laboratory into large-scale production methods, using the most economical manufacturing techniques. Some chemical engineers are employed in production departments and others are in selling, customer service, market research, and writing jobs which require technical knowledge and skill.

Other types of engineers are also employed in industrial chemical firms. *Mechanical engineers* design and lay out power and heating equipment, such as steam turbines. They often supervise the installation, operation, and maintenance of chemical processing equipment. *Electrical engineers* design and develop electrical and electronic machinery and equipment, such as control devices and instruments, as well as facilities for generating and distributing electric power.

In addition to the large number of such professional personnel, the industry employs many technical assistants such as laboratory technicians, draftsmen, and engineering aids. *Laboratory technicians* assist chemists and engineers in research and development work and in quality control. They may perform simple routine tests or experiments, or do highly technical testing and analyses of chemical materials, depending on their training and experience. Much of the work of laboratory technicians consists of conducting tests and recording the results—often in the form of simple reports, charts, or graphs—for interpretation by chemists and chemical engineers.

Administrative, Clerical and Related Occupations. About 1 out of every 5 employees in the industrial chemical industry is an administrative, clerical, or other white-collar worker. Many high-level administrative and management positions are filled by men with training in chemistry or chemical engineering. At the top of the administrative group are the executives who make policy decisions concerning matters of finance, types of products to manufacture, and location of plants. To make such decisions, executives require the help of a large body of specialized personnel in the company. Some of these workers are accountants, purchasing agents, sales representatives, lawyers, and personnel employed in such activities as industrial relations, public relations, transportation, advertising, and market research. Other workers are required to assist these specialized administrative workers. For example, clerical employees keep records on personnel, payroll, raw materials, sales, shipments, and plant maintenance.

(Detailed discussions of professional, technical, mechanical, and other occupations found not only in the industrial chemical industry but in other industries as well are given elsewhere in this *Handbook* in the sections covering the individual occupations. See index for page numbers.)

Operator monitors machine that processes manmade fiber.

Training, Other Qualifications, and Advancement

The industrial chemical industry generally hires inexperienced workers for processing and maintenance jobs and trains them on the job. Companies in the industry prefer to hire young workers who are high school graduates.

In many plants, a new worker is sent to a labor pool from which he is assigned to such jobs as filling barrels and moving materials. After several months, he may be transferred to one of the processing departments when a vacancy occurs. As he gains experience and know-how, he moves to more skilled jobs in his department. Thus, he may advance from laborer to chemical operator helper, to assistant chemical operator, and then to skilled chemical operator. Skilled processing workers are rarely recruited from other plants.

Most maintenance jobs are filled by men who are trained on the job in the plant. Many industrial chemical companies have training programs to meet the needs of their maintenance shops. These programs may last from a few months to several years; they include mainly on-the-job training and some classroom instruction related to the trainees' particular work. Instrument repair trainees often learn how to assemble and repair instruments in the factories which manufacture them. Many companies encourage skilled maintenance workers as well as trainees to take courses related to their jobs in local vocational schools and technical institutes, or to enroll in correspondence courses. Upon the successful completion of these courses, some companies reimburse the workers for part or all of the tuition.

A bachelor's degree in engineering, chemistry, or one of the other sciences is the minimum educational requirement for entry into scientific and engineering jobs in the industrial chemical industry. For jobs in research laboratories, applicants with advanced degrees are generally preferred. Some companies have formal training programs for young college graduates with engineering or scientific backgrounds. These men work for brief periods in the various divisions of the plant to gain a broad knowledge of chemical manufacturing operations before being assigned to a particular department. Other firms immediately assign junior chemists or engineers to a specific activity such as research, process development, production, or sales.

Technicians in the industrial chemical industry qualify for their jobs in many different ways. Companies prefer to hire men and women who have obtained a formal education in technical institutes or junior colleges. However, most workers become technicians through on-the-job training and experience. Generally, industrial chemical firms select young men from their labor pool and give them training while they work at one of the technician jobs. Sometimes, technicians may be sent to a technical institute for training, usually at company expense. Students who have not completed all requirements for a college degree, especially those who have received some education in mathematics, science, or engineering, are often employed in technician jobs.

Laboratory technicians begin their work in routine jobs as assistants and advance to jobs of greater responsibility after they have acquired additional experience and have shown their ability to work without close supervision. Inexperienced draftsmen

usually begin as copyists or tracers. With additional experience and training, they may advance to more skilled and responsible jobs as draftsmen.

Administrative positions frequently are filled by men and women who have college degrees in business administration, marketing, accounting, economics, statistics, industrial relations, or other specialized fields. Some companies have advanced training programs in which they give their new employees additional training in their chosen specialties.

Clerks, bookkeepers, stenographers, and typists in industrial chemical firms generally have had commercial courses in high school or business school. Although the qualifications for and the duties of administrative, sales, clerical, and related occupations in this industry are similar to those in other industries, a knowledge of chemistry is often helpful. This is especially true of those sales jobs in which it is necessary to give technical assistance to customers.

Employment Outlook

The growing industrial chemical industry is expected to provide many thousands of job opportunities for new workers each year through the 1970's. Large numbers of job openings for new workers will be created by retirements, deaths, or transfers to jobs in other fields of work. Retirements and deaths alone probably will provide, on the average, more than 10,000 openings for new workers each year during the late 1960's and throughout the 1970's.

The industrial chemical industry's emphasis on research and development is expected to continue to stimulate the growth of this dynamic industry, which has far outstripped most other major industries in the development of new products. Some of these products, such as plastics and synthetic fibers, have not only created completely new markets, but also have competed successfully in markets previously dominated by wood, natural textile fibers, and metals. They are expected to continue to make inroads into these markets. A plentiful supply of the raw materials used in chemical manufacturing is also favorable to the industry's future growth.

The atomic energy field is an area where continued growth, in civilian as well as military applications, will favorably affect the demand for industrial chemicals. These chemicals are used in various aspects of atomic energy work, such as the processing and purification of uranium ores and the development and operation of nuclear reactors.

Although industrial chemical production has grown rapidly, employment has increased at a much slower rate. Since 1958, the number of industrial chemical workers has grown by about 21 percent in contrast with output, which has more than doubled. The major reason for this difference is the industry's emphasis on improved methods of making chemicals. The widespread use of automatic processing and control equipment has enabled the industry to increase its production considerably with a relatively small increase in labor. Increases in output per worker are expected to continue in the years ahead, as new plants with the latest equipment are constructed and more modern devices are installed in the older plants.

Some occupational groups in the industry are expected to grow faster than others. For example, the number of professional and administrative jobs is expected to increase more rapidly than the number of plant (processing and maintenance) workers if recent trends in this industry continue. Emphasis on research and development and greater complexity of products and processes are expected to increase the need for chemists, engineers, technicians, and other technical personnel.

Most of the demand for additional plant workers will be for skilled maintenance workers, such as instrument repairmen, pipefitters, electricians, and maintenance machinists, because of the increasing use of instrumentation and automatic equipment in processing operations. Process equipment operators will continue to be the largest occupational group in the industry, although employment of these workers is not expected to increase as much as employment of maintenance workers.

Earnings and Working Conditions

Production workers in the industrial chemical industry are among the higher paid factory workers. Average earnings are relatively high because of the large proportion of workers in skilled occupations. In mid-1967, production workers in plants producing industrial inorganic and organic chemicals had average earnings of $145.74 a week or $3.47 an hour and those in plants producing plastics materials and synthetic rubber, resins, and fibers had average earnings of $129.89 a week or $3.10 an hour. In comparison, average earnings in mid-1967 for production workers in manufacturing industries as a whole were $113.65 a week or $2.82 an hour.

Entry salaries for inexperienced chemists and chemical engineers in the chemical industry are among the highest in American industry, according to a 1966 survey conducted by the American Chemical Society. In this industry, the median starting salary was $625 a month for chemists with a bachelor's degree and $690 a month for chemical engineers with a bachelor's degree. Chemists and chemical engineers with graduate degrees received higher starting salaries.

Paid vacations are universal in this industry and are generally based on length of service. Plant workers generally receive a 1-week vacation after 1 year of employment, 2 weeks after 3 years, 3 weeks after 10 years and 4 weeks after 20 years.

A majority of the workers are covered by insurance plans. These plans include life, sickness, accident, hos-

pitalization, and surgical insurance. Practically all plants have pension plans.

Many chemical workers are employed in plants that operate around the clock—three shifts a day, 7 days a week. Owing to the widespread industry practice of rotating shifts, processing workers can expect to work the second or third shift at one time or another. Nearly all workers receive extra pay for shift work, about 10 cents more an hour for the second shift, and about 15 cents more an hour for the third or night shift. Very few maintenance workers are employed on these shifts. Work in the industry has little seasonal variation and regular workers have year-round jobs.

With the exception of work performed by laborers and material handlers, most industrial chemical jobs require little physical effort. Much of the plant work involves tending, inspecting, repairing, or maintaining machinery and equipment, since most of the process operations are controlled automatically or semiautomatically. Some workers climb stairs and ladders to considerable heights in the course of their duties. Other jobs are performed out of doors in all kinds of weather.

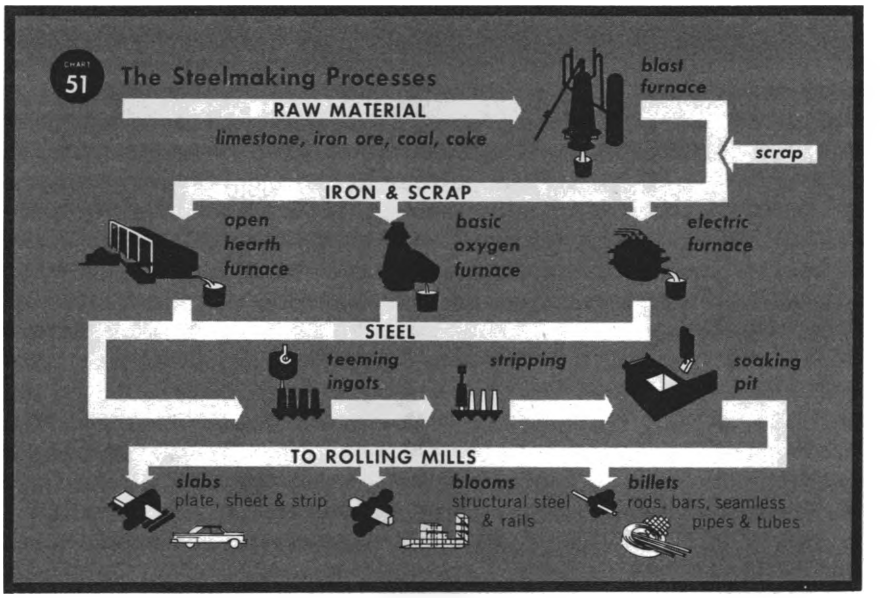
In some plants, workers may be exposed to dust, disagreeable odors, or high temperatures. Chemical companies, however, have reduced the discomforts arising from these conditions by installing ventilating or air-conditioning systems. Safety measures, such as protective clothing and eye glasses (usually provided by the company), warning signs, showers and eye baths near dangerous work stations, and first-aid stations, have also reduced hazards. These measures have helped to make the injury-frequency rate (number of disabling injuries for each million man-hours worked) in the industrial chemical industry less than half that for all manufacturing industries.

Most production workers in the industrial chemical industry are members of labor unions. The leading unions are the International Chemical Workers Union; Oil, Chemical and Atomic Workers International Union; and District 50, United Mine Workers of America (Ind.).

Where To Go for More Information

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

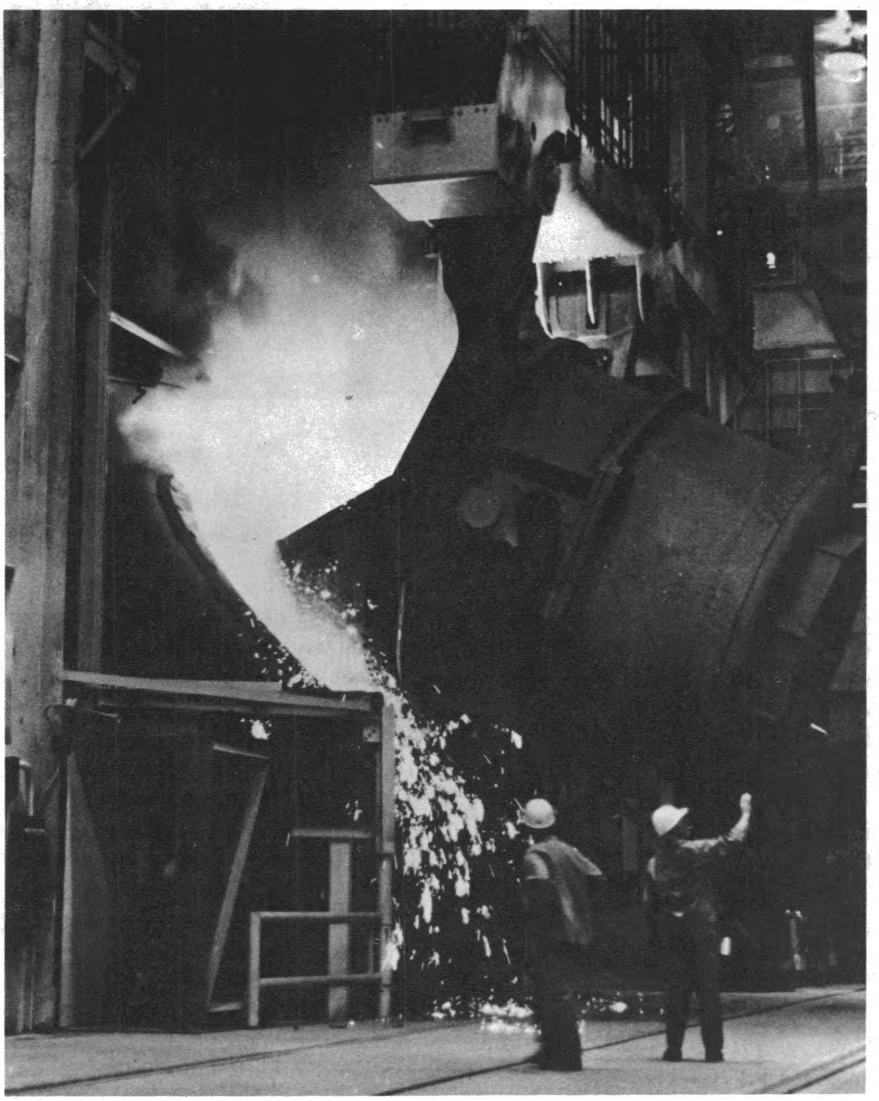
There is hardly a product in daily use that has not been made from steel, or processed by machinery made of steel. The Nation's high and rising standard of living, its industrial might, and its military strength depend largely on its ability to produce great quantites of high quality steel. In 1966, United States steelmakers produced about 135 million tons of steel—more than one-fourth of the world's output of this vital metal.

The iron and steel industry is one of the Nation's largest employers. About 640,000 wage and salary workers were on the payrolls of the industry's more than 700 plants in early 1967. Employees work in a broad range of jobs requiring a wide variety of skills—from unskilled to technical and professional jobs. Many of these jobs are found only in iron and steel making or finishing.

The iron and steel industry, as discussed in this chapter, consists of blast furnaces, steelmaking furnaces, and rolling mills, including mills engaged in finishing and rolling steel products, from purchased sheets, strips, bars and rods, and other materials. The production of iron and steel consists of a closely related series of production processes. First, iron ore is converted to molten iron in blast furnaces. The molten iron is poured into "hot metal cars" and either transported directly to the steelmaking furnace, or cast into "pigs" (iron in rough bar form) for use by foundries or by steel mills that do not produce their own iron. (See chart 54.) Molten iron or pig iron is then converted into steel in various types of steelmaking furnaces, including open hearth, basic oxygen, and electric furnaces. The steel is then rolled into basic products, such as plates, sheets, strips, rods, bars, rails, and structural shapes. Many plants carry the manufacturing processes beyond the primary rolling stage to produce finished products such as tinplate, pipe, and wire products. (This chapter does not describe the mining of coal, iron ore, limestone, and other raw materials used to make steel, or the casting, stamping, forging, machining, or fabrication of steel. These activities are not considered to be in the iron and steel industry. Employment opportunities in foundry, forging, and machining occupations are discussed elsewhere in the *Handbook*.)

Because iron and steel are produced in huge quantities, the industry uses gigantic processing equipment. A modern blast furnace may be as high as a 23-story building (about 230 feet tall). A single blast furnace may produce up to 4,000 tons of molten iron in a 24-hour period. The several different types of furnaces used to convert iron into steel are also immense. For example, open-hearth furnaces, used to make most steel, may be 70 feet long, 2 stories deep, and 20 feet wide or even larger. Limestone and scrap metal are loaded into open-hearth furnaces by enormous electrically operated "charging" machines. After the initial charge is heated, molten iron is poured into open hearths from huge crane-operated ladles. Six to eight hours later, molten steel is "tapped," or emptied from the furnace into other giant ladles, which are moved by a crane to a pouring platform where the steel is "teemed," or poured, into ingot molds. These ingots later are rolled into finished and semifinished products.

An increasing tonnage of steel today is being made in basic oxygen furnaces. In these "pear-shaped" vessels, steel scrap, molten iron, and limestone—plus alloying additives—are charged in closely controlled amounts. Pure oxygen is blown into the charge, raising the temperature rapidly and burning off the impurities in the charge. A 250-ton heat of steel can be made in less than 1 hour—charge to tap time. BOF's are computer controlled to increase the qual-



Molten metal is poured into basic oxygen furnace.

ity of the steel produced and to speed up the steelmaking process.

The rolling equipment which forms steel into various shapes is hundreds of feet long. A hot sheet mill, for example, is more than 2,000 feet long. Some of the steel cylinders, or "rolls," used in this equipment may weigh 40 or 50 tons.

Steel companies differ in the number of operations they perform. Many of them, known as integrated companies, produce their own coke from coal, reduce ore to pig iron, make steel, and form the steel into products by rolling and other finishing methods. Such companies account for the bulk of total steel production and employ most of the industry's workers. Another group of companies make various types of steel from steel scrap and pig iron purchased from other companies. A third group rolls and finishes purchased raw steel. A fourth type makes only pig iron to be sold to small steel plants and foundaries.

Most of the basic products made by steel mills are shipped to the plants of other industries, where they are made into thousands of different products. Some steel mill products, however, such as rails, pipe, and nails, are produced in their final form at the mills. The leading steel consuming industries are automobile, construction and building materials, machinery and machine tools, containers, and household appliances.

Steel sheets are made into such things as automobile bodies, household appliances, and metal furniture. Steel bars are used to make parts for automobiles and machinery, and to reinforce concrete in building and highway construction. Steel plates become parts of ships, bridges, heavy machinery, railroad cars, and storage tanks. Strip steel is used in the manufacture of such items as pots and pans, automobile body parts, razor blades, and toys. Tin coated steel, known as "tinplate," is used primarily to make "tin" cans.

Individual plants in this industry typically employ a large number of workers. About 70 percent of all the industry's employees work in plants which have more than 2,500 wage and salary workers. A few plants have more than 20,000 employees. However, many plants employ fewer than 100 workers, particularly those plants which make highly specialized steel products.

Iron and steel producing plants are located mainly in the northern and eastern parts of the United States. There are large plants at the South Shore of Lake Michigan; Cleveland and Youngstown, Ohio; Buffalo, N.Y.; and Pittsburgh, Johnstown, Bethlehem, and Morrisville, Pa. The Nation's largest steel plant is located at Sparrows Point, near Baltimore, Md. Much of the steelmaking in the South is in the vicinity of Birmingham, Ala. Important steelmaking facilities also are located in the Far West.

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 in Pennsylvania.

Occupations in the Industry

Workers in the iron and steel industry hold more than 1,000 different types of jobs. Some workers are di-

rectly engaged in making iron and steel and converting it into semifinished and finished products. Others take care of the vast amount of machinery and equipment used in the industry, operate cranes and other equipment which move raw materials and steel products about the plants, or perform other kinds of work. In addition, many workers are needed to do the clerical, sales, professional, technical, administrative, and supervisory work connected with the operation of steelmaking plants.

More than four-fifths of all employees in the iron and steel industry in early 1967 were production and maintenance workers. These workers were directly concerned with the production and finishing of iron and steel, the maintenance of plant equipment, and movement of materials within and among plant departments. The remaining employees were employed in clerical, sales, professional, technical, administrative, research, managerial, and supervisory occupations.

Men constitute 96 percent of all employees in the iron and steel industry, and an even higher proportion of the industry's production workers since much of the production work is strenuous. However, the physical labor involved in steelmaking has been reduced through mechanization. About two-thirds of all the women employed in the industry work in clerical and other office jobs, including research and other technical work. Women employed in production departments are in jobs such as assorter and inspector.

Processing Occupations. The majority of the workers in the iron and steel industry are employed in the many processing operations involved in converting iron ore into steel and then into semifinished and finished steel products. To provide a better understanding of the types of jobs in this industry, brief descriptions of the major steelmaking and finishing operations and of the more important occupations connected with them are given below.

Blast furnaces. The blast furnace is used to reduce iron ore to molten iron. Calculated mixtures of iron ore, coke, and limestone are fed into the top of the furnace. Hot air, blown in from the bottom of the furnace, rises through the mass of material and causes combustion. The gases formed by the burning of the coke combine with and remove the oxygen from the ore.

Molten iron trickles down through the charge and collects in a pool at the bottom of the furnace. At the same time, the intense heat melts the limestone which combines with silica and other impurities in the iron ore and coke and forms molten "slag," a useful byproduct. This, too, trickles down through the charge and floats on top of the heavier molten iron. The slag and molten iron ore are separately tapped or "cast" from the blast furnace.

A blast furnace operates continuously, 24 hours a day, 7 days a week, unless it has to be shut down for repairs or for other reasons. Molten iron is removed every 3 to 4 hours; slag is removed more frequently. The charging of iron ore, coke, and limestone into the furnace is a continuous operation.

The raw materials used in blast furnaces are stored in a stock house below furnace level. Here *stockhouse men* or *stockhouse larrymen.* (D.O.T. 919.883) load traveling stock or larry cars with raw materials from storage bins. They weigh all raw materials in accordance with a prearranged schedule, determined by the kind of hot metal desired. The loaded stock cars are emptied into waiting "skip cars," which carry the materials up tracks to the top of the blast furnace where they are automatically dumped. Other stockhouse men or *skipmen* (D.O.T. 921.883), stationed on the ground below, control the skip cars through electric and pneumatic controls. *Stove tenders* (D.O.T. 512.782) and their assistants operate huge, bricklined stoves which heat air for the blast furnace. They regulate valves to control the heating cycle of the stoves and regulate the flow of heated air to the furnace.

The men responsible for the quantity and quality of iron produced are called *blowers* (D.O.T. 519.132). They direct the operation of one or more blast furnaces, including loading and tapping the furnace, and regulating the air blast and furnace heat. Blowers carefully check the metal produced, periodically sending samples of the molten iron and slag to the laboratory where quality tests are made and the results reported to the blower. *Keepers* (D.O.T. 502.884), under the direction of the blower, are responsible for tapping the furnace. They direct their helpers and *cindermen* or *slaggers* (D.O.T. 519.887) in lining (with special refractory sand) the troughs and runners through which the molten iron and slag are run off into waiting cars. In plants where both iron and steel are made, most of the molten iron is carried in insulated "hot metal cars" or in giant ladles to the steelmaking furnaces. If the iron is to be shipped or stored, it is carried to a casting machine where it is cast into pigs (bars).

Steel furnaces. The second major step in steelmaking is to convert the iron into steel. This is done in several types of furnaces: Open hearth; basic oxygen; and electric.

Open-hearth steel, which accounts for about two-thirds of all steel produced in the United States, is produced by adding molten pig iron to previously charged and heated steel scrap and limestone and melting the mixture in furnaces. It is possible to make from about 125 to more than 500 tons of steel per load or "heat" in most furnaces. Some furnaces, however, have capacities in excess of 600 tons. The open-hearth process is named because the saucer-shaped hearth, or floor of the furnace, is exposed to the sweep of the flames which melt the steel. Most of the open-hearth steelmaking facilities now use oxygen in the refining operation to speed up the process. The use of oxygen has improved heat transfer

and melting rates to such an extent that the "heat" time has been cut by 50 percent or more when compared with traditional open-hearth operations.

A *melter* (D.O.T. 512.132) is in charge of one open-hearth furnace or more and is responsible for the quality and quantity of the steel produced. Each heat of steel is made to specifications, which depend upon the end use for the steel. The melter makes the steel to the desired specifications by varying the proportions of limestone, iron ore, scrap steel, and molten pig iron in the furnace, and by adding small amounts of other materials, such as manganese, silicon, or copper. He supervises three grades of helpers—*first* (D.O.T. 512.782), *second* (D.O.T. 502.884), and *third* (D.O.T. 519.887). These helpers prepare the furnaces for the heat, regulate furnace temperatures, take samples of molten steel for laboratory tests, direct the adding of various alloying materials, and tap the molten steel from the furnace into a ladle. One first helper is responsible for each open-hearth furnace.

The *charging machine operator* (D.O.T. 512.883) runs an electrically controlled machine with a long steel arm which picks up, one by one, long steel boxes full of limestone, scrap, and other materials. The machine pushes each box through the open furnace doors, turns it upside down to discharge its contents, and then withdraws it. The *hot metal craneman* (D.O.T. 921.883) operates a large overhead crane, that picks up ladles of molten iron and pours the contents into the open-hearth furnaces.

When the heat of steel is ready to be tapped, the furnace crew knocks out a plug at the back of the furnace with a "jet tapper" (small explosive charge which is fired into the plug) which allows the molten metal to flow into a ladle. The slag, which floats to the top of the ladle, overflows into a smaller ladle, called a slag pot.

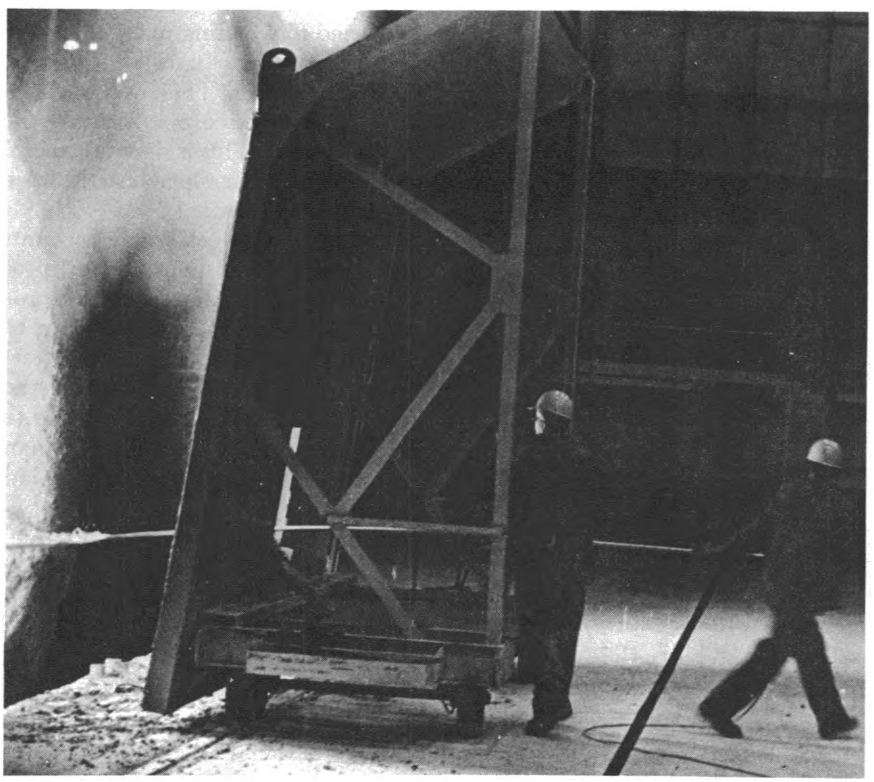
The molten steel is then poured from the ladle into ingot molds (hollow cast iron forms). A *ladle craneman* (D.O.T. 921.883) operates an overhead crane which picks up the ladle and moves it over a long row of ingot molds resting on flat-bottom cars. The *steel pourer* (D.O.T. 514.884) operates a stopper on the bottom of the ladle to let the steel flow into the molds.

As soon as the steel in the molds has solidified sufficiently, an *ingot stripper* (D.O.T. 921.883) operating an overhead crane, removes the molds from the still hot blocks of steel, called ingots, leaving the stripped ingots standing to cool on the "ingot buggies" (four-wheel carts running on rails).

About one-fourth of all steel produced in 1966 was made in basic-oxygen furnaces, and the proportion is expected to increase rapidly in the years ahead. Basic oxygen furnaces can make steel faster than any other type of furnace currently in use, and continual displacement of the open-hearth steelmaking process by the basic oxygen method is expected. Some basic oxygen furnaces can produce more than 6,000 tons of steel in a 24-hour period. In this steelmaking process, oxygen is "blown" into the furnace through vertical pipes, or "lances," after it has been loaded with steel scrap, and molten pig iron. Limestone and other slag forming materials are added to remove impurities from the steel. The use of oxygen speeds the steelmaking process because it is blown directly into the molten metal forcing a faster chemical reaction and a higher bath temperature.

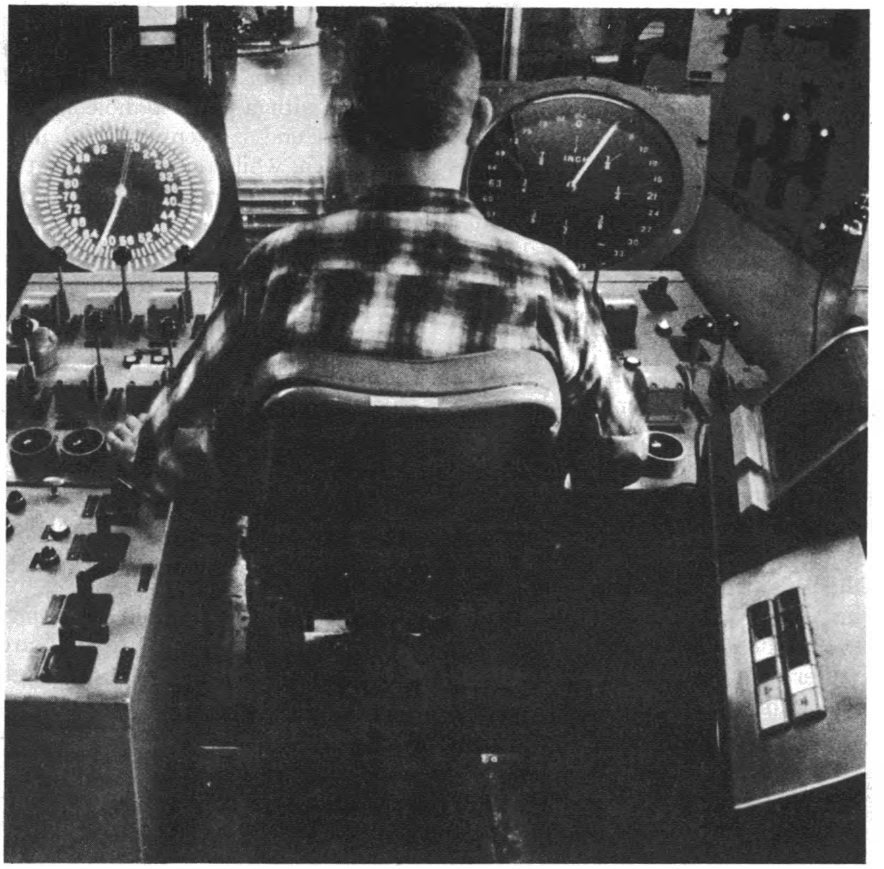
Electric furnaces accounted for about one-tenth of all steel produced in 1966. In electric furnaces, steelmaking can be controlled very closely. Consequently, such furnaces are used to produce high quality and high alloy steel, such as tool and stainless steels, as well as the more common steels.

Rolling and finishing. The three principal methods of shaping metal in steel plants are rolling, casting, and forging. About three-fourths of all



Melter helpers sample steel from basic oxygen furnace.

steel products are shaped by the rolling process. In this method, heated steel ingots are squeezed longer and flatter between two cylinders or "rolls." Before ingots of steel are rolled, they are heated to the temperature specified by the plant's metallurgist. The heating is done in large furnaces, called "soaking pits," located in the plant floor. A *heater* (D.O.T. 613.782) controls the soaking pit operation. He directs helpers in heating the ingots to the specified temperature and, with the help of control equipment, determines when they are ready for rolling. A *soaking pit craneman* (D.O.T. 921.883) operates an overhead crane, by means of electrical controls, to lift the stripped ingots from an ingot car and place them into the soaking pit. When the ingots are sufficiently "soaked" with heat, the heater opens the furnace doors and the craneman removes the ingots and places them on ingot buggies, which carry them to the rolling mills. Here, the ingots are rolled into semifinished shapes—blooms, slabs, or billets. Blooms are generally more than 6 inches wide and 6 inches thick. Slabs are much wider than blooms. Billets are the smallest of these three shapes.



Blooming mill roller manipulates controls to reduce ingot to slab.

The rolling of blooms illustrates the semifinishing process. In the blooming mill, as in other rolling mills, the ingot moves along on a roller conveyor to a machine which resembles a giant clothes wringer. A "two-high" blooming mill has two heavy 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 a "pass" through the rolls, the rolls are revolved in the opposite direction, 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. Guides, located on each side of the roll table, properly position the ingot for entry into the rolls. This operation is repeated until the ingot is reduced to a bloom of the desired size. The bloom is then ready to be cut to specified lengths.

A blooming mill *roller* (D.O.T. 613.782), the man in charge of the mill, works in a glass-enclosed control booth, or "pulpit," located above or beside the roller line. His 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 his skill. The roller regulates the opening between the rolls after each pass. 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 pulpit beside the roller and coordinates his controls with those of the roller.

Upon leaving the rolling mill, the red-hot bloom moves along a roller conveyor to a place where a *shearman* (D.O.T. 615.782) controls a heavy, hydraulically operated shear which cuts the steel into desired lengths.

In a blooming mill with automatic (electronic) process controls, a rolling mill attendant is given a card which has been punched with a series of holes. The holes represent coded information and directions as to how the ingot is to be rolled. The attendant inserts the card into a card "reader," then presses a button that starts the rolling sequence. The information in punched-card form governs the setting of the roll opening, the speed of the rolls, the number of passes to be made, and the number of times the ingot must be turned. When the automatic process is used, the roller's function is shifted from operating the rolling controls to directing and coordinating the entire rolling process. This consists of heating, rolling, and shearing.

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One of the latest developments in steel shaping is the continuous casting process. In this process molten steel is poured into a water-cooled mold located at the top of a tower. As the mold is filled, the steel solidifies along the bottom and lower sides. The mold bottom is then withdrawn and the slab starts its descent through the tower. As the slab ribbon emerges from the mold, additional molten steel is continuously added at the top. Continuing downward, the slab passes through a spray chamber where it is further cooled by a water spray to solidify the still liquid core. Pinch rolls control the slab's descent and support its weight. Finally the slab is cut into lengths as it emerges from the rolls. In some continuous casting installations, a curved mold is used, so that the slab comes out horizontally rather than vertically.

Another relatively new process which is capable of displacing the conventional method of casting steel into rolling ingots is known as "pressure pouring." In this process, molten steel is forced up through a tube into a graphite mold to produce a finished steel slab.

After the steel is rolled into semifinished shapes—blooms, slabs, or billets—most of it is put through "finishing" operations. For example, steel slabs may be reduced and shaped into plates and sheets. Even after additional rolling, some steels must be worked further. Some rods, for instance, are reduced to wire by drawing. Wire can be further processed into wire rope, nails, fencing, or other end products. Much sheet steel is further reduced by cold-rolling, and then it may be run through galvanizing or tinplating lines. Bars, skelp (a thick, narrow sheet), and plate can be formed into pipe of widely varying diameters.

Equipment operator, inspector, and *assorter* are among the major occupations in finishing operations; women frequently are employed in these jobs.

An important occupation in wire making is the *wire drawer* (D.O.T. 614.782). This worker pulls the pointed end of a steel rod through a die (a block of hard steel or sintered carbide with a tapered hole in it). The rod end is then attached to a reel which, while revolving, pulls the rest of the rod through the die. As the rod passes through the die it is made thinner and longer and becomes wire, which is automatically coiled around the revolving reel. If extensive reduction of the rod is required, it is passed through a series of dies, each die reducing the diameter of the wire slightly.

Pipe, both welded and seamless, is also an important steel mill product. In making welded pipe, the flat steel is fed into a machine which rolls it into tube shape; then the edges of the pipe are fused by continuous welding.

Seamless pipe and tubing are formed from a solid billet of steel, called a tube round. In the seamless operation, the *piercer-machine operator* (D.O.T. 613.885) passes a preheated tube round between two barrel-shaped rolls. The revolving rolls spin the tube round and force one end against a piercing plug or "mandrel." The combined rolling action and the pressure of the rolls tend to make the steel draw apart providing space for the mandrel to enter. The mandrel smooths the inside walls and makes the diameter of the hole uniform.

Tinplate is another important steel product. To make tinplate, thin sheets of steel are fed continuously through an electrolytic bath where a coat of tin is deposited on the steel.

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, and others operate the equipment which provides power, steam, and water. Other groups of workers move material and supplies and perform a variety of service operations.

In the machine shops, machinists and machine tool operators make and repair metal parts for machinery or equipment. Diemakers use machine tools to form dies, such as those used in wire drawing units. *Roll turners* (D.O.T. 613.780) use lathes, grinders, and other machine tools to finish steel rolls to desired shapes and sizes for use in the rolling mills.

Millwrights in this industry maintain mechanical equipment. They overhaul machinery, and repair and replace defective parts. Electricians install electric wiring and fixtures and "hook up" electrically operated equipment. Electrical repairmen (motor inspectors) keep wiring, motors, switches, and electrical equipment in good operating condition and make repairs when electrical equipment breaks down.

Electronic repairmen install, repair, and adjust the increasing number of electric devices and systems used in steel manufacturing plants. Typically, this equipment includes communication systems, such as public address systems; closed-circuit television installations; 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, and coke ovens, as well as mill buildings and offices. Pipefitters lay out, install, and repair piping that is used to carry the large amount of water, gas, steam, oil, air, oxygen, and acetylene used in the steelmaking process. Boilermakers test, repair, and rebuild heating units, storage tanks, stationary boilers, and condensers. Locomotive engineers and other train crew members operate diesel or electric trains used to transport materials and products in the vast yards of iron and steel plants. Welders operate welding equipment to join metal parts in repairing and rebuilding plant machinery and in fabricating steel products. Skilled workers run the various boilers, turbines, and switchboards in the powerplants which provide the large amounts of electric power needed in steelmaking.

Other types of maintenance and service workers found in steel plants

include carpenters, oilers, painters, instrument repairmen, scale repairmen, loaders, riggers, greasers, janitors, and guards. Many laborers are employed to load and unload materials and do a variety of cleanup operations.

Administrative, Clerical, and Technical Occupations. Professional, technical, administrative, clerical, and sales workers accounted for nearly one-fifth of the industry's total employment in 1967. Of these, the majority were clerical workers, such as secretaries, stenographers, typists, accounting clerks, and general office clerks.

Engineers, scientists, and technicians made up a substantial proportion of the industry's "white-collar" employment. Several thousand of these workers were engaged in research and development to improve existing iron and steel products and processes, and to develop new products and processes. For example, these workers are now developing and improving alloy steels that are highly resistant to heat, extremely strong, and corrosion resistant.

The technical specialists in iron and steel plants also include mechanical engineers whose principal work is the design, construction, and operation of mill machinery and material handling equipment. Many mechanical engineers work in operating units where their jobs include, for example, determination of roll size and contour, rolling pressures, and operating speeds. Others are responsible for plant and equipment maintenance. Metallurgists and metallurgical engineers work in laboratories and in production departments where they have the important task of testing and controlling the quality of the steel during its manufacture. They also develop and improve the industry's products and processes through research. Civil engineers are engaged in the layout, construction, and maintenance of steel plants and the equipment used for heat, light, and transportation. Electrical engineers design, lay out, and supervise the operation of electrical generating distribution facilities that provide the power essential in modern steel mill operation. These engineers are concerned also with the operation of electrical machinery and electrical and electronic control equipment.

Chemists work in the laboratories, making chemical analyses of steel and raw materials used in steel manufacture. Laboratory technicians do routine testing and assist chemists and engineers. Draftsmen prepare working plans and detailed drawings required in plant construction and maintenance.

Among the employees in administrative, managerial, and supervisory occupations were office managers, labor relations and personnel managers, purchasing agents, plant managers, and industrial engineers. Working with these personnel were several thousand professional workers, other than scientists and engineers. By far the largest group of these professional employees were accountants, but there were also many nurses, lawyers, economists, statisticians, mathematicians, librarians, and social workers. In addition, the industry employed several thousand workers in sales positions.

(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 at the unskilled level, as laborers. Openings in higher rated jobs usually are filled by promoting workers from lower grade jobs. Factors considered when selecting workers for promotion are ability to do the job, physical fitness, and length of service with the company.

Training for processing occupations is done almost entirely on the job. Workers move to operations requiring progressively greater skill as they acquire experience. A craneman, for example, is first taught how to operate relatively simple cranes, and then he advances through several steps to cranes much more difficult to run, such as the hot-metal crane.

In selecting workers for processing jobs, steel companies generally give preference to high school graduates. To help them advance in their work, many workers take part-time courses in subjects such as chemistry, physics, and metallurgy. In some cases, this training is provided by the steel companies and may be given within the plant. Other workers take evening courses in high schools, trade schools, or universities in their communities or enroll in correspondence courses.

Workers in the various operating units usually advance along fairly well-defined lines of promotion within their department. Examples of possible lines of advancement in the various operating units follow.

To become a blast furnace blower, a worker generally starts as a laborer, advancing to cinderman or slagger, keeper's helper, keeper, blower's helper, and finally, to blower. In the open-hearth department, a man may begin by doing general cleanup work around the furnace and then advance to third helper, second helper, first helper, and eventually, to melter. A possible line of job advancement for a roller in a finishing mill might be pitman, roll hand, manipulator, rougher, and finish roller. Workers can be trained for skilled jobs, such as blower, melter, and roller (which are among the highest rated steelmaking jobs), in a minimum of 4 or 5 years, but usually wait a much longer time before openings occur.

Most companies conduct some type of apprenticeship program to meet the needs of their maintenance shops. There are apprentice training programs for more than 20 different crafts in the steel industry. The apprenticeship programs for maintenance workers usually are of 3 or 4

years' duration and consist mainly of shop training in various aspects of the particular jobs. In addition, classroom instruction in related technical subjects 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 be high school or vocational school graduates. In most cases, the minimum age is 18 years; sometimes an upper age limit is specified. 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 young workers already employed in the plant. The following occupations are among those most often included in apprentice training programs in iron and steel plants: Blacksmith, boilermaker, bricklayer, coremaker, carpenter, electrician, instrument repairman, lead burner, machinist, molder, painter, patternmaker, pipefitter, rigger, roll turner, sheet-metal worker, tool and die maker, and welder.

Applicants for jobs as helpers to skilled maintenance workers are usually given aptitude tests. Helpers receive on-the-job training and may be promoted to jobs requiring greater skill as openings occur. However, vacancies in these higher grades may not occur for several years, depending on the rate of turnover.

The minimum requirement for engineering and scientific jobs is usually a bachelor's degree with an appropriate major. Practically all the larger companies have formal training programs for college-trained technical workers in which the 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 sales work 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 for jobs 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 usually 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

The iron and steel industry will hire many thousands of workers during the remainder of this decade and through the 1970's. Retirements and deaths alone in this large industry should provide about 12,000 job openings annually. However, because of the expected increase in output per worker, total employment in the industry is not expected to increase substantially above the 1967 level of approximately 640,000, even assuming relatively full employment nationally and the high levels of economic activity needed to achieve this goal.

Future employment levels are difficult to determine at this time, because it is too early to evaluate completely the laborsaving effects of many of the technological developments being introduced in the iron and steel industry. However, should total employment levels decline over the long run, employment in some occupations, or occupational groups, still is expected to rise.

Among white-collar workers, for example, employment of engineers, chemists, physicists, mathematicians, laboratory aids, and other technical personnel will increase, because of the industry's expanding research and development programs. Job opportunities for electronic technicians, electronic computer programers, and other personnel trained in the preparation of data for use in these machines also are expected to increase. Among skilled plant personnel, maintenance workers (particularly instrument repairmen) are expected to be needed in greater numbers, because of the increasingly complex machinery, instruments, and other equipment used. In contrast, the number of less skilled processing jobs is expected to decline.

A moderate increase in the production of iron and steel is expected during the decade ahead. The growing population and rising levels of personal disposable income will result in greater demand for products that require large amounts of steel, such as automobiles, houses, household appliances, and highways. New machinery also will be needed to produce the growing quantity of goods needed to feed, clothe, and otherwise satisfy the requirements of an expanding population.

Continued increases in the efficiency of office and production operations in the iron and steel industry are expected in the decade ahead. The efficiency of office operations, for example, will be improved by the growing use of electronic data-processing and communications equipment. Production efficiencies will be gained by the increasing use of beneficiated ores in blast furnaces; the replacement of open-hearth furnaces with basic oxygen furnaces; the use of oxygen in open-hearth and electric furnaces; and the substitution of continuous casting equipment for primary rolling mills. The trend toward more automatic production operations and the greater use of instruments to control the quality of steel also will result in increased operating efficiency. The use of automatic production techniques is growing in rolling mills, in tin coating processes, and in heating and controlling furnaces; and these techniques are being improved and extended to other operations.

Earnings and Working Conditions

Earnings of production workers in iron and steelmaking establishments are among the highest in manufacturing. In early 1967, their earnings averaged $143.72 a week, or $3.54 an hour. This compares with average earnings of $113.02 weekly, or $2.77 an hour, for all production workers in manufacturing establishments.

Basic (standard) hourly wage rates for nine selected processing occupations in the United States Steel Corp., the largest single steel company, are shown in the following tabulation:

	Job Class [1]	*Approximate basic hourly rates* [2]
Blast furnaces:		
Keeper	14	$3.35
Stockhouse man	10	3.05
Cinderman	6	2.75
Steelmaking:		
Charging-machine operator, open hearth	16	3.50
Ingot stripper, open hearth	12	3.20
Helper, third, open hearth	6	2.75
Rolling and finishing mills:		
Roller, blooming mill	26	4.25
Manipulator, blooming mill	13	3.27
Assorters, tin plate	5	2.67

[1] An arrangement of jobs into a series of categories rated according to skill, experience, training, and other factors.

[2] These rates are from the wage agreement between the company and the United Steelworkers of America and include the increase effective on Aug. 1, 1967

Basic hourly wage rates for skilled processing jobs ranged from about $3.12 to $4.70; for semiskilled jobs, from approximately $2.67 to $3.05; and for unskilled jobs, from $2.45 to about $2.60. (The individual worker's rate depends on his particular job classification.) These rates were representative of those from processing jobs throughout the industry and were guaranteed minimum for those workers who were paid on the incentive (piece rate) basis. Since about two-thirds of the industry's production workers were paid on an incentive basis, a majority of such workers generally earned more than the basic hourly wage rate.

In addition to the above rates, steelworkers receive premium pay for overtime work and for work on Sundays and holidays.

Agreements between most steel companies and the United Steelworkers of America include provisions for various fringe benefits, such as vacation pay, shift differentials, paid holidays, retirement pensions, and unemployment benefits. Most workers receive vacation pay ranging from 1 to 4 weeks depending on length of service. In addition, the top 50 percent of the workers, ranked on the basis of seniority, receive 13-week vacations (including regular vacation time) every 5 years; and the remaining 50 percent receive extra single weeks vacation, expected to average about 3 weeks in a 5-year period. Professional and executive personnel in a few companies receive similar benefits. Workers may retire on full pension after 30 years of service, regardless of age. Retiring workers are eligible for a company-paid pension, in addition to social security benefits for which they may be eligible. Employees having 2 years or more of service are eligible to receive supplemental unemployment benefits for up to 52 weeks. Other important provisions include a $100 monthly disability pension provided by the companies, and accident and sickness, hospitalization, surgical, and life insurance benefits financed by the companies.

The American Iron and Steel Institute estimates wage supplements in 1966 as 27.5 percent of total employment costs or $1.27 per hour worked.

Working conditions depend upon the particular plant department in which the worker is employed. Maintenance shops generally are clean and cool. Rolling mills, however, generally are hot and noisy. Some plants are developing methods to reduce job discomfort. For example, the use of remote control enables employees to work outside the immediate vicinity of processing operations. In other instances, the cabs in which the men work, while operating mechanical equipment, are often air conditioned. Some of the workers near blast and steel furnaces are exposed to considerable heat. Because certain processes are operated continuously, some workers are on night shifts or work on weekends.

The iron and steel industry is a leader in the development of safety programs for workers, emphasizing the use of protective clothing and devices on machines to prevent accidents. In 1966, steel plants had an average injury frequency rate (injuries per million hours of work) that was about a third of the rate for all manufacturing.

Most plant workers in the iron and steel industry are members of the United Steelworkers of America.

Where To Go for More Information

American Iron and Steel Institute, 150 East 42d St., New York, N.Y. 10017.

United Steelworkers of America, 1500 Commonwealth Building, Pittsburgh, Pa. 15222.

MOTOR VEHICLE AND EQUIPMENT MANUFACTURING OCCUPATIONS

Few products have had as great an impact on everyday life as the automobiles, trucks, buses, and other vehicles manufactured by the motor vehicle and motor vehicle equipment industry (automobile industry). Four out of five families owned automobiles in 1966, and over 94 million passenger cars, trucks, and buses traveled the Nation's streets and highways. In addition, the widespread use of motor vehicles has made significant contributions to the Nation's economy by helping to create new industries and develop existing ones. Many businesses, including automotive repair shops, gasoline service stations, and truck and bus transportation facilities have been created as a result of the motor vehicle. Moreover, the automobile industry is a major consumer of many basic commodities such as steel, rubber, and plate glass.

To manufacture the more than 10 million motor vehicles (mainly automobiles) produced in 1966, the motor vehicle industry (SIC 371) employed approximately 860,000 employees. (In addition, thousands of people, whose employment is not included in this chapter, are employed outside motor vehicle plants in the production of components for the motor vehicle industry. These are persons engaged in the production of tires and tubes, automobile glass, vehicular lighting systems, storage batteries, and many other items.) Like other large industries, the automobile industry offers employment to men and women with widely different backgrounds of education and skill. Requirements for jobs vary from the college degrees necessary for engineers and other professional and technical personnel, to the few hours of on-the-job training necessary for some other occupations, such as assembler, materials handler, and custodial employee. The largest number of employees work in factory (plant) occupations. Plant occupations range from the skilled tool and die maker, millwright, and electrician, to those requiring little skill, such as machine tender, assembler, materials handler, and custodial worker. A great number of automotive employees also work in office and administrative jobs as clerks, business machine operators, stenographers, purchasing agents, and personnel assistants.

Nature and Location of the Industry

This industry's ability to produce millions of complex motor vehicles is due mainly to mass production of standardized parts and assembly-line manufacturing methods. Thousands of identical parts are produced by employees whose jobs are divided into a limited number of operations on high-speed machinery. These mass-produced parts are then put together by other employees to form the completed vehicle. As a result, new cars can be driven off assembly lines at the rate of more than one a minute.

The motor vehicle industry in 1966 consisted of approximately 2,500 plants that manufactured parts or assembled these parts into cars, trucks, buses, and special-purpose vehicles such as ambulances, fire engines, and taxicabs. The plants ranged in size from huge assembly plants employing many thousands of workers, to parts plants employing a small number of workers. About 80 per cent of the industry's workers are employed in establishments with 1,000 employees or more.

In 1966, about 15 percent of the employees in the industry were engaged in the manufacture of bodies for passenger cars, trucks, and buses, and in the production of truck trailers and truck trailer chassis. The remaining 85 percent were almost equally divided between plants that supply parts for new motor vehicles, and plants that assemble the components into the final product that appears on the highway.

Hundreds of companies supply the parts for new vehicles and also produce the replacement parts necessary to keep the millions of vehicles already on the road in operation. These firms often specialize in producing individual parts—for instance, brakes, axles, and transmissions. There are relatively few companies that assemble complete vehicles.

More than 90 percent of the motor vehicle industry's workers are employed in 12 States. Michigan alone accounts for more than 40 percent of the industry's employment; Ohio, Indiana, and New York account for another 25 percent. The eight other States with large concentrations of motor vehicle manufacturing employment are Wisconsin, California, Missouri, Illinois, Pennsylvania, New Jersey, Georgia, and Texas.

In Michigan, the Detroit metropolitan area is the center of the industry. About 1 out of every 4 of the Nation's motor vehicle workers is employed within its industrial area, which includes Dearborn and Pontiac. Several other cities, especially Flint, Lansing, and Saginaw, employ large numbers of automobile workers.

The Great Lakes region has many other important centers; Cleveland, Lorain, Toledo, and Cincinnati, Ohio; Indianapolis and Fort Wayne, Ind.; Chicago, Ill.; Buffalo, N.Y.; and Milwaukee and Kenosha, Wis.

Much of the motor vehicle manufacturing on the East Coast is centered in the New York-Northeastern New Jersey-Philadelphia industrial area in such localities as Newark, Paterson, Linden, and New Brunswick, N.J.; and New York, N.Y.

The Los Angeles industrial area is the leading automobile manufacturing center in the Pacific Coast region. The East Bay area is another automobile manufacturing center in California.

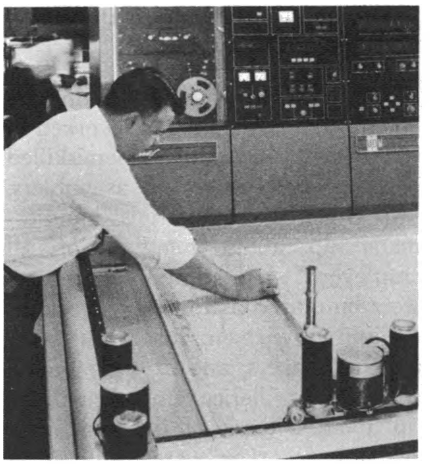
How Motor Vehicles Are Made

Automobiles and other motor vehicles are produced in three steps: Preliminary designing and engineering; production of motor vehicle parts and subassemblies; and final assembly of parts into completed vehicles.

Preliminary Designing and Engineering. Approximately 2 to 3 years of designing, planning, and testing often precede the actual production of each year's model. Stylists constantly strive to improve the appearance of the automobile. They work closely with engineers and other technical personnel concerned with improving mechanical operation, design, and safety. The stylists' creative designs are transferred to blueprints, from which skilled modelmakers make clay, wood, and plastic models of the new automobile. From these models, refinements in styling and design of the new car are developed. In order to mass-produce the car, master dies based on the finally accepted model are made.

Companies that produce parts work closely with the automobile manufacturers on questions of designing, engineering, and testing. Problems of production methods, costs, and scheduling also are worked out long before the actual manufacturing process begins.

In recent years, computers have played an increasingly important role in calculating engineering data and have been linked up with numerically controlled drafting machines. These machines, automatically operated by a tape containing instructions prepared on a computer, produce engineering drawings. Another recent technique is the recording of points on a clay model using photographic equipment which the computer can then convert into full scale drawings. These methods have enabled the manufacturers to shorten the lead time that is necessary to bring forth the new model automobiles that appear annually.



Draftsman checks automobile design drawings prepared by numerically controlled machine.

Production of Motor Vehicle Parts. After the designing and engineering phases have been completed, thousands of component parts that will later be assembled into a complete motor vehicle must be produced. A large variety of materials are used, the most common being steel, aluminum, copper, zinc, plastic, rubber, fabric, glass, iron, and lead.

The large number of metal parts used in a motor vehicle are shaped by several different methods, depending on the purpose and size of the part and the metal being used. The casting process is used to produce bulky parts such as engine blocks. Those parts which must be capable of withstanding great stress, such as axles and wheel spindles, are produced by the forging process. Huge presses form the sheet metal and aluminum that compose the exterior body. Those metal parts that require precise size and shape dimensions, such as pistons and engine blocks, undergo further machine processing. These various processes are explained more fully under plant occupations.

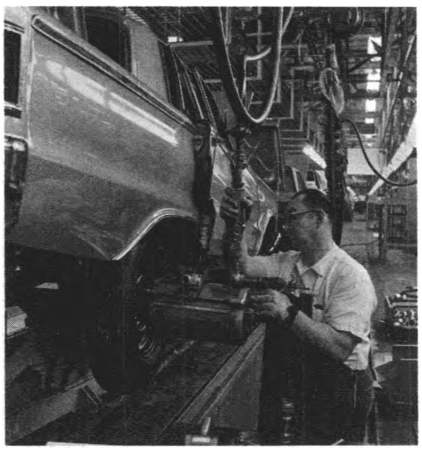
The production of parts does not entirely consist of metalworking operations. For example, parts are made rustproof and attractive by painting and baking them in ovens lined with infrared lights.

Throughout the production of parts, numerous inspections are made so that the quality of the assembled vehicles will meet established standards.

Assembling the Final Product. The last stage of motor vehicle manufacturing takes place on the final assembly line. Final assembly is the process of putting together in sequence the individual parts and the subassemblies, with the completed vehicle rolling off the end of the line. Overhead wires and pipes feed electric power and air to nut tighteners, welding equipment, and other tools used by workers on the assembly line. A conveyor carries the motor vehicle forward while men at work stations attach the necessary parts and subassemblies in proper sequence.

Generally, large and heavy subassemblies, such as the engine and the body, are lowered by hoists into

Assembly line worker alines automobile body with power train.



Operator tightens all wheel lugs at once with pneumatic impact wrench.

position on the chassis as it comes down the line. The finishing accessories, such as bumpers, hubcaps, and floor mats, are added near the end of the line. Finally, gasoline is pumped into the fuel tank, and the new motor vehicle is driven off the line. The headlights and wheels are then alined and the finished car is inspected before it leaves the factory.

As the chassis move down the assembly line, "banks" of material located in aisles along the line are continually fed to the assemblers in accordance with a careful system of scheduling arranged by the production control department. Behind the movement of the parts and subassemblies to the assembly line is the work of the materials control men who, months before, coordinated the movement of material from outside suppliers with a planned production schedule.

The sequence of the models to be built may be transmitted to the various stations along the line by either teletype or telautograph. The information on color and on the special equipment desired in each car is obtained from car orders placed by automobile dealers. By this scheduling program, cars of different colors and types follow each other down the assembly line—for example, a light blue sedan may be followed by a beige station wagon.

Motor Vehicle Manufacturing Occupations

The motor vehicle industry's 860,000 employees in 1966 worked in hundreds of occupations. Semiskilled plant workers such as assemblers, inspectors, and materials handlers made up about one-half of all employees. An additional quarter were employed as foremen, mechanics and repairmen, machinists, tool and die makers, and in other skilled occupations. Clerical employees made up about a tenth of the total. The remaining workers were employed in professional, technical, sales, and managerial occupations, and as unskilled workers and guards.

About 90 percent of all the automobile industry's employees are men. Of the women employed in the industry, about half are in production jobs in which the work is not physically strenuous, such as assemblers, inspectors, machine operators, and sewers and stitchers; the rest are in clerical and other office jobs, including research and technical work.

The duties and training requirements of some of the important occupations are described briefly below. (Detailed discussions of professional, technical, mechanical, and other occupations found in the automobile industry, as well as in many other industries, are given elsewhere in this *Handbook,* in the sections covering individual occupations.)

Professional and Technical Occupations. The modern automobile is a product of the research, design, and development work of thousands of engineers, chemists, metallurgists, physicists, and other scientists and engineers, as well as mathematicians, draftsmen, and other professional and technical personnel employed by the motor vehicle companies. About 21,000 scientists and engineers were employed in the motor vehicle industry in early 1967. Engineers make up the largest group of professional and technical workers in the motor vehicle industry. Motor vehicle companies hire engineers specializing in mechanical, electrical, industrial, and other fields. For example, the mechanical engineer seeks ways of improving the engine, transmission, or other parts of the automobile through research and development and better design. The electrical engineer works on the design of electrical parts, such as ignition systems, voltage regulators, and generators. The industrial engineer concentrates on the layout of plant equipment, improved processes, and production scheduling. The industry also employs civil, chemical, and ceramic engineers, and metallurgists.

About two-fifths of the scientists and engineers are principally engaged in research and development. Others may supervise technical production jobs; for example, the metallurgist may supervise the melting operations in the precision casting and forging departments, and the chemist may head the testing and analytical laboratory.

The industry also employs many thousands of technicians, such as draftsmen, engineering aids, and laboratory assistants, to assist professional engineers and scientists.

Administrative, Clerical, and Related Occupations. Many types of employees are necessary in the automobile industry to perform a great variety of administrative functions. These include executives who determine how many vehicles to produce, what styles to make, what prices to charge, which parts the company should produce and which parts it should buy, and where it is best to locate plants. Other administrative personnel are those, such as personnel manager and purchasing agent, who direct individual departments or special phases of operations. Among those assisting the administrators are accountants, lawyers, market analysts, economists, statisticians, and industrial relations experts. This large industry also has many supervisory personnel in charge of specific groups of office or plant employees.

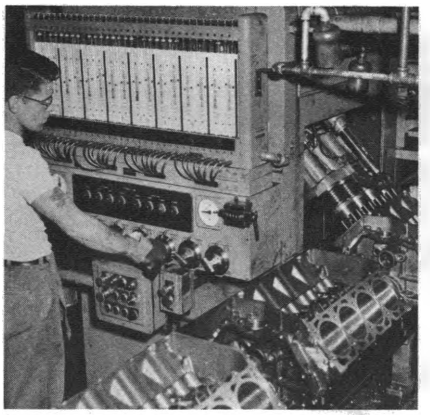
A large staff of clerical workers also is employed, including secretaries, stenographers, bookkeepers, clerks and typists, key punch operators, and business machine operators. A large proportion of these are women.

Plant Occupations. More than three-fourths of the employees in the motor vehicle industry work in factory jobs and are directly concerned with production operations. Most plant employees make automobile parts, assemble them into the complete vehicles, and put the finishing touches on them. Other plant employees service and maintain the vast amount of machinery and equipment needed for automobile manufacturing.

Machining Occupations. Machining is the metalworking process generally best adapted for the production of parts to precise sizes. It is a process of cutting or chipping away excess metal from a part or a piece of metal by the use of power-driven machine tools. Among the more common types of machine tools are lathes, boring machines, drill presses, grinding machines, milling machines, and gear cutters.

Automobile parts are manufactured to precise dimensions by machining workers. One of the largest metalworking occupations in the automobile industry is that of machine tool operator. These workers operate power-driven machines which hold both the piece of metal to be cut and an instrument, or "tool," that cuts, shapes, drills, or grinds the metal. The job titles of these employees, such as engine lathe operator, drill press operator, and milling machine operator, depend on what type of machine tool they operate.

Among the most highly skilled machining workers are the tool and the die makers .Toolmakers make the jigs, fixtures, and other accessories that hold the metal being machined. Diemakers construct the dies that are used in stamping, pressing, forging, and other metalforming operations. Tool and die makers read blueprints,



Operator monitors machine that checks accuracy of cylinder bores.

set up and operate machine tools, use precision-measuring instruments, and make shop computations. They work to closer tolerances (more exact dimensions) and do more precision handwork than most other machining workers.

The motor vehicle industry has taken the lead in developing continuous automatic production for many machining operations. This approach to production depends on a variety of instruments to direct and control manufacturing processes. In applying automation to machining processes, automobile manufacturers have linked automatic machine tools to perform various operations. Less labor is required because the parts or pieces being machined are not handled manually.

For example, in an automated engine plant, a rough engine block goes through hundreds of different cutting, drilling, and grinding operations using little direct manual labor. The engine block is moved into and out of load stations mechanically, machined automatically by a battery of machine tools, and transferred by conveyors to the next machining operation. Much of the inspection is done automatically. The machine tools, the conveyors, and the inspection equipment often are controlled by electronic, hydraulic, or air control mechanisms. Workers tend the automated lines of machine tools by watching the control panels for interruptions of the machines' normal functioning.

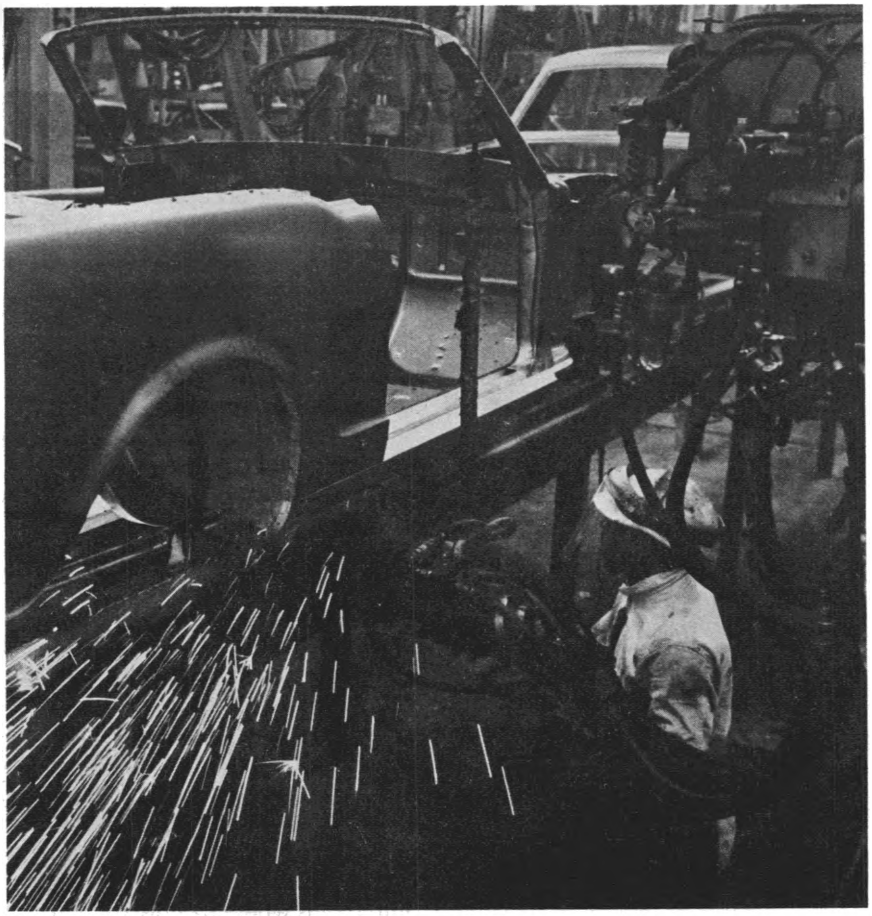
Other Metalworking Occupations. The motor vehicle industry employs large numbers of workers in other metalworking occupations. These include punch press operators who run power-driven presses that vary in size from small presses used for forming brackets, clips, or other small parts to massive presses which form, trim, and pierce holes in automobile doors, body panels, and frames.

Automobile plants employ many thousands of welders to join metal parts. Some manual electric-arc welders and gas welders work in production jobs in parts and body manufacturing plants, and others work in maintenance jobs repairing and rebuilding machinery and equipment. Machine (resistance) welders are employed on assembly lines to weld the separate parts of the bodies and subassemblies.

Foundry Occupations. Castings for automobile parts, such as engine blocks, are produced by pouring metal into molds where it cools and hardens in the shape of the molds. Patternmakers make a wood or metal pattern in the shape of the final casting desired. Coremakers shape the bodies of sand, or "cores," which are placed inside molds in order to form hollow spaces needed in castings. Machine molders make the sand mold into which the metal is poured.

Many other workers in the foundries are in less skilled occupations. Melters operate electric furnaces and cupolas used to melt metal for castings. The actual pouring is done by metal pourers. After the casting cools, the shakeout men remove it from the mold. Other workers clean the castings and remove the excess metal.

Forging occupations. Those automobile parts which must withstand great stress, such as axles, are shaped by forging hammers and presses in the forge shop. Hammermen operate drop hammers which pound metal into various shapes between closed dies.



Welder fastens rocker panel to steel body structure.

The hammermen are assisted by heaters who heat the metal stock in a furnace to prepare it for forging and then pass the stock to the hammermen. Other forge shop workers are engaged in cleaning, finishing, heat treating, or inspecting forgings.

Inspection Occupations (D.O.T. 806.281; 283; 381; 382; 387; 684 and 687). Automobiles can be mass-produced because parts and subassemblies for the same make of automobile are interchangeable. These parts are made to exact measurements and are subject to close quality control and inspection. (The industry employs statisticians and engineers in quality control departments who use statistical techniques designed to control the quality of the product.)

Inspectors check incoming raw materials, examine parts during the manufacturing stages, and make quality and conformity checks during the subassembly and assembly operations. Micrometers, specially designed gages, and other measuring and testing instruments are used by inspectors and testers in performing their duties.

Finishing Occupations. Many finishing operations must be performed before a car is completed. For example, the metal surfaces must be readied for finishing, the exteriors painted, the interiors covered, the seats upholstered, and finally, the finished product must undergo a thorough inspection. Among these employed in the finishing departments are metal finishers, platers, sprayers, polishers, sanders, trim cutters, sewing machine operators, and trimmers. *Metal finishers* (D.O.T. 705.884) file and polish rough surface areas of metal parts in preparation for painting. *Platers* (D.O.T. 500.885) put a thin coat of chrome on automobile bumpers and "hardware" for ornamentation and protection against corrosion. *Sprayers* (D.O.T. 741.887) operate spray guns to apply paint or other finishes to the metal parts. *Polishers* (D.O.T. 705.884) rub the finished surfaces by hand or polish them with a portable motor-driven buffing wheel.

Cutters, sewing machine operators, and trimmers combine their skills to provide comfortable and attractive interiors. With hand shears or an electric knife, the *cutter* (D.O.T. 781.884) cuts fabric or leather to the specific shape according to a pattern. The *sewing machine operator* (D.O.T. 787.782), using a power-driven machine, sews together the upholstery sections after they have been cut to size. *Trimmers* (D.O.T. 780.884) arrange and fasten springs and padding or foam rubber for the seats and backs and tack the covering material in place.

Assembling Occupations (D.O.T. 806.887). The workers who do motor vehicle assembling make up the largest occupational group in the automobile industry. Assemblers may put together small parts to form subassemblies or they may put together the parts and subassemblies to form the motor vehicle (line assemblies). Those employed on subassemblies work in parts plants or in automobile manufacturing plants. Those who put together the completed car work in automobile assembly plants.

Most assembly jobs are repetitive and require little skill; however, they do require coordination and may be strenuous. Assembly-line work is divided into many simple operations. Each employee is assigned a job to be done when the automobile passes his work station. For example, one employee may start nuts on bolts and the next worker may tighten the nuts.

Materials Handling, Custodial, and Plant Protection Occupations. The production of motor vehicles by the

Employee alines front wheels before automobile leaves assembly line.

assembly-line process requires an elaborate system of materials movement to supply the assembly lines and to remove finished products. A considerable number of workers are employed to move materials in automobile and automobile parts plants. Drivers operate power trucks which deliver parts or subassemblies to the asembly line or move materials between plants. Materials handlers load and unload parts from trucks or into and out of containers. Overhead crane operators use machines to move raw steel stock, heavy dies, and other materials that cannot be lifted by hand.

Many employees are needed to keep the production employees supplied with tools, parts, and materials, and to keep records of materials. Factory clerks, such as checkers, stock chasers, and stock clerks, coordinate the delivery of parts to the proper location on the assembly line. They check, receive, and distribute materials and keep records of incoming and outgoing shipments.

The motor vehicle industry also employes many workers in plant protection and custodial work. These employees include plant patrolmen, gatemen, janitors, and porters.

Maintenance Occupations. A large staff is required to keep machines and equipment in good operating condition and to make changes in the layout of automobile plants. Because breakdowns in the assembly lines and in the highly mechanized machining lines are particularly costly, the automobile industry employs many skilled maintenance employees to service this complicated production system. The maintenance and repair of complex electrical, electronic, and hydraulic equipment require well-trained electricians, electronic technicians, and machinery repairmen. Millwrights move, install, and maintain heavy machinery and mechanical equipment. Plumbers and pipefitters lay out, install, and repair piping, valves, pumps, and compressors. Other

maintenance employees in automobile plants include carpenters, stationary engineers, and sheet metal workers.

Training, Other Qualifications, and Advancement

The training requirements for jobs in the motor vehicle industry range from a few hours of on-the-job training to years of preparation. Many plant workers can learn their jobs in a day or two. On the other hand, engineering and scientific jobs, as well as craft jobs, are filled by people who have spent many years in training for their occupations.

The motor vehicle industry's emphasis upon new designs and mechanical improvements has made it an important employer of persons with engineering and scientific backgrounds. The minimum requirement for professional engineering jobs is a bachelor of science or a bachelor of engineering degree from a recognized college. Advanced degrees are often required for scientists, particularly for those engaged in research and development work. Many of the companies give their newly hired engineers and scientists specialized training courses. Many of the industry's top executives have been selected from this professional group.

The requirements for other technical employees vary according to their specialities. For example, engineering aids, laboratory assistants, and draftsmen are often technical institute or junior college graduates. Some automobile companies train their own seimprofessional technical employees at company-run schools or subsidize students at local junior colleges or technical institutes. These employees may also take advanced training and acquire engineering degrees.

Administrative positions are usually filled by men and women who have college degrees in business administration, marketing, accounting, industrial relations, or other specialized fields. Some companies have advanced training programs for employees in these specialties. Most of the top administrative jobs are filled by promotion from within the organization.

Most motor vehicle firms hire people who have had commercial courses in high schools or business schools for office jobs such as clerk, bookkeeper, keypunch operator, stenographer, and typist. These people usually have not been trained specifically for jobs in this industry.

Applicants for most plant jobs must be physically able, dependable, and have aptitude for mechanical work. For semiskilled jobs, the industry looks for applicants who are high school graduates, and who can do routine work at a steady and fast pace. Many assembling jobs can be learned in a few hours or days. Some of the less skilled machine operating jobs can be learned in a few weeks. Other plant production jobs require about a month of on-the-job experience.

Extensive periods of training are required for craft jobs in the motor vehicle industry. Tool and die makers, patternmakers, electricians, millwrights, and machinery repairmen are some of the highly skilled workers who generally require at least 4 years of training before they can perform their specialized jobs. Although many of the workers in craft jobs have acquired the skills of their trade by working for many years with experienced workers, most training authorities agree that apprenticeship is the best way to learn a skilled trade. Automobile firms, in cooperation with labor unions, conduct apprenticeship programs for many of the skilled trades. The industry's apprenticeship programs enable several thousand young men each year to prepare themselves for skilled jobs.

Applicants for apprenticeship training are generally required to be between the ages of 18 and 26 (one-third of the apprentices can be workers between the ages of 26 and 41 who are already employed in automobile companies) and graduates of a high school, trade, or vocational school. Training authorities stress that young people interested in apprenticeship training should prepare themselves by taking courses in mathematics and other sciences. Apprentice applicants are given physical examinations, mechanical aptitude tests, and other qualifying tests.

Apprenticeship training includes both on-the-job and classroom instruction related to the occupation. Mathematics, blueprint reading, shop theory, and specialized subjects are studied in the classroom and the operation and use of tools of a particular trade are learned in the shop.

Most motor vehicle companies select their foremen from among workers already employed. Frequently, persons who have completed apprentice training in a company are selected for supervisory jobs after they have acquired further experience. Applicants for foreman jobs, if selected, go through a training period when promoted to the foreman level.

Employment Outlook

The motor vehicle industry is expected to provide thousands of job openings annually during the remainder of the 1960's and throughout the 1970's, as a result of the need to replace experienced workers who transfer to other industries, retire, or die. Retirements and deaths alone should provide about 14,000 job openings annually. On the other hand, because of laborsaving technological advances, employment in the industry is expected to show little change from the 1966 level of 860,000, despite anticipated large increases in production of motor vehicles and parts.

Production of motor vehicles and parts and therefore, employment, have fluctuated sharply since the end of World War II, reflecting the industry's sensitivity to factors such as changes in general business conditions, consumer preference, availability of credit, and defense production needs. In the future, assuming the realization of relatively full employ-

ment nationally, the production of motor vehicles and equipment is expected to increase greatly. Factors contributing to the growth in demand for motor vehicles include expected large increases in the driving age population and in the number of households, growth of multicar ownership, higher levels of personal spendable income, and a continuing shift of families from the cities to the suburbs. Also, as the stock of motor vehicles in use continues to grow, the demand for vehicles will be stimulated by the increasing numbers of new vehicles needed each year to replace those that are scrapped.

In addition to the production of motor vehicles and parts, another major factor determining employment in this industry is the number of man-hours required to build a motor vehicle or to produce a part. Man-hour requirements have declined in recent years and have exerted a downward pressure on employment. In the decade ahead, the industry's continued emphasis upon mechanized production methods, such as automatic assembly operations, especially subassembly, is expected to continue to increase output per worker. The emphasis on research and development of new materials is also likely to continue in the future. Recent examples include the use of metal powders to manufacture certain precision parts, which eliminates a substantial amount of machining, the substitution of plastics for many metal parts, and the growing use of electrical discharge and electrochemical machining. New and modernized plants are also expected to lead to further efficiencies in production that will reduce labor requirements. However, increased production efficiency will be partly offset by the greater number of man-hours required to produce an increasing variety of models and a growing number of motor vehicles with additional equipment, such as improved safety devices, air conditioners, power brakes, and exhaust control devices.

Taking into account all of these factors, and assuming the realization of relatively full employment nationally and the high rates of economic growth necessary to achieve this goal, employment in the motor vehicle and equipment manufacturing industry in the late 1970's is expected to be about the same as the 1966 level. If these high levels of economic activity are not realized a decline in employment in this industry may be anticipated.

The occupational distribution of employment in the motor vehicle industry has been changing as a result of the industry's emphasis upon research and development activity, and its increasing use of automatic manufacturing operations. For example, white-collar employment as a proportion of total employment in this industry has been increasing slowly in the postwar period.

Following recent occupational trends, the number of engineers, scientists, and other professional and technical personnel is expected to increase as a proportion of total employment because of the anticipated expansion in research and development activities. Moreover, this emphasis upon research and development will create more job opportunities for engineers and scientists with advanced degrees. The growing complexity of the automobile industry will lead to a greater need for more accountants, particularly those specializing in tax accounting. The industry is expected to expand its use of electronic data-processing equipment in the future, and programers will be employed in greater numbers. Employment of clerical and administrative workers is expected to remain at about the present level. Although the introduction of data-processing equipment may reduce the number employed in some clerical occupations, a slight increase in the number of stenographers and typists is anticipated.

The employment of skilled workers, as a group, is expected to remain relatively stable. However, some skilled occupations, including millwright, pipefitter, electrician, and machinery repairman, are expected to increase; others, including carpenter and upholsterer are expected to decline. The number of semiskilled workers, such as assemblers and machine operators, is expected to continue to decline.

Earnings and Working Conditions

The earnings of production workers in this industry are among the highest in manufacturing. In 1966, production workers in the motor vehicle industry earned, on the average, $147.23 for 42.8 hours a week, or $3.44 an hour. This compares with average earnings of $111.92 for a 41.3-hour week, or $2.71 an hour, for production workers in all manufacturing industries.

As a result of collective bargaining contracts negotiated between employers and unions, most employees in the industry receive benefits such as life insurance, accidental death, and dismemberment benefits, and weekly accident and sickness benefits for temporary disability. Many employers pay the entire cost of these benefits. Hospitalization, surgical, and medical benefits, which are provided as a result of collective bargaining, are usually financed solely by employers. Most employees also receive paid sick leave; paid vacations (or payments in lieu of vacations) ranging from 1 to 3 weeks depending on length of service; and an average of 9 paid holidays a year. Most companies provide for automatic increases in hourly wages when the cost of living rises beyond a given amount. Employees are paid at one and one-half their normal rate for working more than 40 hours a week or for working on Saturdays. They receive double the hourly rate for working on Sundays or holidays.

Supplemental unemployment benefit plans (paid for solely by the employers) cover the majority of workers. These plans provide cash payments for employees with at least 1 years service, ranging up to $56 a

week for hourly rated employees and up to $66 a week for some salaried employees. In most States these benefits are in addition to those received from State unemployment compensation plans. These plans also provide supplementary pay benefits (short workweek benefits) to help stabilize the income of hourly rated employees when they are required to work less than a normal week. In addition, provisions are included for hospitalization, surgical, and medical benefits during layoff; separation payments for those laid off 12 or more continuous months; and relocation allowances for some laidoff employees.

A great majority of the motor vehicle workers are covered by pension programs, almost all of which are paid for entirely by the employer. Retirement benefits vary with length of service. In a typical case, a retiring employee, age 65, with 30 years' service, receives a monthly company pension of $127.50 in addition to his Federal social security benefits. Many pension programs also include provisions for voluntary retirement as early as age 55.

The great bulk of the production and maintenance workers in the motor vehicle assembly plants, and a majority employed in the parts plants belong to the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America. In some automobile parts plants, the International Union, Allied Industrial Workers of America is the bargaining agent for the employees. Other unions with membership in the automobile industry include the International Association of Machinists and Aerospace Workers; the Pattern Makers' 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 Mechanics Educational Society of America; the International Brotherhood of Electrical Workers; and the International Die Sinkers' Conference (Ind.).

In general, the work surroundings in automobile plants are more favorable than those in most other types of metalworking facilities. Most motor vehicle workers are employed in plants which are relatively clean and free from dust, smoke, and fumes. Some work surroundings, however, particularly in the foundry and forge departments, may be hot, and the worker may be exposed to noise, dust, and fumes. Working conditions in foundries and forge departments have been greatly improved by the introduction of larger, more efficient ventilation systems.

Motor vehicle plants are, on the whole, comparatively safe places to work, although safety conditions vary somewhat among the individual departments or facilities. The rate of disabling injuries in motor vehicle plants has been less than half that of all manufacturing industries in most of the recent years. Some automobile plants have fully equipped hospital facilities with doctors and nurses in attendance.

PETROLEUM AND NATURAL GAS PRODUCTION AND PROCESSING

The petroleum industry provides about 75 percent of all the energy fuels consumed in this country. Products refined from crude oil supply the fuels and lubricants used for nearly all our cars, trucks, buses and trains; military and civilian aircraft; and ships. Oil and gas provide much of the heat for our homes, factories, and commercial establishments, as well as the fuel for over one-quarter of the electric power generated in this country. In addition, basic petroleum compounds are essential in the manufacture of hundreds of products in everyday use, such as synthetic rubber, plastics, and fertilizer.

In early 1967, about 430,000 workers, with a wide range of educational backgrounds and skills, were employed in the various activities that make up the crude oil and natural gas production and processing sectors of this industry. They worked in oil and natural gas exploration and drilling operations, in natural gas processing plants, and in oil refineries located throughout the country.

Nature and Location of the Industry

Petroleum is one of the fossil fuels, having been formed from the decay of once living matter. It is extracted mainly in the form of crude oil and natural gas.

Thousands of companies are in the petroleum business, most of them specializing in a single activity, such as exploring for gas or oil, drilling wells, operating wells, transporting petroleum products, processing gas, and refining crude oil. Others operate gasoline service stations, or supply natural gas for heating and cooking. Much of the petroleum business, however, is done by a small number of large firms that are involved in many of the industry's activities—from exploring for oil and gas to selling finished petroleum products. These firms provide a large share of the industry's jobs.

This chapter deals with the jobs and activities involved in getting oil and gas to the surface of the earth (production) and converting it to usable products (processing and refining). It excludes the transporting and marketing of petroleum products.

Petroleum Production. Because the processes involved in finding and extracting crude oil and natural gas are the same, the jobs and activities involved are identical up to the point where the gas or oil well starts producing. In this chapter, references to "petroleum production" also cover the discovery and extraction of natural gas.

In early 1967, about 280,000 wage and salary workers were employed in the United States in petroleum production, including the production and processing of natural gas. Although drilling for oil and gas is done in about three-fourths of the States, nearly 90 percent of the workers are employed in 10 States. Texas is the leading State in the number of oilfield jobs, followed by Louisiana, Oklahoma, California, Kansas, Illinois, New Mexico, Wyoming, Mississippi, and Colorado. Many additional American workers are employed in foreign countries by United States oil companies, particularly in the Middle East, Africa, South America, and Canada.

The jobs and processes in petroleum production involve finding crude oil and extracting it from the earth. Petroleum production includes three broad fields of work: Exploration, drilling and oilfield servicing, and well operation and maintenance. Firms that specialize in performing one or more of these activities under contract to oil companies, employ about one-half of all the workers in petroleum production. Major oil companies engage in all of these production activities.

Since oil is difficult to find—only rarely are there any signs on the earth's surface of its presence underground—an important part of petroleum production activity involves using scientific methods to search for oil. After scientific tests are made which indicate the possible presence of oil beneath the surface of the earth, a site is selected and the drilling process begins.

Before a well can be drilled, a towerlike steel drilling rig is installed to support the tools and pipes that must be lowered into the well. Most rigs used today are portable ones brought to the drilling site, but some rigs are built at the site. Although a few large firms do some of their own drilling, over 90 percent of this work is performed by about 2,800 specialized drilling contractors.

A number of other services are performed in connection with oilfield drilling. These include building access roads, hauling supplies, cementing wells, cleaning and treating wells, and other special operations. Much of this work is handled by contractors.

When oil is reached, the job of the drilling crew is finished and that of the well-operating crew begins. About half of all petroleum production workers operate or maintain some 700,000 oil and gas producing wells in the United States. These wells are operated by thousands of companies which range in size from

large firms with wells all over the world to small firms with only a single well. After oil or gas is brought out of the ground, it is transported to refineries or processing plants by pipelines, ships, barges and trucks.

Petroleum Refining. Crude oil as it comes from the ground has few uses. To make useful end products, such as gasoline, fuel oil, kerosene and lubricants, oil must be heated under pressure or in a vacuum, or treated with chemicals. This processing, called refining, is done in plants known as refineries.

About 265 refineries were in operation throughout the country in 1966, employing some 150,000 wage and salary workers. Refineries range in size from small plants with fewer than 50 employees to plants with several thousand employees. Although refineries are located in most States, nearly 90 percent of refinery workers are employed in only 10 States: Texas, California, Pennsylvania, Louisiana, Illinois, Oklahoma, Indiana, New Jersey, Ohio, and Kansas. Refineries usually are located near oilfields, consuming centers, and deepwater ports where tankers can dock.

Natural Gas Processing. Natural gas as it comes from the ground is difficult to transmit through pipelines for long distances because of the various liquid compounds dissolved in it. As a result, natural gas processing plants, which remove these liquids, usually are located at or near gas fields. However, a few companies have found it desirable to locate large processing plants adjacent to main transmission lines, at a point several hundred miles from the producing area. Recently constructed plants are highly automated and usually have relatively few employees.

There are over 600 natural gas processing plants employing about 15,000 workers. More than 75 percent of the plants had fewer than 50 employees. Although natural gas processing plants are located in 20 States, over 85 percent were located in 6 States: Texas, Oklahoma, Louisiana, California, West Virginia, and New Mexico.

Employment Outlook

Employment in petroleum and natural gas production and petroleum refining is expected to continue the slow decline which began during the 1950's. However, little or no change in employment is anticipated among natural gas processing workers. Most of the job opportunities that will arise through the 1970's will result from the need to replace workers who retire, die, or transfer to other fields of work. Deaths and retirements alone will account for more than 7,000 job openings in this industry each year during the remainder of the 1960's and over the next decade.

Employment in the industry is expected to decline despite the fact that the demand for petroleum and natural gas products will continue to increase. The anticipated decline, however, will be concentrated among production and related workers as a result of the continued application of technological improvements which, in all likelihood, will lead to further increases in output per worker. (See p. 724 for statements on petroleum and natural gas production occupations.)

Where To Go for More Information

Further information concerning jobs, processes, and working conditions in the petroleum industry can be obtained from the public relations department of individual petroleum companies and from:

American Gas Association,
605 Third Ave., New York, N.Y. 10016.

American Petroleum Institute,
1271 Avenue of the Americas, New York, N.Y. 10020.

National Petroleum Refiners Association,
1725 DeSales St. NW., Washington, D.C. 20036.

PETROLEUM REFINING OCCUPATIONS

Operators regulate processing of crude oil from central controls.

Nature of Work

Petroleum refining changes crude oil into gasoline, kerosene, fuel oil, lubricants, and other products for use in homes and industry. The modern refinery is a complicated structure made up of tanks and towers connected by a maze of pipes. From the time crude oil enters the refinery to the shipment of finished products, the flow of production is continuous. The refining process is highly automatic and is controlled by instruments which measure and regulate the flow, temperature, and pressure of liquids and gases going through the pipes and tanks. Manual handling of materials is virtually eliminated in the modern refinery.

Briefly, 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 crude oil are condensed. The heaviest parts (for example, asphalt) are drawn off along the bottom of the tower where temperatures are highest; lighter parts (kerosene) 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.

About one-third of the plant workers in refineries are employed in processing work. A key worker in converting crude oil into usable products is the *stillman* (D.O.T. 542.280), or chief operator. He is responsible for the efficient operation of one distillation unit or more. The operator watches instrument readings for any changes in temperature, pressure, and oil flow. In the more modern refineries, the operator can watch instruments on graphic panels which show the entire operation of all distillation units in the refinery. He regulates the instruments so that oil products will meet specifications. From time to time, the operator patrols all units for which he is responsible to check their operating condition and to take samples for testing. He may have one *assistant* or more (D.O.T. 542.782), depending on the number and size of the units he directs.

Other plant workers whose jobs are related to the processing of crude oil include *pumpmen* (D.O.T. 549.782) and their *helpers* (D.O.T. 549.884), who maintain and operate power-driven pumps which circulate petroleum products, chemicals, and water through units during processing; and *treaters* (D.O.T. 549.782), who operate equipment to remove impurities from gasoline, oil, and other petroleum products.

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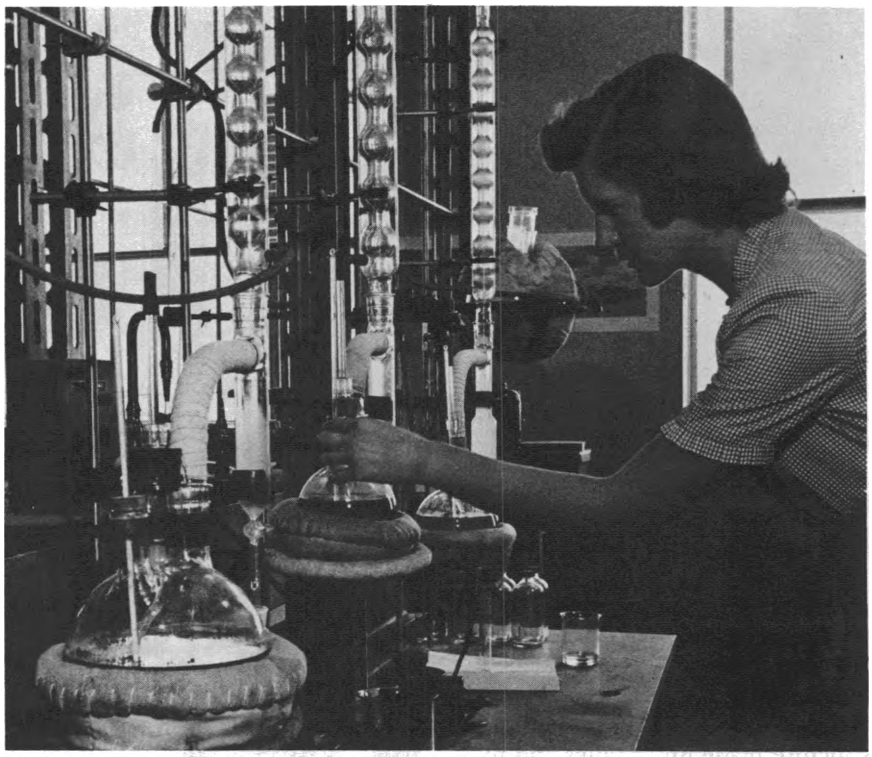
In many refineries, a large percentage of the plant workers repair, rebuild, and clean the highly complicated refinery equipment. In other plants, maintenance work is contracted to companies outside the petroleum industry. A large number of maintenance workers are needed because high heat and pressure and corrosion quickly wear out equipment. Included among these are skilled boilermakers, carpenters, electricians, instrument repairmen, lead burners, machinists, masons, painters, pipefitters, pipe coverers, riggers, sheetmetal workers, and welders. Many helpers and trainees are also in these trades. Some skilled workers have a primary skill in one craft as well as the ability to handle the duties of closely related crafts. For example, a pipefitter also may be able to do boilermaking and welding repair work on a piece of equipment. Maintenance workers who have such combined jobs are sometimes called *refinery mechanics.*

Plant workers who do not operate or maintain equipment do a variety of other tasks in refineries. Some workers are employed in the packaging and shipping department; some load and unload materials on trucks, trains, or ships; some drive trucks and tractors to deliver materials to various parts of the plant; and others keep inventory records of stock and tools. The industry also employs custodial workers such as guards, watchmen, and janitors.

About 15 percent (slightly more than 20,000) of the workers in petroleum refining are scientists, engineers, and technicians, compared with about one-tenth in petroleum production. Among these professional and technical refinery workers are chemists, chemical engineers, mechanical engineers, petroleum engineers, laboratory technicians, and draftsmen. Chemists and laboratory technicians control the quality of petroleum products by making tests and analyses to determine chemical and physical properties. Some chemists are engaged in research and development activities to discover new products and to improve those already produced. Laboratory technicians also 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. Draftsmen prepare detailed plans and drawings needed in refinery construction and maintenance.



Chemist conducts research to develop new petroleum products.

Many administrative, clerical, and other white-collar personnel are employed by refining companies. A large number of top administrative and management positions are filled by technically trained men, many of whom are chemists or engineers. Sales engineers also are technically trained. Other specialized workers in the field of administration include accountants, purchasing agents, and lawyers. Many typists, stenographers, secretaries, bookkeepers, and business machine operators are employed to assist these specialized workers. (Detailed discussions of professional, technical, mechanical, and other occupations found not only in the petroleum refining industry but also in other industries are given in the section of this *Handbook* covering the individual occupations. See index for page numbers.)

Training, Other Qualifications, and Advancement

Petroleum refineries typically require new plant workers to have a high school or vocational school education. In large refineries, aptitude and psychological testing and interviewing are used in selecting employees. Usually, a new worker begins in a labor pool where he does such jobs as moving materials, packing cartons, or filling barrels. When a vacancy occurs either in a processing department or in a maintenance shop, he may be transferred to one or the other, depending on his particular aptitudes and seniority.

A worker newly assigned to a processing department learns to operate processing equipment under the supervision of experienced workers. As

he gains experience and know-how, he moves to the more skilled jobs in his department. For example, one line of advancement for a processing worker may be from helper to assistant operator to chief operator. Formal training courses frequently are provided to assure thorough and current knowledge in a variety of operations.

An inexperienced worker who is assigned to a maintenance shop receives training on the job under the supervision of the foreman. In some refineries, he also may receive classroom instruction related to his particular work. Over a period of 3 or 4 years, he may advance from helper to skilled craftsman in one of the maintenance jobs. Some large refineries have programs under which workers are given training in several related maintenance crafts. For example, a qualified instrument repairman may be given additional training as electrician or machinist.

For scientists and engineers a bachelor's degree in science or engineering usually is the minimum educational requirement. For research jobs, scientists and engineers with advanced degrees are preferred. Laboratory assistants begin their work in routine jobs and advance to positions of greater responsibility as they acquire additional experience and demonstrate ability to work without close supervision. Inexperienced draftsmen begin as copyists or tracers. With additional experience and training, they may advance to more skilled and responsible drafting positions. Administrative positions generally are filled by men and women who have college degrees in business administration, marketing, accounting, industrial relations, or other specialized fields. For positions as clerks, bookkeepers, stenographers, and typists, most refineries employ persons who have had commercial courses in high school or business school.

Employment Outlook

Only a few thousand job openings each year are expected for new workers in petroleum refineries through the 1970's. These will result from the need to replace workers who retire, die, or transfer to other industries. Not all job vacancies created by turnover may be filled, since it is expected that in the future total employment in petroleum refining will continue a slow decline which began during the early 1950's.

This decline is expected despite the continued expansion of refinery output and anticipated increases in consumption of petroleum products in the years ahead. The lower employment level is expected to result from improved methods of refining crude oil and the trend toward fewer but larger and more highly automated refineries.

Most of the job opportunities created by turnover in petroleum refining will be for professional, administrative, and technical workers, particularly chemists, chemical engineers, and technicians, who are needed for the industry's research and development activities. Among plant workers, most job opportunities will be in maintenance occupations, such as those of instrument repairman, pipefitter, machinist, and maintenance electrician, because of the increasing use of automated equipment and complex control instruments.

Earnings and Working Conditions

Refinery workers are among the highest paid employees in American industry. In mid-1967, production workers in petroleum refining averaged $163.07 a week, or $3.81 an hour for a 42.8-hour workweek, compared with an average for all manufacturing industries of $113.65 a week, or $2.82 an hour for a 40.3-hour workweek. The higher average earnings of production workers in refineries reflect the relatively large proportion of workers in skilled occupations.

Entry salaries for chemists and chemical engineers in the petroleum refining industry were among the highest in American industry, according to a survey conducted by the American Chemical Society in 1966. The survey showed that in this industry the average starting salary for chemists with a bachelor's degree and no experience was $643 a month and for chemical engineers, $690 a month.

Most petroleum refinery workers receive a 2-week vacation with pay after 1 year of service; 3 weeks, after 5 years; 4 weeks, after 10 years; and 5 weeks after 20 years. Most refineries have adopted some type of insurance, pension, and medical and surgical plans for their employees. Employee stock-purchase and savings plans, to which the employer makes contributions, are in effect in many firms.

Because petroleum refining is a continuous round-the-clock operation, operators may be assigned to one of the three shifts, or they may be rotated on various shifts and be subject to Sunday and holiday work. Employees usually receive 10 to 20 cents an hour additional pay when they work on the second or third shift. Most maintenance workers are on duty during the day shift; only a few work at night to handle emergencies. Work in the industry has little seasonal variation and regular workers have year-round jobs.

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 in the course of their duties. Others may work in hot places or may be exposed to unpleasant odors. Refineries are relatively safe places in which to work. The injury-frequency rate is about half that of manufacturing as a whole.

A majority of refinery plant workers are union members. A large number of refineries have been organized by the Oil, Chemical and Atomic Workers International Union. Some refinery workers are members of other AFL–CIO unions or of various local unions not affiliated with the AFL–CIO.

OCCUPATIONS IN THE PULP, PAPER, AND ALLIED PRODUCTS INDUSTRY

In early 1967, the pulp, paper and allied products industry (the paper industry) employed about 680,000 workers to produce thousands of paper products such as newsprint, business forms, facial tissue, building board, paper bags, writing paper, and paperboard containers and boxes. Consumption of paper and paperboard in 1966 amounted to more than 530 pounds for each person in the Nation. The industry employs workers in occupations ranging from unskilled to highly specialized technical and professional jobs, many of which are found only in the paper industry.

About 145,000 women were employed in this industry at the beginning of 1967. Many of them worked in plant jobs, mainly as machine operators and inspectors in paper finishing and coverting plants; others were in office jobs. Few women were employed in the actual making of pulp or paper.

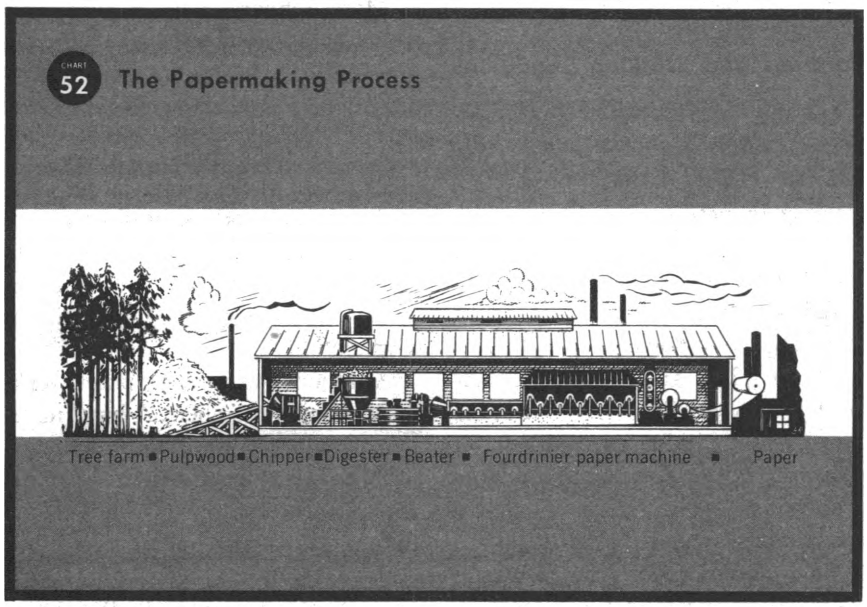
Nature and Location of the Industry

The paper industry is highly mechanized. Pulp and paper and many finished paper products are manufactured by machines—some as long as a football field—in a series of nearly automatic operations involving very little handling of material 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 all paper) from wood, reused fibers, or other raw materials; the manufacture of paper or paperboard (thick paper) from pulp; or the conversion of rolls of paper or paperboard into finished products. Some large plants produce pulp, paper, and paperboard. A few very large plants also produce finished paper products.

The largest group of employees in the industry in 1966 worked in mills that made pulp, paper, or paperboard. The next largest group was employed in plants that produced paperboard boxes and containers; the remainder worked in plants that produced a variety of other paper products.

More than 90 percent of the pulp, paper, and paperboard employees and over 70 percent of the converting plant employees worked in factories employing over 100 workers each.

Workers in this industry are located throughout the country, although more than half are employed in eight States: New York, Pennsylvania, Wisconsin, Ohio, Illinois, Massachusetts, New Jersey, and California. Other States with large numbers of paperworkers are Michigan, Minnesota, Georgia, Washington, Maine, Louisiana, Florida, and North Carolina.



Occupations in the Industry

Workers in the paper industry are employed in a wide 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 equipment such as papermaking machinery, converting equipment, motors, pumps, pipes, and measuring instruments. Truck and tractor drivers make deliveries to and from plants, and other workers load and unload trucks, trains, and ships. Guards, watchmen and janitors do custodial work. Other workers keep inventory records of stock and tools.

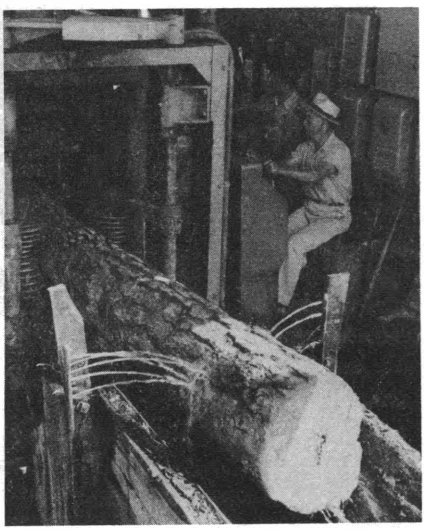
The industry employs many workers in clerical, sales, and administrative occupations. For example, it employs purchasing agents, personnel managers, salesmen, office clerks, stenographers, bookkeepers, and business machine operators. Also, because

Women are frequently employed as carton inspectors.

of the complex processes and equipment used, the industry employs many people in professional and technical occupations such as chemical and mechanical engineers, chemists, laboratory technicians, pulp and paper testers, and inspectors. (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 the sections covering individual occupations. See index for page numbers.)

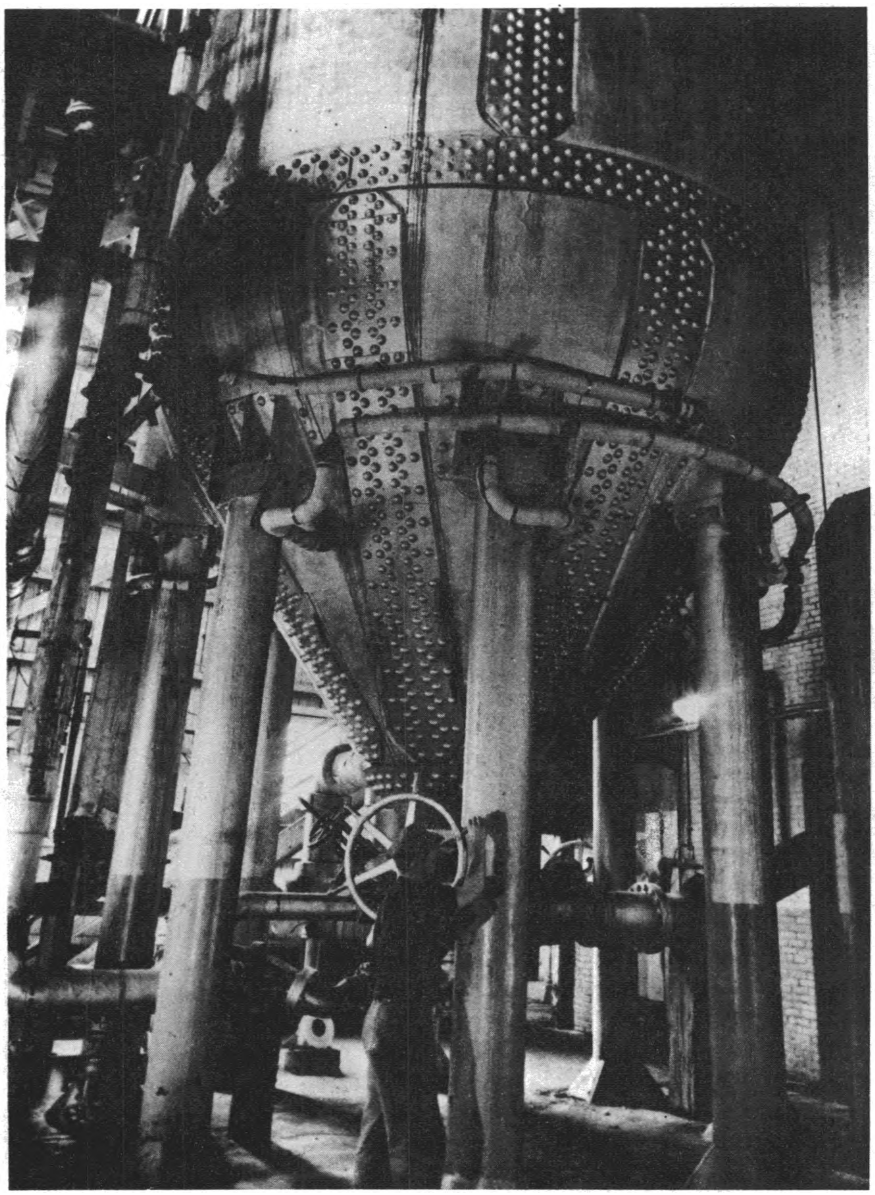
Production Jobs. More than three-fourths of all employees in the industry worked in production jobs. The simplified description of papermaking occupations and processes which follows, applies to a plant which combines the production of pulp, paper, and finished products into one continuous operation. (See chart 52.) It takes between 12 and 15 hours, on the average, for pulpwood or other raw materials to be converted into rolls of paper or paperboard.

After the pulpwood logs are received at the pulp mill, the bark is removed. One machine used for this operation is a large revolving cylinder known as a "drum barker." Logs are mechanically fed into this machine by a semiskilled worker called a *barker operator.* The machine cleans the bark from the logs by tumbling them against each other and against the rough inner surface of the drum. Next, the pulp fibers in the logs are separated from other substances not used in papermaking. This is done by a chemical or mechanical process, or a combination of both, depending on the type of wood used and the grade of paper desired.



Barker operator controls machine that removes bark from logs.

In the mechanical process, the pulpwood is held against a fast-revolving grindstone which separates the fibers. In the more commonly used chemical process, pulpwood is carried on conveyor belts to a chipper machine operated by a *chipperman* (D.O.T. 668.885). The machine cuts the pulpwood into chips about the size of a quarter. These wood chips are then "cooked" with chemicals under high temperature and pressure in a "digester," a kettlelike vat several stories high. The digester is operated by a skilled worker called a *digester operator* (D.O.T. 532.782) (also known as a "cook"). He determines the amount of chemicals to be used and the cooking temperature and pressure, directs the loading of the digester with wood chips and chemicals, and determines, by checking an instrument panel, 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. As a first step in turning pulp into paper, pulp is mixed thoroughly with water and further refined in a machine operated by a skilled worker called a *beater engineer* (D.O.T. 530.782). The kind and amount of chemicals and dyes that he uses and the length of time he "beats" the solution determines the color and strength of the paper.



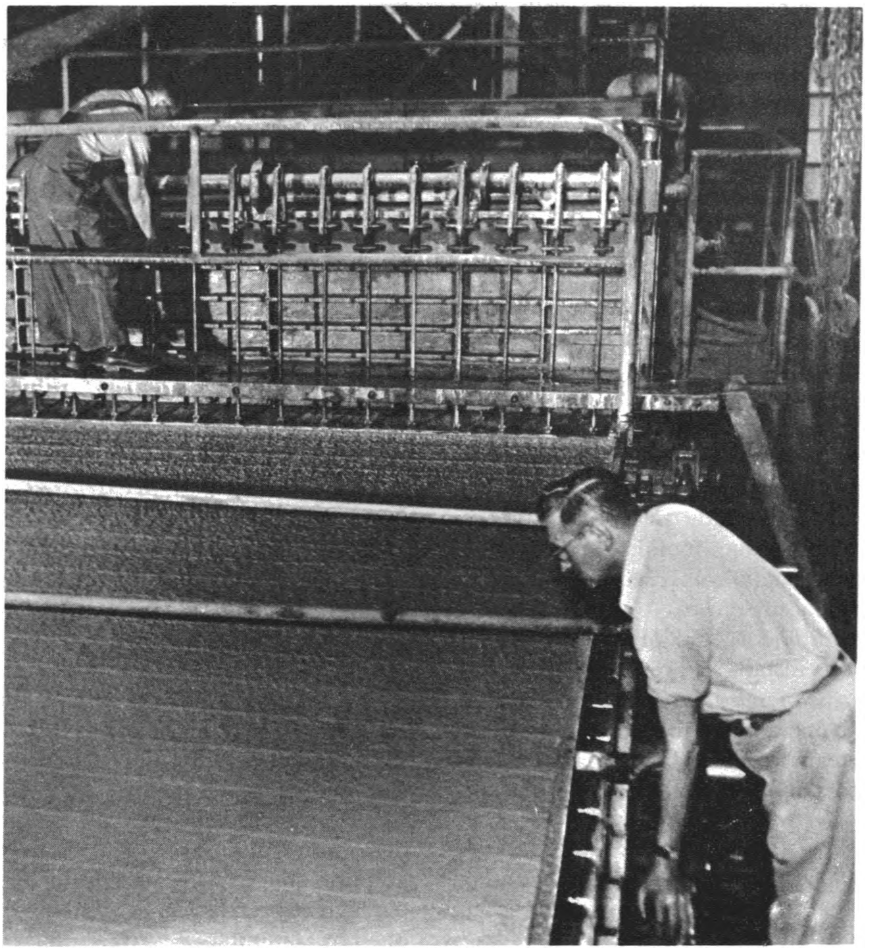
Digester operator adjusts flow of steam in paper digester.

The pulp solution, now more than 99 percent water, is turned into paper or paperboard by machines that are among the largest in American industry. The machines are of two general types. One is the Fourdrinier machine which is, by far, the most commonly used. The other is the cylinder machine used to make certain types of paper such as building and container board. It differs from the Fourdrinier machines in the paper-forming section. In the Fourdrinier, the pulp solution pours onto 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 the remaining water. Papermaking machines are operated by a *paper machine operator* (D.O.T. 539.782) (also called a "machine tender"). The quality of the paper produced largely depends on the skill of this worker. His principal responsibility is to control the "wet-end" of the papermaking machine, where paper of a specified thickness, width, and physical strength is formed. He checks control-panel instruments to make certain that the flow of pulp and the speed of the machine are coordinated. The paper machine operator determines whether the paper meets the required specifications by interpreting laboratory tests or, in some instances, by visually checking and feeling the paper. He also supervises the less skilled workers of the machine crew and, with their help, keeps the paper moving smoothly through the machine. The paper machine operator

and his crew may also replace worn felts and wire screens. The *backtender* (D.O.T. 532.885), who is supervised by the paper machine operator, controls the "dry-end" of the papermaking machine, where the paper is dried and prepared either for shipping or converting into finished products. He controls the pressure and temperature of the rolls that dry and finish the paper and give it the correct thickness, inspects the paper for imperfections, and makes sure that it is being wound tightly and uniformly into rolls. The backtender also adjusts the machinery that cuts the rolls into smaller rolls and, with the help of assistants, may weigh and wrap the rolls for shipment.

Paper mills that produce a fine grade of paper for books, magazines, or stationery usually maintain finishing departments. Most of the workers in these departments are either semiskilled or unskilled. One such semiskilled worker, called the *supercalender operator* (D.O.T. 534.782), aided by several helpers and by mechanical handling equipment, places huge rolls of paper onto a machine which gives the paper a smooth and glossy finish. He also inspects the finished paper to make sure that specifications have been met. Another semiskilled worker in the finishing department, the *paper sorter and counter* (D.O.T. 649.687), inspects sheets of paper for tears, dirt spots, and wrinkles, and counts them.

In converting plants, machines operated by semiskilled or skilled workers convert paper and paperboard into paper products such as envelopes, napkins, corrugated shipping containers, and folding or rigid boxes. Occupations in converting plants differ widely, depending largely on the product being manufactured. An example of a semiskilled worker in an envelope-making plant 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. He loads the rolls of blanks into the machine and supplies the machine with glue. An example of a skilled worker in a converting plant is the *corrugator operator* (D.O.T. 643.782) who regulates the speed of the machine that glues together three pieces of paperboard into corrugated paperboard (paperboard with alternate ridges and grooves) which is used in the manufacture of shipping containers. Another of the few skilled workers in a converting plant is the *printer-slotter operator* (D.O.T. 651.782) who sets, adjusts, and operates a machine which cuts and creases corrugated or paperboard sheets and prints designs or lettering on them. He also positions the printing plates and cutting devices and turns keys to control the distribution of printing ink, pressure of rollers, and speed of the machine. Another skilled job is that of the *die maker* (D.O.T. 739.381) who makes cutting dies used on machines that produce folding cartons (the familiar collapsible cartons used by clothing stores to pack purchases).



Paper machine operator and helper inspect and adjust flow of wet stock.

Converting plants employ thousands of workers to print text, designs, and lettering on paper products, such as cartons, bags, wallpaper, and envelopes. Among these are skilled compositors who set type, and pressmen 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 maintain, install, and repair machinery and equipment and

examine paper machine rolls, bearings, and pumps to insure that they are in good working condition. They also take apart and reassemble machines and equipment when they are moved about the plant.

Instrument repairmen install and service electrical, electronic, and mechanical instruments that measure and control the flow of pulp, paper, water, steam, and chemical additives. The job of instrument repairman is becoming increasingly important with the greater use of automatic control equipment in pulp and paper manufacturing.

Other important maintenance employees include *electricians,* who repair wiring, motors, 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, motors, and turbines.

Professional and Technical Occupations. The complexity of pulp and paper manufacturing requires the employment of thousands of workers with engineering, chemical, or other technical training and education. More than 15,000 scientists and engineers and 7,000 technicians were employed by the paper industry in early 1967.

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 properties. In addition, some chemists and engineers are employed as salesmen, supervisors of plant workers, or as administrators in positions requiring technical knowledge.

Chemical and mechanical engineers design, construct, operate, control, and improve pulp and papermaking equipment. They transform new pulp and papermaking techniques, developed in the laboratory, into practical production methods. Some chemical engineers are employed in plant jobs to supervise the application of pulp and paper technology to the production process.

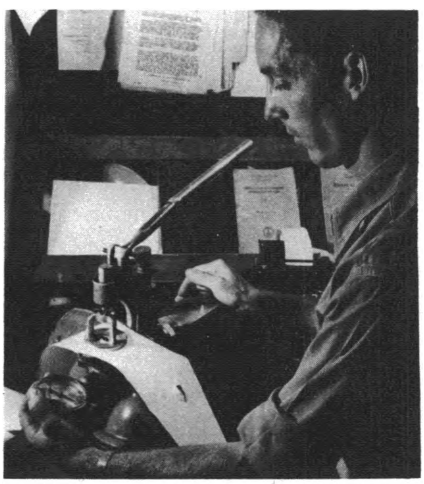
Electrical engineers are employed to supervise the design, development, and operation of electrical and electronic instruments and power-generating and distributing equipment.

Packaging engineers (D.O.T. 019.-187) design and supervise the production of paper and paperboard containers and packages. A few box manufacturers also employ artists who work out the letterings, designs, and colors for containers.

Professionally trained *foresters* manage large areas of timberland and assist in the wood-buying operations of pulp and paper companies.

Systems analysts and computer programers are becoming increasingly important to this industry. Computers are being used to coordinate the complex papermaking process by collecting and analyzing data on chemical mixtures, pulp flows, temperatures, pressures, machine speeds, and performing quality control tests. In addition, much of the accounting and management statistical data are processed by computers.

Frequent tests are performed during the manufacturing of pulp or paper to determine whether the size, weight, strength, color, and other properties of the material meet specified standards. Some of this testing is done by machine operators, but in many mills, testing technicians are employed. These employees, who have job titles such as *laboratory technician, paper tester, pulp tester, paper inspector,* and *chemical analyst,* work in plant laboratories. They use chemicals and laboratory testing equipment when performing tests. They also assist professional engineers and chemists in research and development activities. Depending on their training and experience, technicians perform simple, routine tests or do highly skilled technical or analytical work. Technicians working in laboratories conduct tests and record the results on charts or graphs for interpretation by engineers and chemists.



Technician tests bursting strength of paper sample.

Administrative, Clerical and Related Occupations. The paper industry employs many administrative, clerical, and other office personnel. At the top of the administrative group are the executives who make and administer company policy. Many of these are technically trained men. To do their work effectively, executives require information that must come from a large group of personnel. Some are accountants, purchasing agents, sales representatives, lawyers, and personnel employed in such activities as industrial relations, public relations, transportation, advertising, and market research. Clerical employees who keep records of personnel, payroll, inventories, sales, shipments, and plant maintenance are also employed in this industry.

Training, Other Qualifications, and Advancement

The training for new workers in the pulp, paper, and allied products industry ranges from a few days to years of preparation. Many operating jobs can be learned in a few days of on-the-job training. On the other hand, maintenance jobs, some machine operating jobs, and, particularly, engineering and scientific jobs require years of specialized training.

Paper and pulp companies generally hire inexperienced workers for processing and maintenance jobs and train them on the job. Many companies prefer to hire high school graduates between the ages of 18 and 25. Production workers usually start as laborers or helpers and advance along fairly well-defined paths to more skilled jobs. Maintenance jobs generally are filled by men trained in the plant. When no qualified workers are available, however, jobs are filled by hiring experienced men from outside the plant.

Most companies in this industry do not have formal apprenticeship programs to meet the needs of their own maintenance shops. In recent years, however, some of the large plants that make pulp, paper, and paperboard have started formal apprenticeship programs which require 3 to 4 or more years of training. Under these programs, young men are trained for skilled maintenance jobs such as machinist, electrician, millwright, and pipefitter. Generally, an applicant is given a physical examination, mechanical aptitude tests, and similar qualifying tests. Apprentice training includes both on-the-job training and classroom instruction related to the occupation. For example, the machinist apprentice receives classroom instruction in mathematics, blueprint reading, shop theory, and specialized subjects. During shop training, the apprentice learns the use and care of the tools of his trade.

A bachelor's degree from a recognized college is usually the minimum educational requirement for scientists, engineers, foresters, and other specialists employed by the industry. For research work, persons with advanced degrees are preferred. Many engineers and chemists (called *process engineers* and *paper chemists*) have specialized training in paper technology. A listing of the schools offering such training is available from the American Paper Institute, 260 Madison Ave., New York, N.Y. 10016. Many companies hire students specializing in papermaking for summer work, and upon graduation, frequently hire them on a permanent basis. Some associations, colleges, universities, 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 may work for brief periods in various plant operating divisions to gain a broad knowledge of pulp and paper manufacturing before being assigned to a particular department. Other firms immediately assign junior chemists or engineers to a specific research operation or maintenance unit.

Generally, no specialized education is required for laboratory assistants, testing technicians, or other kinds of technicians. Some employers, however, prefer to hire those who have had training in a technical institute or junior college. Training, usually, is on the job. Laboratory assistants, for example, begin in routine jobs and advance to positions of greater responsibility after they have acquired experience and demonstrated their ability to work without close supervision.

Administrative positions are filled frequently by men and women who have college degrees in business administration, marketing, accounting, industrial relations, or other specialized business fields. A knowledge of paper technology is helpful for administrative, sales, and related occupations. This is especially true of sales jobs, where customers often require technical assistance. Most pulp and paper companies employ clerks, bookkeepers, stenographers, and typists who have had commercial courses in high school or in business school.

Factors affecting advancement of plant workers include the length of time that a worker has held a plant job, how well he performs his job, and his physical condition. Promotion is generally limited to jobs within a "work area," which may be a department, section, or an operation on one type of machine. To become a paper machine tender, for example, the worker may start as a laborer, wrapping and sealing the finished rolls of paper as they come off the papermaking machine. As he gains experience and skill, he moves to more difficult assignments, finally becoming a machine tender in charge of the operation of a machine. These promotions may take many years, depending on the availability of jobs. Experience gained within a work area is generally not transferable; unskilled or semiskilled workers who transfer to jobs outside their senority area or to other plants usually must start again in entry jobs.

Many plant foremen and supervisors are former production workers. In some plants, qualified workers may be promoted directly to foreman or other supervisory positions. In others, workers are given training before they are eligible for promotion to higher level jobs. This training is often continued after the worker is promoted—through conferences, special plant training sessions, and sometimes by taking courses at universities or trade schools. Most firms provide some financial assistance for employees who take training courses outside their plant.

Employment Outlook

Young people will find many thousands of job openings annually during the remainder of the 1960's and throughout the 1970's in the pulp, paper, and allied products industry. Although employment is expected to increase by several thousand workers each year, most job opportunities will result from the need to replace experienced workers who retire, transfer to other fields of work, or die. Deaths and retirements alone are expected to provide about 14,000 job openings annually.

Employment in this industry is expected to continue to grow fastest in the South and West. Employment prospects, however, will remain good in the Northeast and North Central areas because of the need to replace experienced workers.

The production of paper is expected to increase as a result of the increased demand resulting from population growth, business expansion, and new uses of paper. For example, rising population will create a greater demand for textbooks, writing papers, periodicals, and newspapers. Business expansion will increase the need for paper products, such as business forms and packaging. The greater use of paper products, such as disposable garments, stretchable grocery bags, carpet backing, and refuse bags is also expected to stimulate paper production. Employment will increase at a slower rate than production, however, because of the increasing use of more efficient, labor-saving machinery and automatic control equipment.

Occupational groups in the industry are expected to increase at different rates. The numbers of engineers, scientists, technicians, and skilled workers, such as electricians, machinery repairmen, instrument repairmen, pipefitters, and millwrights are expected to increase faster than other occupational groups in the industry. Scientific and technical personnel will be needed as research and development activities increase, and more skilled maintenance and repair men will be required to service the growing inventory of complex machinery. The employment of administrative and clerical workers is also expected to increase at a faster pace than total employment. On the other hand, employment of semiskilled workers will grow more slowly, while the number of helpers, laborers, and other unskilled plant workers is expected to remain about the same or decline slightly as more automatic machinery is introduced.

Earnings and Working Conditions

Production workers in the paper and allied products industry had average earnings of $2.75 an hour, or $119.35 for a 43.4-hour workweek in 1966. In the same year, earnings of production workers in all manufacturing industries averaged $2.71 an hour or $111.92 for a 41.3-hour workweek.

The following data, collected from more than a score of union-management agreements in the paper industry, illustrate the approximate range of hourly wage rates for selected production and maintenance occupations for the country as a whole in 1966. Local wage rates within these ranges depend on factors such as type and size of mill and kind of machines used.

	Hourly rate ranges
Pulp plants	
Woodyard and wood preparation occupations:	
Crane operator	$2.50–$3.75
Barker, drum	2.20– 2.75
Chipperman	2.20– 3.00
Pulpmaking occupations:	
Digester operator (cook)	2.50– 4.54
Grinderman	2.20– 3.77
Screenman	2.30– 3.62
Bleacherman	2.40– 4.53
Pulp tester	2.30– 2.82
Paper and paperboard plants	
Stock preparation occupations:	
Head stock preparer (beater engineer)	2.70– 4.12
Beaterman	2.25– 3.50
Hydrapulper operator	2.30– 3.67
Machine room occupations:	
Paper machine tender	2.64– 4.50
Backtender	2.40– 4.00
Third hand	2.30– 3.70
Fourth hand	2.25– 3.15
Paper tester	2.30– 3.12
Finishing occupations:	
Supercalendar operator	2.60– 3.56
Rewinder operator	2.22– 3.20
Rewinder helper	2.31– 2.77
Cutters	2.22– 3.14
Converting plants	
Converting occupations:	
Envelope machine operator	1.60– 2.55
Corrugator operator	2.00– 3.07
Printer-slotter operator	1.95– 3.07
Diemaker	2.40– 3.70
Compositor	2.20– 3.72
Pressmen (printing)	2.20– 5.26
Miscellaneous occupations	
Maintenance occupations:	
Maintenance mechanic (also millwright, welder, pipesetter, sheet-metal worker, machinist, blacksmith, and boilermaker)	2.20– 3.78
Painter	2.15– 3.62
Carpenter	2.10– 3.78
Electrician	2.35– 3.86
Other:	
Oiler	2.30– 3.25
Trucker, power	2.20– 2.87

Most of the workers in pulp and paper producing operations work in plants that operate around the clock—three shifts a day, 7 days a week. Owing to the widespread industry practice of rotating shifts, production workers can expect to work on the evening or night shifts from time to time. Maintenance workers, for the most part, are employed on the regular day shift. Many plants pay between 5 and 11 cents more an hour for work on the evening shift and between 9 and 15 cents extra an hour for the night shift. Most workers in the industry have year-round employment because paper production is not subject to seasonal variations.

A work schedule of 40 hours a week is in effect in most mills. A few plants in the industry have a standard workweek of 36 hours or less.

Paid vacations are almost always provided and generally are based on length of service. In practically all mills, workers receive 1 week of vacation after 1 year of employment, 2 weeks after 3 to 5 years, and 3 weeks after 10 years or more. Many companies give 4 weeks' vacation to employees who have been with them 20 years and 6 weeks after 30 years. Nearly all workers receive paid holidays; the number of days range from 4 to 11 a year, with most mills granting 7 or 8 paid holidays.

Insurance or pension plans, financed at least partially by employers, are in effect in the majority of plants. These plans generally include life, sickness, accident, hospitalization, and surgical insurance benefits for the employee and, in some cases, his dependents. Employee stock-purchase and savings plans, to which the company makes contributions, are in effect in some firms.

Most pulp and papermaking jobs do not require strenuous physical effort. Some employees, however, work in hot, humid, and noisy areas. They may also be exposed to disagreeable odors from the chemicals used in the papermaking process, but the pulp and paper companies have made in-

tensive efforts in recent years to improve working conditions.

The rate of disabling injuries in this industry in recent years has been about the same as the average for all manufacturing. Protective clothing, warning signs in danger areas, locking devices on potentially dangerous equipment, guards and rails around moving machinery, and instruction in safe practices have been important in reducing the accident rate. Some of the more hazardous jobs are in converting plants, where many cutting tools and moving equipment are used.

A majority of the production workers in this industry are members of trade unions. A large number belong to either the International Brotherhood of Pulp, Sulphite and Paper Mill Workers or the United Papermakers and Paperworkers. Many printing workers in the industry belong to the International Printing Pressmen and Assistants' Union of North America. Some maintenance workers and other craftsmen belong to various craft unions.

Where To Go for More Information

American Forest Products Industries,
1835 K St. NW., Washington, D.C. 20036.

American Paper Institute,
260 Madison Ave., New York, N.Y. 10016.

Fibre Box Association,
224 South Michigan Ave., Chicago, Ill. 60604.

National Paper Box Manufacturers Association, Inc.
121 North Broad St., Philadelphia, Pa. 19107.

National Paper Trade Association, Inc.,
220 East 42d St., New York, N.Y. 10017.

United Papermakers and Paperworkers,
Papermakers Building, Albany, N.Y. 12201.

WHOLESALE AND RETAIL TRADE

Wholesaling and retailing are the final stages in the process of transferring goods from producers to consumers. Wholesalers assemble goods in large lots and distribute them to retail stores, industrial firms, and institutions such as schools and hospitals. Retailers sell goods directly to housewives and other 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 American industry—automobiles, clothing, food, furniture, and countless others.

In 1966, more than 13 million persons (not counting an estimated 2½ million self-employed and unpaid family workers) worked in wholesale and retail trade. Retail trade accounted for the largest number of workers—9.8 million—or about three-fourths of the employment in the broad industry group. The majority of these workers are employed in department stores, food stores, and in restaurants and other eating places. About 3½ million persons worked in wholesale trade.

Wholesale and retail businesses are a major source of job opportunities for women. In 1966, for example, about two-fifths of the workers employed in retail trade were women. They comprised about one-fifth of all workers employed in wholesale trade. Many women employed in retail stores work part time.

Workers with a wide range of education, training, skill, and ability are employed in wholesale and retail trade. In 1966, white-collar workers accounted for more than 3 out of every 5 persons employed in the major industry group, as shown in the accompanying table. Sales workers, the largest single group, make up nearly one-fourth of total industry employment. Managers and proprietors, the second largest group of workers, account for about 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 gasoline service stations. Clerical workers make up roughly one-sixth of the work force; many are employed by retail stores 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 are employed in both wholesale and retail trade.

Blue-collar workers (craftsmen, operatives, and laborers) accounted for nearly one-fourth of all employment in the industry group in 1966. Many are employed as mechanics and repairmen, auto parking attendants, drivers and deliverymen, meat cutters, and materials handlers. Most mechanics and auto parking attendants work for motor vehicle dealers and gasoline service stations. A large number of meat cutters are employed in wholesale grocery establishments and in supermarkets and other food stores.

Service workers accounted for roughly 1 out of every 7 workers employed in the industry group, mostly in retail trade. Food service workers such as waiters, cooks, and bartenders made up by far the largest concentration of persons employed in this occupational group. These workers were employed mainly in restaurants, drug stores and other retail businesses where food is served to the public. Other large groups of service workers were janitors, charwomen and cleaners, and guards and watchmen.

Major occupation group	*Estimated employment, 1966 (percent distribution)*
All occupation groups	100
Professional, technical, and kindred workers	2
Managers, officials, and proprietors	21
Clerical and kindred workers	16
Sales workers	24
Craftsmen, foremen, and kindred workers	7
Operatives and kindred workers	12
Service workers	14
Laborers	4

Employment in wholesale and retail trade is expected to increase moderately through the mid-1970's. The major factors contributing to the expected growth of employment in trade are increasing population and consumer expenditures, continuation of the population movement from rural to urban areas and from city to suburbs, and the trend toward keeping stores open longer hours. Growth in employment requirements is expected to be slowed somewhat by the increasing applications of labor-saving technology. For example, technological change may affect employment because of improvements in materials-handling methods, packaging innovations, the growing use of computers for inventory control and billing operations, the increasing use of mechanized equipment in supermarkets, and the continued growth in the number of stores using self-service operations.

Within retail trade, employment in department stores and in restaurants and other eating places is expected to rise the most rapidly. Among wholesale establishments, the rates of employment growth are likely to be highest in businesses that distribute

motor vehicles and automobile parts and in firms selling industrial machinery, equipment, and supplies.

The statement that follows covers the major occupations in restaurants, where, for example, large numbers of waiters and waitresses and cooks and chefs are employed. More detailed information about occupations that cut across many industries appear elsewhere in the *Handbook*. These include salesmen, office workers, shipping and receiving clerks, maintenance trades, and many others. (See index in the back of the book.)

Restaurant Industry

Millions of people eat in restaurants, cafeterias, snack bars, and other eating places daily. There are about 335,000 establishments whose main business is to serve food and beverages, and in early 1967, they employed about 2.0 million persons. Many other food-service workers were employed in establishments that serve meals in connection with some other activity—for example, drug and department stores, hotels, hospitals, schools and colleges operating lunchrooms for students and staff, and factories operating cafeterias for employees. Commercial airlines, railroads, and shiplines also employ food-service workers. (See statements on the two largest restaurant occupations—Waiters and Waitresses and Cooks and Chefs.)

Nature and Location

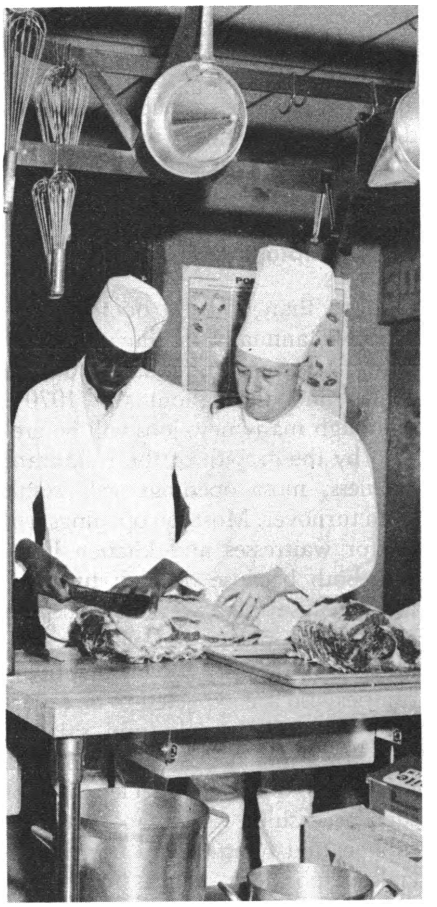
Establishments catering to the custom of "eating out" range from small diners to luxurious and expensive restaurants. The kind of food offered and the way it is served depend upon the size, location, and financing of the restaurant, as well as the type of customer it seeks to attract. For example, cafeterias, which usually are located downtown in office buildings or factories, or in a suburban shopping center, emphasize rapid service and inexpensive meals. In contrast, some restaurants cater to customers who have the time to eat in a leisurely manner and, thus, they serve elaborate meals which may include unusual dishes or "specialties of the house."

Most restaurants are small businesses with fewer than 10 paid employees; many of these are operated by their owners with no paid help or with only 1 or 2 part-time workers. A small proportion of all restaurants are run by proprietors or business firms owning more than one restaurant.

Although restaurant employment is concentrated in the States with the largest populations, and particularly in large cities, even very small communities usually have coffee shops, luncheonettes, and roadside diners.

Restaurant Workers

About three-fourths of all restaurant employees prepare and serve food, or do other kinds of related service work. The two largest service groups, each with several hundred thousands of workers, are waiters and waitresses and cooks and chefs. In addition to these two groups, there are counter attendants who serve food to customers in cafeterias; bartenders who mix and serve alcoholic drinks to customers; busboys and busgirls who clear tables, carry soiled dishes back to the kitchen, and sometimes set tables; kitchen workers who wash dishes and prepare vegetables; pantrymen and pantrywomen who prepare salads and certain other dishes for serving; and janitors and porters who dispose of trash and garbage, sweep and mop floors, and do other cleaning jobs. Some of these workers operate mechanical equipment, such as powerdriven dishwashers, floor polishers, vegetable slicers and peelers, and garbage disposal equipment. These specialized service jobs, however, are likely to be found only in the largest restaurants. In many small



eating places, waiters and waitresses clear and set up tables, sometimes prepare certain kinds of dishes, and help in the kitchen when they are not busy with customers.

Another large group of restaurant workers—about one-sixth of the total—are managers and proprietors. Many are owners and operators of small restaurants and, in addition to acting as managers, may do cooking and other work. Some are salaried employees managing restaurants for others.

All other restaurant workers combined account for less than one-tenth of total industry employment. They are employed principally in large restaurants. Most are clerical employees—cashiers who receive payments and make change for customers; food checkers who total the cost of the meals selected by cafeteria customers; and bookkeepers, stenographers, typists, and other

office workers. Some large restaurants also employ mechanics and other maintenance workers, accountants, advertising or public relations directors, personnel workers, and musicians or other entertainers.

Employment Outlook

More than 150,000 openings are expected annually in the restaurant industry during the remainder of the 1960's and throughout the 1970's. Although many new jobs will be created by the growth of the restaurant business, most openings will result from turnover. Most job openings will be for waitresses and kitchen helpers—both because of high turnover 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. There will be a number of openings in clerical jobs such as cashier, bookkeeper, stenographer, and typist, and a few in specialized positions such as food manager and dietitian.

The volume of restaurant business is expected to increase substantially over the next decade and the number of restaurant workers will rise rapidly. A growing population, increasing leisure time, and higher income levels, will raise the demand for restaurant services. More people will "eat out" as large numbers of housewives take outside employment and more people travel. Restaurants, hotel and motel dining rooms, school and factory lunchrooms, drugstore fountains, and even vending machines which dispense prepared foods will share in the increased business.

Manpower changes taking place within the restaurant industry will tend to reduce the number of employees needed to prepare and serve food. Restaurants—particularly those serving hundreds of meals daily—have achieved substantial reductions in manpower requirements during recent years, as managers have centralized the purchase of food supplies, introduced self-service, made use of precut meats and modern mechanical equipment, and otherwise increased the efficiency of their operations. Although further improvements of this kind can be expected, the number of restaurant employees is likely to increase rapidly as the volume of business continues to expand to meet the population's need for restaurant services.

Earnings and Working Conditions

The location, size, and type of restaurant affect earnings of restaurant workers. Other significant factors include the tipping practice for some occupations and the degree of unionization.

In early 1967, average earnings of nonsupervisory employees in the restaurant industry (excluding tips) were $47.60 a week or $1.40 an hour for a 34.0 hour workweek, compared with $68.57 a week or $1.91 an hour for a 35.9 hour workweek for workers in all retail trade establishments.

Limited wage data obtained from union-management contracts, in effect in early 1967, covering eating and drinking places in large metropolitan areas on the East and West Coasts and in the Midwest, provide an indication of earnings for various types of restaurant workers. In these contracts, straight-time hourly pay rates generally ranged from $1.90 to $3.35 for bartenders; $0.95 to $2.15 for bus boys and girls; $1.35 to $2.45 for cashiers; $1.25 to $2.25 for dishwashers; $1.50 to $2.50 for food checkers; $1.50 to $2.50 for kitchen helpers; $1.50 to $2.80 for pantry men and women; and $1.45 to $2.25 for porters. (For earnings of waiters and waitresses, and cooks and chefs, see statements on these occupations.) Most restaurant workers, however, are not covered by union-management contracts.

Salaries of employees in managerial positions have a wide range, mainly because of differences in duties and responsibilities. Many college graduates with specialized training in restaurant management received starting salaries ranging from $6,000 to $8,000 annually in 1967. Managerial trainees without this background often started at lower salaries. Many experienced restaurant managers receive salaries between $10,000 and $15,000 a year, depending on size, location, and type of restaurant. Salaries below this range may be paid to managers of small restaurants, and considerably higher salaries are likely to be paid to managers of exclusive restaurants and large restaurant chains.

In addition to wages, restaurant employees usually receive at least one free meal a day at their place of work and are often provided with uniforms. Waiters, waitresses, and bartenders also receive tips. Paid vacations and holidays are common and various types of health and insurance programs also are available. Most full-time restaurant workers have work schedules of 40 to 48 hours a week. 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 during the next period of heavy activity. Scheduled hours may include work in the late evenings and on holidays and weekends.

Many restaurants are air-conditioned, have convenient work areas, and are furnished with the latest equipment and laborsaving devices. In other restaurants—particularly small ones—working conditions may be less desirable. In all restaurants, workers spend long periods on their feet, and may be required to lift heavy trays and other objects, or work near hot ovens or steam tables. Work hazards include the possibility of burns; injury from knives, broken glass or china, or mechanical equipment; 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 contract agreements, however, varies greatly from city to city.

Where To Go for More Information

Additonal information about careers in the food service industry may be obtained by writing to:

Educational Director, National Restaurant Association,
1530 North Lake Shore Dr., Chicago, Ill. 60610.

A list of public and private schools and colleges offering courses which train restaurant employees may be obtained by writing to:

Council on Hotel, Restaurant and Institutional Education,
Statler Hall, Cornell University, Ithaca, N.Y. 14850.

Information on courses relating to 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 GOVERNMENT

Government service, one of the Nation's largest fields of employment, provided jobs for 11.5 million civilian workers in early 1967—about 1 out of every 7 persons employed in the United States. More than three-fourths of these workers are employed by State or local governments (county, city, town, village, or other local government division); the rest work for the Federal Government, either in the United States or abroad. Opportunities for jobs in government service will be very favorable through the 1970's. Rapid growth is expected in State and local government employment, continuing the trend in the post-World War II period. Only a small increase is expected in Federal employment. Large numbers of job opportunities will arise in Federal, State, and local governments from the need to replace workers who retire, or die, or leave government service. Hundreds of thousands of individuals will be hired each year for jobs in a wide variety of occupations.

Government employees are a significant part of the nonagricultural work force in every State. Their jobs are found not only in capital cities, county seats, and metropolitan areas, but also in small towns and villages, and even in remote and isolated places such as lighthouse installations and forest ranger stations.

Government Activities and Occupations

More than a third of all government workers are engaged in providing educational services (chart 53); the majority are in schools and colleges supported by State and local governments. In addition to teachers, employees in this field include administrative and clerical workers, maintenance workers, librarians, dietitians, nurses, and counselors. The great majority of workers in educational services are employed in elementary and secondary schools.

The second largest group of government workers is engaged in national defense activities. This group, numbering more than a million employees, includes civilians working in the Department of Defense and a few other defense-related agencies such as the Atomic Energy Commission. Within this group are administrative and clerical employees, doctors, nurses, teachers, engineers, scientists, technicians, and craftsmen and other manual workers. Employees in this group work in offices, research laboratories, navy yards, arsenals, and missile launching sites, and in hospitals and schools run by the military services.

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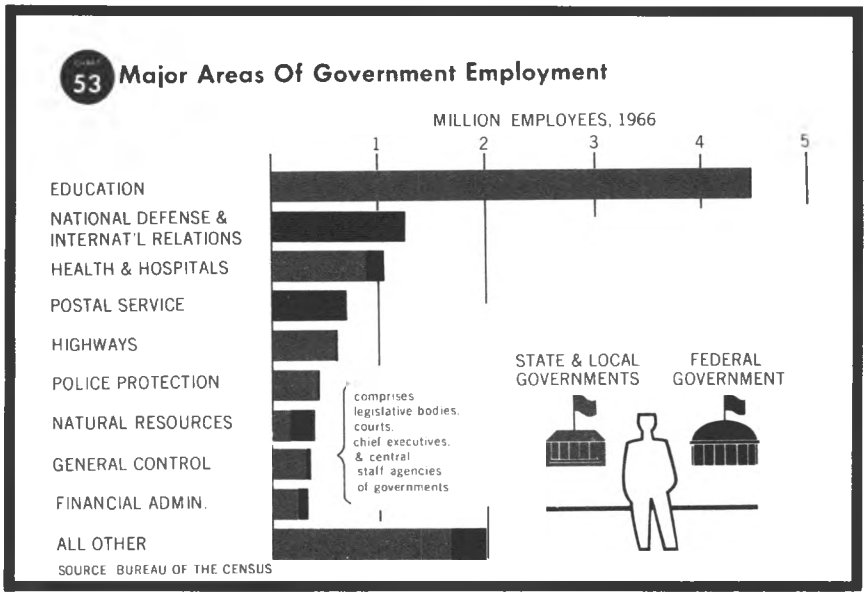
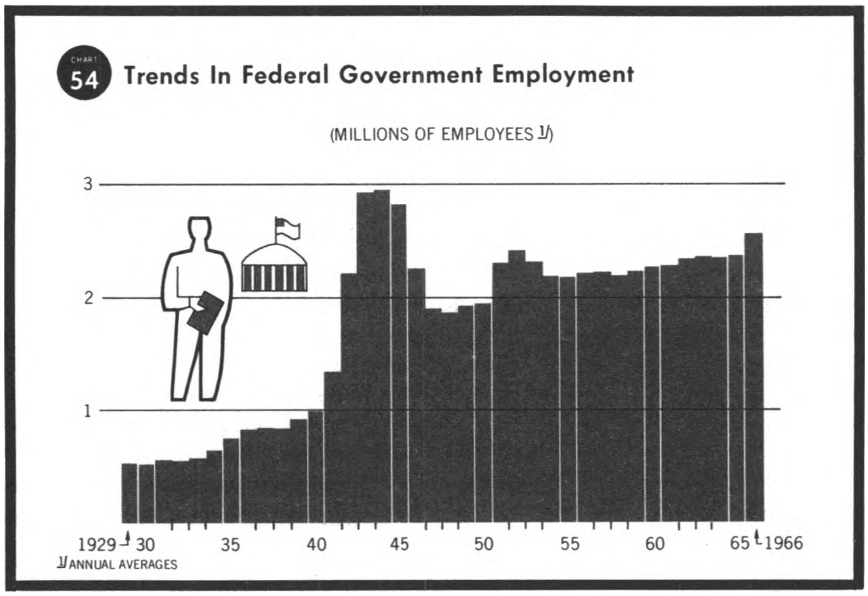




Large concentrations of employees are found in health services and hospitals, the postal service, and highway work. Workers are employed also by government agencies in activities such as housing and community development, police and fire protection, social security and public welfare services, transportation and public utilities, conservation of natural resources, tax enforcement and other financial functions, as well as in general administrative, judicial, and legislative activities.

Most employees in the health and hospital fields, in highway work, and in police and fire protection activities work for State and local government agencies. On the other hand, jobs in national defense and in the postal service are Federal, as are over half the jobs concerned with natural resources, such as those in the National Park and Forest Services.

Although the many different governmental activities require a diversified work force with many different levels of education, training, and skill, the majority of 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 occupations and occupational groups among service, craft, and other manual workers are aircraft and automotive mechanics and repairmen; policemen; firemen; truckdrivers; skilled maintenance workers (for example, carpenters,

painters, plumbers, and electricians); custodial workers; and laborers.

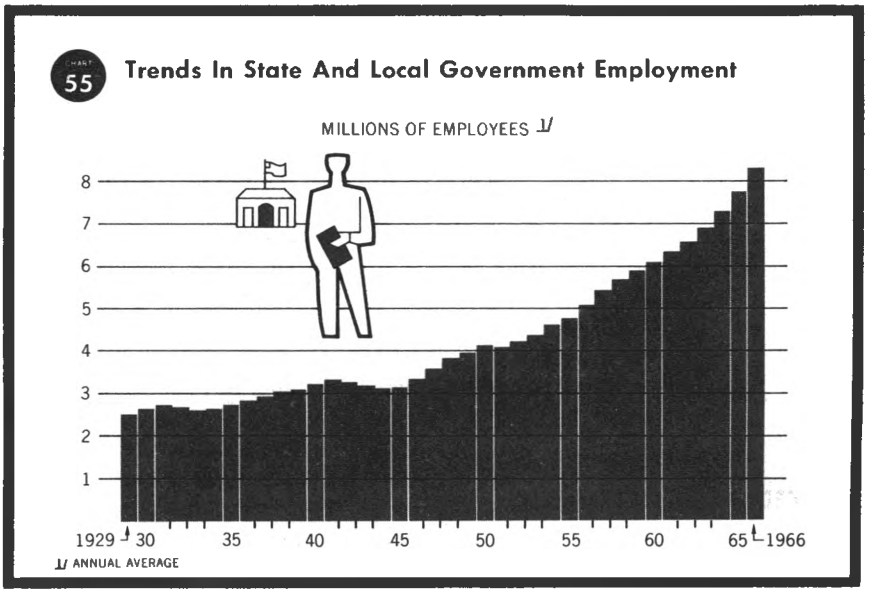
The wide variety of government functions requires employees in many different occupations. Because of the special character of many government activities, the occupational distribution of employment is very different from that in private industry, as shown in the distributions of employment in early 1967 which follows:

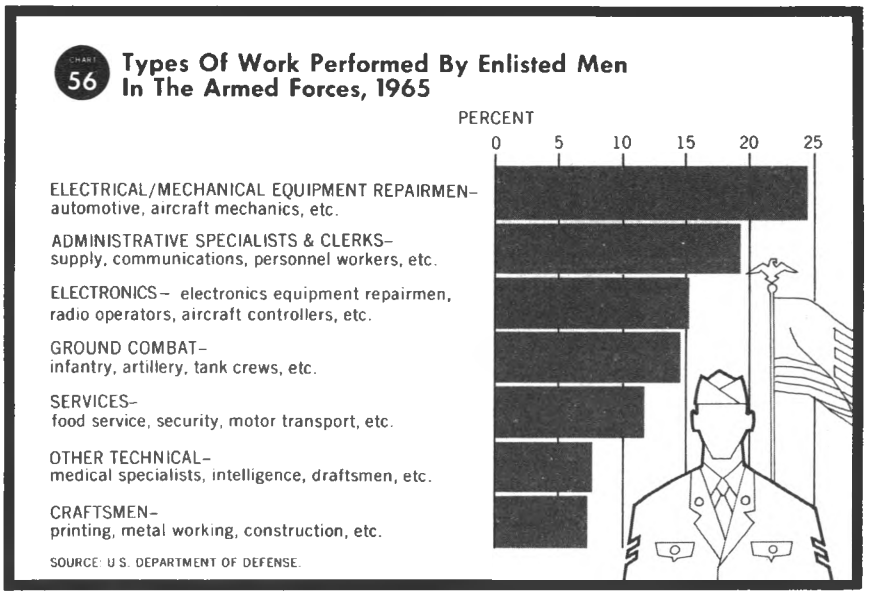
Occupational group	Percent of— Government employment [1]	Nongovernment employment
Total	100	100
White-collar workers	65	43
Professional and technical	36	9
Managers, officials, and proprietors	6	11
Clerical	23	15
Sales	(2)	7
Blue-collar workers	16	40
Craftsmen, foremen	8	14
Operatives	5	21
Nonfarm laborers	4	5
Service workers	19	12
Farm workers	(2)	5

[1] Data excluded overseas Federal employment.
[2] Less than 0.5 percent.

NOTE: Because of rounding, sums of individual items may not equal totals.

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 detailed information on post office occupations.





CIVILIAN EMPLOYMENT

FEDERAL GOVERNMENT

The Federal Government, the largest employer in the United States, had about 2.7 million civilian workers in early 1967. Federal employees are engaged in occupations representing nearly every kind of job in private employment, as well as some unique to the Federal Government such as postal clerk, border patrolman, immigration inspector, foreign service officer, and Internal Revenue agent. Practically all Federal employees work for the departments and agencies that make up the executive branch of the government. The others are employed in the legislative and judicial branches.

The executive branch includes the Office of the President, the 12 departments with cabinet representation, and a number of independent agencies, commissions, and boards. This branch is responsible for such activities 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 more than 1.2 million civilian workers in early 1967; the Post Office Department employed nearly 700,000. The Veterans Administration, the Department of Agriculture and the Department of Health, Education, and Welfare each had more than 100,000 workers. The remaining employees of the executive branch were distributed among more than 70 departments, agencies, commissions, offices, and boards. There were about 27,000 employees in the legislative branch, which includes the Congress, the Government Printing Office, the General Accounting Office, and the Library of Congress. About 6,000 persons were employed by the judicial branch, which includes the Supreme Court and the other United States courts.

The Federal Government employs about 1.4 million white-collar workers. Entrance requirements for white-collar jobs vary widely. Entrants into professional occupations are required to have highly specialized knowledge in a specified field, as evidenced by completion of a prescribed college course of study or, in many cases, the equivalent in experience. Occupations typical of this group are attorney, physicist, and engineer.

Entrants into administrative and managerial occupations usually are not required to have knowledge in a specialized field but rather, they must indicate by graduation from a 4-year college or by responsible job experience, that they have potential for future development. The entrant usually begins at a trainee level, and learns the duties of the job after he is hired. Typical jobs in this group are budget analyst, claims examiner, purchasing officer, administrative assistant, and personnel officer.

Technician, clerical, and aid-assistant jobs have entry level positions that usually are filled by persons having a high school education or the equivalent. For many of these positions, no prior experience or training is required. The entry level position is usually that of trainee, where the duties of the job are learned and skill is improved. Persons with junior college or technical school training, or those having specialized skills may enter these occupations at higher levels. Jobs typical of this group are engineering technician, supply clerk, clerk-typist, and nursing assistant.

With its wide range of responsibilities, the Federal Government employs white-collar workers in a great many occupational fields. About 130,000 Federal workers are employed in engineering and related fields. Included in this total are 75,000 engineers, representing virtually every branch and specialty of the profession. There are also large numbers of technician positions in areas such as engineering, electronics, surveying, and drafting. More than half of all engineering positions are in the Department of Defense.

Of the 110,000 workers employed in accounting and budgeting work, more than 30,000 are professional accountants and Internal Revenue agents. Among administrative and managerial occupations in the accounting and budgeting field are tax technician and budget administrator. There are also large numbers of clerical positions involving specialized accounting work. Accounting workers are employed throughout the Government, particularly in the Department of Defense, the Treasury Department, and the General Accounting Office.

About 90,000 Federal workers are employed in medical, public health, and hospital work. Professional occupations in this field include medical officer, nurse, dietitian, medical technologist, and physical therapist. Among technician and aid jobs are medical technician, medical laboratory aid, and nursing assistant. Employees in this field work primarily in the Veterans Administration; some others are in the Defense Department and Department of Health, Education, and Welfare.

Approximately 40,000 workers are employed in the biological and ag-

ricultural sciences. Large numbers of professional workers are engaged in forestry and soil conservation work. Others administer farm assistance programs. Technician and aid-assistant occupations include biology technician, forest and range fire control technician, soil conservation technician, and forestry technician. 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. Aids and technicians in this field include physical science technician, meteorological technician, and cartographic technician. Most of the 40,000 workers in the physical sciences are employed by the Department of Defense, National Aeronautics and Space Administration, the Department of Agriculture, the Department of Health, Education, and Welfare, and the Commerce Department.

Within the mathematics field are professional mathematicians and statisticians and mathematics technicians and statistical clerks. There are also a number of administrative positions in the related field of computer programing. Mathematics workers are employed primarily by the Defense Department, the National Aeronautics and Space Administration, the Department of Agriculture, the Commerce Department, and the Department of Health, Education, and Welfare. Positions in the computer field are found in most agencies.

In the field of law are about 11,000 employees in professional positions such as attorney, and others in administrative positions such as claims examiner. There are also many clerical positions involving 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, primarily in the Veterans Administration, and foreign affairs and international relations specialists in the Department of State. Among social science administrative workers are social insurance administrators in the Department of Health, Education, and Welfare, and intelligence specialists in the Department of Defense.

The Federal Government employs more than 50,000 persons in investigating and inspection work. Large numbers of these workers engage in administrative activities such as criminal investigation and food and customs inspection. These jobs are primarily in the Defense, Treasury, Justice, and Agriculture Departments.

Jobs concerned with purchasing, cataloging, storing, and distribution of supplies for the Federal Government provide employment for about 80,000 workers. 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.

Some 275,000 general clerical workers are employed in virtually every department and agency of the Federal Government. Included within this group are office machine operator, secretary, stenographer, clerk-typist, mail and file clerk, telephone operator, and other related workers. (In addition, there are several hundred thousand postal clerks employed by the Federal Government. See the following section on Post Office occupations for further information.)

Blue collar jobs—service, craft, and manual labor—provided employment to over 600,000 workers in early 1967. The majority of these workers were in establishments such as naval shipyards, arsenals, air bases, or army depots; or they worked on construction, harbor, flood-control, irrigation, or reclamation projects. Approximately three-fourths of these workers were employed by the Department of Defense. Others worked for the Veterans Administration, Post Office, General Services Administration, Department of the Interior, Tennessee Valley Authority, and Department of Agriculture. Within this group are a wide range of occupations, including many of the service, craft, and manual occupations found in industry.

The largest single group of blue-collar workers consists of mobile equipment operators and mechanics. Among these jobs are 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 repairman, maintenance electrician, electronics equipment repairman, and aircraft mechanic.

Skilled construction workers also are utilized widely throughout the Federal Government. Included in these fields are jobs such as carpenter, painter, plumber, steamfitter and pipefitter, and sheetmetal worker. Other large blue-collar occupations include warehouseman, food service worker, and printer.

Many skilled occupations may be entered through apprenticeship programs. To qualify, experience normally is not required, but a test may be given to indicate whether an applicant has an aptitude for the occupation. There are also jobs as helpers for skilled workers, such as carpenter's helper and machinist's helper.

(Detailed descriptions of the work duties of most white-collar, service, craft, and manual labor jobs mentioned above are provided in other sections of the *Handbook*.)

Federal employees are stationed in all parts of the United States and its territories and in many foreign countries. Although most Government departments and agencies have their headquarters offices in the Washington, D.C. metropolitan area, only 1 out of 10 (under 300,000) Federal

workers were employed in that area in early 1967. California had about 265,000 workers, and New York, Pennsylvania, Texas, and Illinois each had more than 100,000. About 40,000 U.S. citizens were employed in foreign countries and about 20,000 worked in U.S. territories.

The Merit System

Approximately 9 out of 10 jobs in the Federal Government in the United States are covered by the Civil Service Act. This act was passed by the Congress to ensure 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 U.S. Civil Service Commission, which administers the Civil Service Act, is responsible for examining and rating applicants and supplying Federal departments and agencies with names of persons eligible for the jobs to be filled.

Some Federal jobs are excepted from Civil Service requirements either by law or by action of the Civil Service Commission. However, most of the excepted positions are under separate merit systems of other agencies, such as the Foreign Service of the Department of State, the Department of Medicine and Surgery of the Veterans Administration, the Federal Bureau of Investigation, the Atomic Energy Commission, and the Tennessee Valley Authority. These agencies establish their own standards for the selection of new employees.

Civil service competitive examinations may be taken by all persons who are citizens of the United States, or who owe permanent allegiance to the United States (in the case of residents of American Samoa). To be eligible for appointment, an applicant must meet minimum age, training, and experience requirements for the particular position. A physical handicap will not in itself bar a person from a position if it does not interfere with his performance of the required duties. Examinations vary according to the types of positions for which they are held. Some examinations include written tests; others do not. Written examinations test the applicant's ability to do the job applied for or his ability to learn how to do it. In nonwritten examinations, applicants are rated on the basis of the experience and training described in their applications and any supporting evidence required by the Commission.

The Commission notifies applicants whether they have achieved eligible or ineligible ratings, and enters the names of eligible applicants on a list in the order of their scores. When a Federal agency requests names of eligible applicants for a job vacancy, the Commission sends the agency the names at the top of the appropriate list. The agency can select any one of the top three available eligibles. 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

Assuming defense activities approximate the level prior to the Vietnam build-up, it is anticipated that Federal employment will grow at a relatively slow rate during the 1970's.

A number of factors will tend to limit employment in many clerical and blue-collar occupations. Among these factors are the Federal Government's increasing use of laborsaving electronic data-processing and materials-handling equipment and the introduction of improved data-transmission and communications systems.

The manpower requirements of the Federal Government will, in general, tend to reflect the demand for services of an increasing population, and the country's domestic and international programs. These demands are expected to be reflected in rapidly rising requirements for professional, administrative, and technical workers.

Population expansion will lead to an increased employment of workers such as social security claims examiners, accounting and budget workers, and business and industry specialists. Laws providing new or expanded services to the public should result in increased employment of food and drug inspectors, highway engineers, and education personnel. Employment in legal and kindred occupations will increase also, mainly because of the existence of more laws and regulations to interpret, administer, and enforce; and more claims to examine for payment of retirement, disability, and death benefits.

Federal employment gains in science, engineering, and other fields will reflect the demands of vigorous national research and development efforts in a variety of programs, such as space exploration, urban development, military weapons, nuclear energy, medicine and health, transportation, and natural resource development. The number of engineers and engineering technicians will continue to grow rapidly. Employment of scientists, as well as that of technicians working with them, also will increase, and the number of medical personnel employed should continue to rise also.

Opportunities for employment in the Federal Government will continue to be favorable during the 1970's. In addition to new opportunities due to growth in employment, several hundred thousand job opportunities will become available each year because of the need to replace employees who leave the Federal service, retire, or die. Thus, many job opportunities will occur in occupations in which total employment is relatively stable, as well as in those in which it is rising.

Earnings, Advancement, and Working Conditions

Federal civilian employees are paid under several pay systems.

Pay rates of employees under the General Schedule are set by the Congress and are nationwide. This General Schedule provides a pay scale for employees in professional, administrative, technical, and clerical jobs, and for employees such as guards and messengers. General Schedule jobs are classified and arranged in 18 pay grades according to difficulty of the duties, and the responsibilities, knowledge, experience, or skill required. The distribution of Federal white-collar employees by grades, the entrance and maximum salaries, and the amount of periodic increases for each grade, are listed in the accompanying table.

Distribution of All Full-Time Federal Employees Under the General Schedule, June 30, 1966, by Grade Level and Salary Scale, Effective July 1, 1966

General schedule grade	Employees		Salaries		
	Number	Percent	Entrance	Periodic increases	Maximum
Total	1,118,577	100.0	.....	.....	.....
1	2,552	0.2	$3,609	$122	$4,707
2	58,040	4.9	3,925	133	5,122
3	145,839	12.3	4,269	144	5,565
4	171,776	14.5	4,776	160	6,216
5	145,585	12.2	5,331	176	6,915
6	55,945	4.7	5,867	198	7,649
7	101,010	8.5	6,451	213	8,368
8	18,054	1.5	7,068	235	9,183
9	130,443	11.0	7,696	261	10,045
10	15,785	1.3	8,421	288	11,013
11	125,320	10.5	9,221	315	12,056
12	97,151	8.2	10,927	379	14,338
13	69,326	5.8	12,873	448	16,905
14	32,074	2.7	15,106	523	19,813
15	15,644	1.3	17,550	607	23,013
16	2,874	0.2	20,075	670	25,435
17	812	0.1	22,760	760	25,800
18	347	(1)	25,890	.....	.....

[1] Less than 0.05 percent.

SOURCE: U.S. Civil Service Commission.

Employees in all grades except GS–18 receive within-grade increases after they have completed the required service periods, if their work is determined to be of an acceptable level of competence. Within-grade increases also may be given in recognition of high-quality service.

High school graduates with no related work experience are usually appointed to GS–2 positions, but some with special skills begin at GS–3. Graduates of 2-year junior colleges and technical schools can often begin at the GS–4 level. Most young people appointed to professional and administrative positions enter at grades GS–5 or GS–7 depending on their academic record. Those who hold a master's degree or the equivalent in education or experience usually enter at grade GS–7; they may enter at grade GS–9 if they are well qualified. In addition, the Federal Government also appoints very well-qualified, experienced people at the GS–11 level and above. These appointments are for such positions as psychologist, statistician, economist, writer and editor, budget analyst, accountant, and physicist.

New appointments usually are made at the minimum rate of the salary range for the appropriate grade. However, appointments in hard-to-fill positions frequently are made at a higher rate. For example, in 1967 engineers, accountants, mathematicians, certain physical scientists, and those in a few other specialized occupations were being recruited at above minimum rates.

Advancement depends upon ability, work performance, and generally, upon openings in jobs at higher grades. Employees frequently get promotions by qualifying for jobs at higher grades. Promotions also may be obtained when jobs are reclassified to a higher grade to reflect more difficult work assignments and increased responsibilities.

Craft, service, and manual workers employed by the Federal Government in the United States are paid under the wage board system. The pay rates for these workers are fixed by wage boards on the basis of "prevailing" rates paid for similar work by private employers in the areas where they work. The average (median) annual pay of employees under this system was $6,180 ($2.97 per hour) in June 1966. The following tabulation of Army–Air Force Wage Board pay rates for selected occupations illustrates hourly wage rates in early 1967 for workers paid under the wage board system.

Employees in agencies with separate merit systems are paid under acts other than those already mentioned.

The standard workweek for Federal Government employees is 40

City	*Common laborer*	*Electrician*	*Machinist general*
Atlanta, Ga	$2.17	$3.23	$3.37
Boston, Mass	2.45	3.36	3.50
Chicago, Ill	2.64	3.54	3.69
Denver, Colo	2.58	3.28	3.39
Hampton Roads, Va	2.17	3.18	3.30
Houston-Galveston, Tex	2.45	3.34	3.47
Los Angeles, Calif	2.76	3.63	3.75
New Orleans, La	2.31	3.32	3.44
New York, N.Y.-Newark, N.J	2.67	3.39	3.49
Pensacola, Fla	2.15	3.50	3.63
Philadelphia, Pa	2.66	3.37	3.49
Puget Sound, Wash	2.74	3.60	3.73
San Francisco, Calif	2.85	3.50	3.62
St. Louis, Mo	2.65	3.56	3.68
Washington, D.C	2.58	3.38	3.51

Source: Army–Air Force Wage Board, U.S. Department of Defense. Rates are for the second step of a 3-step pay range.

hours, and the pay schedules are based on this workweek. If an employee is required to work overtime he is either paid overtime rates for the additional time worked or given compensatory time off at a later date. Most employees usually work 8 hours a day, 5 days a week, Monday through Friday, but in some cases, the nature of the work may call for 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 during each of their first 3 years of service, then 20 days each year until they have completed 15 years; after 15 years, they earn 26 days of leave each year. In addition, they earn 13 days of paid sick leave a year. Eight paid holidays are observed annually. Employees 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 employee 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 supported in part by the Government; and training programs to develop maximum job proficiency and help employees achieve their highest potential. These training programs may be conducted in Government facilities or in outside educational facilities at Government expense.

Where To Go for More Information

Information on Federal employment opportunities is available from a number of sources. For college students, the college placement office is often a good source of such information. High school students in many localities may obtain information from their high school guidance counselors. Additional information may be obtained from State employment service offices and many post offices.

The Interagency Board system, operated by the U.S. Civil Service Commission, consists of boards of examiners located in population centers throughout the country. These boards announce and conduct examinations and evaluate and refer eligible applicants to employing agencies for their geographic areas. They also provide a complete one-stop information service, so that all interested citizens may learn of local and nationwide employment opportunities in the Federal Government service.

Information about a specific agency also may be obtained by contacting the agency directly.

Post Office Occupations

The mailman, carrying the familiar leather pouch over his shoulder, and the clerk standing behind the stamp window in the Post Office, are the two employees of the Federal Government most familiar to the general public. Although we all receive or send mail almost every day, few people realize how many workers are employed by the Post Office Department and exactly what they do.

In early 1967, more than 700,000 postal service workers—about 13 percent of whom were women—were employed in 38,000 separate installations throughout the country. These workers collected and distributed nearly 80 billion letters, post cards, newspapers, magazines, parcels, and other items of mail. They also provided special mail services such as registration (giving evidence of mailing and delivery), insurance, and c.o.d. (the collection of the price of an article, and the cost of postage from a customer upon delivery). Other services performed by these workers included selling United States savings stamps and money orders.

Although many postal jobs are located in small communities and in rural areas, postal employment is concentrated in large centers of population. The metropolitan area of New York City, in its various post offices and other installations, employs about 56,000 postal service workers, or 8 percent of all post office employees. Other large centers of postal employment include the Chicago, Los Angeles, Boston, and Philadelphia metropolitan areas.

Occupations in the Postal Service

Clerks are the largest group of postal workers, many of whom are employed in the workrooms behind the lobbies of large post offices. At all hours of the day and night, an endless flow of mail moves from unloading platforms through the workrooms and out to loading platforms. In the workrooms, the mail goes through a series of separations in which distribution clerks sort it according to type and destination. Other clerks work behind the windows in the lobbies of post offices selling stamps and money orders, registering and insuring mail, and accepting parcel post. In all, there were about 280,000 postal clerks employed throughout the country in early 1967.

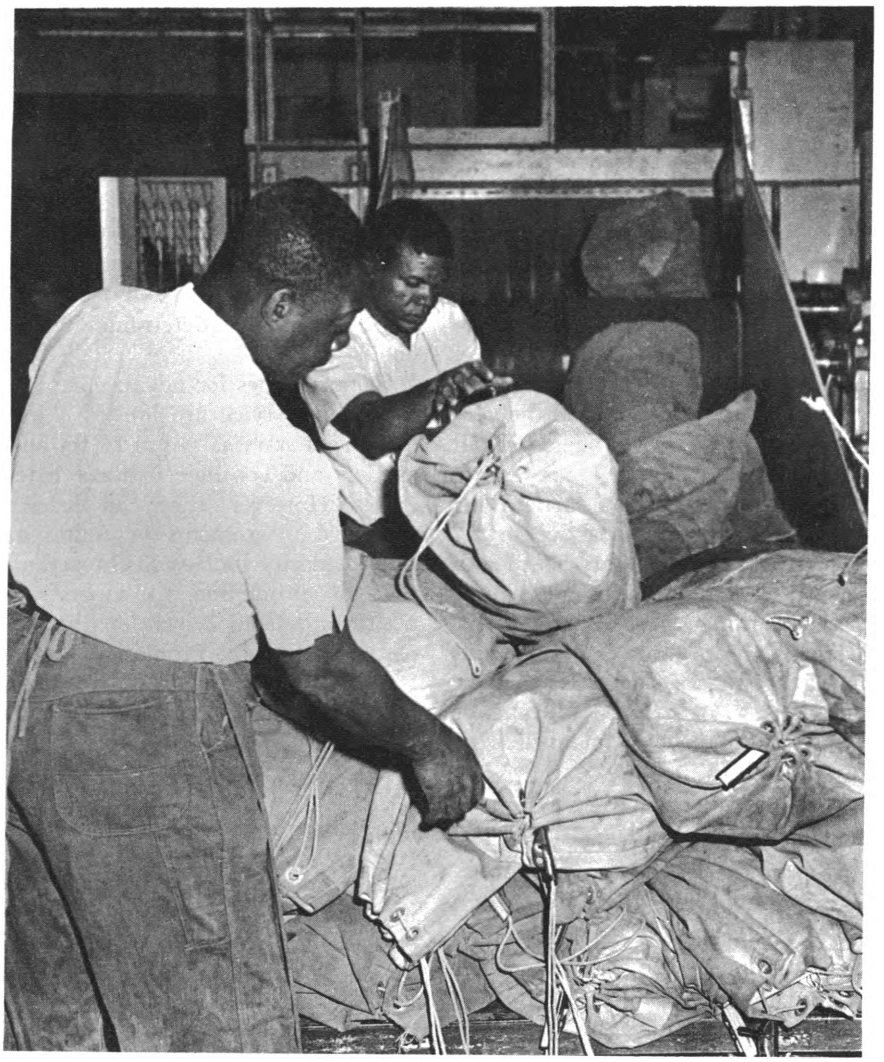
The city carriers are the second largest group of postal workers (over 190,000 in early 1967). These workers collect the mail which flows into city post offices and deliver it after it has been sorted by the distribution clerks. Rural carriers collect and deliver mail in the country and provide some of the services available in post offices. In early 1967, there were about 47,000 of these workers. Both city and rural carriers cover assigned routes on regular schedules. Some city carriers may work exclusively delivering parcel post or collecting mail. (A detailed description of the duties, training, qualifications, employment outlook, earnings, and working conditions for clerks and carriers appears

in later sections of this chapter.) A relatively small number of postal employees deliver only special delivery mail.

The "Star" route carrier transports mail under contract with the Post Office Department and is not an employee of the Department. There were approximately 12,000 "Star" route contracts in early 1967. The length of the routes varied considerably. Most of these carriers use trucks to carry the mail, but in certain remote areas where there are no roads, some use horses or boats.

In all post offices, bulk mail in large, heavy sacks must be loaded, unloaded, and moved about. In small post offices, clerks perform this work; in large post offices, mail handlers are employed to do most of it. Besides handling sacked mail, mail handlers separate the mail into parcel post, paper mail, and letter mail, and bring the mail to distribution clerks for processing. They also pick up the processed mail and put it into sacks. In early 1967, there were approximately 43,000 mail handlers.

About 33,000 postal supervisors and 11,000 postmasters directed the work of more than a half million clerks, carriers, and mail handlers in large post offices. (About 22,000 additional postmasters were employed in small post offices.)



Mail handlers are employed primarily in large post offices.

Approximately 21,000 maintenance service employees were concerned with the operation, maintenance, and protection of post office buildings and equipment. About 14,000 of these employees were janitors, building guards, elevator operators, and laborers. The remainder were mechanics or craftsmen, such as electricians, carpenters, and painters.

The Post Office Department employed more than 6,000 motor vehicle operators who drove trucks transportating bulk mail. About 4,600 other employees were concerned with the maintenance of the trucks driven by the motor vehicle operators as well as the rest of the post office vehicle fleet, including more than 57,000 trucks and mailsters (light three-wheel motor vehicles) driven by carriers. This group included garagemen who did routine servicing of vehicles, automotive mechanics, body and fender repairmen, and parts clerks.

About 1,000 postal inspectors are employed in the oldest investigative agency in the Federal Government—the Post Office Inspection Service. The main function of these employees is to inspect post offices to see that they are efficiently operated, that funds are being properly spent, and that postal laws and regulations are observed. Other principal duties include the prevention and detection of crimes, such as theft, forgery, and fraud involving use of the mail.

Another small, but very important, group of employees is made up of the several hundred workers who service semiautomatic and automatic mail processing equipment. As the mechanization of the Post Office Department continues, many more of these employees will be needed.

The Post Office Department also employs a small number of engineers, accountants, lawyers, and clerical and office workers, such as typists, stenographers, file clerks, and personnel assistants.

Training, Other Qualifications, and Advancement

To qualify for a job in the Post Office Department, an applicant must be a citizen, pass a civil service examination, and meet the minimum age requirements. Generally, the minimum age for post office employment is 18. For high school graduates, the minimum age limit is 16, except for jobs which may be considered hazardous or may require operation of a motor vehicle. Usually the applicant must also live in the area served by the particular post office in which he would work if selected for appointment. Before deciding on a permanent career in the Post Office Department, young men and women may work at a post office during the summer or at Christmas when temporary help is employed.

In recent years, most applicants who have been appointed to post office jobs were high school graduates. However, formal education or special training, although highly recommended, is not required for most post office entry jobs.

As in other civil service examinations, an honorably discharged war veteran has 5 extra points added to his passing grade and a disabled veteran receives 10 extra points. Veterans with compensable disabilities are placed at the top of the list. Certain jobs (guards, elevator operators, laborers, janitors, etc.) are reserved for veterans.

The names of applicants who pass an examination are placed on a register in the order of their scores. The appointing officer selects one of the top three available applicants to fill a job vacancy. Those not selected are put back on the list for consideration for the next job opening. Appointments to jobs are made without regard to an applicant's race, color, sex, marital status, national origin, or religion. Postal employees, like all other Federal workers, are subject to an investigation of their moral character and loyalty. Before an applicant may be appointed, he must pass a physical examination. Specific physical requirements differ according to the nature of the work in the various jobs.

In general, most of the work in the post office requires considerable physical stamina. An even more important quality is a good memory. Clerks, for example, must be able to remember the streets and numbers which make up a district so that they can sort mail rapidly.

Window clerks and carriers are expected to be pleasant and tactful in dealing with the public. Distribution clerks in the large post offices have no contact with the public. However, since they have constant deadlines and work in large groups in close quarters, they are expected to get along well with coworkers.

All new postal employees serve a probationary period of 1 year. During this period the employee's conduct and performance are observed and, if warranted, he may be dismissed at any time.

The amount of training given to a new employee varies considerably, depending on his job and the size of the post office. On-the-job training is generally provided by the supervisor or an experienced employee. The new employee performs the simpler tasks of his job from the very first day. To become proficient in all of his work, however, takes much longer. The new clerk or carrier must spend many hours of practice sorting mail to get the necessary speed and accuracy. In addition, he must spend time learning postal regulations, schemes, and routes. (A scheme is a group of places consisting of States, cities, zones, or streets and numbers arranged for the convenient delivery of mail.)

Career postal employees are classified as regulars or substitutes. The great majority begin as substitutes. The positions of clerk, city carrier, special delivery messenger, mail handler, and positions in the vehicle service are initially filled by substitute appointment from the civil service register. Substitutes replace regular employees who are absent and also supplement the regular work force. As vacancies occur in the regular work force, they are filled by converting substitutes to regulars according to seniority.

Some jobs, even at the same salary level, may be considered more desirable than others because of the type of work performed, the hours of work, or for other reasons. When a vacancy occurs, it is posted and employees in the occupational group may submit "bids" (written requests for assignment to the vacancy). The preferred assignment is given to the qualified bidder who has the longest service. A few nonsupervisory jobs at a higher salary level may also be bid on.

For assignment to most higher level positions, however, merit, not seniority, is the controlling factor. Qualifications for promotion may include experience, training or education, aptitude as measured by a written examination or performance test, work record, and personal characteristics. (The last mentioned is particularly important in supervisory positions.) If the leading candidates for the job are about equally qualified, length of service determines which one is selected.

Opportunities for advancement in the postal service are limited. Most employees start as postal clerks and carriers and continue in those categories. However, they can receive preferred assignments or routes as their seniority increases. Opportunities for promotion to supervisory positions depend largely on the size of the post office. Promotion opportunities are better in large post offices, where each department has a supervisor, than in small post offices.

Employment Outlook

The Post Office Department will hire many thousands of young workers each year during the remainder of the 1960's and throughout the 1970's. Most job opportunities will arise from the need to replace employees who retire, die, or transfer to other employment. Deaths and retirements

alone should provide more than 17,000 jobs openings annually. In addition, some job openings will result from an expected moderate increase in post office employment.

As in the past, the volume of mail is expected to grow rapidly, largely as a result of an expanding population and rising business activity. Employment, however, is expected to grow at a slower rate than mail volume because of the continuing modernization of postal facilities and equipment which is increasing the amount of mail an individual employee can handle. In advanced stages of development, and in actual use at a few post offices, are a variety of electromechanical and electronic devices and controls which receive, process, and dispatch mail at a considerable saving in postal clerk manpower. Light weight vehicles (mailsters) are also in use on a number of residential routes, and additional ones are being purchased. The carrier provided with such a vehicle delivers parcel post as well as letter mail and paper mail. For every 10 routes so mechanized, one less parcel post carrier is required. Neverthless, because of the large increase expected in mail volume in the next decade, employment should still continue to grow.

Earnings and Working Conditions

Almost all postal employees are paid under the Postal Field Service Compensation Act, under which three separate pay schedules are provided. One schedule determines the salaries of rural carriers and is based primarily on route length. Another schedule covers fourth-class postmasters, whose compensation is based on the annual receipts of their post offices. Salaries of all other postal field service employees are determined under the third schedule, the Postal Field Service Schedule (PFS). The grade level of a position under this schedule depends upon the duties and responsibilities, and the knowledge, experience, or skill required.

In all three pay schedules, employees receive periodic "step" increases, up to a specified maximum, if their job performance is satisfactory. A distribution of employees by PFS level, together with the entrance and maximum salary, as well as the amount of the periodic increases for each grade, is shown in the accompanying table.

Most regular postal employees work an 8-hour day, 5 days a week. If a regular employee works more than 8 hours in a day or 40 hours in a week, he is paid at 1½ times the regular rate for the extra hours worked. A substitute employee receives overtime pay if he works more than 40 hours in a week.

Postal employees, both substitutes and regulars, receive the same vacation, sick leave, and other benefits available to Federal employees generally. They earn 13 days' annual (vacation) leave during each of their first 3 years of service, then 20 days each year until they have completed 15 years of service; and after that, 26 days of leave a year. In addition, they earn 13 days of paid sick leave a year.

Postal field service level	Employees [1]		Salary schedules [2]		
	Number	Percent of total	Entrance	Periodic increase	Maximum
Total employees under PFS schedule [3]	618,419	100.0	.....	.....	.....
1	4,726	0.8	$4,204	$139	$5,733
2	25,653	4.1	4,552	149	6,191
3	64,008	10.4	4,919	166	6,745
4	430,434	69.6	5,331	176	7,267
5	35,282	5.7	5,697	191	7,798
6	11,983	1.9	6,113	203	8,346
7	17,208	2.8	6,545	218	8,725
8	10,869	1.8	7,088	235	9,203
9	8,082	1.3	7,665	255	9,960
10	3,962	.6	8,345	283	10,892
11	2,169	.4	9,221	315	12,056
12	1,317	.2	10,202	347	13,325
13	1,147	.2	11,274	389	14,775
14	839	.1	12,427	432	16,315
15	404	.1	13,736	474	18,002
16	202	(4)	15,179	528	19,931
17	82	(4)	16,793	587	22,076
18	19	(4)	18,530	615	24,065
19	19	(4)	20,525	685	25,320
20	14	(4)	22,760	760	25,800

[1] As of June 30, 1966.
[2] In effect as of March 10, 1967.
[3] Does not include postmasters of fourth-class offices and rural carriers.
[4] Less than 0.05 percent.

NOTE.—Because of rounding, sums of individual items may not equal 100.

Source: U.S. Post Office Department.

Other benefits include: Retirement and survivorship annuities, optional participation in low-cost group life insurance and health insurance programs supported in part by the Federal Government, and compensation to employees injured in the performance of duty.

Postal workers are covered by the civil service system and enjoy a maximum of job security. The physical surroundings usually are pleasant. Most postal employees have frequent contact with the public or other employees, a work situation which many people enjoy. Prospective employees have the opportunity to choose between outdoor work (carrier) and indoor work (postal clerk).

Some of the work requires considerable physical exertion, such as walking, reaching, lifting, and carrying heavy sacks of mail. Some of the work is also of a routine nature.

Most postal employees are members of unions. There are more than a dozen unions which represent postal employees.

Where To Go for More Information

Information on post office employment opportunities and civil service competitive examinations for postal

jobs may be obtained from the local post office, the regional offices of the Civil Service Commission, or State employment service offices.

MAIL CARRIERS

(D.O.T. 233.388)

Nature of Work

Most carriers or mailmen, as they are commonly known, travel along predetermined routes delivering and collecting mail. Some city carriers (usually new workers), however, only collect mail from street letter boxes and from office mail chutes. Other carriers drive trucks and deliver parcel post; still others—called rural carriers—deliver and collect mail along routes usually located outside the city limits. In addition, they may sell stamps and money orders and accept parcel post, letters, and packages to be registered or insured. All carriers answer questions about postal regulations and service and provide change of address cards and other postal forms when requested.

The carrier begins his work early in the morning. He spends a few hours at the post office arranging the mail in the order it will be delivered. He readdresses mail to be forwarded and marks the mail of persons who have moved without leaving forwarding addresses to show how it should be handled. He also prepares reminders for special mail, such as insured mail which requires a signature by the person receiving it. He signs receipts for postage due and c.o.d. mail.

When the mail has been arranged, it is assembled into bundles. The carrier's mail is generally too heavy for all of it to be carried at one time. (Thirty-five pounds is the maximum to be carried.) He therefore makes up larger bundles of mail—called "relays"—which are transported in trucks by other carriers and placed in storage (relay) boxes at intervals along the route.

The carrier starts on his route with the mail in a large leather bag, which is carried over his shoulder, or in a mail cart. In some cities, a carrier who is assigned an outlying residential route may use a light, three-wheeled motor vehicle called a "mailster" to deliver mail.

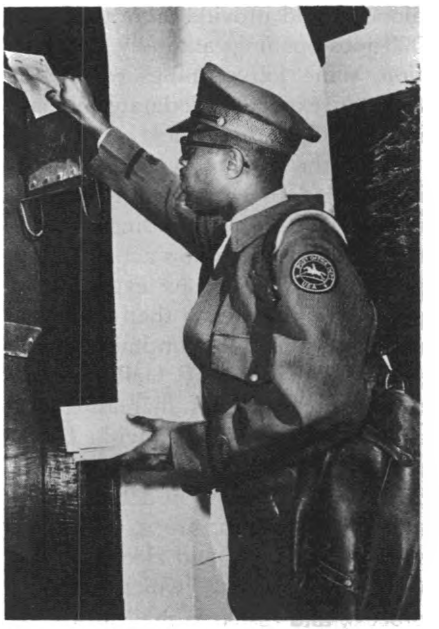
On his route, the carrier goes from door to door, placing mail in boxes or through door slots. Mail is delivered throughout residential areas and office buildings served by elevators; however, in apartment houses, the mail is usually deposited in the boxes located near the front entrances. The carrier collects charges on postage-due and c.o.d. mail and obtains receipts for registered and certain insured mail.

When the carrier completes his route, he returns to the post office, bringing with him the letters left in mail boxes for mailing, and the mail he has collected from street letter boxes. He then arranges the letters he brought back so that stamps can be easily canceled and turns in the money and receipts he has collected during the day.

Training, Other Qualifications, and Advancement

To be considered for a carrier position, an applicant must be a citizen, meet the minimum age requirements, and pass a civil service examination. To be eligible for employment, most post offices require carrier applicants to be at least 18 years of age and pass a road test.

The same written civil service examination is given to applicants interested in either city carrier or postal clerk jobs. The written test consists of three parts. The longest part is a test of general intelligence, including questions on simple arithmetic, spelling, vocabulary, and reading comprehension. Another part tests the applicant's reading accuracy by requiring him to compare addresses arranged in pairs and to indicate whether they



are the same or different. The third part tests the applicant's ability to follow instructions carefully in making changes on a mailing scheme and in routing mail. Sample questions are sent to applicants with their notices of admission to the written tests.

Persons being considered for appointment as carriers are given a road test in which they must demonstrate their ability to handle, under various driving conditions, vehicles of the type and size they may be required to operate as carriers. At the time of appointment, the applicant must have a valid driver's license.

Applicants must pass a rigorous physical examination to determine whether they are able to stand the physical exertion required to perform the jobs. They must be able to stand for long periods of time, walk considerable distances, and handle heavy sacks of mail. Carriers must weigh at least 125 pounds. The minimum weight requirements may be waived for veterans, and for those who can pass a strength test consisting of lifting a sack weighing 80 pounds to their shoulders.

In addition to good health and physical stamina, a carrier should have a good memory. He relies on his memory in arranging the mail on his route in the proper order for delivery.

He must also memorize many postal rules and regulations. Other desirable qualities for a carrier are a pleasant manner and a neat appearance.

City carriers begin as substitutes and become regulars in order of seniority as vacancies occur. New carriers are taught the procedures for casing mail. Substitute city carriers may be assigned to postal-clerk duties and may sometimes be required to pass examinations on schemes of city "primary distribution" (first sorting by destination). About once a year, the carrier is checked on how well he performs his job.

Promotional opportunities for carriers are limited. Some carriers in city delivery service may advance to special nonsupervisory jobs such as carrier-technician or to jobs as carrier foreman and route examiner. Such employees, however, constitute only a small percentage of the number of city carriers. Most carriers, therefore, can only look forward to preferred routes as their seniority increases.

Employment Outlook

There will be many thousands of job openings for mail carriers during the remainder of the 1960's and throughout the 1970's. Many of these openings will result from the need to replace carriers who die, retire, or transfer to other work. Deaths and retirements alone should provide about 4,000 job opportunities annually. Additional job openings will result from an expected moderate increase in mail carrier employment.

Most job openings will be for city carriers. Employment of city carriers is expected to increase moderately as population continues to grow and spread out into suburban areas. However, such innovations as the increasing use of motor vehicles will probably limit employment growth.

Employment of rural carriers is expected to show little or no change in future years. Although new rural routes will be established to provide service in areas where fourth-class post offices are discontinued, many rural routes near large cities will be connected to city routes as the suburbs continue to spread.

Earnings and Working Conditions

Almost all city carriers begin as substitutes and receive $2.64 an hour. If their work is satisfactory, they receive an increase of 8 or 9 cents an hour each year for the first 6 years, and an increase of 8 or 9 cents an hour every 3 years thereafter, up to a maximum of $3.60 an hour. Regular city carriers are paid on an annual basis, beginning at $5,331 and increasing each year by $176 for the first 6 years, and by $176 every 3 years thereafter, up to a maximum of $7,267 after 21 years of service. All city carriers receive an allowance for the postal uniforms they are required to wear.

Rural carriers are paid a salary based on a combination of fixed annual compensation and the number of miles in their routes. In addition, they receive a maintenance allowance of 12 cents a mile for the use of their automobiles. A carrier with a 61-mile route (the average route length in 1966) would receive $5,806 a year in his first year and $6,862 in his seventh year. The allowance for the use of his automobile would give him an additional $7.32 a day.

A substitute rural carrier receives a base pay for the days he works, and, in addition, receives the same mileage compensation and automobile maintenance allowance as the regular carrier whose route he is covering.

The regular city carrier usually works an 8-hour day, 5 days a week. If he works more than 8 hours a day or 40 hours a week, he is paid at 1½ times his regular rate for the extra hours worked. A substitute city carrier receives overtime pay if he works more than 40 hours a week. Both regular and substitute city carriers receive 10-percent additional pay for work between 6 p.m. and 6 a.m. Rural carriers work a 6-day week.

Most carriers begin work very early in the morning. In some cities, carriers with routes in the business district report to the post office at 6 a.m. They work outdoors in the pleasant spring and fall weather, as well as under the hot summer sun and in the snow and ice of winter.

The carrier must cover his route within certain time limits. Otherwise, he is on his own while delivering the mail and has the opportunity of meeting different people along his route.

Most carriers have to do a great deal of walking with a mail bag slung over the shoulder. Even the carriers who drive vehicles have to do considerable walking and lift heavy sacks of parcel post while loading their vehicles. They may also carry heavy packages in making deliveries to business establishments or homes.

POSTAL CLERKS

(D.O.T. 232.368)

Nature of Work

The great majority of post office clerks—called distribution clerks—work behind the scenes and are never seen by the public. These workers sort incoming and outgoing mail in post offices. Other clerks—called window clerks—serve the public at the windows in post office lobbies, selling stamps and money orders and providing other services. In small post offices, the same clerks may do both types of work.

After the carriers collect the mail, they bring it into the post office workroom and dump it onto long tables. Here distribution clerks (and sometimes mail handlers) separate the mail into parcel post, paper mail, and letter mail. They then "face" (stamps down and facing the same direction) the letter mail and feed it into stamp canceling machines. (Many large post offices have machines which can au-

Postal clerk feeds letters into canceling machine.

tomatically "find" and cancel stamps.) Parcel post and paper mail are canceled by hand. After the stamps have been canceled, the mail is taken to different sections where other clerks begin a series of sortings according to destination.

Clerks who process letter mail separate it into even finer groupings. They begin by making a "primary distribution" (first sorting by destination) of the letters. The letters are sorted into a "letter case" (an upright box with compartments) which usually has one or two compartments for local mail, a number of compartments for groups of distant States, a compartment for each of the nearby States, one for each of the largest cities in the country, etc.

The primary distribution is followed by one or more "secondary" distributions in which the mail from each compartment in the primary case is sorted in greater detail. For example, clerks gather the local mail from the appropriate compartment in each primary case and combine it with the local mail which has come in from outside the city to be sorted in a secondary case. The clerks who sort local mail must know the streets and street numbers that are included in each postal zone, branch, or station. Mail is sometimes further separated by sections within postal zones so that when it arrives at a neighborhood post office, it is almost ready for immediate delivery by carriers.

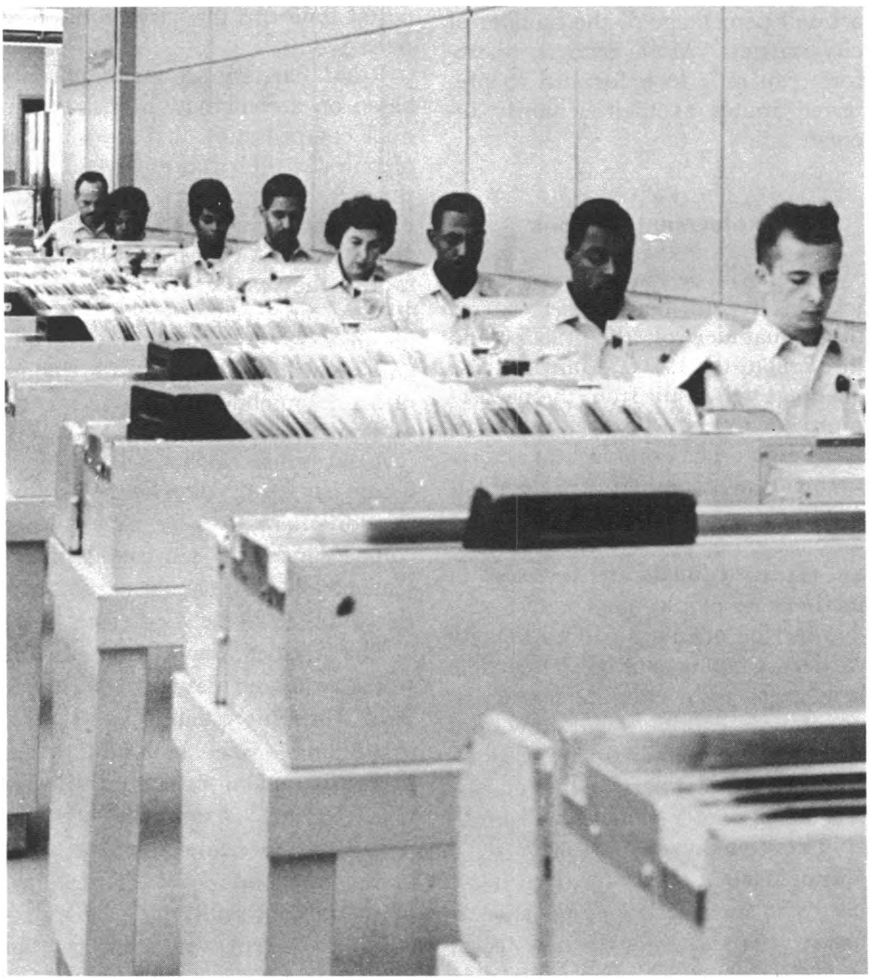
Parcel post is sorted in the same way as letter mail. However, clerks use chutes, conveyors, slides, tables, and bags or other containers instead of letter cases when sorting parcels.

Some distribution clerks separate mail while traveling in trains or buses. Other clerks, known as transfer clerks, arrange for the mail to be moved to and from trains promptly and at the lowest possible cost.

Distribution clerk (machines) is a relatively new post office occupation. Clerks in this occupation are employed in some of the large post offices and operate electronic machines that distribute mail automatically. For example, a clerk using an electronic sorting machine merely pushes buttons to direct letters automatically to the proper compartments. These clerks must know distribution schemes, as do the clerks who sort mail by hand.

Distribution clerks have to work quickly because mail must be delivered as speedily as possible. Accuracy is also most important because placing a letter in the wrong compartment of a case will result in delayed delivery.

Window clerks weigh letters and



Postal workers sort letters rapidly with high speed machines.

parcels and determine the amount of postage required. They check packages and envelopes to see if their sizes, shapes, and condition are acceptable. They register and insure mail and sell the postage or collect the charges required for the service.

Window clerks also sell and cash money orders, distribute general delivery mail and parcels and other undeliverable mail being held at the post offices, and rent post office boxes. They also answer questions on rates, mailing restrictions, and other postal matters. Occasionally, a window clerk will help someone file a claim for mail that has been damaged. In large post offices, a window clerk will perform only one or two of these services. Thus, in these offices there are such clerks as registry, stamp, and money order clerks.

Training, Other Qualifications, and Advancement

Some of the requirements for entry as a postal clerk are the same as for any post office job and are discussed earlier in this chapter. The written civil service examination and physical requirements are the same as for carrier applicants and are discussed on page 606. A special type of examination, including a machine aptitude test, is given to applicants for the position of distribution clerk (machines).

Good health and a good memory are essential for those who want to be postal clerks. The work requires much stretching and lifting, walking and standing, and throwing of packages of mail as well as handling of heavy sacks of mail. Clerks have to memorize distribution schemes and many postal rules and regulations. They also need good eye-hand coordination, and the ability to read rapidly.

The distribution clerk works closely with other clerks, frequently under the tension and strain of meeting mailing deadlines and should, therefore, be even-tempered. The window clerk is in constant contact with the public, and considerable tact may be required in his replies to questions and complaints.

Most postal clerks begin as substitutes and become regulars in order of seniority as vacancies occur. New clerks receive brief instructions in their duties. They are given a primary scheme to learn and, when they have mastered this, they are given one or two secondary schemes to learn. They practice on their own time to achieve speed and accuracy. All postal clerks are required periodically to pass scheme examinations on the work for which they are responsible.

Promotion opportunities for postal clerks are limited. In large post offices, there are some special postal clerk jobs at a higher level, as well as some scheme examiner jobs, mail dispatch expediter jobs, and foreman jobs. Compared with the large number of postal clerk jobs, these "higher level" jobs are relatively few. Most postal clerks, therefore, do not advance to a higher level. However, as their seniority increases, they may receive preferred assignments such as the day shift, or a window clerk job.

Employment Outlook

There will be many thousands of job openings for postal clerks during the remainder of the 1960's and throughout the 1970's. Most of these openings will result from the need to replace clerks who retire, die or transfer to other fields of work. Deaths and retirements alone should provide nearly 6,000 job opportunities annually. Additional job opportunities will result from an expected moderate increase in postal clerk employment.

Employment requirements for postal clerks are expected to increase mainly as a result of a substantial increase in the volume of mail, arising from increases in population and business activity. However, employment is expected to grow at a slower rate than the volume of mail because of technological developments which are increasing the amount of mail a clerk can handle.

Earnings and Working Conditions

Most postal clerks are at the same grade level as city carriers and the earnings information for clerks is, therefore, the same as that presented on page 605. Clerks working on the night shift receive 10-percent additional pay. Postal clerks who separate mail while traveling in trains or buses receive higher salaries than clerks in large post offices, and the clerks in large post offices receive higher salaries than those in the small (third-class) post offices.

The working conditions of post office clerks differ according to the specific work assignment and the amount and kind of laborsaving machinery in the particular post office. Generally, distribution clerks work in close contact with each other and often there is a spirit of friendliness and cooperation within a group. Much of the work is routine, however, and may become boring unless the clerk accepts the challenge of improving his speed and accuracy. The work is also physically demanding. The clerk has to do considerable walking, throwing, and reaching. He is on his feet much of the time and may have to handle heavy sacks of mail.

The work of the window clerk requires considerably less physical exertion. It is usually more varied, and the window clerk also has the constant contact with the public to keep him interested. Furthermore, very few window clerks work at night. For these reasons, the job of the window clerk is generally regarded as a preferred assignment.

STATE AND LOCAL GOVERNMENTS

State and local governments provide a very large and growing source of job opportunities in many different

occupational fields. In 1966, about 8.6 million workers were employed in State and local government agencies. Three-fourths of these workers were with units of local governments, such as counties, municipalities, towns, and school districts, and one-fourth were employed in State government agencies.

About 4.4 million employees, or over half of all State and local government workers, were employed in public schools, colleges, or other educational services in 1966.

In addition to more than 2.5 million classroom and college teachers, school systems and colleges and universities also employ administrative personnel, librarians, guidance counselors, nurses, dietitians, clerks, and maintenance workers. Almost 80 percent of employment in the field of education is in elementary and secondary schools, which are administered largely by local governments. State employment in education is concentrated chiefly in institutions of higher learning.

The next two largest fields of State and local government employment in 1966 were in health and hospital work and highway work. The 860,000 persons employed in health and hospital work include physicians, nurses, medical laboratory technicians, and hospital attendants. About 590,000 workers were employed in highway activities, such as construction and maintenance of roads, highways, city streets, toll turnpikes, bridges, and tunnels. Among these employees are civil engineers, surveyors, operators of construction machinery and equipment, truckdrivers, concrete finishers, carpenters, and construction laborers.

In 1966, about 540,000 workers were employed in general and financial control activities—most of them at the local level. General and financial control functions include the activities of chief executives and their staffs and legislative bodies; the administration of justice; tax enforcement and other financial work; and general administrative work. These functions require the services of individuals such as lawyers, judges, and other court officials, city managers, property assessors, budget analysts, stenographers, and clerks.

Protective services, such as those provided by police and fire departments, is another large field of State and local government employment. There were over 410,000 people employed in police work in 1966, principally by local governments. Employment in police work includes administrative, clerical, and custodial personnel, as well as uniformed and plainclothes policemen. All of the 250,000 firemen are employed by local governments, and about a third of these are part-time employees.

Other State and local government employees are engaged in a wide variety of fields—local utilities (such as water, electricity, transportation, and gas supply systems); natural resources; public welfare; parks and recreation; sanitation; correction; local libraries; sewage disposal; and housing and urban renewal. These activities require workers in many different occupations such as economist, electrical engineer, electrician, pipefitter, clerk, forester, and busdriver.

Clerical, administrative, maintenance, and custodial workers constitute a significant proportion of all employees in many areas of government activity. Among the more important groups of workers engaged in these occupations are clerk-typists, stenographers, secretaries, office managers, fiscal and budget administrators, bookkeepers, accountants, carpenters, painters, plumbers, guards, and janitors. (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 employment trend in State and local governments has been steadily upward. (See chart 55.) Much of this growth has occurred because of the need to provide services for increasing numbers of younger and older persons, and because of population movements from rural to urban areas. City development has required more street and highway facilities; police and fire protection; and public health, sanitation, welfare, and other services. Population growth and increasing personal income have generated demands for more and improved education, housing, and hospital and other services provided by State and local governments.

Much of the increase in State and local government employment in the 1956–66 decade was due to increased employment of teachers and other educational personnel. Expansion in health and hospital services, highway programs ,and protective (police and fire) services also contributed to the increase.

Rapid growth in State and local government employment is expected to continue during the remainder of the 1960's and through the 1970's. Employment of elementary and secondary school teachers, however, is expected to increase more slowly than in the past, as the areas of rapid school enrollment growth shift to higher education. This shift will create greater needs for college and university teachers and administrators.

A larger 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 and hospital facilities.

New or recently expanded Federal-State programs in education, vocational training, medicine, and other fields will increase greatly the requirements of local and State governments for professional, administrative, and technical personnel, such as engineers, scientists, social workers, counselors, teachers, doctors, and librarians.

In addition to job opportunities resulting from the expected overall growth in State and local government employment, large numbers of employees will be needed to replace workers who transfer to other fields of work, retire, or die.

Most positions in State and local governments are filled by permanent residents of the State and locality where they seek employment. Often, however, it is necessary for State and local governments to recruit outside their areas if shortages of particular skills exist in their areas.

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. Clerical and blue-collar earnings in State and local governments are generally comparable to those of workers in similar occupations in private industry. Earnings of administrative and professional employees in many areas tend to be somewhat lower than those for workers in similar occupations in private industry.

The *Handbook* statements for individual occupations often give salary information for State and local government employment. Salary information can be obtained also from the appropriate agency in each State and locality.

A majority of State and local government positions are filled through some type of formal civil service test, and personnel are hired and promoted on the basis of merit. In some areas, broad groups of employees, such as teachers, firemen, and policemen have separate civil service coverage which applies only to their specific groups.

Most State and local government employees are covered by retirement systems, or by the Federal Social Security program. They usually work a 40-hour week; overtime pay or compensatory time benefits often are granted for hours of work in excess of the standard workweek.

Where To Go for More Information

People interested in working for State or local government agencies should contact the appropriate agencies in the State, county, or city. Local school boards, city clerks, school and college counselors or placement offices, and local offices of State employment services also will have further information.

General information on administrative careers in government may be obtained from:

American Society for Public Administration,
1329 18th St. NW., Washington, D.C. 20036.

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ARMED FORCES

When planning their careers, young men must take into account their military service obligation. By knowing the choices available for fulfillment of this obligation, they can better fit their service period into their occupational plans. In many instances, the service activities provide valuable vocational training which is helpful in obtaining civilian jobs later on. The Armed Forces also offer many opportunities to qualified young men and young women for lifetime service careers in many occupations.

The Armed Forces are maintained through voluntary enlistment, supplemented by a Selective Service System which drafts young men between the ages of 18½ and 26. A young man may enlist in any one of a variety of programs involving different combinations of active service and reserve duty; or he may wait to be drafted for a 2-year period of active duty, followed by 4 years in the reserves; or, if qualified, he may enter one of several officer training programs and discharge his obligation in a commissioned status.

Additional choices for fulfilling a military obligation are available in reserve programs. One of these choices allows a young man to fulfill his military obligation by enlisting in the reserves for 6 years, at least 4 months of which are spent in active duty training. These enlistment choices and the draft, however, are subject to change at any time by congressional action. The alternative choices described here in a general way serve only to illustrate a few possibilities. Detailed up-to-date information can be obtained from local Armed Forces recruiting stations or from publications available at high schools, colleges, and State employment service offices.

In early 1967, military personnel were distributed among the various services as follows: Army, 1,427,000; Air Force, 904,000; Navy, 747,000; Marine Corps, 280,000; and Coast Guard, 35,000. About half of all enlisted jobs in the Armed Forces require special in-service school training. On-the-job training is given for the remainder. It is possible for a young man, during his military service, to receive training in electronics, aircraft maintenance, metalworking, or other skilled work. (See chart 56.)

In addition to specific on-the-job training, the Armed Forces provide military personnel with a wide choice of voluntary off-duty academic and technical training programs. Military personnel may enroll in (1) the U.S. Armed Forces Institute (USAFI), (2) the Resident Center Program, (3) the Group Study Program, or (4) the Military Extension Correspondence Course Program. USAFI offers approximately 200 correspondence courses ranging from elementary school through the second year of college. In addition, approximately 6,000 courses are offered by colleges and universities under contract with USAFI. In the Resident Center Program, civilian institutions offer courses leading to high school diplomas and college degrees; these courses may be taken either on the military installation or on a nearby campus. The Group Study Program is offered on military installations where local civilian classes are not available. The Military Extension Correspondence Course Program provides technical courses in military specialties which are designed to advance career capabilities.

Each of the services publishes handbooks describing entrance requirements, training, advancement, and other aspects of their career fields. These publications are available at all recruiting stations and at most State employment service offices, high schools, colleges, and public libraries.

SERVICE AND MISCELLANEOUS

The long-term growth in the American economy has created a growing demand for services of all kinds. Thus, in addition to the multitude of goods produced and distributed, a growing share of our national wealth and manpower is being devoted to needed services, resulting in greater emphasis on better medical care, quality education, and increased personal and recreational services. In many ways, the rapid growth in the importance of the service industries reflects the country's aspirations for a better and fuller life for all of its citizens.

In today's job market, the service industries represent an important source of employment to new as well as experienced workers and offer job opportunities to persons with various levels of skill and with differing degrees of training and education.

In 1966, about 19 million workers were employed in one of the various service industries. Approximately one-half were wage and salary workers employed by private firms, 4.9 million were government employees (mainly in educational and medical services), and 2.3 million were self-employed persons. The remainder, accounting for 2.5 million persons, were employed in private households.

Educational services, including public and private elementary and secondary schools and institutions of higher education, make up the largest sector of the service industry's employment. In 1966, educational services accounted for more than one-fourth of the service work force. Hospitals and other establishments that provide health services constitute the next largest industry sector, accounting for roughly 1 of every 5 workers. In both the educational service and health 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 and other personal services, private households, business and repair services, and entertainment services.

The service industries represent a major source of job opportunities for women. In 1966, for example, women made up about three-fifths of the total employment in the service industry. Among the various service industries that make up the broad industry group, however, their employment ranged from less than one-tenth in automobile and other types of repair businesses to virtually all of the workers in private households. Women workers also accounted for an especially high proportion of the total employment in hospitals, medical and dental offices, educational services, hotels and establishments that provide personal services, such as beauty shops and laundries.

Workers with a wide range of education, training, skills and abilities are employed in the service industries. In 1966, as shown in the accompanying table, white-collar workers (professional, managerial, clerical, and sales workers) made up more than one-half of the service industry's work force. The service industry em-

ploys the highest proportion of professional, technical, and kindred workers found in any major industry, accounting for nearly one-third of total industry employment. By far the largest concentration of professional and technical workers is represented by teachers employed in the educational services industry. Other major employers of professional workers are found in the medical and health services industry—where doctors, dentists, and nurses make up a large share of the work force, and professional services where large numbers of engineers and architects are employed. Self-employment is typical for most of the male professional workers in the health service industry. By way of comparison, women in this field—typified by the case of professional nurses—are mainly salaried workers. Clerical workers account for about 1 out of every 7 workers in the service industry. Most are women who are employed as stenographers, typists, and secretaries, and office machine operators or in general office occupations. Managers, officials, and proprietors, including hospital administrators, make up a relatively small fraction of total employment in the service industry.

Service workers represent the largest occupational group and make up more than one-third of the total industry employment. The major service occupations are private household worker, practical nurse, hospital attendant, charwoman, janitor, waiter, waitress, cook, and protective service worker.

Blue-collar workers, mainly skilled craftsmen and maintenance workers, account for a relatively small share of total industry employment—only about 1 out of every 8 workers. Many of the craftsmen are employed as mechanics and repairmen in automobile and other repair service industries or as maintenance workers in hotels, schools, theaters, and other establishments. Motion picture projectionists are especially important in the entertainment service industry. Operatives are employed mainly in laundries, automobile 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, 1966 (percent distribution)*
All occupation groups	100
Professional, technical and kindred workers	32
Managers, officials and proprietors	6
Clerical and kindred workers	14
Sales workers	1
Craftsmen, foremen, and kindred workers	5
Operatives and kindred workers	5
Service workers	35
Laborers	3

NOTE.—Because of rounding, individual items may not add to total.

Employment in the service industry is expected to increase rapidly through the mid-1970's, rising by nearly two-fifths over current levels. Major factors contributing to the sharp growth in the demand for services are expected to stem from population growth, expanding business activity, rising personal incomes, and the general awareness of the benefits that educational, health, and other services can provide. The fastest growing components of the service industry will be educational services, medical health services, and among firms that provide computer services and laboratory research facilities.

The necessity for extensive person-to-person contact in the performance of many service functions tends to limit the impact of technological innovations on employment requirements. Although the adoption of automatic data-processing equipment may moderate employment growth in some areas—for example, in accounting and bookkeeping services—technological change is not expected to influence greatly or limit the demand for workers in the service industries.

The statement that follows discusses job opportunities in the hotel industry. More detailed information about occupations that cut across many industries appears elsewhere in the *Handbook*. (See index in the back of the book.)

HOTEL OCCUPATIONS

Throughout the United States, travelers find hotels and motels ready to provide them with a "home-away-from-home." More than 700,000 people worked in these hotels, motels, and related businesses in early 1967. The great majority were employed in the Nation's hotels and motor hotels, located chiefly in urban areas. Of the remainder, most worked in the large number of motels and tourist courts located on the outskirts of large cities, along major highways, and in resort areas. A few were employed in related businesses such as summer camps and dude ranches. Slightly less than half of the employees in hotels and related businesses were women.

Some hotel occupations can be entered with little or no specialized training. In many kinds of hotel work, however, the demand for specially trained people is increasing. Hotels are complex organizations and need specialized personnel to direct and coordinate operations which may involve thousands of guests annually and millions of dollars of property and equipment.

This chapter deals with employment opportunities in hotels, motels, and related businesses, and includes separate statements on several hotel occupations.

The Hotel Business and Its Workers

Hotels are of three general types—commercial, residential, and resort. The vast majority are commercial hotels which cater chiefly to transients—that is, travelers seeking a room for a brief stay. A relatively small number are residential hotels, which chiefly accommodate people for long periods, ranging from a few months to many years. Others are resort hotels, which provide lodging for vacationers. Motor hotels, motels, and other establishments cater especially to vacationers and other travelers seeking accommodations for a short time. Commercial and residential hotels generally operate the year round. Although many resort hotels, motor hotels, and motels are open for only part of the year—for example, during the winter season in Florida, or the summer months in northern parts of the country—an increasing number are remaining open the year round.

Hotels range in size from those which have fewer than 25 rooms and only a few employees, to some which have 1,000 or more rooms and many hundreds of workers. In the past few years, an increasing number of motor hotels have been built, some of which have large staffs. Most motels, however, are relatively small, including a sizable number which are run by the owners with few, if any, paid employees.

Most hotels have restaurants, ranging from simple coffee shops to vast dining rooms, wine cellars, and elaborate kitchens. Large hotels and motor hotels also may have banquet rooms, exhibit halls, and spacious ballrooms—to accommodate conventions, business meetings, and social gatherings. Many hotels, especially in resort areas, have recreational facilities such as swimming pools, boating facilities, golf courses, and tennis courts. For the convenience of guests, hotels may provide information about interesting places to visit, sell tickets to theaters and sporting events, and even call in babysitters. Their facilities often include newsstands, gift shops, barber and beauty shops, laundry and valet services, and railroad and airline ticket reservation offices. Although motels and tourist courts usually offer fewer services than hotels, the number with restaurants, swimming pools, and other conveniences for guests is steadily increasing.

Because of the many services they offer, hotels need workers in a wide variety of occupations. One of the largest groups of hotel employees is in the housekeeping department. Many thousands of maids, porters, housemen, linen room attendants, and laundry room workers are employed in "back of the house" jobs—to make beds, clean rooms and halls, move furniture, hang draperies, provide guests with fresh linens and towels, operate laundry equipment, and mark and inspect laundered items. Women are usually employed for the lighter housekeeping tasks, whereas men have jobs requiring more strenuous physical effort, such as washing walls and arranging furniture. Large hotels and motor hotels usually employ executive housekeepers to supervise these workers, and some hotels may also have a special manager in charge of laundry operations.

In most hotels, a uniformed staff performs guest services in the lobby. This staff includes the bellmen who carry baggage for guests and escort them to their rooms. Doormen are also a part of the uniformed staff, as are elevator operators.

The front office staff work as room clerks, key clerks, mail clerks, and information clerks. Their chief duties are to greet guests, assign rooms, and furnish information. About half of the hotel clerical workers are front office employees. The remainder, mainly women, are employed in a variety of office occupations such as bookkeeper, cashier, telephone operator, and secretary. These occupations are discussed elsewhere in the *Handbook*.

Hotel managers and their assistants are a relatively small group with the highly important task of super-

vising operations and making them profitable. A general manager is in charge of all hotel operations. Some general managers have assistants who are in charge of the front office or help with other phases of hotel management. Some assistants may be responsible for specific operations; for example, food-service managers who operate the dining rooms and other eating facilities, or sales managers responsible for attracting more business to the hotel.

In addition, hotels employ workers who also are found in other industries. Among these are accountants, personnel workers, entertainers, recreation workers, waiters, chefs, and bartenders. Maintenance workers, such as carpenters, electricians, stationary engineers, plumbers, and painters, also work for hotels. Still other types of workers employed in hotels include detectives, barbers, beauty salon operators, valets, seamstresses, and gardeners. Most of these occupations are discussed elsewhere in the *Handbook*.

Employment Outlook

A rapid increase in employment is likely in this industry during the rest of the 1960's and through the 1970's. In addition, about 30,000 workers will be required each year to replace those who retire or die. Many additional openings will result from the need to replace workers who transfer to positions in other industries.

Most of the anticipated employment growth in the industry will stem from the need to staff the new hotels, motor hotels, and motels being built in urban areas. Limited expansion probably will take place in older hotels that try to meet the challenge of increasing competition for business by modernizing their facilities and expanding their services. Hotels that are unable to modernize their facilities are likely to experience low occupancy rates and may be forced to reduce overhead costs by eliminating services and workers. Thousands of temporary jobs will continue to be available each year in resort hotels, motels, and other establishments which are open only part of the year or have more business in some seasons than others.

The demand for lodging is expected to increase through the 1970's as the country's population grows and travel for business and pleasure increases. Jet air travel, which permits businessmen and others who travel frequently to make a trip to a distant city, complete their business, and return home the same day, may somewhat limit this increase. Employment is likely to rise most rapidly in motels, motor hotels, and other businesses catering especially to motorists. This trend has been evident for some time and will continue, as the Federal highway building program further stimulates both automobile travel and the building of motels and motor hotels. In motels, most of the additional employees (not counting new owners) will be housekeeping and food-service workers.

Most of the job openings in hotels will continue to be for workers who need little specialized training, such as maids, porters, housemen, kitchen helpers, and some dining room employees. These jobs account for a large proportion of all hotel workers, and have high turnover rates. When general employment conditions are good, people in such jobs find it relatively easy to shift to other kinds of work. Also many of the workers are women, who often leave their jobs to take care of their families. In a few of these occupations technological changes may limit the number of openings. For example, the increased use of automatic dishwashers, vegetable cutters and peelers, and other mechanical kitchen equipment is likely to reduce the need for kitchen helpers.

A number of people will also be needed every year in front office jobs, to replace workers who are promoted to managerial posts as well as to fill new jobs in the increasing number of hotels and motels. People in these occupations are less subject than many other workers in the industry to changes in general economic conditions. In addition, there will be openings for clerical workers, although the increasing use of office machines may adversely affect clerical employment in some hotels. Opportunities are expected to be favorable for young people who acquire the training and experience necessary to qualify for jobs as cooks and food managers. (Food service workers and office workers are discussed elsewhere in the *Handbook*.)

Earnings and Working Conditions

The location, size, and type of hotel affect earnings of hotel workers. Other significant factors include the tipping practice for the occupation and the degree of unionization. More than one-half of all hotel workers are now covered by the Fair Labor Standards Act, a Federal statute which sets minimum wages. Hotel workers covered by the law receive at least $1 an hour. In addition, more than half the States have their own wage and hour laws that cover hotel workers among others.

Salaries of hotel employees in managerial positions have an especially wide range, mainly because of great differences in duties and responsibilities. Hotel manager trainees who are graduates of specialized college programs start out at salaries ranging from $5,000 to $7,200 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 or more a year. In addition to salary, hotels customarily furnish managers and their families with lodging in the hotel, meals, parking facilities, laundry, and other services.

Since earnings of bellmen are greatly affected by tips, obtaining meaningful data on their income is difficult. In large luxury and resort hotels, bellmen may earn $100 or more a week (including tips).

The earnings for all nonsupervisory workers in the hotel industry averaged about $53 a week in 1966. However, the wage rates of hotel workers varied greatly from occupation to occupation according to limited information obtained from union-management contracts in various cities throughout the United States. For example, bellmen earned from $30 to $57 a week depending upon geographic location, type of hotel, and whether they worked the day or night shift. Housemen averaged from $53 to $80 a week and maids and chambermaids earnings ranged from about $47 to $60 a week. Front office clerks earned from about $53 a week to $73 a week. In addition to the wage rates contracted for in these agreements, some workers such as bellmen, maids, and housekeepers may receive tips from hotel or motel guests.

Nonsupervisory employees generally work a 40-hour week, except in the South where the scheduled week is usually 48 hours. For most front office clerks the scheduled workweek ranges from 40 hours—particularly common in the Northeast—to 48 hours in practically all southern cities. In a few cities, the workweek is less than 40 hours.

Since hotels are open round the clock, workers may be employed on any one of three shifts. Usually, more people are employed during the day than at night, and additional compensation may be paid for work during late hours. Managers and housekeepers who live in the hotel usually have regular work schedules, although managers may be called on at any time.

Waiters and waitresses, cooks, pantry workers, dishwashers, and other kitchen workers commonly receive free meals; in a few hotels, maids, elevator operators, and room clerks also receive free meals. More than three-fourths of nonsupervisory employees are covered by paid vacation provisions, the duration of the vacation usually being determined by length of service. Paid holidays—usually 4 to 6 a year—are provided for nearly half of the nonsupervisory hotel employees.

The Hotel & Restaurant Employees and Bartenders International Union is the major union in the hotel business. Uniformed personnel, such as bellmen and elevator operators, may be members of the Building Service Employees' International Union. The degree of unionization, however, differs sharply from area to area. In Boston, Chicago, Detroit, New York, St. Louis, and San Francisco-Oakland, 90 percent or more of nonsupervisory employees, except front desk and office, are in establishments with union contract agreements. In New Orleans, Atlanta, and Memphis the percentage is 20 or below.

Where To Go for More Information

Information on careers in hotel work may be obtained from:

American Hotel and Motel Association,
221 West 57th St., New York, N.Y. 10019.

Additional information on training opportunities, and a directory of schools and colleges offering courses in the hotel field may be obtained by writing to:

Council on Hotel, Restaurant, and Institutional Education,
Statler Hall, Cornell University, Ithaca, N.Y. 14850.

Information on housekeeping in hotels, including a list of schools offering courses in housekeeping, may be obtained from:

National Executive Housekeepers Association, Inc.,
Business and Professional Building, Gallipolis, Ohio 45631.

Information on courses relating to hotel work may be obtained from the local Director of Vocational Education, the Superintendent of Schools in the local community, or the State Director of Vocational Education in the Department of Education in the State capital.

BELLMEN AND BELL CAPTAINS

(D.O.T. 324.138 and .878)

Nature of Work

Bellmen, also called *bellboys* or *bellhops,* carry the baggage of incoming hotel guests while escorting them to their rooms. The bellman checks the lights and the supply of towels and soap, and sees that everything is in order in the room. He may suggest the use of various hotel services, including the dining room and the valet service. Bellmen also perform errands for guests and deliver packages. In early 1967, more than 25,000 such workers were employed in the Nation's lodging places. In large hotels, special baggage porters are usually employed to carry baggage for guests who are checking out. In smaller hotels, bellmen carry baggage for outgoing as well as incoming guests and may also relieve the elevator operator or switchboard operator.

Bell captains are employed in large and many medium-size hotels to supervise the bellmen. They assign work to these employees, keep their time records, and instruct new bellmen in their duties. They may also help guests arrange for transportation by giving them information on train and plane schedules and sending a baggage porter or a bellman to pick

up the transportation tickets. In addition, they handle complaints from guests regarding the work of their department, and take care of requests for unusual services. At times, bell captains may also perform the duties of bellmen.

Superintendents of service—found in only a few hotels with large service departments—supervise elevator operators and starters, doormen, and washroom attendants, as well as bellmen and bell captains.

Training, Other Qualifications, and Advancement

No specific educational requirements exist for bellman jobs. Graduation from high school, however, enhances a bellman's opportunities for transfer to front office clerical jobs, and for promotion. (See statement on Front Office Clerks in this chapter.)

In many hotels, bellman jobs are filled by promoting elevator operators. In the service department of the hotel, the line of promotion is from bellman to bell captain to superintendent of service. Some of the factors which may affect a bellman's chances for advancement are a favorable work record showing few complaints by guests, good work habits, and leadership qualities. Since there is only one bell captain's position in each hotel a number of years may pass before an opening occurs. Opportunities for advancement to superintendent of service are even more limited.

Since bellmen are in frequent contact with the public, it is important that they be neat, tactful, and courteous. A knowledge of the attractions and geography of the local community is an asset. They must also be able to stand all day and to carry heavy baggage.

Employment Outlook

Nearly a thousand openings for bellmen are expected each year during the rest of the 1960's and through the 1970's to take care of growth and deaths and retirements. Many additional openings will also be created as bellmen transfer to other occupations. Since many hotels promote from within by advancing men elevator operators to bellman jobs, chances for outsiders to enter year-round jobs as bellmen will be best in hotels which employ women as elevator operators, and in the increasing number of hotels which have automatic elevators. Many opportunities for temporary jobs will also arise in resort hotels which are open only part of the year and hire college students and other young men. Many beginners will also be needed in small hotels, to replace experienced bellmen who shift to jobs in luxury hotels where earnings from tips may be higher. Competition among employed bellmen for the relatively few bell captain jobs that will become available in the future is expected to remain keen.

The number of bellmen employed is expected to increase slowly during the rest of the 1960's and through the 1970's. Some additional jobs will be created as new hotels and motor hotels are built and additions are made to existing hotels. The fast growing motel business will also provide some additional jobs; however, because of the type of construction and the emphasis on informality, relatively few motels employ bellmen.

See introductory section to this chapter for information on Earnings and Working Conditions, Where To Go for More Information, and for additional information on Employment Outlook.

FRONT OFFICE CLERKS

(D.O.T. 242.368)

Nature of Work

Hotels and motels employ front office clerks to greet guests, rent rooms, handle mail, and do other work related to assigning rooms. More than 50,000 such workers were employed in the Nation's lodging places in early 1967. By working "upfront," they deal directly with the public and help build an establishment's reputation for courteous and efficient service. In small hotels and in motels, a front office clerk (who may be the owner) may not only rent rooms, issue keys, sort mail, and give information, but also do some bookkeeping and act as cashier. On the other hand, large hotels usually employ several front office clerks, who may be assigned to the following different kinds of jobs.

Room or desk clerks rent the available rooms. Customarily, they are the first of the front office clerical staff to great guests. In assigning rooms, they must be aware of advance registrations, consider any preferences guests may express, and at the same time try to obtain maximum revenues for the hotel. Room clerks give information about rates and the types of services available, and see that guests fill out registration forms properly. After registration is completed, room clerks signal bellmen to carry guests' luggage. *Reservation clerks* acknowledge room reservations by mail or telephone, type out registration forms, and notify the room clerk when guests are due to arrive. To keep room assignment records current, *rack clerks* insert or remove forms indicating the

Front office clerks check advance room reservations.

time when rooms become occupied or vacant or when they are closed for repairs. They also keep housekeepers, telephone operators, and other personnel informed about changes in room occupancy. Other special clerks, such as *key, mail, and information clerks* are employed in some hotels. In the largest hotels *floor supervisors or floor clerks* are assigned to each floor to handle the distribution of mail and packages and perform other incidental duties.

In all but the very largest hotels and motels, front office clerks may be responsible for a combination of these various duties. They may have other duties as well, particularly when they work on late evening shifts. For example, the night room clerk may perform bookkeeping functions or assist cashiers with their clerical work.

Training, Other Qualifications, and Advancement

High school graduates who have some clerical aptitude and the personal characteristics necessary for dealing with the public may be hired for beginning jobs such as mail, information, or key clerk. Neatness, a courteous and friendly manner, and ease in dealing with people are important personal traits for front office clerical workers. Typing and bookkeeping courses given in high school may be helpful, particularly for night-shift work where additional clerical duties are often performed, or for jobs in smaller hotels and motels, where the front office clerks often have a variety of duties. Although education beyond high school is generally not required for front office work, hotel employers are increasingly attaching greater importance to college training in selecting personnel who may later be advanced to managerial positions. Front office clerks may improve their opportunities for promotion by taking home study courses, such as those sponsored by the Educational Institute of the American Hotel and Motel Association.

Inexperienced workers learn about the front office routine mainly through on-the-job experience. They usually have a brief initial training period during which their duties are described and they are given information about the hotel, such as the location of rooms and the types of services offered. After new employees begin working, they receive help when necessary from the assistant manager or some experienced front office worker.

Front office workers usually start as key clerks or mail clerks, or in other fairly routine jobs. Occasionally, employees in other types of related work—for example, bellmen or elevator operators—may be transferred to front office jobs. Most hotels have a promotion-from-within policy for front office workers. A typical line of promotion might be from key or rack clerk to room clerk, to assistant front office manager, and later to front office manager. (See statement on Hotel Managers and Assistants later in this chapter.)

Employment Outlook

Employment in this occupation will probably increase moderately during the rest of the 1960's and through the 1970's. Many openings will result from the need to replace workers who are promoted to higher level jobs or transfer to other occupations. Some new jobs will become available in cities where new hotels will be built or existing ones expanded. In addition, new front office jobs will be created in the hundreds of motels and motor hotels expected to open in the next decade.

A front office clerk has relatively stable employment. Employment in this occupation does not expand or contract as sharply with changes in general economic conditions as employment in many other hotel occupations.

See the introductory section to this chapter for information on Earnings and Working Conditions, Where To Go for More Information, and for additional information on Employment Outlook.

HOUSEKEEPERS AND ASSISTANTS

(D.O.T. 321.138)

Nature of Work

Hotel housekeepers are responsible for keeping the hotels clean and attractive. They account for furnishings and supplies; hire, train, and supervise the maids, linen room and laundry workers, housemen, seamstresses, and repairmen; keep employee records; and perform other duties which vary with the size and type of the hotel. Those employed in middle-size and small hotels not only supervise the cleaning staffs but may do some of the maids' work. In large hotels and smaller luxury-type hotels, the duties of executive or head housekeepers are primarily administrative. Besides supervising a staff which may number in the hundreds, they prepare the budget for the housekeeping department; make regular reports to the manager on the condition of rooms, needed repairs, and suggested improvements; purchase or assist in purchasing supplies; and have responsibility for interior decorating work. Some executive housekeepers employed by large hotel chains may have special assignments such as reorganizing housekeeping procedures in an established hotel or setting up the housekeeping department in a new or newly acquired hotel.

In many hotels, executive housekeepers are assisted by floor housekeepers who directly supervise the work on one floor or more. Large hotels also may employ assistant executive housekeepers. More than 18,000 hotel housekeepers were employed in early 1967, most of whom were women.

Executive housekeeper instructs new employees in bed-making procedures.

Training, Other Qualifications, and Advancement

Although no specific educational requirements exist for housekeepers, most employers prefer applicants who have at least a high school diploma. Experience is also an asset in obtaining a hotel housekeeping job.

Specialized training in hotel administration, including courses in housekeeping, was available at several colleges in 1966. Some universities offer short summer courses or conduct evening classes in cooperation with the National Executive Housekeepers Association. In addition, the Educational Institute of the American Hotel and Motel Association also offers housekeeping oriented courses, for class or individual home study. The most helpful courses are those emphasizing housekeeping procedures, personnel management, budget preparation, interior decorating, and the purchase, use, and care of different types of equipment and fabrics.

Employment Outlook

More than 1,500 openings for hotel housekeepers and their assistants are expected annually during the rest of the 1960's and through the 1970's. Most openings will result from the need to replace workers who retire or leave the occupation for other reasons. However, some new positions for housekeepers also will become available in newly built hotels and the growing number of motor hotels and large luxury motels. In established hotels, most openings for housekeepers and their assistants will be filled from within by promoting assistant housekeepers and maids. However, since only one top job as executive housekeeper exists in each hotel, many years may pass before an opening of this kind occurs in a given hotel. Experienced hotel housekeepers will also find employment opportunities in hospitals, clubs, college dormitories, and a variety of welfare institutions.

See introduction to this chapter for information on Earnings and Working Conditions, Where To Go for More Information, and for additional information on Employment Outlook.

MANAGERS AND ASSISTANTS

(D.O.T. 163.118 and 187.118 and .168)

Nature of Work

Hotel and motel managers are responsible for operating their establishments profitably and at the same time, providing maximum comfort for guests. Of the more than 150,000 hotel and motel managers employed in early 1967, more than 50,000 were salaried and about 100,000 were owner-managers. Managers direct and coordinate the activities of the front office, kitchen and dining rooms, and the various hotel departments, such as housekeeping, accounting, personnel, purchasing, publicity, and maintenance. They make decisions on room rates, establish credit policy, improve operations, and have final responsibility for dealing with many other kinds of problems that arise in operating their hotels or motels. Like other managers of business enterprises, they may also spend considerable time conferring with business and social groups and participating in community affairs.

In small hotels, the manager also may perform much of the front office clerical work. In the smallest hotels and in many motels, the owners—sometimes a husband - and - wife team—do all the work necessary to run the business.

Manager helps guest with special problem.

The general manager of a large hotel may have several assistants who manage one department or more and assume general administrative responsibility when the manager is absent. Because preparing and serving food is so important in the operation of most large hotels, a special manager is usually in charge of this department. Managers of large hotels usually employ a special assistant, known as a sales manager, whose job it is to promote maximum use of hotel facilities. The sales manager spends much time traveling about the country explaining to various groups the facilities his hotel can offer for meetings, banquets, and conventions.

Since large hotel chains often centralize such activities as purchasing supplies and equipment and planning employee training programs, managers of these hotels may have fewer duties than managers of independently owned hotels. Hotel chains may assign managers on a temporary basis to help organize work in a newly acquired hotel, or may transfer them to established hotels in different States or in foreign countries.

Training, Other Qualifications, and Advancement

Since most hotels promote from within, individuals who have proved their ability usually in front office jobs, may be promoted to assistant manager positions and eventually to general manager.

Although successful hotel experience is generally the first consideration in selecting managers, employers increasingly emphasize a college education. Many believe that the best educational preparation is provided by the few colleges which offer a specialized 4-year curriculum in hotel and restaurant administration. Specialized courses in hotel work, available in a few junior colleges, and study courses given by the Educational Institute of the American Hotel and Motel Association, are also helpful.

In colleges offering a specialized 4-year curriculum in hotel management, the courses include hotel administration, hotel accounting, economics, food service management and catering, and hotel maintenance engineering. Students are encouraged to spend their summer vacations working in hotel or restaurant jobs—for example, as busboys or bellmen, room clerks, or assistant managers. The experience gained in these jobs and the contacts with employers may enable young people to obtain better hotel positions after graduation. In addition, students are encouraged to study foreign languages and other subjects of cultural value such as history, philosophy, and literature.

College graduates who have majored in hotel administration usually begin their hotel careers as front office clerks; after acquiring the necessary experience, they may advance to top managerial positions. An increasing number of employers require some experience in food operations. Hotel chains may offer better opportunities for advancement than independent hotels, since vacancies may arise in any hotel of the chain as well as on the central management staff.

Some large hotel organizations have established special programs for management trainees who are college graduates or for less highly trained personnel promoted from within. Such programs consist mainly of on-the-job training assignments in which the trainee is rotated among jobs in the various hotel departments. In addition, some large hotels provide financial assistance to outstanding employees for college study.

Employment Outlook

Well-qualified young people will find favorable opportunities during the rest of the 1960's and through the 1970's to obtain entry positions that offer the possibility of promotion to managerial work. Young men applicants who have college degrees in hotel administration will have an advantage in seeking such entry positions and later advancement, if they have had training in food management or can qualify as sales managers. Many openings for management personnel will probably result from the need to fill vacancies resulting from turnover.

The number of hotel managers is expected to increase rapidly over the long run. New positions will arise as additional hotels are built, and as the number of motor hotel and luxury motels expand.

See the introductory section of this chapter for information on Earnings and Working Conditions, Where To Go for More Information, and for additional information on Employment Outlook.

AGRICULTURE

A farmer's workday may begin early and end late, but he works for himself and thus has considerable flexibility. He does not have to punch a time clock. If he needs an extra few minutes to complete a job, he can take it without imposing on anyone. If he is cultivating land and it rains, he may shift to repair work or marketing, catch up on odd jobs, or spend the time with his family. Modern transportation and communication, public utilities, and conventional up-to-date household and farming appliances have reduced most differences that once existed between rural and urban living. Many people prefer living in the country or rural area.

Earlier agriculture was synonymous with farming, or the growing of crops and the production of livestock, using simple tools and methods of production. Science and technology have made agriculture a complex and diversified industry including many of the activities existing outside the farm sector.

Today the typical farmer is a mechanic, welder, tractor operator, bookkeeper, financier, scientist, and supervisor. He buys items from a variety of dealers. He has many competitors and sells his products in several markets at different times.

Significance of Agriculture in the Economy

Only about 6 percent of the total population now live on farms, compared with 23 percent in 1940. Five percent of the total civilian labor force is employed on farms. Whereas one farmworker produced enough food and fiber for himself and only 10 other people three decades ago, today he can produce enough food for himself and 38 others.

Although the number of farmworkers has declined, the number of people who work in jobs closely related to agriculture has been growing. These include the workers in feed mills, fertilizer plants, farm machinery industries, farm marketing and farm supply stores, food processing plants, and many other businesses that process, distribute, or transport farm products and farm supplies. The total number of trained persons needed to carry on this whole complex of activities on and off the farm—often called "Agri-Business"—is rising. The nonfarm sector of agriculture consists of (1) firms manufacturing and distributing equipment and supplies used in farm production; (2) processing and marketing establishments that convert and distribute farm produces in the form, place, and time needed for consumption, and (3) organizations providing services to the farmer directly or to agriculture in general.

OPPORTUNITIES ON FARMS

The typical farm of today is much larger and more highly mechanized than the farm of 25 years ago, and consequently requires much more capital and many farming skills to own and operate. The standard of living of American farmers today is higher than ever before. Opportunities for the small farmer, however, have become very limited.

Investment per Worker on Farms

Since before World War II, agriculture in the United States has increased greatly in the value of productive assets relative to the number of workers, resulting mostly from the higher cost of land and equipment and the substitution of machinery for labor. Capital investment in land, farm buildings, livestock, machinery, equipment, and other items amounted to about $36,000 per farmworker in 1966, compared with less than $3,500 in 1940; the investment in farm machinery and equipment alone has increased tenfold. Technological progress has brought the farmer many new laborsaving devices and production-expanding aids.

Size of Farm Operations

Many farms in the United States are too small to provide an adequate income. In 1964, about 69 percent of all farms were classified as commercial (those providing the farmer with his major source of income). Fewer than 45 percent of all farms reported sales of $5,000 or more. The trend toward fewer and larger farms means that more managerial skills, capital, and mechanical equipment are needed.

Farm Employment Outlook

Because of current trends on the farm, openings for new workers during the remainder of the 1960's and over the next decade will be fewer than the number of workers who die, retire, or leave the farm for other reasons. From 1954 to 1964, an estimated 1.2 million operators left commercial farms, and farmworkers declined by 1.8 million. This trend is likely to continue for some years. Since the number of young men growing up on farms and living in rural communities is declining, there will be some opportunity for those possessing farm skills and backgrounds. Though finding skilled and interested farmworkers is difficult, employment opportunities will not improve significantly for most hired farmhands.

Agriculture cannot expect the same increase in per capita consumption of its products as can many other segments of the economy. Expansion of domestic markets will depend mainly on population growth. Although exports of farm products are expected to continue at relatively high levels, farming nevertheless will continue to be highly competitive because of the rapid advances in technology, faster communication and transportation, and better informed producers and consumers. Agriculture in the underdeveloped countries will improve, and they will depend less on our exports.

Training Opportunities Available for Farming

The best initial training for farming is to grow up on a farm. The necessary experience also may be gained by working as a closely supervised tenant or hired worker on a successful farm.

Several types of vocational training are available under the federally assisted program of vocational education, including the teaching of agriculture in high school. Training may be given in the following:

1. All-day programs supervised by teachers who are agricultural college graduates.
2. Young farmer programs consisting of short courses during the day, including intensive training in farm planning, farm layout, farm structures, construction, welding and related shop and repair work, plant breeding, pest control, growing broilers and breeding cattle, swine, sheep, and other aspects of farming.
3. Adult farmer programs in evening classes (or day classes in off-seasons) give intensive training in conservation, crop and livestock production, and special problems, such as control of pests and planning adjustments in land use and treatment.

The most significant general 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. These include the facilities of State and Federal experiment stations, the Cooperative Extension Services, and resident teaching. 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.

OPPORTUNITIES ON SPECIFIC TYPES OF FARMS

Although the number of openings in farming is decreasing, desirable and rewarding openings occur from time to time. The decision to enter farming may be made simply because an opening exists on the family farm or on one nearby. To be successful, a young man should carefully appraise the requirements in specific types of farm operations, and the prospects for success in them, taking into consideration his aptitudes, interests, preferences, experience, knowledge, and skills in directing labor and handling livestock and machinery. He must take into account also his family labor supply and his financial resources, as the labor and capital requirements for an operation of adequate size vary widely from one type of farm to another.

A realistic decision to go into farming can be made only in terms of a particular type (or types) of farming in a particular area or community. This section evaluates from an occupational standpoint some of the more common farm types. The accompanying table gives illustrative data on size of farm, labor and 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 operator little income or opportunity to improve his status without major changes. On most of the farms, the major part of the work is done by the farm operator and his family. Whereas, some of the smaller farms hire workers only during the peak labor season, large ones often use hired labor year-round.

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 allowing more of their funds for the purchase of livestock, machinery, and equipment. Still others have partners who provide most of the working capital. For example, many farmers raise broilers in partnership with a feed dealer.

No brief general statement about specialization versus diversification in farm operations that would apply in all parts of the country can be made. The general trend is for 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. If the farm operator is to receive the full benefit from his investment, he must produce on a large scale. Two other factors contributing to specialization are the greater emphasis on quality of farm products and the increased knowledge and skill required for effective production of each. Few farmers, however, find it advantageous to produce only one product. The main reasons are the spreading of price and production risks, the more effective use of labor, particularly family labor, and the inefficient utilization of other resources in a one-product system.

Dairy Farms

Dairy farms are located in most parts of the country. Despite modern methods of processing and transporting milk, dairy production is still concentrated near the large population centers, particularly in the Northeast and the Great Lakes States. However, many areas in the Far West and the South also are becoming large producers of dairy products. Although many of these are "drylot" operations, on dairy farms in the Lake States and to a lesser extent in the Northeast, crops are important, causing peak labor loads, especially at harvesttime. However, there is plenty of work throughout the year on dairy farms, so that effective use can be made of labor, and a regular force can be kept fully occupied most of the time.

Although most people do not like to be "tied down" 7 days a week, this obstacle presents no great hardship for the man who enjoys working with animals. Dairying is also a good choice for the man who likes to work with mechanical equipment. As many dairy farmers still produce much of their feed, the work varies enough to prevent monotony.

The dairyman's sales and income are evenly distributed throughout the year. Moreover, the prices he receives are less subject to year-to-year fluctuations than some other types of farming. The accompanying table shows the average net farm income on dairy farms in the Central Northeast and Midwest for 1963 to 1965.

Compared with farmers in most other areas, dairy farmers in the more concentrated milksheds of the Northeast (such as the dairy farms in the Central Northeast shown in the table) frequently milk larger herds, purchase a larger proportion of their feed, and buy rather than raise their herd replacements. Exceptions are the specialized dairy farms on the Pacific Coast and a few other isolated areas. In the most highly specialized producing area near Los Angeles, dairy farms are quite small in acreage but large in milk production and number of cows milked. No crops are produced; these dairy operators buy their entire feed requirements from outside the area. Most of the cows

are bought at freshening time and are replaced when their lactation period is completed.

Net farm income represents the return to the farm operator and his family for their labor and the capital invested in the farm business—provided the operator owns his land and is free from debt. If he rents part or all of his farm, not all of net farm income is available for family living; part of it must be used for rent. Similarly, the farmer who is in debt must deduct interest and principal.

Livestock Farms and Ranches

A general livestock farm is a good choice for the farmer who is interested and skilled in working with livestock and mechanical equipment. Many farmers consider general livestock farms—such as the hog-fattening beef-raising farms, and hog-beef fattening farms of the Corn Belt—an advantage because they require fewer chores than dairy farms. (See table.) Although livestock producers often work shorter hours than dairymen, during the slack season they cannot always use effectively the regular

Size of Farm, Labor Used, Capital Invested, and Net Farm Income on Commercial Farms, By Type, Size, and Location, 1963–65 Average

Type of farm and location	Size of farms, in 1965 as measured by—	Total labor used (hours)	Capital invested in—				Total farm capital	Net [1] farm income
			Land and buildings	Machinery and equipment	Livestock	Crops		
Dairy farms:								
Central Northeast	33.5 milk cows	4,610	$25,230	$8,230	$9,130	$3,070	$45,660	$4,212
Eastern Wisconsin:								
Grade A	34.2 milk cows	4,690	41,290	12,910	11,570	5,910	71,680	6,334
Grade B	22.4 milk cows	3,850	30,510	6,520	6,140	4,660	47,830	3,323
Western Wisconsin, Grade B	25.4 milk cows	4,350	22,350	4,400	7,420	4,290	38,460	4,135
Dairy-hog farms, Southeastern Minnesota	22.6 milk cows	4,210	39,580	7,560	6,750	4,070	57,960	4,492
Egg-producing farms, New Jersey	5,200 layers	5,010	36,420	2,280	7,250	0	45,950	2,977
Broiler farms:								
Maine	72,802 produced annually	2,350	24,210	9,480	0	0	33,690	3,592
Delmarva:								
Broilers	59,376 produced annually	1,870	17,000	2,700	0	0	19,700	2,472
Broiler-crop	63,630 produced annually	2,730	41,360	10,300	0	0	51,660	6,868
Georgia	32,594 produced annually	1,600	12,550	4,110	700	160	17,520	1,036
Corn Belt farms:								
Hog-dairy	130 acres of cropland	4,640	52,040	8,370	8,310	5,310	74,030	7,969
Hog fattening—beef raising	145 acres of cropland	3,640	46,870	6,830	7,380	4,460	65,540	5,301
Hog-beef fattening	198 acres of cropland	3,980	87,410	10,670	16,320	11,630	126,030	10,908
Cash grain	277 acres of cropland	2,320	137,490	14,480	380	440	152,790	13,423
Cotton farms:								
Southern Piedmont	107 acres of cropland	4,840	29,560	2,230	1,040	510	33,340	2,944
Mississippi Delta:								
Small	40 acres of cropland	2,730	13,120	3,390	480	170	17,160	2,518
Large-Scale	640 acres of cropland	25,100	235,330	41,080	7,630	1,860	285,900	35,180
Texas:								
Black Prairie	248 acres of cropland	2,850	51,570	7,070	2,140	590	61,370	5,053
High Plains (nonirrigated)	480 acres of cropland	3,760	79,840	10,510	690	310	91,350	7,351
High Plains (irrigated)	427 acres of cropland	5,670	130,450	17,460	730	430	149,070	16,073
San Joaquin Valley, Calif. (irrigated):								
Cotton-specialty crop	340 acres of cropland	12,590	258,890	27,350	0	0	[2] 310,250	58,461
Cotton-general crop (medium size)	340 acres of cropland	9,730	259,280	28,600	0	0	[3] 307,980	30,815
Cotton-general crop (large)	1,196 acres of cropland	29,220	932,770	76,420	0	0	[4] 1,057,730	89,994
Peanut-cotton farms, Southern Coastal Plains	72 acres of cropland	3,690	20,000	3,460	1,750	650	25,860	6,006
Tobacco farms:								
North Carolina Coastal Plain:								
Tobacco	48 acres of cropland	5,430	36,390	4,510	460	530	41,890	5,940
Tobacco-cotton	54 acres of cropland	6,230	39,930	4,780	470	460	45,640	5,896
Kentucky Bluegrass:								
Tobacco-livestock, inner area	63 acres of cropland	4,570	95,930	5,450	7,360	2,210	110,950	8,173
Tobacco-dairy, intermediate area	25 acres of cropland	3,450	17,750	3,000	2,670	920	24,340	3,059
Tobacco-dairy, outer area	43 acres of cropland	4,860	35,510	6,150	4,640	1,800	48,100	5,926
Pennyroyal, Kentucky-Tennessee:								
Tobacco-beef	240 acres of cropland	4,490	70,290	7,550	8,630	3,550	90,020	5,780
Tobacco-dairy	179 acres of cropland	5,010	50,910	7,180	5,790	2,560	66,440	6,063
Spring wheat farms:								
Northern Plains:								
Wheat-small grain-livestock	605 acres of cropland	2,560	43,120	11,260	4,220	1,880	60,480	8,579
Wheat-corn-livestock	411 acres of cropland	3,470	42,160	9,240	9,080	3,440	63,920	8,526
Wheat-fallow	670 acres of cropland	2,740	49,960	9,860	4,150	1,590	65,560	9,047
Winter wheat farms:								
Southern Plains:								
Wheat	625 acres of cropland	2,930	93,240	11,340	7,180	2,420	114,180	9,129
Wheat-grain sorghum	700 acres of cropland	3,110	109,410	10,890	8,450	1,730	130,480	9,029
Pacific Northwest:								
Wheat-pea	555 acres of cropland	3,520	182,530	23,600	2,410	1,020	209,560	16,741
Wheat-fallow	1,088 acres of cropland	3,780	140,230	20,160	4,680	1,270	166,340	14,373
Cattle ranches:								
Northern Plains	110.5 cows	4,320	54,590	7,750	24,440	3,300	90,080	7,009
Intermountain Region	154.6 cows	5,170	41,600	6,830	40,080	4,290	92,800	8,503
Southwest	150.6 cows	3,710	148,140	5,520	29,340	1,930	184,930	4,243
Sheep ranches:								
Northern Plains	1,323 sheep	6,970	72,220	6,930	25,170	1,230	105,550	13,129
Utah-Nevada	2,208 sheep	7,790	102,910	6,820	51,050	1,930	162,710	15,504
Southwest	1,250 sheep	5,280	198,530	5,080	21,400	840	225,850	6,331

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

[2] Includes $24,010 cost of irrigation system.

[3] Includes $20,100 cost of irrigation system.

[4] Includes $48,540 cost of irrigation system.

NOTE.—Prepared in the Farm Production Economic Division, Economic Research Service, U.S. Department of Agriculture.

labor force. This may not present particularly great problems when a larger part of the labor force consists of young people of school age. The busiest times come when these workers are out of school.

The livestock farmer's income is not as well distributed throughout the year as the dairyman's and it is less likely to be uniform from year to year. Financial management problems result, increasing the risks of operation. Moreover, on farms of limited acreages—often found in the Eastern States—the level of income from general livestock is usually lower than from a dairy herd on similar acreage.

Most hog producers have their own breeding stock and raise the pigs they fatten for market. Cattle and sheep present a different situation. Most of the cattle and sheep fattened and marketed by the livestock farmer are bred and raised originally by someone else—usually the livestock rancher of the West. The accompanying table includes data for six types of Western livestock operations: Northern Plains sheep and cattle ranches, Intermountain cattle ranches, sheep ranches in Utah and Nevada, and sheep and cattle ranches in the Southwest. In these areas of low rainfall, the main source of feed is range grass, and several acres are required to support one animal. Except where irrigation is available, few feed crops are harvested. Some ranchers, particularly those in the Intermountain region and the Northern Plains, own only a small part of the land on which they graze their livestock. Most of the land on which they buy grazing rights is public. Large acreages are required to provide enough pasture for their stock, so the ranchers spend much time in the saddle, truck, or jeep, managing their herds.

Poultry Farms

Most farmers in the United States raise some poultry, but in 1964 fewer than 3.8 percent of them were classified as poultry farmers. Many poultry farms concentrate on egg production; most of the larger and more specialized of these farms are in the Northeast and in California. Others produce broilers; many highly concentrated centers of broiler production are east of the Mississippi River and a few are on the West Coast. Turkey producers also are specialized. A concentration of specialized producers of ducks are in Suffolk County, Long Island, New York.

A few poultrymen produce some crops for sale and purchase special poultry feeds and laying mash. Crops are not grown by most specialized poultry producers, particularly those who produce broilers or large laying flocks. Commercial poultry farmers in New Jersey, for example, buy all their feed. The typical broiler producer in Maine, the Delmarva (Delaware, Maryland, Virginia) peninsula, and Georgia devotes almost all of his capital and labor to the production of broilers.

Poultry farming requires specialized skill in handling birds, chiefly on the part of the operator. Bulk handling of feed and mechanical feeding is widespread and requires little physical strength. For these reasons, poultry farms can use available family help.

Data on average capital investment and net farm income for representative egg producers in New Jersey and broiler operators in Maine, Delmarva, and Georgia from 1963 to 1965 are given in the table. These averages do not reveal the sharp year-to-year fluctuations in income that occur. Because they have a high proportion of cash costs and a thin margin of profit, relatively small changes in feed, broiler, and egg prices can produce sizable fluctuations in net farm income.

The incomes of most broiler producers, however, are more stable because of the high proportion of broiler growers who produce "under contract." Contract production is more widespread in broiler production than in any other major type of farming. Under these arrangements, the financing agency (usually a feed dealer) furnishes the feed, chicks, and technical supervision—almost everything except the buildings, equipment, and direct production labor. The grower receives a stipulated amount for each bird marketed, and often a bonus for superior efficiency. Many turkey producers operate under similar contracts, but these arrangements are not nearly so universal for the production of turkeys as for broilers.

Corn and Wheat Farms

For the man who likes working with crops and farm machinery, cash grain, corn, and wheat farming have much to offer. Many farmers dislike year-round association with livestock and chores. They prefer instead to work long hours using laborsaving equipment during the busy seasons, and then having more freedom when the rush times end.

The table shows the investment required and the recent income experience of some representative cash grain farms. Farms of this type include cash grain farms in the Corn Belt, spring wheat farms in the Northern Plains, winter wheat farms in the Southern Plains, and wheat-pea and wheat-fallow farms in the Pacific Northwest. Some of these farmers—particularly in the Northern Plains—raise some beef cattle for sale as feeders and keep a few milk cows. However, this livestock production is usually of secondary importance. Many of these farmers do not raise any livestock.

One of the main risks faced by the commercial wheat grower is the uncertainty of favorable weather. Government programs have taken out much of the price risk in wheat farming.

Cotton, Tobacco, and Peanut Farms

In terms of numbers of farmers, the production of cotton, tobacco, and peanuts makes up a large part of the agriculture in the Southeastern and South Central States. These products

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are grown on farms that range from very small operating units to comparatively large ones. Competition among these growers has been keen, and many have been forced to diversify and enlarge their farms—adjustments which require expenditures of capital. Industrial expansion in the South and competition from cotton growers in the irrigated areas of the West and Southwest have forced many farmers in the Southeast to discontinue cotton growing. Some of them have stopped farming, and some have diversified their operations. Competition will continue in the growing of cotton, tobacco, and peanuts.

Crop Specialty Farms

Many farmers throughout the country have special background, skills, resources, and other advantages, chiefly because of location and home training. They may specialize in production of a single crop—such as grapes, oranges, potatoes, sugarcane, or melons—or a combination of related specialty crops.

Operators of these enterprises usually employ many seasonal workers and require relatively expensive specialized equipment. They also need specific skills, many of which can be obtained only through experience. Enterprises of this kind should be undertaken only by persons with considerable experience and some of the special skills and techniques required. An individual having an aptitude for these skills can usually learn them by working a few years as a laborer for an operator or as a tenant for a landlord who can give direction and assistance.

Annual returns from these specialty farms usually vary greatly from year to year, because of the vagaries of nature and the changes in prices. Operators of these farms must keep abreast of production and marketing conditions and are well rewarded for their ability to manage, produce, and market.

Private Outdoor Recreation Farms

Public demand for outdoor recreation is far in excess of the existing and projected supply of public facilities. The public sector is not flexible enough to supply the specialized types of recreation or services demanded by smaller groups. The privately owned outdoor recreation enterprise, particularly the farm-base type, is in a unique position to supply these types of recreation services and activities to the public.

The 1964 Census of Agriculture reported over 3 million farms in the United States. Of this total, about 28,000 earned money from some type of recreation activity.

Many farm operators in the vicinity of national, State, and local parks, or wildlife reservations have taken advantage of the location in establishing recreation businesses. The average amount received from this activity was about $1,500 per farm reporting.

These farmers sell hunting rights to individuals, form hunting clubs, establish private campgrounds, and take the overflow from public campgrounds or cater to the individuals who want more privacy with their camping. Vacation farms cater to family groups during the summer and take in hunters later during the year when children are in school. Many farmers enlarge and improve their irrigation reservoirs. They stock ponds for fishing and have swimming areas in the summer and skating areas in the winter. Old farm buildings, sheds, and barns are converted into riding stables or horse boarding stables, or a combination of both. Shore and backwater areas are used to dock privately owned craft. In so doing, many farmers have converted a liability into an asset. Farmers become guides for hunters during the game season and mechanics and service engineers for watercraft. Guides are also in demand for nature trails and scenic tours.

Other Specialties

Other highly specialized operations, such as fur farms, apiaries, and hop farms are very sensitive to price and market conditions. Special land skills and equipment are required, and risks are high. Even with the high risk, from the standpoint of capital invested and income, the venture is often rewarding to individuals who have the ability and resources.

Where To Go for More Information

Additional information may be obtained from the U.S. Department of Agriculture, Washington, D.C. 20250; the Department of Commerce, Washington, D.C. 20230; and from State Land Grant Colleges and Universities.

OCCUPATIONS RELATED TO AGRICULTURE

As agriculture becomes more technical and more commercial, the number of people directly engaged in farming decreases, but the number in occupations related to agriculture increases. Power machinery, for example, saves many man-hours of labor on the farm, but many highly trained nonfarmworkers are required to develop, distribute, and service these machines.

Technological changes have been applied to the production, processing, and marketing of farm products and have brought about diversification and specialization in the farm and agri-business sectors. This has resulted in an increased demand for people in occupations related to agriculture. A large number of these vocations are professional or technical and require college training or its equivalent. Others can sometimes be learned on the job. A farm background is helpful, but not essential. Following is a discussion of some of these occupations.

COOPERATIVE EXTENSION SERVICE WORKERS

(D.O.T. 096.128)

Nature of Work

Extension Service workers are engaged in educational work in 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.

County agricultural agents are interested in improving the efficiency of agricultural production and marketing, including the development of new market outlets. County home economics agents work closely with women in home management and nutrition. There are 4–H extension agents who work with youth. In some counties special agents concentrate on community resource development.

Extension workers help people analyze and solve their farm and home problems. Much of this educational work is carried on in groups, through meetings, tours, demonstrations, and local voluntary leaders. Individual assistance is given on problems that cannot be solved satisfactorily by group methods. Extension workers rely heavily on mass communication media, such as newspapers, radio, and television.

The county extension staff is supported by State extension specialists in such subject-matter fields as agronomy, livestock, marketing, agricultural economics, home economics, horticulture, and entomology. Each of these specialists keeps abreast of the latest research in his particular field and works with agents in applying this information to local needs and problems.

Where Employed

Extension agents are located in nearly every county in the United States. Counties having many farmers who produce a variety of crops may have as many as 10 agents or more, each specializing in a particular field such as dairying, poultry production, crop production, or livestock.

Training and Other Qualifications

A county agent must have a bachelor's degree in agriculture or home economics. In most States, the Extension Service maintains an in-service training program to keep agents informed of the latest developments in agricultural research, of new programs and policies that affect agriculture, and of new teaching techniques. To be successful, extension workers must like to work with people.

In most instances, specialists on the State staff are expected to have a master's degree and special training in their particular lines of work.

Employment Outlook

Employment of Extension Service workers has grown to 15,000 in 1967. The demand for additional workers is expected to continue, 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 is being sought from trained Extension Service personnel. The Extension Service also is being extended to new segments of the population, as rural nonfarm families and suburban residents recognize the value of their assistance.

Counterparts of the Cooperative Extension Service are being established in many countries and Extension Service personnel are often recruited to help initiate and organize these programs.

Earnings and Working Conditions

The salaries of extension agents vary from State to State and county to county. In 1966, starting salaries for assistant agricultural agents ranged

from $5,600 to $7,500 and averaged $6,200. That of home economics agents was approximately $5,800.

Ordinarily, the assistant agent is promoted rapidly to a more responsible job, either in the county where he works or in another county in the State. In 1966, salaries for experienced agricultural agents ranged from $9,500 to $15,500. Salaries of experienced home economics agents ranged from $7,200 to $12,000 annually. Extension specialists salaries averaged $10,000 to $12,000; some earned around $20,000.

Where To Go for More Information

Additional information may be obtained from County Extension Offices, State Director of Extension located at each State College of Agriculture, or the Federal Extension Service, U.S. Department of Agriculture, Washington, D.C. 20250. (Also see statement on Home Economists.)

SOIL SCIENTISTS

(D.O.T. 040.081)

Nature of Work

Soil scientists study the physical, chemical, and biological characteristics and behavior of soils. They investigate the soils both in the field and the laboratory and grade them according to a national system of soil classification. From their research, scientists can classify soils in terms of response to management practices and capability for producing crops, grasses, and trees, as well as their utility as engineering materials. Soil scientists prepare maps, usually based on aerial photographs, on which they plot the individual kinds of soil and other landscape features significant to soil use and management in relation to land lines, field boundaries, roads, and other conspicuous features.

Soil scientists also conduct research to determine the physical and chemical properties of soils and their water relationships, in order to understand their behavior and origin. They predict the yields of cultivated crops, grasses, and trees, under alternative combinations of management practices.

Soil science offers opportunities for those who wish to specialize in soil classification and mapping, soil geography, soil chemistry, soil physics, soil microbiology, and soil management. Training and experience in soil science also will prepare persons for positions as farm managers, land appraisers, and many other professional positions.

Where Employed

Most soil scientists are employed by agencies of the Federal Government, State experiment stations, and colleges of agriculture. However, many are employed in a wide range of other public and private institutions, including fertilizer companies, private research laboratories, insurance companies, banks and other lending agencies, real estate firms, land appraisal boards, State highway departments, State and city park departments, State conservation departments, and farm management agencies. A few are independent consultants and others work for consulting firms. An increasing number are employed in foreign countries as research leaders, consultants, and agricultural managers.

Training and Advancement

Training in a college or university of recognized standing is important in obtaining employment as a soil scientist. For Federal employment, the minimum qualification for entrance is a B.S. degree with major study in Soil Science, or a closely related field of study, having 30 semester hours of course work in the biological, physical, and earth sciences including a minimum of 15 semester hours in soils. Those with graduate training—especially those with the doctor's degree—can be expected to advance rapidly into a responsible and high paying position. This is particularly true in soil research, including the more responsible positions in soil classification, and in teaching. Soil scientists who are qualified for work with both field and laboratory data have a special advantage.

Many colleges and universities offer fellowships and assistantships for graduate training, or employ graduate students for part-time teaching or research.

Employment Outlook

Opportunities for well-trained soil scientists are expected to be favorable through the mid–1970's. A number of positions were vacant in early 1967 because of the shortage of qualified persons.

The demand is increasing for soil scientists to help complete the scientific classification and evaluation of the soil resources in the United States. One of the major program objectives of the Soil Conservation Service of the U.S. Department of Agriculture is to complete the soil survey of all rural lands in the United States. This program includes research, soil classification and correlation, interpretation of results for use by agriculturists and engineers, and training of other workers to use these results. Also, demand is increasing for both basic and applied research to increase the efficiency of soil use.

Earnings

The incomes of soil scientists depend upon their education, professional experience, and individual abilities. The entrance salary in the Federal service for graduates holding a B.S. degree was $5,300 in early 1967. They may expect advancement to $6,400 after 1 year of satisfactory performance. Further promotion depends upon the individual's ability to do high-quality work and to accept responsibility. Earnings of well-

qualified Federal soil scientists with several years' experience range from about $9,200 to $15,100 per year.

Where To Go for More Information

Additional information may be obtained from the U.S. Civil Service Commission, Washington, D.C. 20415; Office of Personnel, U.S. Department of Agriculture, Washington, D.C. 20250; or any office of the Department's Soil Conservation Service.

Also see statements on Chemists and Biologists.

SOIL CONSERVATIONISTS

(D.O.T. 040.081)

Nature of Work

Soil conservationists supply farmers, ranchers, and others with technical assistance in planning, applying, and maintaining measures and structural improvements for soil and water conservation on individual holdings, groups of holdings, or on watersheds. Farmers and other land managers use this technical assistance in making adjustments in land use; protecting land against soil deterioration; rebuilding eroded and depleted soils; stabilizing runoff and sediment-producing areas; improving cover on crop, forest, pasture, range, and wildlife lands; conserving water for farm and ranch use and reducing damage from flood water and sediment; and in draining or irrigating farms or ranches.

The types of technical services provided by soil conservationists are as follows: Maps presenting inventories of soil, water, vegetation, and other details essential in conservation planning and application; information on the proper land utilization and the treatment suitable for the planned use of each field or part of the farm or ranch, groups of farms or ranches, or entire watersheds; and estimates of the relative cost of, and expected returns from, various alternatives of land use and treatment.

After the landowner or operator decides upon a conservation program that provides for the land to be used within its capability and treated according to the planned use, the conservationist records the relevant facts as part of a plan which, together with the maps and other supplemental information, constitute a plan of action for conservation farming or ranching. The soil conservationist then gives the land manager technical guidance in applying and maintaining the conservation practices.

Where Employed

Most soil conservationists are employed by the Federal Government, mainly by the U.S. Department of Agriculture's Soil Conservation Service and the Bureau of Indian Affairs in the Department of the Interior. Some are employed by colleges and State and local governments; others work for banks and public utilities.

Training and Advancement

A Bachelor of Science degree and a major in soil conservation or a related agricultural science constitute the minimum requirement for professional soil conservationists. Those with unusual aptitude in the various phases of the work have good chances of advancement to higher salaried technical and administrative jobs.

Employment Outlook

Employment opportunities for well-trained soil conservationists were good in 1966. Opportunities in the profession will expand because government agencies, public utility companies, banks, and other organizations are becoming interested in conservation and are adding conservationists to their staffs. Other new openings will occur in college teaching, particularly at the undergraduate level. In addition, some openings will arise because of the normal turnover in personnel.

Earnings

In early 1967, soil conservationists having a bachelor's degree and employed by the Federal Government received $5,300 a year. Advancement to $6,400 could be expected after 1 year of satisfactory service. Further advancement depends upon the individual's ability to accept greater responsibility. Earnings of well-qualified Federal soil conservationists with several years' experience range from $9,200 to $15,100 a year.

Where To Go for More Information

Additional information on employment as a soil conservationist may be obtained from the U.S. Civil Service Commission, Washington, D.C. 20415; Employment Division, Office of Personnel, U.S. Department of Agriculture, Washington, D.C. 20250; or any office of the Department's Soil Conservation Service.

OTHER PROFESSIONAL WORKERS

Nature of Work

There are many employment opportunities in the field of agriculture for people trained in other professional fields. The following are general descriptions of the work performed by other professional persons employed in occupations related to agriculture. Many of these occupations are discussed more fully elsewhere in the *Handbook*. (See index.)

Entomologists study insects, both beneficial and harmful in farming. They are concerned especially with developing measures to control insects that injure growing crops and animals, harm human beings, and damage agricultural commodities in

shipping, storage, processing, and distribution.

Agronomists are concerned with the growing and improving of field crops such as cereals and grains, legumes, grasses, tobacco, cotton, and others. They also do research in the fundamental principles of plant and soil sciences and study and develop seed propagation and plant adaptation.

Plant scientists study diseases, structure, and growth factors in plants, and try to improve the quality of fruits, vegetables, flowers and ornamentals.

Microbiologists study bacteria and the relation of other micro-organisms to human, plant, and animal health; they also study the function of these micro-organisms in the making of such products as vitamins, antibiotics, amino acids, sugars, and polymers.

Geneticists try to develop strains, varieties, breeds, and hybrids of plants and animals that are better suited than those currently available to the production of food and fiber.

Animal physiologists and animal husbandmen study the environmental influences in relation to efficient management of farm animals; they also are concerned with the breeding, growth, nutrition, and physiology of livestock.

Home economists specialize in family household management; the study of foods in relation to human nutrition; and the use of household equipment, textiles and clothing.

Veterinarians inspect livestock at public stockyards and points of entry into the U.S.; inspect establishments that produce veterinary biological supplies; administer tests for animal diseases; conduct animal disease control programs; and do research in diseases of livestock.

Plant quarantine and plant pest control inspectors 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.

Human nutritionists study the process by which the human body utilizes food substances.

Agricultural engineers develop new and improved farm machines and equipment; study the physical aspects of soil and water problems in farming, such as irrigation layout, watershed protection, flood control and related problems; and devise new techniques for harvesting and processing farm products; and design more efficient farm buildings.

Agricultural economists deal primarily with problems related to the production, financing, and marketing of farm products. They are fact-finders, evaluators, analysts, and interpreters who help farmers understand economic problems. They estimate benefits; allocate costs; and determine economic justification of plans for flood prevention, irrigation, drainage, recreation, and other types of resource development projects.

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

School teachers in vocational agriculture and related fields supervise and give instructions in farm planning and management, communications, mechanics, engineering, and related fields.

Where Employed

Persons trained in these specialties work in various capacities that relate to agriculture. Government agencies, colleges, agricultural experiment stations, and private businesses that deal with farmers hire many research workers. They also hire people to take technical and administrative responsibilities in public agencies involving farmers or programs affecting farmers. Agri-business and farmer cooperatives, private business, commercial, and financial companies that buy from, sell to, or serve farmers also employ many people. State, county, and municipalities hire many who serve as vocational agriculture teachers and workers in agricultural communications, in farmers' organizations, or in trade associations whose members deal with farmers.

The number of research activities related to agriculture has increased very rapidly. The largest agencies in this field are the State experiment stations connected with the land-grant colleges and the various research branches of the U.S. Department of Agriculture. Other research organizations include some engaged in independent research, and others connected with companies that finance farming operations, market farm products, or produce chemicals, equipment, and other supplies or services for farmers. 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.

Various independent research organizations, foundations, and private business groups in many parts of the country have recently initiated research related to agriculture. They tend to be located either in industrial centers or in areas of high agricultural activity, and include producers of feed, seed, fertilizer, farm equipment; and insecticides, herbicides, and other chemical dusts and sprays.

Public and private lending institutions which make loans to farmers, employ men with broad training in agriculture and business. These workers are ordinarily 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 and county offices; by rural banks; and by insurance companies that have substantial investments in farm mortgages.

The Federal and State Governments also employ various specialists in activities relating to agriculture. These specialists have technical and managerial responsibilities in activities such as programs relating to the production, marketing, inspection, and grading of farm products; prevention of the spread of plant pests, animal parasites and diseases; and management and control of wildlife.

Large numbers of professionally trained persons are employed by cooperatives and business firms that deal with farmers. 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.

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 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 people. Agricultural reporters and editors compile farm news and data for farm journals, bulletins, and broadcasts. Closely related to agricultural communications is employment in farmers' organizations or in-trade associations whose members deal with farmers.

The nationwide, federally aided program of vocational education continues to offer employment for persons technically trained in agriculture and related subjects. Instruction under this program is given in public high schools and in classes organized for persons over 14 years of age "who have entered upon or who are preparing to enter upon the work of the farm or the farm home." Vocational agriculture teachers also supervise farm programs and give instruction in farm mechanics in school shops as well as serving as advisers to the local chapters of the Future Farmers of America. In addition to working with "in-school" students, the teachers provide organized instruction to assist young farmers in becoming satisfactorily established in farming and in becoming community leaders. They also provide organized instruction for adult farmers giving individual consultation on their farms to keep them abreast of modern farm technology.

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 been increased because of the need to recruit professional personnel to staff agricultural missions and to give technical aid to agricultural institutions and farmers in other countries.

Where To Go for More 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 publications will be valuable:

"Profiles-Careers in the U.S. Department of Agriculture," U.S. Department of Agriculture, September 1964. Superintendent of Documents, GPO, Washington, D.C. 20402. Price $2.

"There is a New Challenge in Agriculture," American Association of Land-Grant Colleges and State Universities, Washington, D.C., 1962. Copies can be obtained from your State Agricultural College.

Opportunities in Agricultural Finance. Inquiries on employment opportunities in agricultural finance may be directed to the following:

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

Farm Credit District—Springfield, Mass.; Baltimore, Md.; Columbia, S.C.; Louisville, Ky.; New Orleans, La.; St. Louis, Mo.; St. Paul, Minn.; Omaha, Nebr.; Wichita,, Kans.; Houston, Tex.; Berkeley, Calif.; Spokane, Wash.

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

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

Opportunities With Cooperatives. Farmer cooperatives are located in every State. Information relating to job opportunities in farmer cooperatives may be obtained from local or regional cooperatives. If no jobs are available with these cooperatives, they may be able to make referrals to

others which have openings. Other sources of information are the county agent and the Agricultural Economics Departments of State Agricultral Colleges. General information may be obtained from the American Institute of Cooperation or the National Council of Farmer Cooperatives, both located at 1200 17th St. N.W., Washington, D.C. 20036, and the Cooperative League of the U.S.A., 59 East Van Buren St., Chicago, Ill. 60605.

Opportunities for Agricultural Economists. For additional information about opportunities in agricultural economics, check with 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. As salaries, travel, and programs of vocational agriculture teachers vary slightly among States, prospective teachers should consult 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.

FARM SERVICE JOBS

In almost every type of agriculture, farmers require specialized services which can be readily learned and performed by other workers. A person can enter many of these services, either as an independent operator or as an employee. Some services require an extensive outlay of capital, and others require very little. Some are highly seasonal; others are performed year round. These services and the operation of a small farm can sometimes be combined.

Services that provide year-round employment include the following: Cow testing, artificial breeding, livestock trucking, whitewashing, well drilling, fencing, and tilling.

In cow testing and artificial breeding, an association of farmers employs one worker or more on a monthly basis to conduct the operations. Supervisors who do cow testing are employed by dairy herd improvement associations. They must have a high school education, and a farm background is almost essential. Artificial breeding associations employ inseminators who must have at least a high school education. Agricultural college training is desirable but not essential for employment in these occupations. Brief periods of approximately a month of specialized training are available through the associations.

Other services for farmers are more seasonal. These include the following: Fruit spraying (2–3 months), airplane dusting (4–6 months), grain combining (2 months), hay and straw baling (2–8 months), tractor plowing and cultivating (4–6 months), and sheep shearing (2–3 months).

These and many other services are often done by farmers who engage in custom work as a sideline to keep their equipment busy. In areas where the growing season is long, however, the period when these services can be carried on is long enough to permit individuals to specialize in them.

Closely associated but somewhat more remote from farm operation are such activities as repairing and servicing farm machinery; feed grinding and mixing; maintaining storages and warehouses of agricultural products; operating nurseries and greenhouses; and packing, grading, and processing farm products.

Although these activities are sometimes performed on the farm, the current trend is to conduct them as specialized lines of business away from the farm. An agricultural background is helpful to people who enter these lines of work. The agricultural aspects, however, can be learned more readily than the required specialized skills.

TRANSPORTATION, COMMUNICATION, AND PUBLIC UTILITIES

The transportation, communication, and public utilities industries make possible the smooth functioning of our society and produce most of the energy that powers, heats, and lights our factories and homes. The transportation industry moves goods and people about the country by air, rail, water and highway; the communications industry provides communication systems such as telephones and radio and TV broadcasting. Other public utilities supply the Nation with electricity and gas, and with sanitation services. Transportation, communication, and public utility firms are all 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 other public authorities to make sure they operate in the public interest.

In 1966, about 4.1 million persons were employed in the transportation, communication, and public utilities industry group. In addition, one-half million persons were employed by State and local governments in publicly owned transit and utility systems. Almost half of the workers in this major industry group were employed in two industries—motor freight (1.0 million workers) which includes local- and long-distance trucking, and the communications industries (0.9 million workers) which includes telephone, telegraph, and radio and TV broadcasting. Railroads employed over 700,000 workers in 1966; over 600,000 were employed by electric, gas, and sanitary services companies. Other industries with significant employment included local and interurban passenger transit and air transportation. The remainder of the workers were employed by firms that provided water and pipeline transportation and transportation services.

Nearly one-fifth of the persons employed in transportation, communication, and public utilities are women—a ratio somewhat less than for the economy as a whole. Employment of women varies greatly among the industries that make up the major industry group. For example, they make up only 8 percent of employment in local and interurban passenger transit; however, in the communications industry, where many work as telephone operators, women account for over one-half of the work force.

White-collar workers account for about 2 of 5 workers in transportation, communication, and public utilities, mostly in communications, and electric, gas, and sanitary services. White-collar jobs in these industries reflect the many clerical workers in the telephone industry, technicians and managers in radio and TV broadcasting, and engineers and technicians employed throughout the various trans-

portation and public utility industries. Clerical workers make up about 1 of 4 workers in the major industry division; over one-half are employed in the communications industry. Professional and technical workers make up about 7 percent of the employment in the industry. Most of these workers are concentrated in the communications industry, where, in addition to large numbers of engineers and technicians, many actors, entertainers, and writers are employed.

Craftsmen account for 1 of 5 workers, and operatives, 1 of 4. Skilled craftsmen are needed to install, maintain, and repair the large amount of mechanical, electrical, and other types of equipment that are used throughout this industry. Among the major blue-collar occupations are airplane mechanic, motor vehicle mechanic, and telephone lineman; other important skilled occupations are locomotive engineer and fireman, stationary engineer, and foreman. This major industry division is the chief employer of workers in a number of semiskilled occupations such as bus and truck driver, taxi driver, brakeman and switchman, and sailor and deckhand.

Major occupational group	*Estimated employment, 1966 (percent distribution)*
All occupational groups	100
Professional, technical, and kindred workers	7
Managers, officials, and proprietors	9
Clerical and kindred workers	24
Sales workers	1
Craftsmen, foremen, and kindred workers	21
Operatives and kindred workers	27
Service workers	3
Laborers	9

NOTE.—Due to rounding, sum of individual items may not add to total.

Employment in transportation and public utilities is expected to increase moderately during the 1970's. In addition to opportunities resulting from growth in employment, many thousands of job openings are expected each year because of the need to replace workers who die or retire. Transfer of employees to other fields of work will provide still additional job opportunities. Replacement needs will be particularly high in clerical positions because many women leave the work force each year to take on family responsibilities.

The rising levels of business and consumer income in the years ahead should increase significantly the overall demand for services in this sector and the need for workers to provide them. Employment growth in the individual industries, however, will vary considerably. The transportation industries are expected to grow faster than average, particularly because of rapid growth in motor freight and air transportation. Rising population, urbanization, and the growth of suburban areas will continue to stimulate employment in local trucking. Although employment in long-distance trucking will continue its long-term growth, competition from rail and air transportation may slow down the rate of growth relative to the recent past. The increasing popularity of air transportation for both passengers and cargo will continue into the 1970's, as rising business activity and more leisure time for travel spur continued rapid growth in this area. On the other hand, not all of the transportation industries will experience rapid employment growth. For example, little employment change is expected in local and interurban passenger transportation (buses, taxis, and subways) as it is likely that consumers will continue to rely heavily on private automobiles.

Employment in the communications industry and electric, gas, and sanitary services is expected to grow slower than the sector as a whole. Rapid advances in technology are expected to limit employment growth, although demand for the products and services of these industries will increase rapidly. Technological changes are expected to be particularly significant in telephone communications. The computer and other electronic equipment are expected to be applied increasingly to functions that have been performed by workers.

Employment in electric and gas utilities also will be affected strongly by advancing technology as the output of the industry nearly doubles by 1975. Substantial improvements in electric generating equipment through the increasing use of nuclear power, the growing use of electronic controls, improved coal-handling techniques, and more efficient techniques of constructing and maintaining transmission lines will work to limit the growth of employment in this important industry.

The statements that follow cover major occupations in the transportation, communication, and public utility fields. More detailed information about occupations that cut across many industries—for example, stenographers and typists, drivers, and others—appear elsewhere in the *Handbook*. (See index in the back of the book.)

CIVIL AVIATION OCCUPATIONS

The rapid development of air transportation in the past two decades has greatly increased the mobility of the population and has created many thousands of job opportunities in the civil aviation industry. By late 1966, about 375,000 persons were employed in this field in a variety of interesting and responsible occupations.

Nature and Location of Civil Aviation Activities

Civil aviation services are provided by many different types of organizations for a variety of purposes. The scheduled airlines (those which operate regularly scheduled flights over prescribed routes) provide transportation for passengers, cargo, and mail. Other airlines, called supplemental airlines, provide charter and nonscheduled service for passengers and cargo. A wide range of other civil aviation activities are conducted in the field of general aviation, including the use of company-owned aircraft to transport employees or cargo (business flying); spraying insecticides, fertilizers, or seed on land, crops, or forest (aerial application); charter service in small aircraft (air-taxi operations); and inspection of pipelines and powerlines for breaks. In addition to these flying activities, general aviation includes maintenance and repair activities conducted by repair stations licensed by the Government to work on general aviation aircraft (certificated repair stations).

Civil aviation activities also include the regulatory functions of the Federal Aviation Administration (FAA) and the Civil Aeronautics Board (CAB)—both Federal Government agencies. The FAA develops air safety regulations, inspects and tests aircraft and airline facilities, provides ground electronic guidance equipment, and gives tests for licenses to personnel such as pilots, copilots, flight engineers, dispatchers, and aircraft mechanics. The CAB establishes policy concerning matters such as airline rates and routes and investgates accidents.

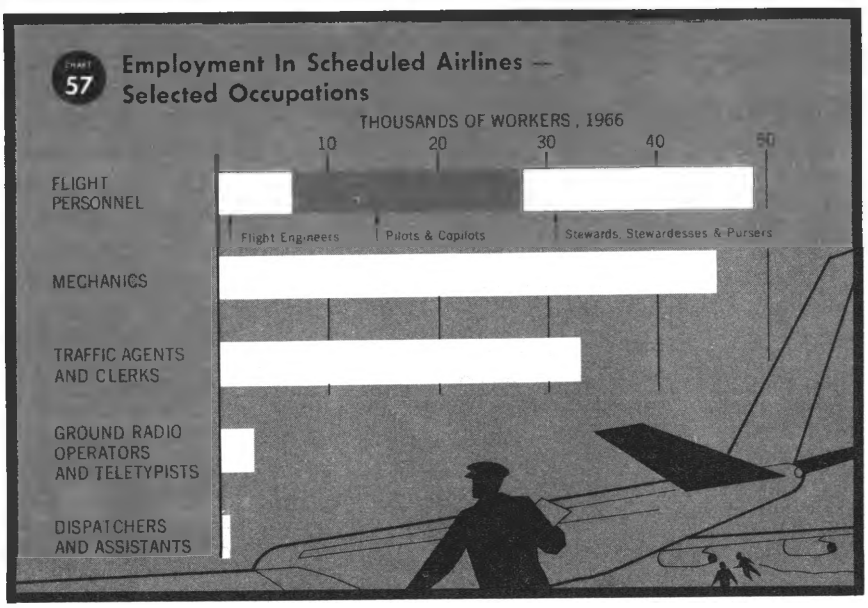
The 49 scheduled airlines were the largest employers of air transportation workers in late 1966, with about 211,000 workers. Of these, about 80 percent (170,000) were employed to fly and service aircraft and passengers on domestic routes—between cities in the United States. About 37,000 other workers handled the operations of the scheduled airlines which flew international routes. The remaining workers were employed by airlines that handled only cargo. More than half of all scheduled airline employees worked for the four largest domestic airlines.

In addition to scheduled airline employees, several thousand workers—all in ground occupations—were employed in the United States by foreign airlines that operate between overseas points and the United States.

An additional 2,400 workers were employed by 15 supplemenal airlines. These workers were in many of the same occupations as scheduled airline workers.

An estimated 112,000 workers—nearly all pilots, copilots, and aircraft mechanics—were employed in general aviation operations to fly and service the 95,000 aircraft used in late 1966. About two-fifths of these workers (46,000) were employed in certificated repair stations. Another one-fourth (29,000) were engaged in business flying. About 10,000 worked for firms that gave flight instruction; approximately 7,500 were in aerial application activities; and nearly 16,000 were employed by for-hire operators of small passenger and cargo aircraft. The remaining 13,500 workers were in other general aviation activities, such as test flying or inspecting pipelines for breaks.

The FAA employed about 43,000 people and the CAB about 830 in late 1966. The largest group of FAA employees worked mainly in occupations



relating to the direction of air traffic, and the installation and maintenance of mechanical and electronic equipment used to control traffic. CAB workers were employed mainly in administrative and clerical jobs concerned with the economic regulation of the airlines, supervision of international air transportation matters, promotion of air safety, and investigation of accidents.

Civil aviation workers are employed in every State, but an estimated half work in five States: New York, California, Florida, Illinois, and Texas. Some of the reasons for the employment concentration in these States are their large populations and geographic areas, their large numbers of airports and aircraft registrations, and the existence of major airline aircraft overhaul bases.

Civil Aviation Occupations

In addition to employing the largest number of air transportation workers, the scheduled airlines employ workers in the widest variety of occupations. Of the 211,000 employed by the scheduled airlines in late 1966, about 4 out of 5 worked in ground occupations.

Mechanics and other aircraft maintenance personnel was the largest occupational category, with 19 percent of scheduled airline employment. (See chart 57.) About 16 percent of all scheduled airline workers were traffic agents and clerks, and almost 2 percent worked at airline ground stations as communications personnel and dispatchers. The remaining workers in ground occupational categories (about 43 percent) were employed as cargo and freight handlers, custodial and other aircraft-servicing personnel, and office, administrative, and professional personnel.

Pilots and copilots represented the largest flight occupation, with over 8 percent of all airline workers; stewardesses and stewards constituted another 8 percent; and flight engineers accounted for the remainder.

More than 50 percent of general aviation workers were pilots or copilots, and about 45 percent were aircraft mechanics. The great majority of the mechanics were employed in certificated repair stations. The remaining general aviation workers were employed in clerical or administrative jobs.

In the Federal Government, the largest group of civil aviation workers were in air traffic servicing work. About 17,700 workers were employed in this category. Most of these workers—about 13,600—were air traffic controllers. Another group of about 4,100 workers were flight service station specialists.

A detailed description of the duties, training, qualifications, employment outlook, earnings, and working conditions for each of the following air transportation jobs appear in the later sections of this chapter: (1) Pilots and copilots, (2) flight engineers, (3) stewardesses, (4) aircraft mechanics, (5) airline dispatchers, (6) air traffic controllers, (7) ground radio operators and teletypists, and (8) traffic agents and clerks.

Employment Outlook

The total number of workers in civil aviation occupations is expected to increase very rapidly during the 1970's, but the rates of growth among the major civil aviation divisions will differ.

General aviation employment is expected to show a rapid rise, mainly because the anticipated greater demand for general aviation services will lead to an increase in the number of aircraft. About 184,000 general aviation aircraft may be flying by 1980—an increase of about 88,000 over the number in 1966. A significant employment increase also will occur in business flying, which will require about 20,000 new employees, mainly well qualified pilots. Even more new job openings will occur in air-taxi operations, largely because of the demand for air transportation in cities not serviced by the scheduled airlines. These jobs will be about equally divided between qualified pilots and copilots and aircraft mechanics. An estimated 40,000 job openings—practically all for aircraft mechanics—will occur in certificated repair stations because of the need for additional maintenance and repair services by a larger general aviation fleet.

The number of operators who give flight instruction and engage in patrol and survey flying will grow very rapidly by 1980, requiring thousands of additional pilots.

Use of aircraft for aerial application which includes the distribution of chemicals or seeds in agriculture, fire fighting, restocking of fish and other wild life will require a few thousand additional employees, mainly pilots.

A slow increase is expected in Federal Government employment of civil aviation workers. Openings that occur will be primarily those resulting from retirements, deaths, and transfers to other fields of work. Although employment declines may occur in some occupations, increasing employment opportunities are expected for those who maintain and repair the increasing array of visual and electronic aids to air traffic.

Airline employment growth will result from anticipated increases in passenger and cargo traffic. By 1980, the scheduled airlines will fly about three times the number of revenue passenger miles flown in 1966. An even larger increase is expected in air cargo traffic which, however, represents a relatively small percent of total traffic. Among the factors which will contribute to increased air travel are a larger population, increased consumer purchasing power, the trend toward longer vacations, the greater use of air travel by businessmen, faster flights on jet aircraft which will save considerable time in long-distance travel, and more economy-class passenger services.

As in the past, airline occupations

will grow at different rates. Occupations such as stewardess and cargo and baggage handler, which provide services for passengers and cargo directly, will grow very rapidly. However, employment in these occupations is not expected to increase as fast as the increases in traffic for several reasons. For example, more widespread installation of mechanical equipment, such as conveyors, will permit airlines to move greatly increased amounts of baggage and cargo without comparable growth in employment of baggage and cargo handlers. Economy flights, which offer fewer in-flight services than first-class flights, will permit airlines to fly greatly increased numbers of passengers without a corresponding rise in employment of flight attendants.

The rapid growth in some airline occupations, particularly those concerned with the operation and maintenance of aircraft, will result from a substantial increase in the number of aircraft in service. Continuing replacement of present equipment by faster, larger capacity jet planes and eventual introduction of supersonic aircraft will accomodate part of the increased traffic, but a significant increase in the total number of aircraft in service will also be necessary. Replacement needs because of retirements and deaths will remain high throughout the 1970's.

Earnings and Working Conditions

Earnings among various civil aviation occupations vary greatly because of such factors as skill requirements, length of experience, and amount of responsibility for safe and efficient operations. Within particular occupations, earnings vary according to the type of civil aviation activity. The statements on individual occupations which follow contain detailed discussions of earnings.

As a rule, airline employees and their immediate families are entitled to a limited amount of free or reduced-fare transportation on their companies' flights, depending on the employees' length of service. In addition, they may fly at greatly reduced rates with other airlines. Flight personnel may be away from their home bases about a third of the time or more. When they are away from home, the airlines either provide living accommodations or pay expenses.

Airlines operate flights at all hours of the day and night. Personnel in some occupations, therefore, often have irregular work schedules. Maximum hours of work per month for workers in flight occupations have been established by the FAA as a safety precaution against fatigue. In addition, union-management agreements often stipulate payment for a minimum number of hours each month, to guarantee a substantial proportion of normal earnings.

Ground personnel who work as dispatchers, mechanics, traffic agents, communications operators, and in administrative jobs usually work a 5-day, 40-hour week. Their working hours, however, often include nights, weekends, or holidays. Air traffic controllers work a 5-day, 40-hour week; they are periodically assigned to night, weekend, and holiday work. Ground personnel generally receive extra pay for overtime work or compensatory time off.

In domestic operations, airline employees usually receive 2 to 4 weeks' vacation with pay, depending upon length of service. Most flight personnel in international operations get a month's vacation. Employees also receive paid sick leave and retirement, insurance, and long-term disability hospitalization benefits. FAA and CAB employees are entitled to the same benefits as other Federal personnel, including from 13 to 26 days of vacation leave and 13 days of sick leave a year, as well as retirement, life insurance, and health benefits.

Many of the workers in air transportation are union members. These unions are identified in the statements covering the individual occupations.

Where To Go for More Information

Information about job openings in a particular airline, and the qualifications required may be obtained by writing to the personnel manager of the company. Addresses of individual companies are available from the Air Transport Association of America, 1000 Connecticut Ave. NW., Washington, D.C. 20036.

Inquiries regarding jobs with the Federal Aviation Administration should be addressed to the Personnel Officer, Federal Aviation Administration at any of the following addresses:

Eastern Region.	Federal Building, John F. Kennedy International Airport, Jamaica, Long Island, N.Y. 11430.
Southwest Region.	P.O. Box 1689, Fort Worth, Tex. 76101.
Southern Region.	P.O. Box 20636, Atlanta, Ga. 30320.
Central Region.	601 E. 12th St., Kansas City, Mo. 64106.
Western Region.	5641 West Manchester Ave., Box 90007, Airport Station, Los Angeles, Calif. 90009.
Alaskan Region.	632 Sixth Ave., Anchorage, Alaska 99501.
Pacific Region.	P.O. Box 4009, Honolulu, Hawaii 96812.

Information concerning FAA-approved schools offering training for work as an airplane mechanic, pilot, or in other technical fields related to aviation may be obtained from the Information Retrieval Branch, Federal Aviation Administration Library, HQ–630, Federal Aviation Administration, Washington, D.C. 20553.

PILOTS AND COPILOTS

(D.O.T. 196.168, .228, .268, and .283)

Nature of Work

The men who have the responsibility for flying a multimillion dollar plane and transporting safely as many as 200 passengers or more are the pilot and copilot. The pilot (called "captain" by the airlines) operates the controls and performs other tasks necessary for flying a plane into the air, keeping it on course, and landing it safely. He supervises a crew which usually includes—in addition to the copilot—a flight engineer and flight attendants. The copilot is second in command. He is present on airline flights to assist the captain in air-to-ground communications, monitoring flight and engine instruments, and in operating the controls of the plane.

Both captain and copilot must do a great deal of planning before their plane may take off. Before each flight, they confer with the company meteorologist about weather conditions and, in cooperation with the airline dispatcher, they prepare a flight plan along a route and at altitudes which offer the best weather and wind conditions so that a safe, fast, and smooth flight will be possible. This flight plan must be approved by Federal Aviation Administration (FAA) air traffic control personnel. The copilot plots the course to be flown and computes the flying time between various points. Just prior to takeoff, both men check the operation of each engine and the functioning of the plane's many instruments, controls, and electronic and mechanical systems.

During the flight, the captain or copilot reports by radio to ground control stations regarding their altitude, air speed, weather conditions, and other flight details. The captain also supervises the navigation of the flight and keeps close watch on the many instruments which indicate the plane's fuel load and the condition of the engines, controls, electronic equipment, and landing gear. The copilot assists in these duties.

Before landing, the captain or the copilot recheck the operation of the landing gear and request landing clearance from air traffic control personnel. If visibility is limited when a landing approach is being made, the captain may have to rely primarily on instruments, such as the altimeter, air speed indicator, artificial horizon, and gyro compass. Both men must complete a flight report and file trip records in the airline office when the flight is ended.

Some pilots, employed by airlines as "check pilots," make at least two flights a year with each captain to observe his proficiency and adherence to FAA flight regulations and company policies. Airlines employ some pilots to fly planes leased to private corporations. Airlines also employ pilots as instructors to train both new and experienced pilots in the use of new equipment.

Although pilots employed in general aviation usually fly planes smaller than those used by the scheduled airlines, their preflight and flight duties are similar to those of airline pilots. These pilots seldom have the assistance of flight crews. In addition to flying, they may perform minor maintenance and repair work on their planes. In some cases, such as in business flying, they may mingle with and act as host to their passengers. Pilots who are self-employed, such as air-taxi operators, in addition to flying and doing some maintenance work, have duties similar to those of other small businessmen.

Where Employed

The scheduled airlines employed over 21,000 pilots and copilots in late 1966. In addition, approximately

1,900 pilots were employed by the certificated supplemental airlines (airlines that provide charter and nonscheduled service).

An estimated 57,000 pilots and copilots (including some who work part time) were employed in general aviation in late 1966. Several thousand worked in business flying and in for-hire operations. About 7,500 pilots were employed in aerial application flying. The Federal Government employed approximately 900 pilots (about half in the FAA) to perform a variety of services, such as examining applicants for pilots' licenses, inspecting navigation facilities along Federal airways, testing planes that are newly designed or have major modifications, enforcing game laws, fighting forest fires, and patrolling national boundaries. In addition, several thousand pilots were employed by companies to inspect pipelines and installations for oil companies, and to provide other aerial services, such as private flight instruction, and flights for sightseeing, skywriting, and aerial photography. A small number worked for aircraft manufacturers as test pilots.

Training, Other Qualifications, and Advancement

To do any type of commercial flying, pilots or copilots must be licensed by the FAA. Airline captains must have an "airline transport pilot's" license. Copilots, and most pilots employed in general aviation, must have a "commercial airplane pilot's" license. In addition, pilots who are subject to FAA instrument flight regulations or who anticipate flying on instruments when the weather is bad, must have an "instrument rating." Pilots and copilots must also have a rating for the class of plane they can fly (single-engine, multi-engine, or seaplane) and for the specific type of plane they can fly, such as DC–6 or Boeing 707.

To qualify for a license as a commercial pilot, applicants must be at least 18 years old and have at least 200 hours of flight experience. To obtain an instrument rating, applicants must have at least 40 hours of instrument time, 20 hours of which must be in actual flight. Applicants for an airline transport pilot's license must be at least 23 years old and have a total of 1,200 hours of flight time during the previous 8 years, including night flying and instrument flying time.

Before a person may receive any license or rating, he must pass a physical examination and a written test given by the FAA covering such subjects as principles of safe flight operations, Civil Air Regulations, navigation principles, radio operation, and meterology. He must also submit proof that he has completed the minimum flight-time requirements and, in a practical test, demonstrate flying skill and technical competence. His certification as a professional pilot remains in effect as long as he can pass an annual physical examination and the periodic tests of his flying skills required by Government regulation. An airline transport pilot's license expires when the pilot reaches his 60th birthday.

A young man may obtain the knowledge, skills, and flight experience necessary to become a pilot through military service or from a private flying school. Graduation from flying schools approved by the FAA satisfies the flight experience requirements for licensing. Applicants who have appropriate military flight training and experience are required to pass only the Civil Air Regulations examination if they apply for a license within a year after leaving the service. Those trained in the armed services have the added opportunity to gain experience and accumulate flying time on large aircraft similar to those used by the airlines.

As a rule, applicants for a copilot job with the airlines must be between 20 and 35 years old, although preference is given to applicants who are between ages 21 and 28. They must be 5 feet 6 inches to 6 feet 4 inches tall and weigh between 140 and 210 pounds. All applicants must be high school graduates; some airlines require 2 years of college and prefer to hire college graduates. Physical requirements for pilots, especially in scheduled airline employment, are very high. They must have at least 20/100 vision corrected to 20/20, good hearing, outstanding physical stamina, and no physical handicaps that would prevent quick reactions. Since flying large aircraft places great responsibilities upon a pilot, the airlines use psychological tests to determine an applicant's alertness, emotional stability and maturity, and his ability to assume responsibility, command respect, and make quick decisions and accurate judgments under pressure.

Men hired by the scheduled airlines (and by some of the larger supplemental airlines) usually start as copilots, although they may begin as flight engineers. An applicant for a copilot's job with a scheduled airline often must have more than the FAA minimum qualifications for commercial pilot licensing. For example, although the FAA requires only 200 flying hours to qualify for such a license, the airlines generally require from 500 to 1,000 flying hours. Airlines also require a "restricted" radiotelephone operator permit, issued by the Federal Communications Commission, which allows the holder to operate the plane's radio.

Pilots employed in business flying are required to have a commercial pilot's license. In addition, some employers require their pilots to have instrument ratings, and some require pilot applicants to have air transport pilot ratings. Because of the close relationship between pilots and their passengers, employers look for job applicants who have pleasant personalities.

All newly hired airline copilots go through company orientation courses. In addition, some airlines give beginning copilots or flight engineers from 3 to 10 weeks of training on company planes before assigning them to a scheduled flight. Trainees also receive classroom instruction in subjects such as flight theory, radio operation, meteorology, Civil Air Regulations, and airline operations.

The beginning copilot generally is permitted only limited responsibility, such as operating the flight controls in good weather over a route that is easy to navigate. As he gains experience and skill, his responsibilities are gradually increased and he is promoted to copilot on larger, more modern aircraft. When he has proved his skill, accumulated sufficient experience and seniority, and passed the test for an airline transport pilot's license, a copilot may advance to captain as openings arise. A minimum of 2 or 3 years' service is required for promotion but, in actual practice, advancement often takes at least 5 to 10 years or longer. The new captain works first on his airline's older equipment and, as openings arise, he is advanced to larger, more modern aircraft.

A few opportunities exist for captains who have administrative ability to advance to chief pilot, flight operations manager, and other supervisory and executive jobs. Most airline captains, however, spend their entire careers flying. As they increase their seniority, they obtain a better selection of flight routes, types of aircraft, and schedules which offer higher earnings. Some pilots may go into business for themselves if they have adequate financial resources and business ability. They may operate their own flying schools or air-taxi and other aerial services. Pilots may also shift to administrative and inspection jobs in aircraft manufacturing and Government aviation agencies, or become dispatchers for an airline when they are not longer able to fly.

Employment Outlook

A rapid rise in the employment of airline pilots is expected through the 1970's. In addition to those needed to staff new positions, several thousand job openings for qualified applicants will result from the need to replace pilots who transfer to other fields of work, retire, or die. Although larger, faster, and more efficient jet planes are likely to be used in the years ahead, increased passenger and cargo miles may substantially exceed the increase in capacity realized from the new equipment. Therefore, employment of pilots is likely to increase to the extent increased growth of traffic exceeds increased capacity.

Employment of pilots outside of the scheduled airlines is expected to continue to grow very rapidly, particularly in business flying, aerial application, air-taxi operations, and patrol and survey flying. Growth in these areas will result from expansion in the use of aircraft to perform these general aviation activities.

Earnings and Working Conditions

Captains and copilots are among the highest paid wage earners in the Nation. Those employed by the scheduled airlines averaged about $21,000 a year in domestic air transportation and nearly $25,000 in international operations in late 1966. Most of the senior captains on large aircraft earned well over $25,000 a year: those assigned to jet aircraft may earn as much as $35,000. Pilots employed by the scheduled airlines generally earn more than those employed elsewhere, although pilots who work for supplemental airlines may earn almost as much. Some experienced copilots were earning as much as $21,000 a year in domestic flying and more than $23,000 in international flying in late 1966.

The earnings of captains and copilots depend on factors such as the type, size, and speed of the planes they fly, the number of hours and miles flown, and their length of service. They receive additional pay for night and international flights. Captains and airline copilots with at least 3 years of service are guaranteed minimum monthly earnings which represent a substantial proportion of their earnings.

Under the Federal Aviation Act, airline pilots cannot fly more than 85 hours a month; some union-management contracts, however, provide for 75-hour a month maximums. Though pilots and copilots, in practice, fly approximately 60 hours a month, their total duty hours, including before- and after-flight activities and layovers before return flights, usually exceed 100 hours each month.

Some pilots prefer the shorter distance flying usually associated with the local airlines and commercial flying activities, such as air-taxi operations, because they are likely to spend less time away from their home bases and fly mostly during the daytime. These pilots, however, have the added strain of making more takeoffs and landings daily.

Although flying does not involve much physical effort, the pilot is often subject to stress because of his great responsibility. He must be constantly alert and prepared to make decisions quickly. Poor weather conditions can also make his work more difficult.

Most airline pilots are members of the International Airline Pilots Association. Some are members of the Allied Pilots Association.

Where To Go for More Information

International Air Line Pilots Association,
55th St. and Cicero Ave., Chicago, Ill. 60638.

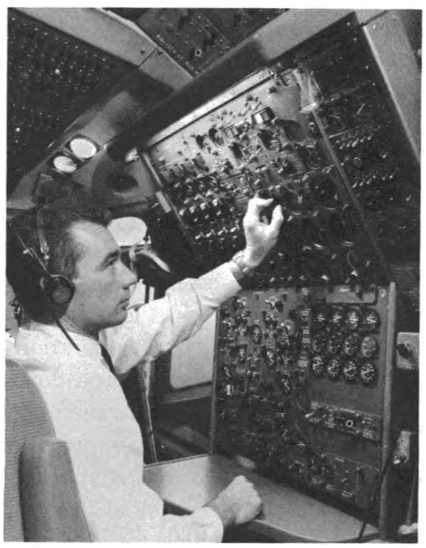
See the introductory section for additional sources of information and for general information on supplementary benefits and working conditions.

FLIGHT ENGINEERS

(D.O.T. 621.281)

Nature of Work and Where Employed

The flight engineer monitors the operation of the different mechanical and electrical devices aboard the airplane. Before takeoffs, he may inspect the tires and other outside parts of the plane and make sure that the plane's fuel tanks have been filled properly. Inside the plane, he assists the pilot and copilot in making preflight checks of instruments and equipment. Once the plane is airborne, the flight engineer watches and operates many instruments and devices to check the performance of the engines and the air-conditioning, pressurizing, and electrical systems. In addition, he keeps records of engine performance and fuel consumption. He reports any mechanical difficulties to the pilot and, if possible, makes emergency repairs. Upon landing, he makes certain that mechanical troubles that may have developed are repaired by a mechanic. Flight engineers employed by the smaller airlines may have to make minor repairs themselves at those few airports where mechanics are not stationed.



Flight engineers or second officers are required on almost all three- and four-engine aircraft and some two-engine jet aircraft. An evaluation of the aircraft and the functions to be performed by the crew determined the need of a flight engineer. In late 1966, about 7,200 workers were employed to perform flight engineers' duties. Most of them worked for the major scheduled airlines and were stationed in or near large cities where long-distance flights originate and terminate.

Training, Other Qualifications, and Advancement

All flight engineers must be licensed by the Federal Aviation Administration (FAA). A man can qualify for a flight engineer's certificate if he has had 2 years of training or 3 years of work experience in the maintenance, repair, and overhaul of aircraft and engines, including a minimum of 6 months' training or a year of experience on four-engine piston and jet planes. He may also qualify with at least 200 hours of flight time as a captain of a four-engine piston or jet plane, or with 100 hours of experience as a flight engineer in the Armed Forces. The most common method of qualifying is to complete a course of ground and flight instruction approved by the FAA.

In addition to such experience or training, an applicant for a license must pass a written test on flight theory, engine and aircraft performance, fuel requirements, weather as it affects engine operation, and maintenance procedures. In a practical flight test on a four-engine plane, he must demonstrate his skill in performing preflight duties and normal and emergency in-flight duties and procedures. He must also pass a rigid physical examination every year. Most scheduled airlines now require applicants for flight engineer positions to have a commercial pilot's license. This qualification is not generally required by the nonscheduled airlines.

Young men can acquire the knowledge and skills necessary to qualify as airline flight engineers through military training as aircraft pilots, mechanics, or flight engineers. They may also attend a civilian ground school and then gain experience as an airplane mechanic.

For jobs as flight engineers, airlines generally prefer men 21 to 35 years of age, from 5 feet 6 inches to 6 feet 4 inches tall, and in excellent physical condition. They require a high school education but prefer men with 2 years or more of college. Airlines prefer to hire young men who already have a flight engineer certificate and a commercial pilot's license, although they do select applicants who have only a commercial pilot's license and give them additional training.

A flight engineer can become a chief flight engineer for his airline. Advancement possibilities usually depend on his qualifications and the seniority provisions established by airline union-management agreements. The flight engineer with pilot qualifications may advance on the basis of his seniority to copilot, and then follow the regular line of advancement open to other copilots. Flight engineers without pilot qualifications can advance from less desirable to more desirable routes and schedules as they gain seniority.

Employment Outlook

Employment of flight engineers is expected to increase rapidly during the 1970's as heavier jet-powered aircraft replace piston engine planes not now requiring flight engineers. This development will contribute to the employment growth in this field since in most cases the third required crew member will be a qualified pilot serving as a flight engineer until his promotion to copilot. (See also the

262-057 O—68——42

Handbook statement for Pilots and Copilots.)

Earnings and Working Conditions

The earnings of flight engineers in late 1966 ranged from $550 to $600 a month for new employees to $1,730 for experienced flight engineers on jet aircraft on international flights. Many flight engineers earned between $1,000 and $1,500 a month. Average monthly earnings for all flight engineers in domestic operations was nearly $1,400; those employed on international flights averaged nearly $1,700. The earnings of flight engineers depend upon factors such as size, speed, and type of plane; hours and miles flown; length of service; and the type of flight (such as night or international). Engineers are guaranteed minimum monthly earnings, which represent a substantial proportion of their total earnings. Their flight time is restricted, under the Federal Aviation Act, to 85 hours a month. Flight engineers in international operations are limited to 100 hours a month, 300 hours every 90 days, or 350 hours every 90 days, depending on the size of the flight crew.

Many flight engineers belong to the Flight Engineers' International Association. Some are represented by the International Air Line Pilots Association and some by the International Association of Machinists and Aerospace Workers.

Where To Go for More Information

Flight Engineers' International Association,
100 Indiana Ave. NW., Washington, D.C. 20001.

See the introductory section for additional soures of information and for general information on supplementary benefits and working conditions.

STEWARDESSES

(D.O.T. 352.878)

Nature of Work and Where Employed

Stewardesses or stewards (sometimes called flight attendants) are aboard almost all passenger planes operated by the commercial airlines. Their job is to make the passengers' flight safe, comfortable, and enjoyable. Like other flight personnel, they are responsible to the captain.

Before each flight, the stewardess attends the briefing of the flight crew. She sees that the passenger cabin is in order, that supplies and emergency passenger gear are aboard, and that necessary food and beverages are in the galley. As the passengers come aboard, she greets them, checks their tickets, and assists them with their coats and small luggage. On some flights, she may sell tickets.

During the flight, the stewardess makes certain that seat belts are fastened and gives safety instructions when required. She answers questions about the flight and weather, distributes reading matter and pillows, helps care for small children and babies, and keeps the cabin neat. On some flights, she heats and serves meals that have been previously cooked. On other flights, she may prepare, sell, and serve cocktails. After the flight, she completes flight reports. On international flights, she also gives customs information, instructs passengers on the use of emergency equipment and repeats instructions in an appropriate foreign language to accommodate foreign passengers.

About 21,000 stewardesses and 1,000 stewards worked for the scheduled airlines in late 1966. About 80 percent were employed by the domestic airlines, and the rest worked for international lines. Nearly all stewards were employed on overseas flights. Airliners generally carry 1 to 6 flight attendants, depending on the size of the plane and what proportion of the flight is economy or first-class. Most flight attendants are stationed in major cities at the airlines' main bases. A few who serve on international flights are based in foreign countries.

Training, Other Qualifications, and Advancement

Because stewardesses are in constant association with passengers, the airlines place great stress on hiring young women who are attractive, poised, tactful, and resourceful. As a rule, applicants must be 20 to 27 years old, 5 feet 2 inches to 5 feet 9 inches tall, with weight in proportion to height (but not to exceed 140 pounds), and in excellent health. They must also have a pleasant speaking voice and good vision. As of mid-1967, some major airlines required that stewardesses be unmarried; and also required them to resign when they married or shortly afterwards. Stewardesses who can no longer qualify for flying, such as those who marry, may obtain jobs in other departments, such as sales or public relations.

Applicants for stewardess' jobs must have at least a high school education. Those with 2 years of college, nurses' training, or business experience in dealing with the public are preferred. Stewardesses who work for international airlines generally must be able to speak an appropriate foreign language fluently.

Most large airlines give newly hired stewardesses about 5 weeks' training in their own schools. Girls may receive free transportation to the training centers and also may receive an allowance while in attendance. Training includes classes in flight regulations and duties, company operations and schedules, emergency procedures and first aid, and personal grooming. Additional courses in passport and customs regulations are given trainees for the international routes. Toward the end of their training, stu-

dents go on practice flights and perform their duties under actual flight conditions.

A few airlines which do not operate their own schools may employ graduates who have paid for their own training at private stewardesses' schools. Girls interested in becoming stewardesses should check with the airline of their choice before entering a private school to be sure they have the necessary qualifications for the airline, and that the school's training is acceptable.

Immediately upon completing their training, stewardesses report for work at one of their airline's main bases. They serve on probation for about 6 months, and an experienced stewardess usually works with them on their first flights. Before they are assigned to a regular flight, they may work as reserve flight attendants, during which time they serve on extra flights or replace stewardesses who are sick or on vacation.

Stewardesses may advance to jobs as first stewardess or purser, supervising stewardess, stewardess instructor, or recruiting representative. Advancement opportunities often come quickly because stewardesses work only about 2 or 3 years, on the average, and then resign to get married.

Employment Outlook

Young women will have several thousand opportunities to get jobs as stewardesses each year during the remainder of the 1960's and throughout the 1970's. Most of these openings will occur as girls marry or leave the occupation for other reasons. (About 40 percent of the employed stewardesses leave their jobs each year.) In addition, total employment of stewardesses will grow very rapidly as a result of the anticipated large increase in passenger traffic.

Young women interested in becoming stewardesses should realize that thousands of girls apply for this type of work each year because of the glamour attached to the occupation. Despite the large number of applicants, the airlines find it difficult to obtain enough young women who can meet their high standards of attractiveness, personality, and intelligence.

Earnings and Working Conditions

An examination of union-management contracts covering several large domestic and international airlines indicates that in 1966, beginning stewardesses earned approximately $413 to $475 a month for 80 hours of flying time. Stewardesses with 2 years' experience earned approximately $475 to $567 a month. Those assigned to piston flights usually earned approximately $30 a month less.

Stewardesses employed on domestic flights averaged $466 a month in late 1966; those working on international flights averaged about $555.

Since commercial airlines operate around the clock, 365 days a year, stewardesses usually work irregular hours. They may work at night, on holidays, and on weekends. They are usually limited to 80 hours of flight time a month. In addition, they devote up to 35 hours a month to ground duties. As a result of irregular hours and limitations on the amount of flying time, some stewardesses may have 15 days or more off each month.

Of course, some time off may occur between flights while away from home.

Airlines generally use the seniority bidding system for assigning home bases, flight schedules, and routes. Stewardesses with the longest service, therefore, get the more desirable flights.

The stewardess' occupation is exciting and glamorous, with opportunities to meet interesting passengers and to see new places. However, the work can be strenuous and trying. A stewardess may be on her feet during a large part of the flight. She must remain pleasant and efficient during the entire flight, regardless of how tired she may be.

Most flight attendants are members of either the Air Line Stewards and Stewardesses Association of the Transport Workers Union of America, or the Stewards and Stewardesses Division of the International Air Line Pilots Association.

See introductory section for general information on supplementary benefits and working conditions.

AIRCRAFT MECHANICS

(D.O.T. 621.281)

Nature of Work

Aircraft mechanics have the important job of keeping airplanes operating safely and efficiently. Mechanics employed by the airlines work either at the larger airline terminals making emergency repairs on aircraft (line-maintenance work) or at an airline main overhaul base, where they make major repairs or perform the periodic inspections that are necessary on all aircraft. These mechanics may specialize in work on a particular part of the aircraft, such as propellers, landing gear, hydraulic equipment, airborne electronic communications and control equipment, instruments, or on sheet metal sections They frequently take apart a complex airplane component, replace damaged or worn parts, put the component together, and test it to make sure that it is operating perfectly.

A line-maintenance mechanic may be instructed by the flight engineer or lead mechanic as to the kinds of repairs to make, or he may examine the aircraft thoroughly to discover the cause of malfunction. He then makes the necessary repairs or adjustments or he may install a new part; for instance, he may replace an entire engine when it cannot be repaired quickly. Line-maintenance mechanics must be all-round mechanics able to to make repairs on all parts of the plane. They may also have to do maintenance work such as changing spark plugs or adding fluid to a hydraulic system.

Aircraft mechanics employed in general aviation usually do maintenance and repair work comparable with the work performed by line-maintenance mechanics. However, the planes which these mechanics service are smaller and less complex than those flown by the airlines. One mechanic frequently does the entire servicing job with little supervision, and he works on many different types of planes and engines. Mechanics who work for employers such as certificated supplemental airlines, air-taxi operators, and independent repair shops may also do overhaul work. Independent repair shops usually specialize in engine, instrument, or airframe overhaul. (The airframe

Line mechanics service engine on jet aircraft.

consists of the plane's fuselage, wings, landing gear, flight controls, and other parts which are not part of the engine, propeller, or instruments.)

Aircraft mechanics use many different kinds of tools in their work. These may range from simple handtools, such as screwdrivers, wrenches and pliers, to large and expensive machines and equipment designed to diagnose troubles and help the mechanic correct them. Examples of such equipment are propeller grinding machines, electrical circuit testers, and magnetic and black light inspection equipment designed to detect flaws and cracks in metal parts.

Where Employed

Over 45,000 mechanics were employed by the scheduled airlines in late 1966. An estimated 46,000 mechanics and supervisory mechanics were employed by independent repair shops. A few thousand mechanics also were employed by certificated supplemental airlines, aerial application and air-taxi firms, and businesses that use their own planes to transport their key employees or cargo. Many other aircraft mechanics work in aircraft manufacturing plants. (These workers, whose duties are somewhat different from those of airline mechanics, are discussed in the chapter on Occupations in the Aircraft, Missile, and Spacecraft Field.)

About 17,000 civilian aircraft mechanics were employed by the Air Force in late 1966. Another 10,000 worked for the Navy. The FAA employs several hundred skilled men with maintenance experience to inspect aircraft manufacturing plants; examine airline and other commercial flying organizations' aircraft maintenance methods, training programs, and spare parts stock; and test applicants for FAA mechanic licenses. This agency also employs approximately 475 aircraft mechanics to maintain its own planes. Most of these men are employed at the FAA Aeronautical Center in Oklahoma City. Some mechanics are employed by other Government agencies, principally the National Aearonautics and Space Administration and the Army.

Most airline mechanics are employed in the larger cities on the main airline routes. Each airline usually has one main overhaul base where more than half of its mechanics are employed. Large concentrations of mechanics are employed in cities such as New York, Chicago, Los Angeles, San Francisco, and Miami, all of which are important domestic and international air traffic centers.

Training, Other Qualifications, and Advancement

Mechanics responsible for any repair or maintenance operation must be licensed by the FAA as either an "airframe mechanic" (to work on the plane's fuselage, covering surface, landing gear, and control surfaces such as rudder or ailerons); "powerplant mechanic" (to work on the plane's engines); "airframe and powerplant mechanic" (to work on all parts of the plane); or as a "repairman" who is authorized to make only specified repairs. Mechanics who maintain and repair electronic communications equipment are required to have at least a Federal Communications Commission Second Class Radio Telephone Operator License.

At least 18 months' experience working with airframes or engines is required to obtain an airframe or powerplant license, and at least 30 months' experience working with both engines and airframes is required for the combined airframe and powerplant license. However, this experience is not required of graduates of mechanics' schools approved by the FAA. In addition to meeting these requirements, applicants must pass a written test and give a practical demonstration of their ability to do the work. Repairmen licenses are issued to mechanics who are able to perform those maintenance and repair operations for which their employers have received FAA authorization.

Mechanics may prepare for the trade and their licenses by working as trainees or apprentices, or as helpers to experienced mechanics. The larger airlines train apprentices or trainees in a carefully planned 3- or 4-year program of instruction and work experience. Men who have learned aircraft maintenance in the Armed Forces are usually given credit for this training towards the requirements of apprenticeship or other on-the-job training programs.

For trainee or apprentice jobs, the airlines prefer men between the ages of 20 and 30 who are in good physical condition. Applicants should have a high school or trade school education, including courses in mathematics, physics, chemistry, and machine shop. Experience in automotive repairs or other mechanical work is also helpful.

Other mechanics prepare for their trade by graduating from an FAA approved mechanics school. Most of these schools have an 18- to 24-month program. Several colleges and universities also offer 2-year programs that prepare the student for the FAA mechanic examinations, and for jobs as engineering aids and research and development technicians in aircraft manufacturing.

Mechanics are generally required to have their own handtools which they must pay for themselves. They usually acquire their tools gradually.

Several advancement possibilities are available to skilled mechanics employed by the scheduled airlines. The line of advancement is usually mechanic, lead mechanic (or crew chief), inspector, lead inspector, shop foreman, and, in a few cases, supervisory and executive positions. In most shops, mechanics in the higher grade positions are required to have both airframe and powerplant ratings. In many cases, the mechanic must pass a company examination before he is promoted.

To qualify for jobs as FAA inspectors, mechanics must have broad experience in maintenance and over-

haul work, including supervision over the maintenance of aircraft. Applicants for this job must also have both airframe and powerplant ratings or a combined rating.

Employment Outlook

The number of aircraft mechanics employed by scheduled airlines is expected to increase rapidly through the 1970's because of the substantial increase in the number of aircraft in operation. In addition to the openings that will arise from employment growth, a few hundred job openings will result annually from the need to replace mechanics who transfer to other fields of work, retire, or die.

The very rapid growth anticipated in general aviation flying will lead to an increase in the number of aircraft. Therefore, an increase is expected in the number of mechanics employed in firms providing general aviation services, and the independent repair shops that repair many of these aircraft.

Employment opportunities for aircraft mechanics in the Federal Government will depend largely on the size of the Government military aircraft program.

Earnings and Working Conditions

Mechanics employed by the scheduled domestic and international airlines earned, on the average, $665 a month in late 1966. Other aircraft mechanics generally had lower average earnings.

Airline mechanics work in hangars or in other indoor areas, whenever possible. However, when repairs must be made quickly, which is sometimes the case in line-maintenance work, mechanics may work outdoors.

Mechanics employed by most major airlines are covered by union agreements. Most of these employees are members of the International Association of Machinists and Aerospace Workers. Many others belong to the Transport Workers Union of America. See introductory section for sources of additional information and for general information on supplementary benefits and working conditions.

AIRLINE DISPATCHERS

(D.O.T. 912.168)

Nature of Work and Where Employed

Dispatchers (sometimes called flight superintendents) are employed by the airlines to coordinate flight schedules and operations within an assigned area; they also make sure that all Federal Aviation Administration (FAA) and company flight and safety regulations are observed. After examining weather conditions, the dispatcher makes a preliminary decision as to whether a flight may be safely undertaken. He frequently must arrange to notify the passengers and crew if there is any change from the scheduled departure time. The dispatcher confers with the captain about the quantity of fuel needed, the best route and altitude at which the plane will fly, the total flying time, and the alternate fields that may be used if landing at the scheduled airport is hazardous. The dispatcher and the captain must agree on all details of the flight before the plane leaves the airport. In some instances, the dispatcher is also responsible for keeping records and checking such matters as the availability of aircraft and equipment, the weight and balance of loaded cargo, the amount of time flown by each aircraft, and the number of hours flown by each crew member based at his station.

After the flight has begun, the dispatcher plots the plane's progress as reported at regular intervals by the captain by radio, and keeps the captain informed of changing weather and other conditions that affect his flight.

Airline dispatcher assists pilot in preflight planning.

The assistant dispatcher helps the dispatcher plot the progress of flights, secure weather information, and handle communications with aircraft.

In late 1966, only about 1,000 dispatchers and assistants were employed in scheduled domestic and international operations, primarily at large airports in the United States. An even smaller number worked for large certificated supplemental airlines, and for private firms which offer dispatching services to small airlines.

Training, Other Qualifications, and Advancement

Dispatchers are required to have an FAA dispatcher certificate. An applicant for such a certificate may qualify if he has spent at least a year engaged in dispatching work under the supervision of a certificated dispatcher. He may also qualify by completing an FAA-approved dispatcher's course at a school or an airline training center. If an applicant has neither schooling nor experience, he may also qualify if he has spent 2 of

the previous 3 years in air traffic control work, or in such airline jobs as dispatch clerk, assistant dispatcher, or radio operator, or in similar work in military service.

An applicant for an FAA dispatcher certificate must pass a written examination on subjects such as Federal aviation regulations, weather analysis, air-navigation facilities, radio procedures, and airport and airway traffic procedures. In an oral test, he also has to demonstrate his ability to interpret weather information, his knowledge of landing and cruising speeds and other aircraft operational characteristics, and his familiarity with airline routes and navigational facilities. A licensed dispatcher is checked periodically by his employer to make sure that he is maintaining the skills required by Federal regulations. All qualified dispatchers are given additional instruction by their airlines at special training centers so that they may become familiar with new flight procedures and with characteristics of new aircraft. Each year he is also required to "fly the line" as an observer over the portion of the system which he services, in order to maintain his first-hand familiarity with airline routes and flight operations.

For assistant dispatcher jobs, which may not require certification, airlines prefer men who have at least 2 years of college or an equivalent amount of time working in some phase of air transportation, such as communications. Preference is given to college graduates who have had courses in mathematics, physics, and related subjects. Some experience in flying, meteorology, or business administration is also helpful.

Most airlines fill assistant dispatcher positions by promotion or transfer from within the company. Men are preferred who have had long experience in ground operations work. As a result, most openings are filled by men who have been dispatch clerks, meteorologists, or radio operators; a few jobs are filled by men who have been pilots.

Employment Outlook

The number of workers in this very small occupation is not expected to change much during the 1970's. Most new workers in this occupation will be hired as assistant dispatchers or dispatch clerks. Job openings for dispatchers will be filled mainly by promoting or transferring experienced persons already employed by the airlines.

The need for some additional dispatchers will result from the increase in air traffic, the addition and extension of routes, and the extra difficulties in dispatching jet aircraft. However, these factors will be largely offset by improved radio and telephone communication facilities, which allow dispatchers at major terminals to dispatch aircraft at other airports and over large geographic areas. Foreign-flag airlines, which fly between overseas points and cities in the United States, will also provide a few job opportunities for dispatchers.

Earnings and Working Conditions

Beginning dispatchers earned between $700 and $800 a month in late 1966. Dispatchers with 10 years' service earned between $1,000 and $1,325 a month. Assistant dispatchers earned $475 and over a month to begin and up to $750 a month after 3 years. Assistant dispatchers with FAA certificates may earn $25 a month extra. Most dispatchers are members of the Air-Line Dispatchers Association.

Where To Go for More Information

Air Line Dispatchers Association, 243 West Maple Ave., Vienna, Va. 22180.

See introductory section for additional sources of information and for general information on supplementary benefits and working conditions.

AIR TRAFFIC CONTROLLERS

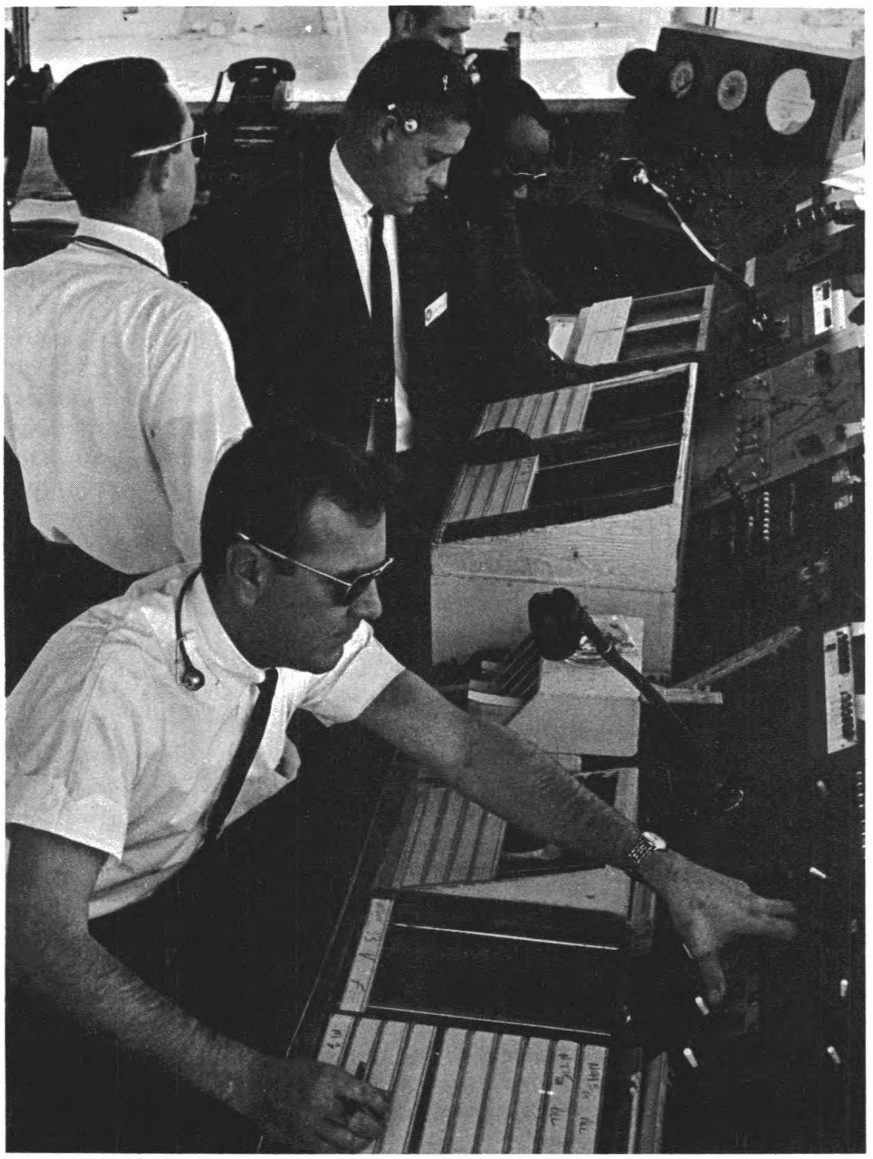
(D.O.T. 193.168)

Nature of Work

Air traffic controllers are the guardians of the airways. These employees of the Federal Aviation Administration (FAA) give instructions, advice, and information to pilots by radio in order to avoid collisions and minimize delays as aircraft fly between airports or in the vicinity of airports. When directing aircraft, traffic controllers must consider many factors including weather, geography, the amount of traffic, and the size, speed, and other operating characteristics of aircraft. The men who control traffic in the areas around airports are known as *airport traffic controllers;* those who guide aircraft between airports are called *air-route traffic controllers.*

Airport traffic controllers are stationed at airport control towers to give all pilots within the vicinity of the airport weather information and takeoff and landing instructions, such as which approach and airfield runway to use and when to change altitude. They must simultaneously control several aircraft which appear as tiny bars on a radar scope. They talk on the radio first to one and then another of the pilots of these planes, remembering their numbers and their positions in the air, and give each of them different instructions. These workers also keep records of all messages received from aircraft and operate runway lights and other airfield electronic equipment. They may also send and receive information to and from air-route traffic control centers about flights made over the airport.

Air-route traffic controllers are stationed at air traffic control centers to coordinate the movements of aircraft which are being flown "on instruments." They use the written flight plans which are filed by pilots and dispatchers before aircraft leave



Air traffic controllers guide aircraft with radio and radar.

the airport. To make sure that aircraft remain on course, they check the progress of flights, using radar and other electronic equipment and information received from the aircraft, other control centers and towers, and information from FAA or airline communication stations.

Where Employed

About 13,500 air traffic controllers were employed by the FAA in late 1966. Of these, nearly half were airport traffic controllers, employed at airport control towers located at key airfields. A few of these jobs are located at towers and centers outside the United States. About 6,600 air-route traffic controllers worked in 24 control centers scattered throughout the United States.

Training, Other Qualifications, and Advancement

Applicants for positions as air-route or airport traffic controller must be at least 21 years of age and able to speak clearly and precisely. They enter the field through the competitive Federal Civil Service system after passing a rigid physical examination, which they must pass every year. Applicants must pass a written test designed to measure their ability to learn, perform the duties of air traffic controller, and meet certain experience, training, and related requirements.

Successful applicants for airport traffic controller jobs are given approximately 8 weeks of formal training to learn the fundamentals of the airway system, Civil Air Regulations, and radar and aircraft performance characteristics. Newly hired air-route traffic controllers are given a slightly longer period of basic instruction. After completing this training, both groups of controllers qualify for a basic air traffic control certificate. At an FAA control tower or center, they receive additional classroom instruction and on-the-job training to become familiar with specific traffic problems. After about 6 months, they generally qualify as assistant controllers and receive additional training. This training is designed to simulate emergency situations to determine the assistant controller's emotional stability under pressure, stress, and strain. Only after he has demonstrated his ability to apply procedures, and to use available equipment under pressure and stress, may he work as a controller. This usually takes about a year from the time he becomes an assistant controller.

Controllers can advance to the job of chief controller. After this promotion, they may advance to more responsible management jobs in air traffic control and to a few top administrative jobs in the FAA.

Employment Outlook

Total employment of air traffic controllers is expected to increase slowly through the 1970's. Both the number of airport traffic controllers and air-route traffic controllers are

expected to increase despite the greater use of automated equipment.

Additional airport traffic controllers will be needed because of the anticipated growth in the number of airport towers that will be built to reduce the burden on existing facilities and to handle increasing airline traffic. More airport controllers will also be needed to provide services to the growing number of pilots outside of the airlines, such as those employed by companies to fly executives.

A small number of additional air-route traffic controllers will be needed during the next few years to handle increases in air traffic. However, with the expected introduction of an automatic air traffic control system and a further decline in the number of control centers, employment of air-route traffic controllers is expected to decline in the longer run.

A few hundred openings will occur each year for both kinds of controller jobs because of the need to replace those workers who leave for other work, retire, or die.

Earnings and Working Conditions

The monthly salary for air traffic controllers during their first 6 to 12 months of training averaged about $490 in late 1966. After this training period, they receive $590 monthly during their first year as an assistant air traffic controller. Air-route traffic controllers can earn over $1,000 a month, depending on the type of work they do. Airport traffic controllers can earn from about $650 to over $1,000 a month, depending on the amount of traffic handled at their facility and how long they have been on the job. In addition, all traffic controllers are eligible for periodic wage increases. In areas that handle extremely large volumes of air traffic, a chief controller may earn $1,460 and over a month. These employees receive the same annual leave, sick leave, and other benefits provided other Federal workers.

FAA controllers work a basic 40-hour week; however, they may work overtime, for which they receive equivalent time off or additional pay. Because control towers and centers must be operated 24 hours a day, 7 days a week, controllers are periodically assigned to night shifts on a rotating basis. However, an additional 10 percent is paid for work between 6 p.m. and 6 a.m.

Because of the congestion in air traffic, a controller works under great stress. He is responsible for directing as many as 10 to 20 or more aircraft at the same time. He must simultaneously check flights already under his control, know the flight schedules of aircraft approaching his area, and coordinate these patterns with other controllers as each flight passes from his control area to another.

See introductory section for sources of additional information and for general information on supplementary benefits and working conditions.

GROUND RADIO OPERATORS AND TELETYPISTS

(D.O.T. 193.282 and 203.588)

Nature of Work

Ground radio operators and teletypists transmit highly important messages concerning weather conditions and other flight information between ground station personnel and flight personnel. Radio operators use a radio-telephone to send and receive spoken messages; some operators may use a radio-telegraph to transmit written messages. Radio operators occasionally may make minor repairs on their equipment. Teletypists transmit only written messages between ground personnel. They operate a teletype machine which has a keyboard similar to that of a typewriter.

Flight service station specialists employed by the Federal Aviation Administration (FAA) do work similar to that of airline ground radio operators and teletypists. They use radio-telephones, radio-telegraph, and teletype machines in their work. In addition to providing pilots with weather and navigational information before and during flights, these workers relay messages from air traffic control facilities to other ground station personnel and to pilots.

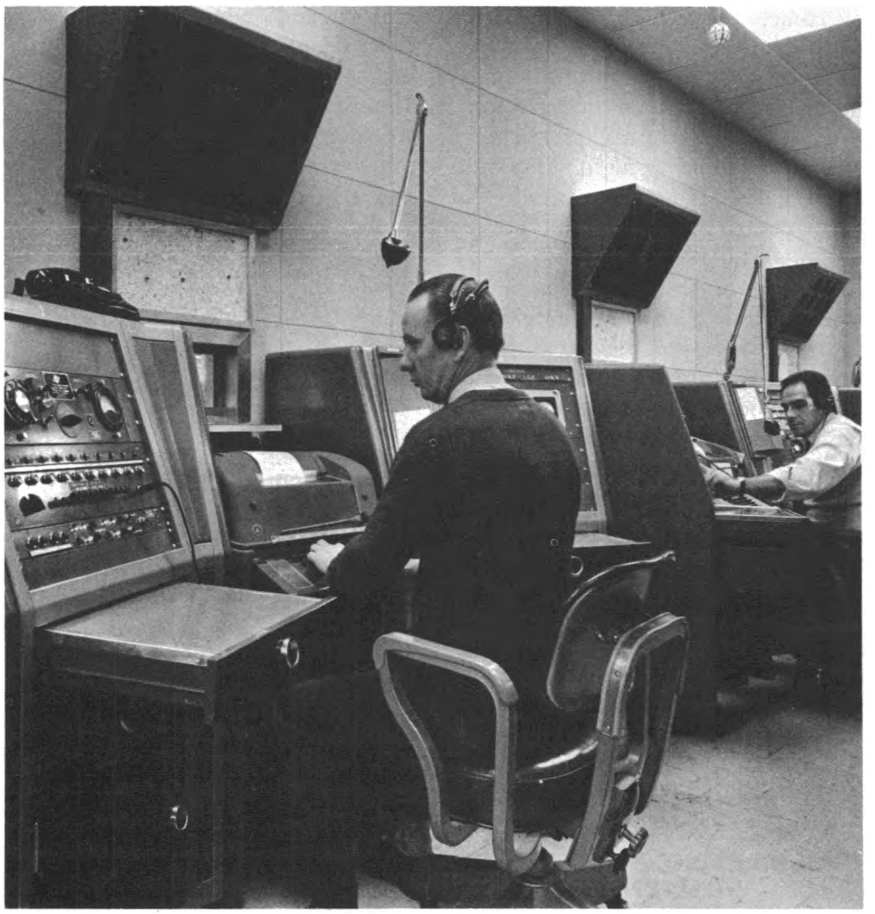
Where Employed

About 8,000 ground radio operators and teletypists were employed in air transportation in late 1966. Flight service station specialists employed by the FAA made up about half of these employees. The scheduled airlines employed about 3,100 radio operators and teletypists. An additional 375 were employed by a cooperative organization which offers the airlines, private pilots, and corporation aircraft its services over a centralized communications system. A few hundred were employed by the Army and Navy in civilian communications occupations.

FAA flight service station specialists work at stations scattered along the major airline routes; some stations are located in remote places. Ground radio operators and teletypists employed by the airlines work mostly at airports in or near large cities.

Training, Other Qualifications, and Advancement

Applicants for airline radio operator jobs usually must have at least a third-class Federal Communications Commission radio-telephone or radio-telegraph operator's permit. However, a second-class operator's permit is preferred. They must also be high school graduates and have a good speaking voice, the ability to type at least 40 words a minute, and a basic knowledge of the language used in weather reports. Teletypists must be able to type at least 40 words a minute and have had training or



Ground radio operators and teletypists process messages in radio room.

experience in operating teletype equipment. Applicants for jobs as radio operators and teletypists must also have a knowledge of standard codes and symbols used in communications.

To qualify for entry positions as FAA flight service station specialists, applicants must be at least 21 years old, pass a written test, and meet certain experience requirements. Permanent appointments are made on the basis of Federal civil service examinations.

The airlines usually employ women as teletypists, and an increasing number are being hired as radio operators. Both airline radio operators and teletypists and FAA flight service station specialists serve probationary periods, during which time they receive on-the-job training. Skill gained in communications is helpful experience for transferring into such higher paying jobs as airline dispatcher or meteorologist.

Employment Outlook

Openings for entry positions as radio operators or teletypists will number less than a hundred each year during the 1970's. These openings will occur as workers transfer to other fields of work, retire, or die.

Overall employment of these workers may decline somewhat because of the use of more automatic communications equipment which permits communications for longer distances.

The number of flight service station specialists employed by the FAA is expected to remain about the same in the years ahead. Need for additional workers to perform more services for pilots will be offset by improvements in equipment, and an increase in two-way radios that permit communications between pilots and air traffic controllers. The number of radio operators and teletypists employed by airlines will increase slowly due to communications systems becoming more automatic and centralized.

Earnings and Working Conditions

The beginning salary for airline radio operators who held the minimum third-class permit generally was between $388 and $490 a month in late 1966. Workers who held a second-class license generally received $10 to $25 more a month. The beginning salary for teletypists ranged from $355 to $400 a month. Beginning FAA flight service station specialists receive between $440 and $480 a month, depending on education and experience; experienced communicators earn from $640 to $835 a month.

Radio operators and teletypists in a number of airlines are unionized. The major union in these occupational fields is the Communications Workers of America.

See introductory section for sources of additional information and for general information on supplementary benefits and working conditions.

TRAFFIC AGENTS AND CLERKS

(D.O.T. 912.368, 919.368)

Nature of Work

Selling flight tickets, reserving seats and cargo space, and taking charge of the ground handling of planes are some of the duties of traffic agents and clerks. This group of workers includes ticket or reservation agents and clerks, operations or station agents, and traffic representatives.

Reservation sales agents and clerks

give customers flight schedule and fare information over the telephone. Reservation control agents record reservations as they are made and report the reservations by teletype machine to a central computer or to clerks in other cities so that the same space will not be sold twice. They also receive teletype messages informing them of the sale of space. On some of the larger airlines, data processing systems receive, record, and transmit flight space information to personnel at airports and reservations offices throughout the entire airline system at great speeds. Ticket agents sell tickets and fill out ticket forms, including such information as the flight number and the passenger's name and destination. They also check and weigh baggage, answer inquiries about flight schedules and fares, and keep records of tickets sold. Traffic representatives contact potential customers in order to promote greater use of the airlines services.

Operations or station agents are responsible for the ground handling of airplanes at their stations. They supervise the loading and unloading of the aircraft and sometimes do this work themselves. They see that the weight carried by the planes is distributed properly, compute gas loads and the weight carried by the plane, prepare a list of the cargo, and keep records of the number of passengers carried. They may also make arrival and departure announcements and prepare the weather forms that pilots use when they plan their routes.

Where Employed

About 33,000 men and women were employed as traffic agents and clerks by the scheduled airlines in late 1966. A few thousand others were also employed by the supplemental airlines, and by foreign-flag airlines that operate between the United States and overseas points.

Traffic staffs are employed principally in downtown offices and at airports in or near large cities where most airline passenger and cargo business originates. Some are employed in smaller communities where airlines have scheduled stops.

Training, Other Qualifications, and Advancement

Traffic agents and clerks must deal directly with the public, either in person or by telephone. For this reason, airlines have strict hiring standards with respect to appearance, personality, and education. A good speaking voice is essential because these employees frequently use the telephone or public address systems. High school graduation generally is required, and college training is considered desirable. Experience with freight, passenger, or express traffic in other branches of transportation is also desirable.

College courses in transportation, such as "traffic management" and "air transportaton," as well as experience in other areas of air transportation, are helpful for a higher grade job, such as traffic representative. Both men and women are employed as reservation and ticket agents; however, most operations agents are men.

Traffic agents may advance to traffic representative and supervisor. A few may eventually move up to city and district traffic and station manager. Some transfer to better paying jobs with travel agencies or to the traffic departments of big corporations.

Employment Outlook

Employment of traffic personnel will increase rapidly over the 1970's, mainly because of anticipated growth in passenger and cargo traffic. In addition to the thousands of opportunities for new workers that will result from this employment growth, additional opportunities will arise as young women leave their jobs to marry or rear children.

Most of the major airlines are installing new machines to record and process reservations, keep records, and perform a variety of other routine tasks. Mechanization will affect the reservation clerks in particular. The employment of ticket agents, however, whose main job involves personal contacts, will not be affected very much, although their paper work will be reduced considerably. The small group of traffic representatives probably will increase substantially as the airlines compete for new business.

Earnings and Working Conditions

Limited wage data collected from union-management contracts covering reservations and ticket agents employed by several airlines indicate that their beginning salaries ranged from $388 to $436 a month in early 1966. Those workers with 5 to 8 years or more of experience earned between $456 and $514 a month. Station and operations agents started at about $411 a month and progressed to about $553 a month after several years.

Many reservation and transportation agents belong to labor unions. Most of the organized agents belong to the Transport Workers Union of America or the Brotherhood of Railway and Steamship Clerks, Freight Handlers, Express and Station Employees.

See introductory section for source of additional information and for general information on supplementary benefits and working conditions.

OCCUPATIONS IN THE ELECTRIC POWER INDUSTRY

Nearly every American home, business, and community is dependent upon electricity. There would be no modern communication systems, no highly mechanized industries, and fewer of the appliances that have become an indispensable part of every day life without this most versatile form of energy. Many types of workers are needed to produce electricity, develop additional markets for it, and distribute it to the consumer. These workers include power plant operators, linemen, electricians, engineers, research scientists, salesmen, technicians, meter readers, and office workers. Electric utilities offer interesting jobs and steady employment for men and women in several thousand communities throughout the country.

Nature and Location of the Industry

The electric power industry includes about 3,600 electric utility systems, which vary greatly in size and type of ownership. Utilities range from large interconnected systems serving broad regional areas, to small power companies serving individual communities. Many utilities are investor owned (private) or owned by cooperatives; others are owned by cities, States, counties, and public utility districts, as well as by the Federal Government. Utility systems include power plants, which make (generate) electric power; substations, which increase or decrease the voltage of this power; and vast networks of transmission and distribution lines.

The delivery of electricity to the user at the instant he needs it is the distinctive feature of the operation of electric power systems. Electricity cannot be stored efficiently but must be used as it is produced. Because a customer can begin or increase his 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 during the day or night.

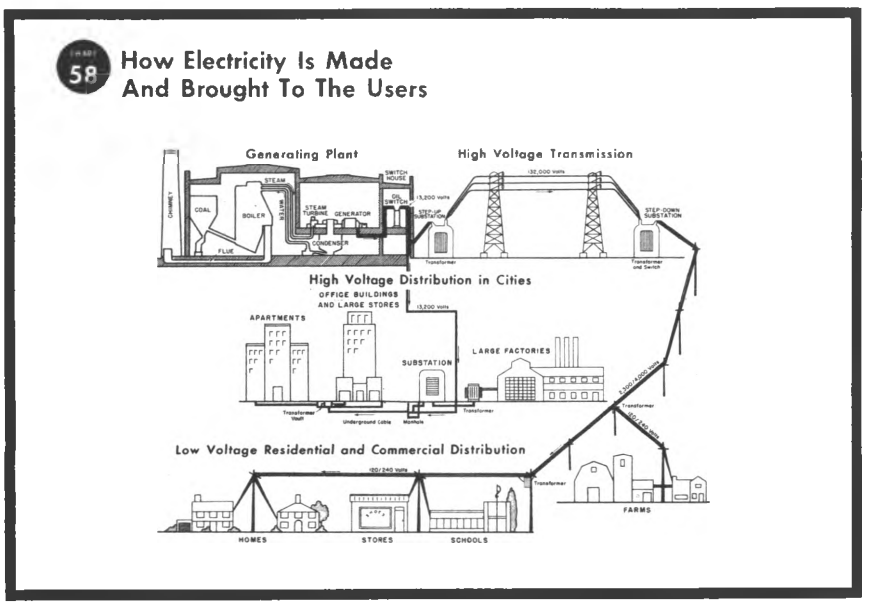
Some utilities generate, transmit, and distribute only electricity; others distribute both electricity and gas. This chapter is concerned with employment opportunities in those jobs relating only to the production and distribution of electric power.

In early 1967, private, cooperative, and government utility systems combined employed almost 460,000 workers. Privately owned utilities and cooperatives employed about 390,000 workers; Federal, State, and municipal government utilities employed the remaining 70,000. A few large manufacturing industries, which produce electric power for their own use, also employ some electric power workers.

Three principal groups of consumers—industrial, residential, and commercial—purchased about 95 percent of all electricity sold in 1966. Industrial customers such as chemical, steel, aluminum, and automobile plants purchased almost half of all the electric power sold. Residential customers purchased nearly 30 percent, and commercial customers such as stores, hotels, and office buildings purchased about 20 percent.

Electric utility service now reaches almost every locality and, therefore, electric utility jobs are found throughout the country. Hydroelectric power projects have created some jobs even in relatively isolated areas. Most utility jobs, however, are in heavily populated urban areas, especially where there are many industrial users, or where a large utility has its headquarters.

Producing and distributing large quantities of electrical energy involves many processes and activities. Chart 58 shows how electric energy is generated, and how it travels from the generating station to the users. The first step in providing electrical energy takes place 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, or oil for fuel. Increasingly, new steam generating stations use nuclear energy as fuel. A considerable amount of electricity is also produced in hydroelectric generating stations which use water power to operate the turbines. Some generators, primarily for use in standby service or to provide electricity for special purposes, are powered by internal combustion and gas turbine engines.

After electricity is generated, it passes through a "switchyard" where the voltage is increased in order that the electricity may travel long distances without excessive loss of power. After leaving the generating plant, electricity passes onto transmission lines. These lines carry electricity 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.

Electric Utility Occupations

Workers are needed in many different occupations to produce electric power for instant use. About 10 percent of the employees in this industry work in occupations directly related to the generation of electricity. About 20 percent are in jobs related to the transmission and distribution of power to the customers. Another 20 percent are in maintenance and repair work and in jobs such as guard, watchman, and janitor. Approximately 30 percent are employed in administrative and clerical jobs, 10 percent in customer servicing jobs, and 10 percent in scientific, engineering, and other technical occupations.

In addition to the powerplant, transmission, and customer service occupations (discussed in detail later in this chapter), the electric power industry employs large numbers of workers in maintenance, engineering, scientific, administrative, sales, and clerical occupations. The latter occupations are discussed briefly below. Detailed discussions of these and other occupations in the electric power industry and in many other industries are given in the *Handbook* sections covering the individual occupations.

Maintenance and Other Occupations. A considerable number of workers are engaged in maintaining and repairing the equipment used by the electrical utilities. The duties of these skilled craftsmen are similar to those of maintenance workers in other industries. Among the more important skilled workers are electricians, instrument repairmen, maintenance mechanics, machinists, pipefitters, and boilermakers. Other workers are employed as guards, watchmen, and janitors.

Engineering and Scientific Occupations. Many interesting job opportunities are available for engineers and technical workers in electric utilities. Engineers plan generating plant additions, interconnections of complex power systems, and installations of new transmission and distribution 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 select plant sites, types of fuel, and types of plants. Engineers also help industrial and commercial customers make the best use of electric power for equipment and lighting. They stimulate greater use of electricity by demonstrating the advantages of electrical equipment and suggesting places where electricity can be more effectively used.

Administrative and Clerical Occupations. Because of the enormous amount of recordkeeping necessary to run the business operations, electric utilities employ a greater proportion of administrative and clerical personnel than many other industries. Nearly a third of the industry's work force is employed in clerical and administrative jobs. Many of these workers are women. 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 is now being performed by electronic data-processing equipment. This generally results in more clerical work being done with the same or fewer employees. The use of this new equipment is also creating some new jobs such as programer and console operator. Administrative employees include specialized workers such as accountants, personnel officers, purchasing agents, lawyers, and salesmen.

Employment Outlook

Employment in the electric power industry is expected to show little or no change during the 1970's, although the production of electric power is expected to increase substantially. Several thousand job opportunities for new workers will occur each year during this period, however, because of the need to replace workers who retire, die, or leave the industry for other work.

Industrial customers are expected to use more electricity because of the widening application of electric power to industrial processes. Use of electricity by residential customers is expected to rise because of the rapid growth in population and the number of households. In addition, residential customers are expected to increase their use of electricity for

heating and air-conditioning, and for an increasing number and variety of appliances. The construction of new stores and office buildings and the modernization of existing structures will expand the use of electricity by commercial customers.

However, the growing use of automatic controls in this already highly mechanized industry makes possible large increases in the production of electric power with little or no increase in total employment. For example, since operators in generating stations are needed chiefly to check gages and control instruments, improvements in generating equipment have made possible great increases in the industry's capacity and production with only small increases in the number of operators. Continuing development of larger and more highly mechanized equipment with many automatic controls will result in a decline in the number of these operators. The employment of substation operators will continue to decline because of the installation of completely automatic equipment in all but the largest substations. Employment decreases in these occupations may be offset by the expected growth in the number of maintenance and repair craftsmen needed to keep the industry's increasing amount of complex machinery in working condition.

The employment of workers in maintenance and repair of transmission and distribution lines is expected to remain relatively stable. Fewer men per crew will be needed to work on electric power lines because of the increasing use of mechanized equipment for setting poles and for stringing and maintaining lines. However, this reduction in jobs per crew may be offset by the larger number of crews needed to service the expanding distribution systems required by the growing number of electric power customers.

Because of the increasing use of electronic data-processing equipment for billing and recordkeeping, only a small increase in office employment is expected. However, the relatively high turnover in office jobs will provide many additional openings for new workers each year. Some increase in employment is also expected in administrative jobs; scientific, engineering, and other technical jobs; and in such areas as sales and market development.

Earnings and Working Conditions

Earnings in the electric utility industry are generally higher than in other public utility industries and in many manufacturing industries. In mid-1967, earnings of nonsupervisory employees in private electric power utilities averaged $3.50 an hour or $145.95 a week.

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.

Because supplying electricity is a 24-hour, 7-day-a-week activity, some employees must work evenings, nights, and weekends. Most union contracts with electric utilities provide a higher rate of pay for evening and night work than the basic day rate. In 1966, most workers on the second shift received from 7 to 17 cents an hour more than the basic day rate, and those on the third shift, from 9 to 24 cents an hour more.

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 to work during nonscheduled hours, the worker is generally guaranteed a minimum of 3 or 4 hours' pay at 1½ times his basic hourly rate. Travel time to and from the job is counted as worktime.

In addition to these provisions which affect the workers' pay, electric utilities provide other benefits. Annual vacations are granted to workers according to length of service. Usually, contracts or employee benefit programs provide 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. A number of contracts and programs provide for 4 weeks after 20 years or more. The number of paid holidays ranges from 6 to 12 days a year, depending on the locality. Nearly all companies have benefit plans for their employees. A typical program provides life, hospitalization, and surgical insurance and paid sick leave. Retirement pension plans supplement Federal social security payments and are generally paid for in full or in part by the employer.

The number of injuries per million man-hours worked is much lower in this industry than in most manufacturing industries. Workers in some occupations in this industry are more subject to accidents than others. Accidents occur most frequently among the line and cable splicing crews. Because of the dangers of electrocution and other hazards, electric utilities and unions have made intensive efforts to enforce safe working practices.

Where To Go for More Information

More information about jobs in the electric power industry may be obtained from local electric utility companies, industry trade associations, or from the local offices of unions which have electric utility workers among their membership. Additional information may be obtained from:

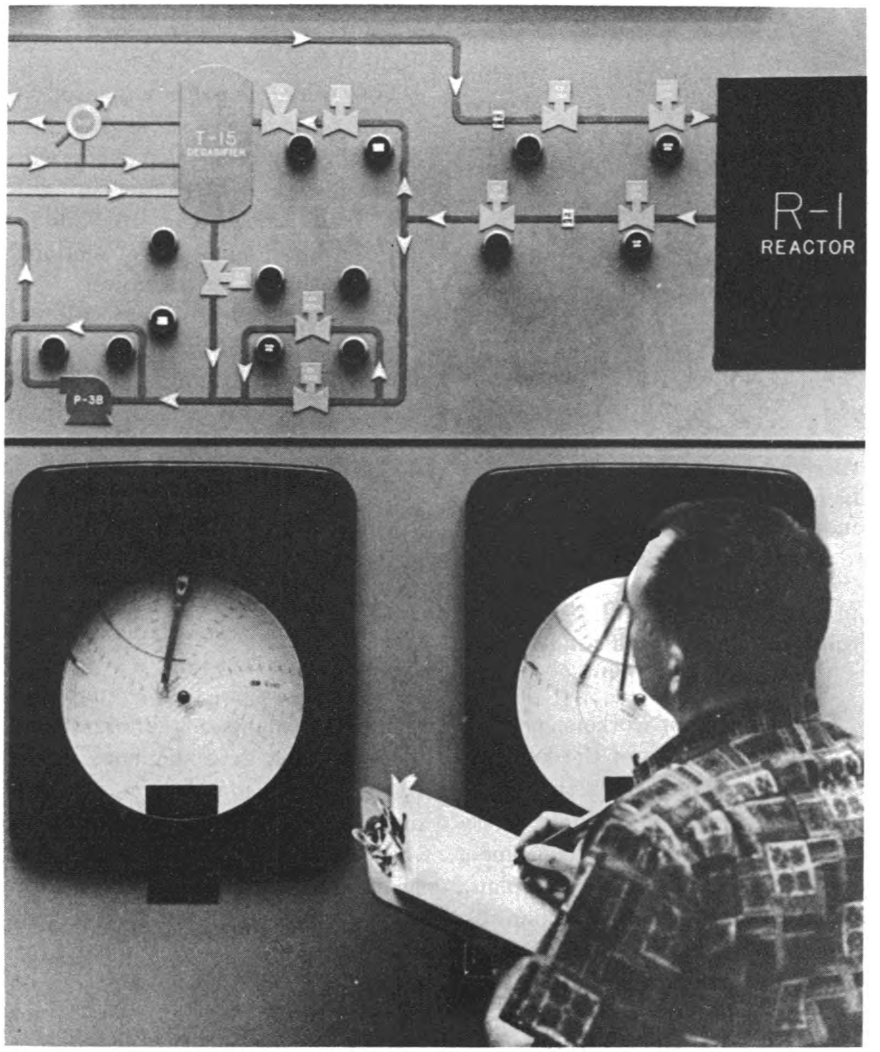
International Brotherhood of Electrical Workers,
1200 15th St. NW., Washington, D.C. 20005.

Utility Workers' Union of America,
1875 Conn. Ave. NW., Washington, D.C. 20006.

POWERPLANT OCCUPATIONS

Nature of Work

Operators are key workers in a powerplant. They watch, check, control, and keep records of the operation of various kinds of equipment. They must see that the equipment functions efficiently and instantly detect any trouble that arises. There are four basic classes of operators—boiler, turbine, auxiliary equipment, and switchboard operators. In many new steam plants, the duties of these operators are combined, and operators and their assistants are known as steam operators, powerplant operators, or central control room operators. Of increasing importance in this highly mechanized industry are the maintenance men and repairmen, including electrical, instrument, and mechanical repairmen. Other powerplant workers include helpers and cleaners, and custodial staff, including janitors and watchmen. Coal handlers are employed in steam generating plants that use coal for fuel. Hydroelectric plants employ gate tenders who open and close the headgates that control the flow of water to the turbines. Supervision of powerplant operations is handled by a chief engineer and by his assistants, the watch engineers.



Operator checks instrument readings at nuclear-powered generating plant.

Boiler operators (D.O.T. 950.782) regulate the fuel, air, and water supply in the boilers and maintain proper steam pressure needed to turn the turbines, on the basis of information shown by gages, meters, and other instruments mounted on panel boards. One man may operate one or more boilers. Boiler operators, of course, are employed only where steam is used to generate electricity.

Turbine operators (D.O.T. 952.-138) control the operation of steam- or water-powered turbines which drive the generators. (In small plants, they may also operate auxiliary equipment or a switchboard.) Modern steam turbines and generators operate at extremely high speeds, pressures, and temperatures; therefore, close attention must be given the pressure gages, thermometers, and other instruments which show the operations of the turbogenerator unit. Turbine operators record the 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 which change the steam back into water. They are also responsible for starting and shutting down the turbines and generators, as directed by the switchboard operator in the control room. Other workers, such as helpers 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 go out of order occasionally, the operators must be able to detect trouble quickly, make accurate judgments, and sometimes make repairs. Some small plants do not employ auxiliary equipment operators; these duties are performed by turbine operators.

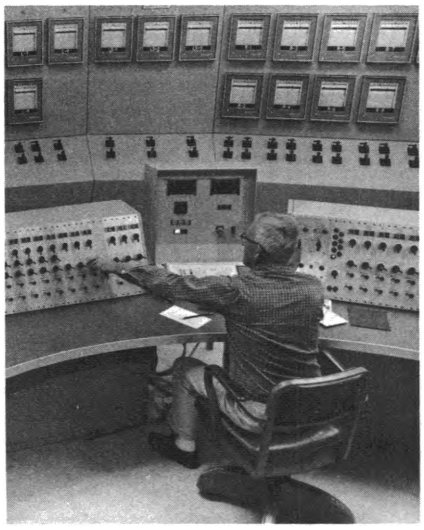
Switchboard operators (D.O.T. 952.782) control the flow of electric power in the generating station from generators to outgoing powerlines. They usually work in a control room

which is equipped with switchboards and instrument panels. 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 in the station, to combine the current from two or more generators, and to regulate the flow of the electricity onto various powerlines to meet the demands of the users served by each line. When power requirements on the station 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 work, 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.

In most powerplants constructed in recent years, the operation of boilers, turbines, auxiliary equipment, and the switching required for efficient balancing of generator output has been centralized in a single control room. Here, central control room operators or power plant operators, by monitoring instrument panels and manipulating switches, regulate all the power generating equipment, which in older plants requires specialists such as boiler and turbine operators. Control room operators have several assistants whose duties include



Operator at instrument console controls generating plant.

patrolling the plant and checking the equipment. The central control room operators report to the plant superintendent or watch engineers when equipment is not operating properly.

Watch engineers (D.O.T. 950.131) are the principal supervisory workers in a powerplant. They supervise the employees responsible for the operation and maintenance of boilers, turbines, generators, auxiliary equipment, switchboards, transformers, and other machinery and equipment. Watch engineers are supervised by a chief-engineer or a plant superintendent who is in charge of the entire plant.

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 job openings occur. Formal apprenticeships in these jobs are rare. Applicants are generally required to have a high school education or its equivalent. Advancement on the job depends primarily on ability to master the skills required.

It takes from 1 to 3 years to become 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 his way up to boiler repairman. In most large cities, boiler operators, who operate high-pressure boilers, are required to be licensed.

Powerplant workers employed in atomic-powered electric plants must have special training to work with fissionable, radioactive fuel, in addition to the knowledge and skills required for operation of conventional steam generated electric power.

Turbine operators are selected from among auxiliary equipment operators in many plants. The line of advancement in other plants is from laborer to turbine helper. The helper then may advance either to junior turbine operator and eventually to turbine operator, or he may transfer to turbine repairman, depending on job openings and his aptitude. Turbine operators in most large cities are required to be licensed.

Where a system has a number of generating plants of different size, operators 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 operations section begin as helpers, advance to junior operators, and then to switchboard operators. They also may advance from jobs in small stations to those in larger stations where operating conditions are much more complex. 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

The total number of jobs for powerplant operators is expected to show little or no change during the 1970's, although the production of electrical energy will increase at a rapid rate. However, several hundred job openings for new workers will occur each year because of the need to replace operators who retire, die, or leave the industry for other work.

The use of increasingly larger and more efficient equipment is expected to make possible great increases in capacity and production with little or no increase in the number of powerplant operators. For example, one operator can control a large modern turbogenerator as readily as he can control a much smaller one. Also, the growing use of more automatic equipment reduces the number of operators needed, and makes it possible to direct all operating processes from a central control room.

Generally, running an atomic-powered plant requires about the same number of employees as running a steam-generating plant using more common fuels.

Earnings and Working Conditions

The earnings of powerplant workers depend on the type of job, the section of the country in which they work, and many other factors. The following tabulation shows estimated average hourly earnings for selected powerplant occupations in privately operated utilities in 1966:

	Average hourly earnings
Auxiliary equipment operator	$3.18
Boiler operator	3.55
Control room operator	4.11
Switchboard operator:	
Switchboard operator, Class A	3.72
Switchboard operator, Class B	3.36
Turbine operator	3.71
Watch engineer	4.53

A powerplant is typically well lighted and ventilated, clean, and orderly, but there is some noise from the whirring turbines.

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 is generally not physically strenuous, particularly in the newer powerplants. Since generating stations operate 24 hours a day, 7 days a week, powerplant employees sometimes must work nights and weekends.

TRANSMISSION AND DISTRIBUTION OCCUPATIONS

Nature of Work

One-fifth of the workers employed by electric light and power systems are in transmission and distribution jobs maintaining the flow of electric power to the users. The principal workers in transmission and distribution jobs are those who control the flow of electricity—load dispatchers and substation operators—and the men who construct and maintain powerlines—linemen, cable splicers, troublemen, groundmen, and helpers. Linemen make up the largest single occupation in the industry.

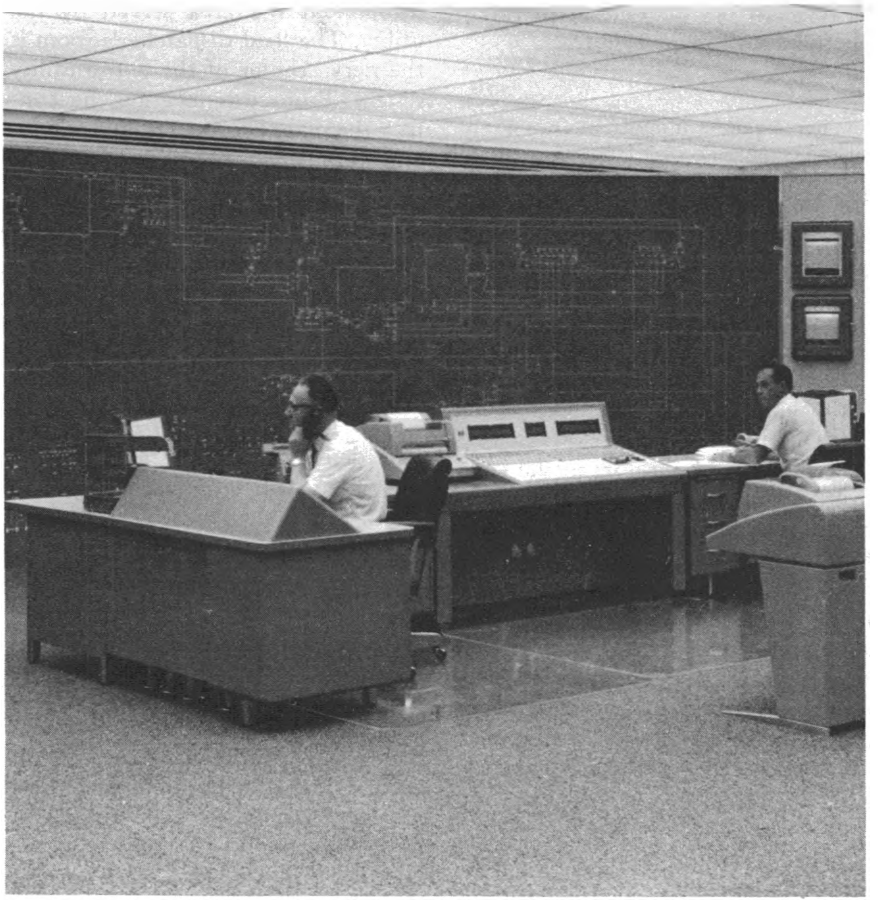
Load dispatchers (D.O.T. 950.168) (sometimes called system operators or power dispatchers) are the key operating workers of the transmission and distribution departments. They control the flow of electricity throughout the area served by the utility. The load dispatcher's room is the nerve center of the entire utility system. From this location, he controls the plant equipment used to generate electricity and directs its flow throughout the system. He telephones his instructions to the switchboard operators at the generating plants and the substations. He tells the operators when additional boilers and generators are to be started or stopped in line with the total power needs of the system.

The load dispatcher must anticipate demands for electric power, so the system will be prepared to meet them. Power demands on utility systems may change from hour to hour. A sudden afternoon rainstorm can cause a million lights to be switched on in a matter of minutes.

He must also be able to direct the handling of any emergency situation, such as a transformer or transmission line failure, and to route current around the affected area. Load dispatchers may also be in charge of interconnections with other systems, and they direct the transfer of current between systems as the need arises.

The load dispatcher's source of information for the entire transmission system centers in the pilot board. This pilot 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 may also have several recording instruments which make a graphic record of operations for future analysis and study.

Substation operators (D.O.T. 952.782) are generally in charge of a substation and are responsible for its operation. Under orders from the load dispatcher, they direct the flow of current out of the station by means of a switchboard. Ammeters, volt-



Load dispatchers control flow of electricity through distribution lines.

meters, 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 levers on the switchboard which 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, the substation operators check the operating condition of all equipment to make sure that it is in good working condition. They supervise the activities of the other substation employees on the same shift, assign them tasks, and direct their work. In smaller substations, the substation operator may be the only employee.

Linemen (D.O.T. 821.381) construct and maintain the network of powerlines which carry electricity from generating plants to consumers. Their work consists of installations, equipment replacements, repairs, and routine maintenance work. Although in many companies the installation of new lines and equipment is important, in other companies this work is performed by outside contractors. When wires, cables, or poles break, it means an emergency call for a line crew. Linemen splice or replace broken wires and cables and replace broken insulators or other damaged equipment.

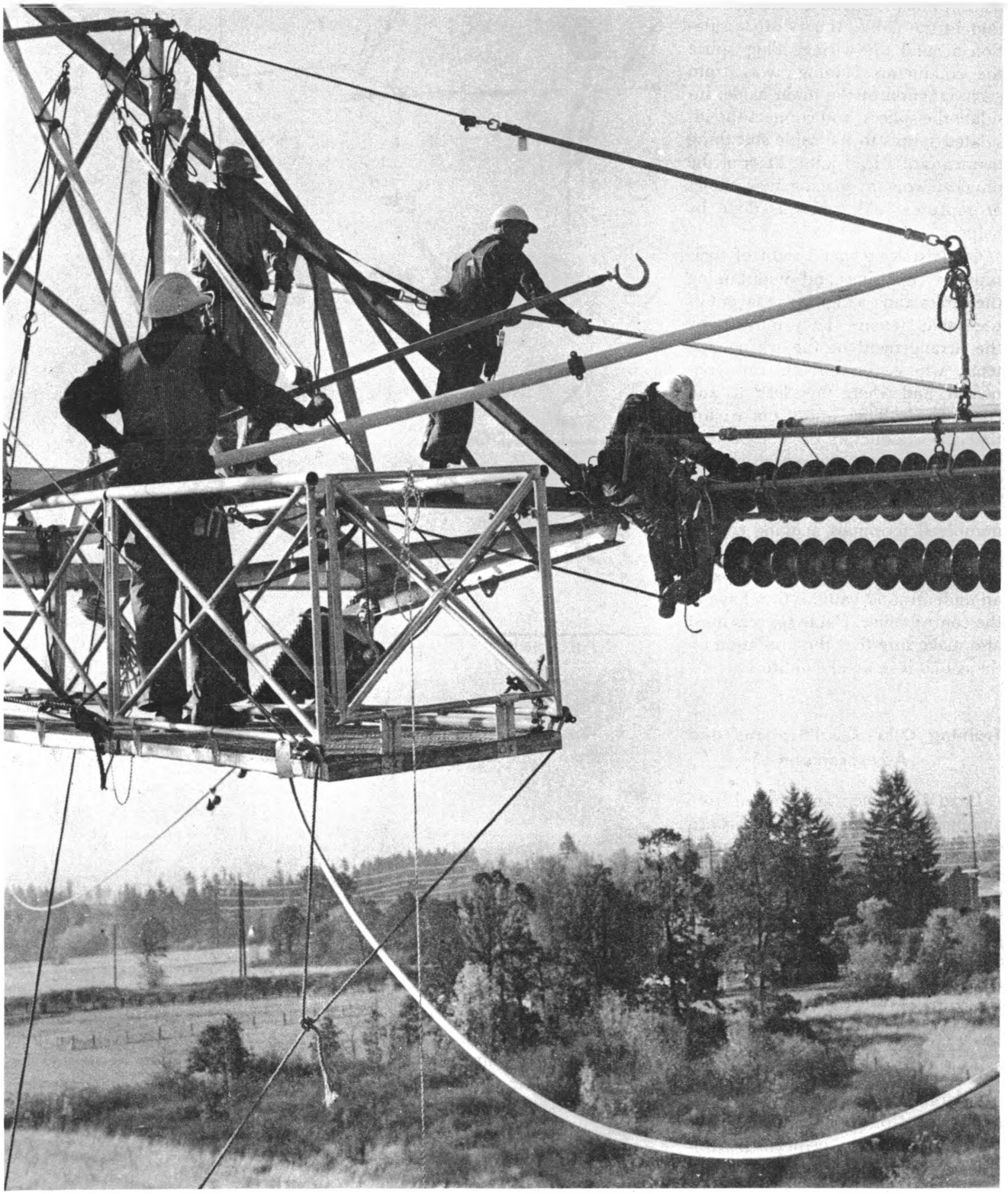
In some power companies, linemen specialize in particular types of work. Those in one crew may work only on new construction and others may do only repair work. In some instances, linemen specialize on high voltage lines using special "hot line" tools to avoid interruptions in the flow of current.

Troublemen (D.O.T. 829.281) are experienced linemen who are assigned to special crews that handle emergency calls for service. They move from one special job to another, as ordered by a central service office which receives reports of line trouble. Often troublemen receive their orders by direct radio communication with the central service office.

These workers must have a thorough knowledge of the company's transmission and distribution 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 trouble, a troubleman may restore service in the case of minor failure, or he may simply disconnect and remove damaged equipment. He must be familiar with all the circuits and switching points so that he can safely disconnect live circuits in case of line breakdowns.

Groundmen (D.O.T. 821.887) dig poleholes and assist the linemen and apprentices to erect the wooden poles which carry the distribution lines. The linemen bolt crossarms to the poles or towers and bolt or clamp insulators in place on the crossarms. With the assistance of the groundmen, they raise the wires and cables and install them on the poles or towers by attaching them to the insulators. In addition, with assistance from groundmen, linemen attach a wide variety of equipment to the poles and towers, such as lightning arrestors, transformers, and switches.

Cable splicers (D.O.T. 829.381) install and repair underground lines, performing about the same service as the linemen do on the overhead lines. When cables are installed, the cable splicers pull the cable through the conduit in which the cable is carried and then join the cables at connecting points in the transmission and



Linemen repair extra-high voltage transmission line.

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 insulated splices to the cable sheathing by means of a lead joint. Most of the physical work in placing new cables or replacing old cables is done by helpers.

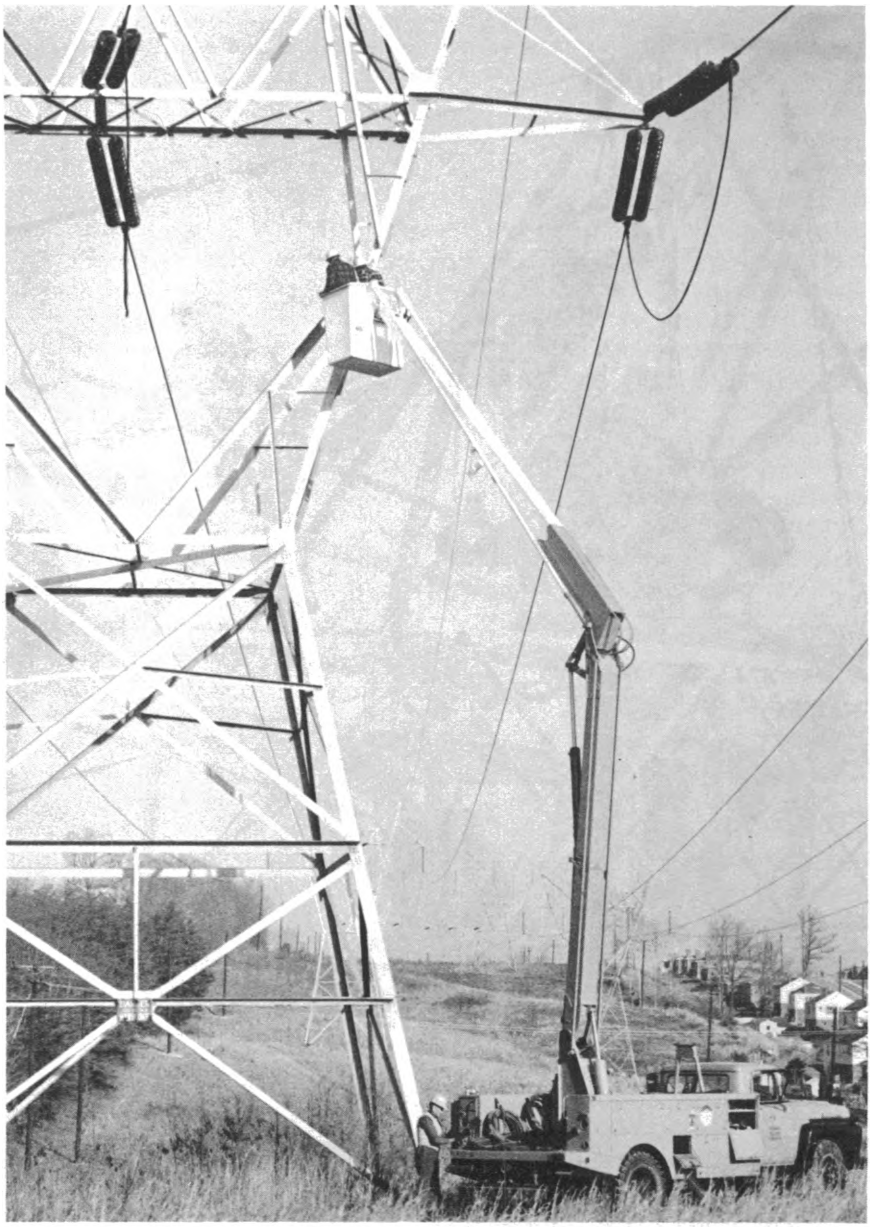
Cable splicers spend most of their time in repairing and maintaining the cables and changing the layout of the cable systems. They must know the arrangement of the wiring systems, where the circuits are connected, and where they lead to and come from. They must make sure that the conductors do not become mixed up between the substation and the customer's premises. The splicers connect the ends of the conductors to numbered terminals, making certain that they have the same identifying number at the remote panel box in an underground vault as they have in the control office. Cable splicers must also make sure that the insulation on the cables is in good condition.

Training, Other Qualifications, and Advancement

Load dispatchers are selected from among the experienced switchboard operators and operators of the larger 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 demonstrate his 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.

Skilled linemen (journeymen) usually qualify for such jobs after about 4 years of on-the-job training. In some companies, this training consists of a formal apprenticeship program. Under formal apprenticeship, there is a written agreement, usually worked out with a labor union, which covers the content of the training and the length of time the apprentice works in each stage of the training. The apprenticeship program combines on-the-job training and classroom instruction in blueprint reading, elementary electrical theory, electrical codes, and methods of transmitting electrical currents.



Linemen work on transmission lines from "bucket truck."

The apprentice usually begins his training by helping the groundman to set poles in place and by passing tools and equipment up to the lineman. After a training period of approximately 6 months, the apprentice begins to do simple linework on lines with low voltage. While on this work, he is under the immediate supervision of a journeyman lineman or the line foreman. After about a year, he is assigned more difficult work but is still under close supervision. During the last 6 months of his apprenticeship, the trainee does about the same kind

of work as the journeyman lineman but with more supervision. When he begins to work independently, he is first assigned simple, routine tasks. After he acquires several years of experience and demonstrates a thorough knowledge of the company's transmission and distribution systems, he may advance from lineman to troubleman.

The training of linemen who learn their skills on the job is generally similar to the apprenticeship program; it usually takes about the same length of time but does not involve classroom instruction. The worker begins as a groundman and progresses through increasingly difficult stages of linework before becoming a skilled lineman.

Candidates for linework should be strong and in good physical condition, since climbing poles and lifting lines and equipment is strenuous work. They must also have steady nerves and good balance to work at the tops of the poles and to avoid the hazards of live wires and falls.

Most cable splicers get their training on the job, usually taking about 4 years to become fully qualified. Workers begin as helpers and are then promoted to assistant or junior splicers. In these jobs, they are gradually assigned more difficult tasks as their knowledge of the work increases.

Employment Outlook

Several thousand job opportunities are expected to be available in transmission and distribution occupations during the 1970'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.

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 linemen and troublemen is expected to increase only slightly because of the use of more mechanized equipment. Some increase in the number of cable splicers is expected because of the growing use of underground lines in suburban areas. The need for substation operators will be reduced substantially since the introduction of improved and more automatic equipment makes it possible to operate most substations by remote control.

Earnings and Working Conditions

The earnings of transmission and distribution workers depend on the type of job they have, and the section of the country in which they work. The following tabulation shows the average hourly earnings for major transmission and distribution occupations in privately operated utilities in 1966:

	Average hourly earnings
Groundman	$2.61
Lineman	3.81
Load dispatcher	4.57
Substation operator	3.71
Troubleman	3.82

Load dispatchers and substation operators generally work indoors in pleasant surroundings. Linemen, troublemen, and groundmen work outdoors and, in emergencies, 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 accident hazards of these jobs.

CUSTOMER SERVICE OCCUPATIONS

Nature of Work

Workers in customer service jobs include those who install, test, and repair meters, and those who read the meters. Also in this group are company agents in rural areas and appliance servicemen working in company-operated shops which repair electrical equipment owned by customers.

Metermen (D.O.T. 710.281) (or meter repairmen) are the most skilled workers in this group. They install, test, maintain, and repair meters on customers' premises, particularly those of large industrial and commercial establishments. Some metermen 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 have meter specialists, such as *meter installers* (D.O.T. 821.381) and *meter testers* (D.O.T. 710.281). Meter installers put in and take out meters. Meter testers specialize in testing the small meters on homeowners' property and some of the more complicated ones used by commercial and industrial customers.

Meter readers (D.O.T. 239.588) go to customers' premises—homes, stores, and factories—to read the figures on the meters which register the amount of electric current used. They record the amount of current used in a specific period so that each customer can be charged for the amount he used. Meter readers also watch for, and report, any tampering with meters.

District representatives usually serve as company agents in outlying districts, in localities where the utility company does not have an office, and where the small number of customers does not justify the use of more specialized workers. Their work includes reading meters, collecting overdue bills, connecting and disconnecting meters, and making minor repairs. They receive complaints about service and reports of line trouble and send them to a central office for handling.

Training, Other Qualifications, and Advancement

Metermen begin their jobs as helpers in the meter testing and meter repair departments. Young men entering this field should have a basic knowledge of electricity. About 4 years of on-the-job training are required to become a fully qualified meterman. Some companies have formal apprenticeship programs for this occupation in which the trainee progresses according to a specific plan.

Utility companies usually employ inexperienced men to work as meter readers. They generally accompany the experienced meter reader on his rounds until they have learned the job well enough to go on the rounds alone. This job can be learned in a few days.

The duties of district representatives are learned on the job. An important qualification for men in these jobs is the ability to deal tactfully with the public in handling service complaints and collecting overdue bills.

Employment Outlook

Little change in employment in customer service occupations is expected through the 1970's. The need for meter readers will be limited because of the trend toward less frequent reading of meters. Moreover, automatic meter reading may become more common and new meters will require less maintenance. However, a few job openings for metermen and meter readers will occur each year to replace those workers who retire, die, or transfer to other fields of work.

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 the average hourly earnings for major customer service jobs in privately operated utilities in 1966:

	Average hourly earnings
District representative	$3.72
Meterman A	3.84
Meterman B	3.30
Appliance serviceman	3.31
Meter reader	2.89

The job of the meter reader is not physically hard but involves considerable walking and some stair climbing. Metermen and appliance servicemen work indoors under typical repair shop conditions except when repairing or installing meters or appliances on customers' premises.

RADIO AND TELEVISION BROADCASTING OCCUPATIONS

The glamour and excitement associated with radio and television make careers in broadcasting attractive to many young people. The electronic technology involved in transmitting programs and the business aspects of operating a broadcasting station or network also are attractions. In early 1967, there were about 90,000 full-time and 21,000 part-time staff employees in commercial broadcasting; altogether, over 55 percent were employed in radio. Staff employees work for a broadcasting station or network on a regularly scheduled and continuous basis. In addition to staff employees, several thousand freelance performers, such as actors, musicians, dancers, comedians, and top-level announcers work on specific assignments from stations, networks, and other program producers. (Several thousand other employees work for independent program producers in activities closely related to broadcasting, such as the preparation of filmed and taped programs and commercials for broadcasting.)

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. Generally, the most specialized and best paying jobs are in large cities, especially those with national network stations. Nevertheless, the talented individual will have many opportunities to advance to good paying jobs in stations located in smaller communities.

Nature and Location of the Industry

In early 1967, about 5,700 commercial radio stations were in operation in the United States. Some 4,100 of these were AM stations (broadcasting on frequencies between 540 and 1600 kilocycles), and 1,600 were FM stations (broadcasting on frequencies between 88 and 108 megacycles).

About 600 commercial television stations were in operation in early 1967. Most of these were VHF stations which broadcast on channels 2 through 13; about 100 were UHF stations, which broadcast on channels 14 through 83. UHF stations generally employ fewer workers than VHF stations.

Most commercial radio broadcasting stations are small independent businesses. In early 1967, the average AM radio station employed about 11 full-time employees and about 3 workers on a part-time basis. FM-only stations, on the average, employed fewer employees—about 5 full time and 3 part time. Because they are more complex, television stations have more staff. The average station had about 70 full-time and 11 part-time employees.

Commercial radio stations are served by four nationwide networks and a large number of regional networks. Stations can affiliate with networks by agreeing to broadcast their programs on a regular basis. National radio networks have affiliated stations in almost every large metropolitan area, although only a minority of all radio stations are affiliated with national networks. Regional radio networks have fewer affiliated stations, and their activities usually consist of arranging for the sale of advertising time, and interconnecting member stations for special events such as baseball and football games. Regional networks have few full-time employees because their programing is conducted by staff employees of the affiliated stations. The four national radio networks together employed over 1,000 workers in early 1967.

Most television stations depend on one or more of the three national television networks for programs that would be too expensive for individual stations to originate—for example, sports events such as world series baseball games or international Olympic contests; broadcasts of operas, plays, and musicals; and newscasts of national and international significance. These networks, in turn, can offer national coverage to advertisers. Since some small cities have only one or two television stations, these stations often arrange to carry the programs of two or three networks in order to offer their viewers a wider variety of programs. A typical network television show may be carried by up to 200 stations across the country. In early 1967, the three national television networks employed about 11,000 workers, or 1 of every 5 staff employees in television.

Almost every community of over 10,000 population has at least 1 broadcasting station (usually radio), and a few of the largest metropolitan areas have as many as 30 radio and television stations. However, one-third of all radio stations are located in communities of less than 10,000, and most of these are in one-station communities. Generally, television stations are located in communities of more than 25,000 population. About three-fourths of all television stations are in communities of 100,000 or more. In contrast, over 60 percent of all radio stations are in communities of less than 100,000 population.

Practically all large broadcasting stations are located in metropolitan areas, but small stations are found in big cities as well as small communities. The largest proportion of broadcasting jobs are in New York and Cali-

fornia because New York City and Los Angeles are the two major centers for origination of network programs. Other large and heavily populated States, such as Illinois, Texas, Pennsylvania, and Ohio, also have many broadcasting workers because of the large number of individual stations.

In addition to commercial broadcasting stations, there were over 300 noncommercial radio stations (mainly FM), and over 100 noncommercial television stations, both VHF and UHF, in early 1967. These stations are operated by nonprofit organizations, principally educational agencies such as State commissions; local boards of education; colleges and universities; and special community educational television organizations. Relatively few full-time staff members were employed in educational radio and television stations; instructors and students often help to operate many of these stations, especially those located on college campuses.

Broadcasting Occupations

Employees of broadcasting stations generally specialize in 1 of 4 major areas of work, although there may be considerable "doubling in brass" in small stations. Those concerned with programing prepare and produce programs; engineering workers operate and maintain the equipment that converts sounds and pictures into electronic impulses that can be picked up on home receivers; sales workers sell time to advertisers and develop publicity and promotional material for the station. The remaining employees handle general business matters, such as accounting, payroll, public relations, personnel administration, and the clerical work related to all the station's activities.

Almost one-half of all full-time staff employees are in programing work and 1 worker in 5 is employed in the engineering department. Workers in the sales, publicity, and promotion departments account for every sixth employee, and one-fourth of all workers are engaged in some aspect of business management. These proportions vary widely among individual stations, depending on station size and type of programing.

Job duties vary greatly between small and large stations. In small radio stations, a large proportion of broadcast time consists of recorded music and weather and news announcements. As a result, small stations employ only a few workers, each of whom performs a variety of tasks. The station manager, who frequently is also the owner, may act as business and sales manager, or perhaps as program director, announcer, and script writer. Announcers in small stations may do their own writing, often operate the studio control board, and may even act as salesmen. The engineering staff may consist of only one full-time broadcast technician assisted by workers from the other departments on a part-time basis. Small low-powered stations, which do not use a directional antenna, may employ a chief engineer on a part-time contract basis, sharing his services with similar stations in the community. In large radio and television stations, jobs are more specialized and usually are confined to 1 of the 4 departments. The kinds of jobs found in each of these departments are described below.

Programing Department. The programing department plans, prepares, and produces radio and television programs. Staff employees plan the station's programing, produce the daily and weekly shows, assign personnel to cover special events, and provide general program services such as music, sound effects, and lighting. In addition to these staff employees, freelance actors, comedians, singers, dancers, some well-known announcers, and other entertainers are hired

Television cameramen sometimes work outdoors.

for specific broadcasts or a series of broadcasts or for special assignments. These performers work on a contract basis for the station, network, advertising agency, sponsor, or an independent company specializing in producing programs. Many radio and television entertainers also perform in stage plays, motion pictures, nightclubs, or other entertainment media.

The size of a station's programing department depends not only on the size of the station, but also on the extent to which its broadcasts are live, recorded, or received from a network. In small stations, the program functions are handled by a few people who make commercial announcements, read news and sports summaries, select and play recordings, and introduce network programs. A large television station, on the other hand, may have a program staff consisting of a large number of people in a wide variety of specialized jobs.

Responsibility for the overall program schedule of a large station rests with a *program director*. He arranges for a combination of programs that he believes will be most effective in meeting the needs of advertisers who buy the station's services and will at the same time be most attractive and interesting to members of the community served by the station. He determines and administers the station's programing policy.

Daily schedules of programs are prepared by a *traffic manager,* who also keeps a record of broadcasting time available for advertising. A *continuity director* is responsible for the writing and editing of all scripts. He may be assisted by a *continuity writer,* who prepares *Announcers' Books* ("copy"). These books contain the script and commercials for each program along with their sequence and length.

Individual programs or series of programs are planned and supervised by a *director*. In large stations, he may work under the supervision of a *producer,* who assumes responsibility for selection of scripts, financial control, and other overall problems of production. Sometimes these functions are combined in the job of *producer-director*. The director's major functions include selecting appropriate artists and studio personnel, scheduling and conducting rehearsals, coordinating the efforts of all the people involved in the show to produce effective entertainment, and directing the on-the-air show. He may be assisted by an *associate director,* who takes over such tasks as working out detailed schedules and plans, arranging for distribution of scripts and changes in scripts to the cast, and assisting in directing the on-the-air show. Some stations employ *program assistants* to aid in carrying out the orders of the director and his assistants. The assistants help assemble and coordinate the various parts of the show. They arrange for obtaining props, makeup service, art work, and film slides. They assist in timing

Program assistants help assemble and coordinate parts of show.

the on-the-air show, preparing cue cards from the scripts and using them to cue the performers. *Education and public affairs directors* act as a link between the station and schools, churches, and civic and charitable institutions. They supervise and edit most noncommercial programs.

Announcers are the largest and best known group of program workers. In radio and television stations of all sizes, the announcer introduces programs, guests, and musical selections, and delivers most of the live commercial messages. (Further information on broadcast announcers is given later in this chapter.)

Music is an important part of radio and television programing. 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 a *music librarian,* who maintains the music files and answers requests for any particular selection or type of music. In addition to recorded music, a few of the largest stations have specialized personnel who plan and arrange for musical services. The *musical director* selects, arranges, and directs suitable music for programs on general instructions from the program director. He selects musicians for live broadcasts and directs them during rehearsals and broadcasts. Musicians are generally hired for particular assignments on a freelance basis, although a few stations employ staff musicians full-time.

News gathering and reporting is an increasingly important aspect of radio and television programing. In addition to daily coverage of the news, sports, weather, and, in rural areas, farm reports, the news department also presents special programs covering such events as conventions, elections, and disasters. The *news director* plans and supervises the overall news and special events coverage of a station. A *newscaster* broadcasts daily news programs and reports special news events on the scene. A *newswriter* selects and writes news copy to be read on the air by the newscasters. In small stations the jobs of newscaster and newswriter frequently are combined.

Stations that originate live television shows must have staff members capable of handling staging jobs, since staging a television show is similar in many ways to producing a professional stage play. The *studio supervisor* plans and supervises the setting up of scenery and props and other studio and stage equipment for broadcasts. The *floor or stage manager* plans and directs the actors' positions and movements on the set in accordance with the director's instructions by relaying stage directions, station breaks, and cues. The jobs of studio supervisor and floor manager often are combined. *Floormen* set up props, hold cue cards, and do the unskilled chores around the studio. (This job is frequently held by a beginner in the programing department.) *Makeup artists* prepare personnel for broadcasts by applying proper makeup, and maintain the supplies and facilities necessary for this work. *Scenic designers* plan and design settings and backgrounds for programs. They select furniture, draperies, pictures, and other properties to help convey the visual impressions desired by the director. *Sound effects technicians* operate special equipment to simulate sounds, such as gunfire, thunder, or falling water during rehearsals and broadcasts.

About half of all television programing is on film, about 15 percent is live, and the remainder is recorded on magnetic video tape. Video tape recording is done by broadcast technicians on electronic equipment that permits instantaneous playback of a television performance. It can be used either to record a live show being broadcast or to prerecord a program for future broadcast. For filmed programs, the role of the station's programing staff is limited to editing the film and timing and scheduling the show. Many stations employ specialized staff members to take care of

Technician rewinds video tape.

filmed program material. The *film editor* edits all film and prepares it for on-the-air presentation. This includes screening all films received as well as cutting and splicing feature films to insert commercials. He also edits all locally produced film. The *film librarian* catalogs and maintains the station's files of motion picture film, which include not only complete programs, but many short sequences that can be fitted into programs to create effects which are difficult to produce in the studio, such as outdoor action.

Engineering Department. The engineering department of a broadcasting station is responsible for converting the sounds and pictures of programs into electromagnetic impulses that can be received on home radio and television sets. The main tasks of the engineering staff are positioning microphones, adjusting levels of sound, keeping transmitters operating properly, moving and adjusting television cameras to produce clear, well-composed pictures, and lighting television scenes and performers. The

staff also installs, maintains, and repairs the many types of electrical and electronic equipment required for these operations.

The basic job in the engineering department is that of the *broadcast technician* who is qualified to perform a variety of jobs in the radio or television station. For example, these technicians control the operation of the transmitter to keep the output level and frequency of the outgoing broadcast within legal requirements. They also set up, operate, and maintain equipment in the studio and in locations from which remote broadcasts are to be made. (Further information on broadcast technicians is given later in this chapter.)

All stations employ a *chief engineer,* who has responsibility for all engineering matters, including supervision of other technicians. In small stations, he also may work a regular shift at the control board. The large stations have engineers who specialize in such fields as sound recording, maintenance, and lighting. A few *development engineers* are employed by the networks to design and develop new electronic apparatus to meet special problems.

Sales Department. Broadcasting stations earn their income by selling services to advertisers. These services consist of the time on the air that is allotted to the advertisers' commercials. Advertisers may buy time as part of a regular daily or weekly show with which they wish to identify their product, or they may simply buy a time segment or "spot" without special reference to the program being broadcast.

Time salesmen, the largest group of workers in this department, sell time on the air to sponsors, advertising agencies, and other buyers. They must have a thorough knowledge of the stations' operations and the characteristics of the area it serves that are of most interest to advertisers, such as population, number of radio and television sets in use, income levels, and consumption patterns. Time salesmen in large stations often maintain close relationships with particular sponsors and advertising agencies, selling time and acting as general consultants and advisers to these clients in matters pertaining to advertising through the station. In very small stations, the time salesman also may handle other functions. Many stations sell a substantial part of their time, particularly to national advertisers, through independent sales agencies known as station representatives, which act as intermediaries for time buyers and stations or groups of stations.

Large stations generally have several workers who do only sales work. The sales manager supervises his staff of time salesmen, directing their efforts and setting general sales policy. He also may handle a few of the largest accounts personally. Some large stations employ statistical clerks and research personnel to assist the sales staff by analyzing and reporting market data relating to the community served, the significance of the ratings of the station's programs reported by the rating services, and other statistical information.

Business Management. Like other businesses, broadcasting stations have a considerable amount of administrative work. In a very small station, the owner and his secretary may handle all the recordkeeping, accounting, purchasing, hiring, and other routine office work. Where the size of the station warrants the employment of 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. Building maintenance men are employed to keep the facilities in good condition.

Training, Other Qualifications, and Advancement

A high school diploma is the minimum educational requirement for entry jobs in broadcasting, although for many jobs some college training is increasingly preferred. A liberal arts education is a good qualification for the beginner because broadcasting needs broadly educated people with knowledge and interests in many areas. Work in television programing for networks and large independent stations generally requires a college degree and some experience in the broadcasting field.

Training in specialized areas such as writing, public speaking, dramatics, designing, makeup, or electronics may be required of beginners in these specialties, even though work experience usually is not necessary. Some young people without specialized training or experience get their start in broadcasting in such jobs as clerk, typist, floorman, or assistant to an experienced worker. As these new workers gain knowledge and experience, they have the chance to advance to more responsible jobs. Young people are sometimes hired on the basis of their potentialities rather than for any specific training or experience, but the more skills, education, and varied background these beginners have, the better will be their chances for advancement. A few young people get started in broadcasting with temporary jobs in the summer when regular workers go on vacations, and broadcast schedules of day-light-hours stations are increased.

Technical training in electronics is required for entry jobs in engineering departments. In addition, anyone who operates or adjusts a broadcast transmitter must have a Federal Communications Commission Radiotelephone First Class Operator License. To obtain this license, an applicant must pass a series of technical examinations given by the Federal Communications Commission. Small radio stations with only a few employees sometimes prefer to have as many personnel as possible legally qualified to operate their transmitters. Because of this, nontechnicians, especially announcers, will have a better chance of getting a job in radio if they have a first class license. A course in elec-

tronics at a recognized technical institute is probably the best way to prepare for the FCC test.

Specific training or experience usually is not required for entry jobs as announcers in small stations, but an applicant must have a good voice, a broad cultural background, and other characteristics that make him a dramatic or attractive personality. Qualifications for administrative and sales jobs in broadcasting are similar to those required by other employers; a business course of study in high school or college is good preparation for such jobs.

Most beginners start out in small stations. Although these stations cannot pay high salaries, they offer new workers opportunities to learn many different phases of broadcasting work because they generally use their personnel in "combination" jobs. For example, in addition to his regular duties, an announcer may perform some of the duties of a broadcast technician.

Women make up about a fourth of broadcasting staff employment. They seldom are employed as technicians, announcers, or salesmen, but frequently work as production assistants, producers, newswriters, continuity writers, casting directors, costume or set designers, and supervisors of religious and children's programs. They also work in the many office occupations often filled by women. A job as secretary is frequently a good entry job for women interested in the programing and administrative areas of broadcasting.

People in the engineering department tend to remain in this area of work, where thorough training in electronics is essential. Program employees usually remain in programing work, although sometimes transfers from and to the sales and business services departments are made. Transfers are easier between sales and administrative 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 the beginning jobs and also in the top-level jobs. At the higher levels, a station executive may be drawn from top-level personnel of any department. Many top-level administrative jobs are filled by people with sales experience.

Employment Outlook

Employment in the broadcasting industry is expected to increase slowly during the 1970's. In addition to job opportunities resulting from growth, job openings will become available as workers transfer to other fields of work, retire, or die. Retirements and deaths alone will provide an estimated 2,000 job openings annually.

Although new radio and television broadcasting stations will be established over the period, most will be small and require few employees. In existing radio stations, employment probably will remain about the same. Continued introduction of equipment that permits the control of transmitters from the studio will eliminate the need for a technical crew at the transmitter site. Automatic programming equipment permits radio stations to provide virtually unattended programing service. These technological advances will tend to offset employment gains in other areas of station operations.

Employment in existing television stations may increase slightly as they continue to broaden the scope of their service, such as more local newscasts and locally produced shows. As more of the smaller stations acquire the capability to originate local color telecasts, there may be a small expansion in the number of technical workers to handle and operate the more complex equipment.

The number of educational broadcasting stations is expected to increase rapidly as private and governmental groups—local, State, and Federal—continue to expand this medium as an educational tool. The growth of educational television stations, particularly, should provide an increasing number of job opportunities, especially in programing, engineering, and station management.

Competition will be very keen for entry jobs in broadcasting in the years ahead, especially in the large cities, because of the attraction this field has for young people, and the relatively few beginning jobs that will be available.

Earnings and Working Conditions

In late 1966, earnings of nonsupervisory broadcasting workers averaged $154.40 a week or $3.86 an hour for a 40-hour workweek. There is a wide range of salaries among various occupations in the industry and among locations. 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.

Working conditions in broadcasting stations are usually pleasant. The work is done in clean, attractive surroundings. It is performed indoors, except where remote pickups are involved. Jobs in programing are particularly attractive to young people interested in the performing arts, both because of the glamour attached to this field of work, and the opportunities it affords for high earnings and artistic expression.

Most broadcasting employees have a scheduled 40-hour workweek. However, some employees, particularly in the small stations, may have a longer workweek. Sales and business services workers generally work in the daytime hours common to most office jobs. However, program and engineering employees must work shifts which may include evenings, nights, weekends, and holidays. In order to meet a broadcast deadline, program and technical employees in the networks may have to work continuously

for many hours and under great pressure.

Many 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 men, and cameramen. 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 talent personnel who appear on films made for television.

Announcers have various duties, such as conducting interviews.

RADIO AND TELEVISION ANNOUNCERS

(D.O.T. 159.148)

Nature of Work

Radio and television staff announcers present news and live commercial messages, introduce programs, describe sporting events, act as masters of ceremonies, conduct interviews, and identify stations. In small stations, they may perform additional duties such as operating the control board, selling time, and writing scripts and news copy. In large stations, their duties are confined to the programing department.

Many announcers act as disc jockeys, introducing selections of recorded music and commenting on the music and other matters of interest to the audience. Disc jockeys "ad-lib" much of the commentary, working without a detailed script.

About 14,000 staff announcers were employed on a regularly scheduled, full-time basis in radio and television broadcasting stations in early 1967. About 85 percent of them were employed in radio. The average radio station employed 3 or 4 announcers; larger stations employed 8 or 10. Most television stations employed three staff announcers, although larger stations sometimes employed five or six. In addition to staff announcers, several thousand free-lance announcers sell their services for individual assignments to networks and stations, or to advertising agencies and other independent producers, for both programs (news, sports, disc jockey, etc.) and commercials. Some announcers become well-known and highly paid personalities.

Training, Other Qualifications, and Advancement

To succeed as an announcer, one must have a pleasant and well-controlled voice, a good sense of timing, and excellent pronunciation. In

addition, a thorough knowledge of correct English usage, and a knowledge of dramatics, sports, music, and current events, improve chances for success. In television, rather high standards of personal appearance also must be met. When on the air, an announcer must be able to react quickly and imaginatively in unusual situations. He also must be a convincing salesman when presenting commercials. In addition to all the above qualifications, the most successful announcers have a combination of personality and showmanship that makes them attractive to audiences. Therefore, anyone considering a career as an announcer should judge his chances of success realistically. Most announcers are men, but there are a few opportunities for women, especially in programs and commercials aimed at women.

High school courses in English, public speaking, dramatics, and foreign languages, plus sports and music hobbies, are valuable background for prospective announcers. A number of vacational schools offer training in announcing, and some universities offer courses of study in the broadcasting field. A college liberal arts education also provides an excellent background for an announcer.

Most announcers get their first broadcasting jobs in small stations. Because announcers in small stations sometimes operate transmitters, prospective announcers often obtain a Federal Communications Commission Radiotelephone First Class Operator License which enable them legally to operate a transmitter and, therefore, makes them much more useful to these stations. Announcers more frequently operate control boards, for which only a Third Class license is required. (For information on how to obtain such licenses, see p. 669.)

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 larger community. He also may advance by getting a regular program as a disc jockey, sportscaster, or other specialist. Competition for announcing jobs in the national networks is intense, and an announcer usually must be a college graduate with several years of successful announcing experience before he will be given an audition.

Employment Outlook

The employment of announcers is expected to increase moderately in the 1970's, as new radio and television stations are opened. The gains in employment resulting from these openings during this period, however, will be reduced slightly by the increased use of automatic programing. Some job openings in this relatively small occupation will also result from transfers to other fields of work and from retirements and deaths. The growth of the industry and replacement needs will create, on the average, several hundred openings for announcers each year through the 1970's.

It will be easier to get an entry job in radio than in television because of the greater number of radio stations, especially small stations, which hire beginners. However, the great attraction this field has for young people and its relatively small size will result in keen competition for entry jobs.

Earnings and Working Conditions

Earnings of staff announcers vary considerably, depending upon whether the announcer works in radio or televison, in a large or small station, or in a large or small community. As a general rule, wages increase with the size of the community and the station. Earnings of an announcer in television tend to be somewhat higher than those in radio.

The earnings of many better paid announcers include fees received from advertisers in addition to the salaries received from stations. Such fees are larger and more common in television than in radio. In small radio stations, announcers generally are paid a fixed weekly or monthly salary. Announcers who work in regular shows, such as disc jockeys or announcers who become identified with popular network radio or television programs, earn considerably more than other staff announcers.

Most announcers in large stations work a 40-hour week and receive overtime for work beyond 40 hours. In small stations, many announcers work 2 to 6 hours of overtime each week. Evening, night, and weekend work occurs frequently since some stations are on the air 24 hours a day, 7 days a week. Announcers' working hours consist of both time on the air and time spent in preparing for broadcasts. Working conditions are usually pleasant because of the variety of work and the many personal contacts which are part of the job. Announcers also receive some satisfaction from becoming well known in the area their station serves.

BROADCAST TECHNICIANS

(D.O.T. 194.281, .282, and .782; 957.282; and 963.168 through .887)

Nature of Work

Broadcast technicians set up, operate, and maintain the electronic equipment used to record or transmit radio and television programs. They work with equipment such as microphones, sound recorders, lighting equipment, sound effects devices, television cameras, magnetic video tape recorders, and motion picture projection equipment. In the control room, broadcast technicians operate equipment that regulates the quality of sounds and pictures being recorded or broadcast. They also operate controls that switch broadcasts from

one camera or studio to another, from film to live programing, or from network to local programs. From the control room, they give technical directions to personnel in the studio by means of hand signals and, in television, by use of telephone headsets. When working on disc jockey programs, they sometimes operate phonograph record turntables. Other control room duties may include operating movie projectors, making recordings of live shows, and keeping an operation log of all broadcasts.

As a rule, broadcast technicians in small stations perform a wide variety of duties. In large stations and in networks, technicians are more specialized, although specific job assignments may change from day to day. Broadcast technicians who specialize may be given titles such as *transmitter technician* (monitors and logs outgoing signals and is responsible for proper operation of the transmitter), *maintenance technician* (sets up, maintains, and repairs electronic broadcasting equipment), *audio control technician* (operates controls that regulate sound pickup, transmission, and switching), *video control technician* (operates controls that regulate the quality, brightness, and contrast of television pictures), *lighting technician* (directs lighting of television programs), *field technician* (sets up and operates broadcasting equipment for programs originating outside the studio), *recording technician* (operates and maintains sound recording equipment), and *video tape recording technician* (operates and maintains magnetic video tape recording equipment). Sometimes the term "engineer" is substituted for technician in the above titles.

Maintenance technicians service complex electronic broadcasting equipment.

Installing and maintaining complex electronic equipment is the most technically difficult work of broadcast technicians. Most technicians do at least occasional maintenance, but large stations usually have one or two experienced men whose chief duties are to repair and maintain electronic equipment under supervision of the chief engineer. In small radio stations, the chief engineer frequently does all maintenance and repair work himself.

When events taking place outside the studios are to be broadcast, technicians go to the site of the pickup and set up, test, and operate the necessary equipment. They also make emergency repairs. After the broadcast, they dismantle the equipment and return to the station.

In early 1967, about 20,000 nonsupervisory broadcast technicians were employed in radio and television stations. Most radio stations employing fewer than four technicians, although a few large radio stations may employ more than 15. Nearly all television stations employ at least five broadcast technicians with the average large station having about 45. A few of the largest television stations may employ more than 75. The majority of broadcast technicians work in communities of more than 250,000 population. The highest paying and most specialized jobs are concentrated in New York, Los Angeles, Washington, D.C., and Chicago, the originating centers for most of the network programs.

In addition to the nonsupervisory technicians, several thousand supervisory personnel with job titles such as chief engineer, assistant chief engineer, director of engineering,

Technician regulates transmission from radio station control room.

technical director, and supervisory technician work in engineering departments. Supervisory personnel are responsible for the operation, maintenance, and repair of all electronic equipment in the studio, at the transmitter, and on remote broadcasting sites. They may also do maintenance and repair work, design and build new equipment, purchase equipment for the station, and help lay out plans for building new studios, transmitters, relay equipment, and towers.

Training, Other Qualifications, and Advancement

A young man interested in becoming a broadcast technician should plan on getting a Radiotelephone First Class Operator License from the Federal Communications Commission. Federal law requires that anyone who operates or adjusts broadcast transmitters in television and radio stations must hold such a license. Some stations require all their broadcast technicians, including those who do not operate transmitters, to have this license. Applicants for the license must pass a series of written examinations covering the construction and operation of transmission and receiving equipment, the characteristics of electromagnetic waves, and Federal Government and international regulations and practices governing broadcasting. Information about these examinations and guides to study for them may be obtained from the Federal Communications Commission, Washington, D.C. 20554.

High school courses in algebra and trigonometry, and in physics and other sciences, provide valuable background for young men anticipating careers in this occupation. Building and operating an amateur radio station is also good training. A good way to acquire the knowledge necessary for becoming a broadcast technician is to take an electronics course in a technical school. Many schools give courses especially designed to prepare the student for the FCC first-class license test. Training at the technical school or college level is a distinct advantage for those who hope to advance to supervisory positions or to the more specialized jobs in large stations and in the networks.

Young men with FCC first-class licenses who get entry jobs are instructed and advised by the chief engineer or other experienced technicians concerning the work procedures of the station. In small stations, they may start by operating the transmitter and handling other technical duties after a brief instruction period. As they acquire more experience and skill, they are assigned to more responsible jobs. Men who demonstrate above-average ability may move into the top-level technical positions, such as supervisory technician and chief engineer. A college degree in engineering is becoming increasingly important for advancement to supervisory positions.

Employment Outlook

The number of broadcast technicians is expected to increase only slightly during the 1970's. Retirements, deaths, and transfers to other jobs will result in some additional job openings.

Some job opportunities for technicians will be provided by the new radio and television stations expected to go on the air during this period. In addition, color television broadcasting may slightly increase the need for technicians. Color television pickup and transmitting equipment is much more complicated than black and white equipment and requires more maintenance and technical know-how. However, other technical advances, such as automatic switching and programing, automatic operation logging, and remote control of transmitters will limit the increase in job opportunities in the new stations and replacement needs in existing stations.

Earnings and Working Conditions

Earnings of broadcast technicians vary greatly depending on such factors as the size and location of the community a station serves, the size of the station, whether he works in a radio or television station, and the experience of the individual. As a rule, technicians' wages are highest in large cities and in large stations. Technicians employed by television stations usually are paid more than those working for radio stations because television equipment is generally more complex.

Most technicians in large stations work a 40-hour week with overtime pay for work beyond 40 hours. Many broadcast technicians in the larger cities work a 37-hour week. In small stations, many technicians work 2 to 8 hours of overtime each week. Evening, night, and weekend work occurs frequently since some stations are on the air as many as 24 hours a day, 7 days a week. Network technicians may occasionally have to work continuously for many hours and under great pressure in order to meet broadcast deadlines.

Broadcast technicians generally work indoors in pleasant surroundings. The work is interesting, and there is often considerable variety of duties. When remote pickups are made, however, technicians may work out of doors at some distance from the studios, under less favorable conditions.

RAILROAD OCCUPATIONS

The railroads, with their network of more than 200,000 miles of rail line reaching into all parts of the country, are one of the Nation's largest employers. About two-thirds of a million railroad workers were employed in early 1967, operating trains, looking after the needs of the traveling public, maintaining and repairing facilities and equipment, and carrying on the hundreds of other activities required in this industry. These activities offer a great variety of interesting careers requiring different kinds of skills and levels of education. In most railroad occupations, a worker starts at the bottom and works his way up by learning his job, proving his ability, and acquiring the seniority which will enable him to advance.

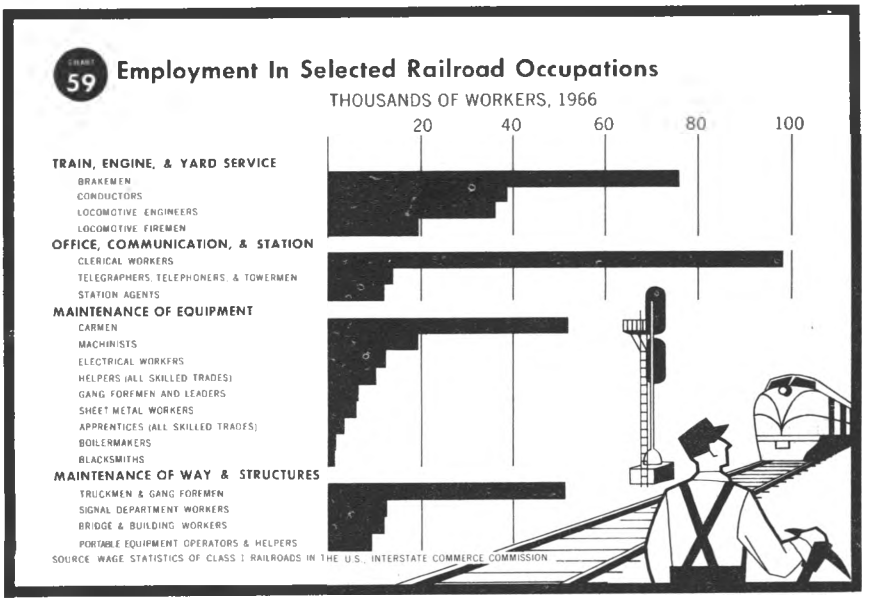
Nature and Location of the Industry

The railroad industry is made up of "line-haul" railroad companies which transport freight and passengers between cities and towns, and switching and terminal companies which operate facilities at stations, freight yards, and other terminal points. About 570 of these railroad companies were operating in 1966. In addition, the Pullman Co. performed special services for passengers traveling on these railroads.

The Class I line-haul railroads, which include all of the large, well-known companies, handle more than 95 percent of the railroad industry's business and employ about 92 percent of all railroad workers. With nearly 28,000 locomotive units, about 20,000 passenger train cars, and about 1.5 million freight cars, they transported more than 2.5 billion tons of freight and 300 million passengers in 1966. Employment and earnings data for jobs on Class I line-haul railroads are used in this chapter to illustrate employment and earnings throughout the entire railroad industry.

Of the various transportation services provided by the railroads, freight movement of commodities, such as coal, ore, grain, lumber, and manufactured products, account for most railroad revenue and employment. Passenger service is important also, although it has declined substantially during the past 20 years. Other railroad services include mail and express.

Railroad workers are employed in every State and in both large and small communities, but the greatest numbers work at terminal points where the railroads maintain their central offices, freight yards, and maintenance and repair shops. The metropolitan area of Chicago, where the great eastern and western railroad systems meet, is the hub of the Nation's railroad network and has more railroad workers than any other area. Other places where particularly large numbers of railroad workers are employed are areas around New York City, Los Angeles, Pittsburgh, Philadelphia, Cleveland, and St. Louis. "Railroad towns," such as Altoona, Pa., and Roseville, Calif., where locomotive and car shops are located, also have relatively large concentrations of railroad workers.



Railroad Occupations

The work force of the railroad industry can be divided into five main groups—employees who (1) operate trains, (2) perform communications, station, and office work, (3) build and maintain locomotives, cars, and other rolling stock, (4) build and maintain tracks, structures, and other railroad property, and (5) handle luggage, prepare and serve food, and provide other personal services to passengers. In 1966, 94 percent of the workers in railroad jobs were men. Most women employed by the railroads do office work.

Chart 59 shows the number of employees in some of the principal railroad occupations. Other occupations in which large numbers of workers are employed but which are not shown on the chart, range from unskilled laundry and cleaning jobs to professional positions such as accountant, engineer, and statistician. (Information about some of these jobs is given elsewhere in the *Handbook.*)

The workers directly engaged in running the trains are known as "operating employees." They represent more than one-fourth of all railroad workers. Class I line-haul railroads had over 170,000 operating employees in 1966. In this group are locomotive engineers, firemen, conductors, brakemen, and, on some passenger trains, baggagemen. These men work together as train crews, either operating trains out on the "run" or operating trains at the terminals and railroad yards where freight is loaded and unloaded, freight cars are received and switched, and trains are broken up and made up. Other operating employees who work in the yards include switchtenders, who assist conductors (or foremen) and brakemen (or switchmen) by throwing the track switches, and hostlers, who fuel locomotives, check their operating condition, and deliver them to the engine crews.

A large group of railroad workers, about one-fifth of all those employed in the industry, consists of communications, station, and office employees who regulate the movement of trains and take care of the business affairs of the railroads. In 1966, Class I line-haul railroads employed about 151,600 persons in such jobs. Communications are handled by dispatchers who coordinate the movement of trains and issue train orders, and by telegraphers, telephoners, and towermen who either pass train orders and other instructions to the train crews or carry them out by setting signals and track switches. At all stations, station agents are in charge of the railroad's business affairs. Railroad clerks work in stations and company offices where they may do secretarial and other kinds of office work, assist station agents, deal with customers, sell tickets, tend baggage rooms, keep records, and perform related tasks. Also included in this group of railroad workers are claims investigators, accountants, lawyers, motor vehicle operators, patrolmen, and watchmen.

More than a fifth of all railroad workers are employed in railroad yards, carshops, and engine houses where they maintain and repair locomotives, cars, and other railroad rolling stock. Class I line-haul roads employed about 145,600 workers in this group in 1966. Carmen perform a variety of repair and maintenance tasks necessary to keep railroad freight and passenger cars in good operating condition. Electrical workers, machinists, boilermakers, blacksmiths, and sheet metal workers also are employed in car shops.

A considerably smaller group of railroad workers, about one-sixth of the total, maintains and constructs tracks, bridges, stations, signals, and other railroad property. The Class I line-haul railroads employed about 94,100 in work of this kind in 1966. Trackmen and other maintenance-of-way workers maintain, construct, and repair tracks and roadbeds. Bridge and building mechanics construct and maintain bridges, tunnels, and many other kinds of structures along the right of way. Signal workers are responsible for installing the railroad's vast network of train and crossing signals and for keeping it in working order.

Another small group of railroad workers provides personal services to passengers at stations and aboard trains. With 10,800 employees in 1966, or 2 percent of all employed in the railroad industry, it is by far the smallest of the five major railroad occupational groups. It includes Pullman conductors who are in charge of sleeping and parlor car service on most trains, as well as porters and attendants who perform many kinds of personal service for passengers. This group also includes cooks and waiters who prepare and serve food and redcaps who work in and around railroad stations where they handle luggage and otherwise assist passengers in boarding and leaving trains. (Additional information about cooks and waiters is given elsewhere in the *Handbook.*)

Training, Other Qualifications, and Advancement

For most jobs, particularly those on the trains, in the yards, and around the stations, training is received on the job. The new employee learns by working and receiving instructions from experienced men. For some office and maintenance jobs, training may be obtained in high schools and vocational schools. Home study courses on railroading are available also. In addition, universities and technical schools offer courses in railway engineering, transportation, traffic management, and other subjects valuable to professional and technical workers.

New employees in some occupations—principally those connected with train or engine service—start as "extra board" men, that is, their names are placed on an "extra list" for individual occupations. From these lists, they are called to fill vacancies that arise due to vacations, days off, or illness of men on regular jobs. They also may be called for extra work because of an increase in railroad traffic. As regular job assignments become available and as the extra board workers gain experience and seniority, they are assigned to regular positions. The time spent on extra board work varies with the type of job and the number of available openings. In some cases workers may not receive regular assignments for a number of years.

Apprenticeship programs are limited chiefly to trainees in the railroad shop crafts. Many of these programs

are planned and operated jointly by the companies and the railroad workers' unions. Of the several thousand men who were taking this kind of training in 1966, the majority were "regular" apprentices, usually high school graduates with no previous work experience, who were working and receiving instruction in their chosen trades for a 4-year period. Others were "helper" apprentices, men with some previous experience as railroad workers, who were receiving the same kind of training, usually for a 3-year period.

Applicants with a high school education or its equivalent are preferred by railroad companies for most kinds of nonprofessional positions. Good physical condition is required for most jobs, and almost all large railroads require applicants to pass physical examinations before they are hired; in some jobs, physical examinations are required periodically. Excellent hearing and eyesight are essential for train and engine service jobs, and color blindness is an absolute bar to employment in work involving the interpretation of railroad signals.

Promotions of qualified workers to jobs covered by union-management agreements are made on the basis of seniority. Most job vacancies are listed on a bulletin board, and all workers interested may "bid" for them. The job goes to the qualified applicant whose length of service places him highest on the seniority list. Often, before workers can qualify for promotion, they must pass written and performance tests. For occupations in train and engine service, there are well-established avenues of promotion. Engineers are usually chosen from the ranks of the firemen, and conductors from the list of brakemen.

A railroad worker's seniority usually entitles him to promotion only for job openings which occur within a limited area or "seniority district" of the railroad system for which he works. In some cases, seniority rights may apply only to one shop, locality, or office. Among train and engine personnel, seniority rights may be limited either to road (freight and/or passenger) service, or yard service. In such cases, workers may bid only for positions in the particular type of service in which they have been employed.

The worker's seniority also determines how much choice he may have about his working conditions. A beginning telegrapher, for instance, may have to work several years on a night shift in an out-of-the-way location before he accumulates enough seniority to get an assignment without these disadvantages.

(Later sections of this chapter contain more complete information about the training and other qualifications for selected occupations in the railroad industry.)

Employment Outlook

The longrun decline in railroad employment is expected to continue, but at a gradually decreasing rate in the immediate years ahead. If the anticipated growth of freight traffic is realized, however, a slow upward movement in employment should occur during the early 1970's.

Technological innovation and changing patterns of transportation and production have resulted in a substantial decline in railroad employment in recent years. Between 1955 and 1966, employment in Class I line-haul railroads dropped 41 percent, from nearly 1.1 million to 631,000. Such developments as the use of larger, more powerful diesel locomotives and the extensive use of machines for roadway upkeep have had a considerable employment impact. The railroad work force also declined as competition from other modes of transportation—notably automobiles, trucks, buses, airplanes, and pipelines—brought a steep drop in railroad passenger travel and relatively little growth in freight traffic.

Most of the factors which have led to reduced employment in the past will continue to influence railroad employment during the decade ahead. In addition, mergers of connecting or parallel railroads could further reduce railroad employment by eliminating facilities, such as those at terminals, and by combining accounting and other functions. Some mergers have occurred in recent years and, on the basis of present developments, other mergers are likely.

Despite prospects for declining employment in the immediate future, job opportunities will be available for thousands of new railroad workers. The railroads have one of the largest work forces in American industry, with a high proportion of older workers. Many jobs will become vacant because of retirements, deaths, promotions to other railroad jobs, and transfers to other fields of work. Retirements and deaths alone may result in tens of thousands of job openings each year during the next 10 years.

Job openings due to replacement needs will number in the thousands. However, opportunities for new workers in some nonoperating occupations—such as clerk, roadway maintenance worker, and signalman—may be restricted as a result of recent labor-management agreements providing for job protection of many nonoperating (other than train and engine service) employee groups. Under these contracts, a limitation has been established on reductions in the number of workers in any one year; provisions were made for moving unneeded workers in a given craft or occupational group in one district to another district where their skills can be usefully employed; and assurances were given that regular seasonal employees in future years would be offered employment at least equivalent to what they performed in 1966. Another restriction on openings for new workers is the recalling of furloughed workers before considering job applicants to fill vacancies. This restriction is most constraining for jobs in specialized railroad work, such as that of telegrapher and towerman. Job opportunities will be affected

much more in some geographic areas than in others by these restrictions.

Job openings for work as locomotive firemen (helpers) have also been extremely limited since May 7, 1964, the effective date of a compulsory arbitration award designed to eventually eliminate 90 percent of firemen (helper) positions in road freight and yard locomotive service. Firemen (helper) positions on locomotives in passenger service were not affected by this award, nor were any positions of firemen (helpers) for any class of locomotive service operating where State law requires employment of firemen on locomotives. This temporary award expired in April 1966 and since no general agreement had been reached between the parties in the dispute by mid-1967, the outlook for job opportunities in this occupation is uncertain.

Future job opportunities for applicants probably will be most numerous in construction and maintenance work along the right-of-way, in operating jobs as brakemen, and in office work. However, because of the seasonality of railroad work, and the seniority system under which new workers are furloughed first and recalled last, many new workers will have less than full-time employment during the first few years on the job.

The number and type of job openings for applicants hired by an individual railroad also will be influenced by the rapidity of the railroad's adoption of new equipment and new methods of operation, and its geographical location in relation to changing marketing conditions. There will be a need for professional engineers and skilled personnel capable of maintaining and improving the new mechanical and electrical equipment gradually being introduced. Opportunities should increase for industrial engineers and methods analysts as railroads seek better means of utilizing equipment and personnel. The increasing use of electronic data-processing equipment to handle a wide range of railroad accounting and statistical activities will generate a growing demand for programers and other trained specialists. As the railroads continue to explore new ways to meet competition, opportunities will arise for specialists in industrial development and marketing.

Railroad freight traffic is expected to rise substantially through the 1970's, continuing the trend of recent years. Toward the end of the 1960's, the need for new workers, due to increasing freight traffic, is expected to about offset the declines in railroad employment that will result from increasing efficiency in operations and the declining passenger traffic. The anticipated rise in demand for railroad freight service is based on the assumption of a high rate of growth in the economy through the mid-1970's. Even higher levels of railroad freight traffic may result, also, if improved freight handling methods and equipment are more widely adopted. For example, the shipment of highway trailers and large containers on railroad flat cars, and the use of larger, special purpose freight cars may increase freight traffic significantly by improving rail carriers' ability to compete more effectively with other modes of transportation.

New interest has also been shown in the use of rapid rail transit for intercity and intraurban passenger movement. Studies of the best methods for moving passengers within and between urban areas are progressing, and may result in a significant resurgence of rail passenger transportation. In that event, railroad employment opportunities would increase substantially.

Earnings and Working Conditions

Average earnings of railroad workers are higher than those of workers in most manufacturing industries. Employees of Class I line-haul railroads, exclusive of executive and administrative personnel, averaged $3.08 an hour and $135.52 a week in 1966, whereas production workers in all manufacturing industries averaged $2.71 an hour and $111.92 a week.

The earnings of individual railroad workers vary greatly because of the great variety of their occupations and skill requirements. Geographic differences in wage levels are considerably less than in most other industries, since the wage scales specified in many labor-management contracts in the railroad industry are identical throughout the country. (Earnings in some of the principal occupations are discussed in later sections of this chapter.)

Most railroad workers are members of trade unions and many of the conditions under which they work are regulated by collective bargaining agreements. Contracts between the unions and the railroad companies contain clauses dealing with wage rates, hours of work, vacation pay, seniority, and other matters. (The principal unions representing each occupational group are listed in the sections of this chapter which deal with individual occupations.)

The work schedules of railroad employees and the conditions under which they are paid for overtime work depend upon the type of operation in which they are employed. The great majority of railroad employees work at terminals—in yards, stations, and railroad offices. In 1966, the "basic" workweek for most workers in this group was a 5-day week of 40 hours. Premium pay, amounting to time and one-half the regular wage rate, usually was paid for any time worked over 8 hours a day.

In freight and passenger road service, the basic workday for train and engine crews is established on an entirely different basis. Generally, when a member of the train or engine crew has covered a specified number of miles, or worked a certain number of hours—whichever occurs first—he receives a day's pay at his regular wage rate. He receives extra pay for any additional miles covered or hours worked on that day.

The basic hours of employees who look after the needs of passengers

aboard trains—dining car cooks and waiters, Pullman porters, and train attendants—are set on a monthly basis. Some workers in these jobs receive time and one-half pay for hours worked over 184 a month and those employed on regular assignments are guaranteed at least 174 hours of work a month. Others receive overtime after 240 hours and are guaranteed 205 hours a month, if working on regular jobs.

Because freight shippers and the traveling public must be served 24 hours a day, the members of train and engine crews, as well as hostlers, telegraphers and telephoners, and station agents, are often required to work nights, weekends, and on holidays. Irregular work schedules are particularly common for extra board workers, since they have no regular assignments and may be called to work any time of the day or night. Some railroad workers, like bridge and building mechanics and certain track and road maintenance workers, are required to work away from home for days at a time.

Practically all railroad employees receive 1 week's paid vacation after 1 year on the payroll, 2 weeks after 3 years, 3 weeks after 10 years, and 4 weeks after 20 years. On most roads, nonoperating employees receive pay for 8 holidays a year and operating employees in yard service receive pay for 7 holidays a year.

Under the federally administered Railroad Retirement Act of 1935, all employees having more than 10 years of service in the railroad industry receive pensions upon retirement. They receive full pensions when they reach age 65 and reduced pensions at age 62. Those who have worked for the railroads for at least 30 years may retire on a reduced pension at age 60. Employees having 10 years or more of service who become disabled and are unable to work, and dependent wives and husbands of railroad workers who have died also receive pensions. As of early 1967, the average pension paid to railroad workers who retired because of age or disability was about $150 a month; the average pension paid to survivors of railroad workers, about $68 a month.

Another Federal law, the Railroad Unemployment Insurance Act, provides benefits for railroad workers who become unemployed. In January 1967, these benefits ranged from $22.50 to $51 a week depending on earnings. In 1966, the average daily unemployment benefit paid was $10.13 (equal to $50.65 for 5 benefit days per week). Unemployment benefits are paid for a period up to 26 weeks, but workers having 10 years or more of service can receive benefits for a longer period.

Under the Railroad Unemployment Insurance Act, railroad workers also receive compensation for workdays lost because of sickness or injury. In early 1966, the average daily sickness benefit paid was $10.10.

Other insurance programs are operated under agreements with trade unions and provide group life insurance to employees and comprehensive hospital and medical insurance to these employees and their dependents.

Where To Go for More Information

Additional information about occupations in the railroad industry can be obtained from railroad offices in your locality. General information about the railroad industry can be obtained from:

Association of American Railroads, Transportation Building, Washington, D.C. 20006.

LOCOMOTIVE ENGINEERS

(D.O.T. 910.383)

Nature of Work

The engineer is responsible for running the locomotive safely and efficiently. He operates the throttle, air brakes, and other controls, and he supervises the work of the fireman (helper) who may work in the cab with him. Engineers work in railroad yards, or on the road in passenger or freight service.

The yard engineer operates the locomotive or switch-engine, which is used to move freight and passenger cars when trains are being made up before a run and broken up after a run, or when cars are being switched for loading or unloading. The engineer in passenger or freight service operates the locomotive which moves trains over the road, in accordance with the train orders for each run or any instructions received en route through the conductor, the wayside signal system, or by train radio.

Before and after each run, the engineer checks on the condition of the locomotive and either sees that minor adjustments are made on the spot or reports to the engine foreman mechanical defects needing attention. While operating his locomotive, he must observe track signals and comply with speed restrictions at all hours and in all weather conditions. To do this he must be thoroughly familiar with the characteristics of the road over which he is operating. He must constantly be alert, especially for obstructions on the track or other emergencies.

In 1966, about 36,200 engineers were employed by Class I line-haul railroads, and a few thousand more were employed by short-line railways and switching and terminal companies.

Training, Other Qualifications, and Advancement

Vacancies in engineer positions generally have been filled by firemen (helpers) who have qualified for promotion. Selection is on a seniority basis. To qualify, the applicant must pass comprehensive examinations which deal with the train's mechanical and electrical equipment, and with fuel economy, safety, timetables, train orders, and other operating rules

Diesel engineer checks track conditions by radio.

and regulations. He must also be able to operate any kind of locomotive in service on his road.

A newly promoted engineer starts out as an extra board man without any regular assignment. It may be several years before he receives such an assignment. During this period, he works on temporary assignments whenever an engineer is needed. An experienced engineer may advance to a supervisory position, such as foreman of engines for his road.

Engineers are required to take physical examinations at regular intervals. They must have good eyesight and hearing. If they fail at any time to meet all of the physical standards, they may be restricted to working as engineers only in certain types of service, or they may be transferred to other kinds of work where physical standards are less exacting.

Employment Outlook

The number of job openings for locomotive engineers during the next decade will be limited. Virtually all openings during the early 1970's will arise from the need to fill positions left vacant by engineers who retire or die. (Most workers are in the older age groups.) These positions will be filled by firemen (helpers) who are promoted, or by firemen whose jobs as engineers were terminated during recent years because of cutbacks in railroad services.

The number of engineers employed by the railroads has been declining for some years because of the decrease in railroad business and increasing multiple-unit operation of diesel locomotives. Introduction of technological innovations, such as the use of remotely and automatically controlled devices for freight car classification and signal control, and other changes in equipment and operating methods, were also important factors in lower employment levels. The total number of engineers employed by class I line-haul railroads dropped from about 44,000 in 1955 to 36,200 in 1966.

Employment is expected to increase slightly in the early 1970's as freight traffic increases. Some additional locomotive engineers may be needed also for passenger service as rapid mass transit rail systems are developed.

Earnings and Working Conditions

The earnings of engineers depend on the class of locomotive operated and the kind of service in which the engineer is employed. Engineers in yard service for Class I line-haul railroads (including extra board men) earned, on the average, about $850 a month in 1966. In road freight service, engineers averaged $1,000 a month. The earnings of passenger service engineers averaged about $1,040 a month in 1966.

In 1966, the standard workweek at straight-time rates for yard engineers varied from 5 days on some railroads and railroad divisions to 7 days on others. All yard engineers worked basic 8-hour days with time and one-half paid for work over 8 hours. The basic unit of work for road freight and passenger engineers is 100 miles. Under certain circumstances they may be paid on an hourly basis or on a miles-hour basis.

On many roads, the amount a road engineer may earn in a single month

is governed by mileage limitations agreed upon by the unions and the railroad companies. Whenever an engineer on one of these roads reaches the maximum number of miles he is permitted to operate a locomotive during a month, his assignment for the rest of the month is taken over by another engineer—usually an extra board man.

The engineer in road service, even on regular assignments, is often scheduled to work nights, weekends, and holidays at straight-time rates. Like other workers in road service, he must often "lay over" away from home for a time at the end of a run before he makes the return trip back to his home terminal.

The assignments of engineers on the extra board may be very irregular, because these men may be called to work at any time of the day or night, and the amount of traffic varies from one season to another on many roads. Extra board engineers are likely to have less work, and lower earnings than those men having regular assignments.

On all major railroads, wages and the conditions under which engineers work are agreed upon by employers and unions. The great majority of engineers are represented by the Brotherhood of Locomotive Engiiners (Ind.). Some are represented by the Brotherhood of Locomotive Firemen and Enginemen.

LOCOMOTIVE FIREMEN (HELPERS)

(D.O.T. 910.383)

Nature of Work

The locomotive fireman (helper) works with the engineer either in the railroad yards or in road service. At the beginning of his run, the fireman (helper) checks to make sure that the locomotive is supplied with the fuel, sand, and water needed for the run, that the engine is in proper working order, and that the flagging equipment, classification markers, and tools needed by the engine crew are on hand and ready to use. During the run, he makes mechanical and electrical adjustments as needed. On passenger trains, he is also responsible for operating the equipment which supplies heat to the train.

From his position at the left side of the cab, the fireman (helper) assists the engineer by acting as lookout for obstructions on tracks and at road crossings, and by checking wayside signals which indicate the speed at which the train is to proceed. In addition, he inspects the train as it rounds curves, because this view of the train enables him to spot smoke, sparks, fire, and other signs of defective equipment.

The fireman (helper) must be prepared to take over the controls of the locomotive, should the engineer become ill or otherwise incapacitated. An important part of his job, therefore, is learning to operate the locomotive by observing the engineer. Often he relieves the engineer at the controls for brief periods, or takes the controls for a "practice run."

Class I line-haul railroads employed about 19,600 firemen in 1966.

Training, Other Qualifications, and Advancement

For the relatively few firemen (helper) positions being filled at present, most railroads prefer that applicants be at least 21 years of age and not over 35. Most applicants hired are over 20 years of age. A high school education or its equivalent is desired. Good health is important, and firemen must be able to pass periodic physical examinations. Standards for eyesight and hearing are particularly high.

A beginning fireman first makes a series of trial trips in the railroad yard or on the road. On these trips, he works under the direction of an experienced engineer or fireman who instructs him about his future duties and about railroad rules and regulations. This training period lasts a few days on some roads and as long as 3 weeks on others. After the newly hired fireman has satisfactorily demonstrated his ability on the trial trips, and after he has passed examinations on railroad rules and regulations, his name is placed on the fireman's extra board and he becomes subject to call for temporary work assignments. He may remain on extra board work up to several years before he obtains his first regular assignment. On some roads, beginning assignments are in yard service and the fireman works his way up first to road freight service and then to road passenger service. On other railroads, firemen usually remain either in yard service or in road service throughout their railroad careers.

Firemen with sufficient experience and seniority—usually at least 3 or 4 years—can become eligible for promotion to engineer by passing qualifying examinations covering the mechanical and electrical equipment on trains, air brake systems, fuel economy, timetables, train orders, and other operating rules and regulations. As engineers are needed, qualified firemen who have the longest seniority are placed on the engineers' extra board.

Employment Outlook

Job openings for work as locomotive firemen (helpers) have been extremely limited since May 1964, the effective date of a compulsory arbitration award designed to eventually eliminate all but a relatively few fireman (helper) positions in road freight and yard locomotive service. Firemen (helper) positions on locomotives in passenger service were not affected by this award, nor were any positions of firemen (helpers) for any class of locomotive service operating where State law requires the employment of firemen on locomotives.

The national arbitration award expired in April 1966, and since no general agreement had been reached between the parties in the dispute by mid-1967, the outlook for job opportunities in this occupation cannot be anticipated with any degree of certainty although it appears that employment opportunities for new entrants may be somewhat limited.

Earnings and Working Conditions

The earnings of firemen depend on the class of locomotive on which they work and the type of service for which the locomotive is operated. Firemen in yard service for Class I line-haul railroads (including extra board men) averaged $670 a month in 1966. Freight service firemen averaged $785 monthly on freight trains. Road passenger firemen averaged $900 monthly.

In 1966, firemen in yard service worked a basic 8-hour day and 40-hour week, and 1½ times the basic hourly rate was paid for work beyond these hours. On many roads, the amount that firemen in road service could earn in a single month was governed by mileage limitations agreed upon by the unions and the railroad companies. Whenever a fireman on one of these roads reached the maximum number of miles he was permitted to cover in a month, his assignment for the rest of the month was taken over by another fireman—usually a man on the extra board.

Firemen must often work at night and on weekends and holidays because train schedules require 24-hour-a-day service. Road service often requires that they be away from their home stations for varying periods of time. Irregular working hours are particularly common among men on the extra board and in road freight service. Extra board men tend to have less work and therefore lower incomes than firemen with regular assignments. On many roads, the amount of work varies from one season of the year to another.

Workers in this occupation on all major roads are covered by union contracts. The great majority of firemen are represented by the Brotherhood of Locomotive Firemen and Enginemen. Some are members of the Brotherhood of Locomotive Engineers (Ind.).

CONDUCTORS

(D.O.T. 198.168)

Nature of Work

Conductors are responsible for seeing that railroad trains are moved according to train orders or other instructions. Freight and passenger train conductors are the "captains" of their trains. They are responsible for the safety of their passengers and cargoes, and they supervise the work of the train and engine crews.

Before a freight or passenger train leaves the terminal, the conductor receives the train orders from the dispatcher and confers with other crew members to make sure they understand the orders. During the run, he sees that the cars in the train are inspected periodically and arranges either for the repair of mechanical breakdowns while the train is on its run, or for defective cars to be set out on the nearest siding. At stops, he signals to the engineer the proper time for departure. As the superior officer on the train, the conductor takes charge in any emergency that may occur while the train is on its run, and all persons employed on it are subject to his instructions.

On freight trains, the conductor keeps a record of the contents and destination of each car, and sees that freight cars are picked up and set out along the route. On passenger trains, the conductor collects tickets and cash fares.

Yard conductors, often called "yard foremen," direct the work of the switching crews who make up and break up trains. In mechanized yards, yard conductors operate consoles that electrically control the alinement of track switches.

Training, Other Qualifications, and Advancement

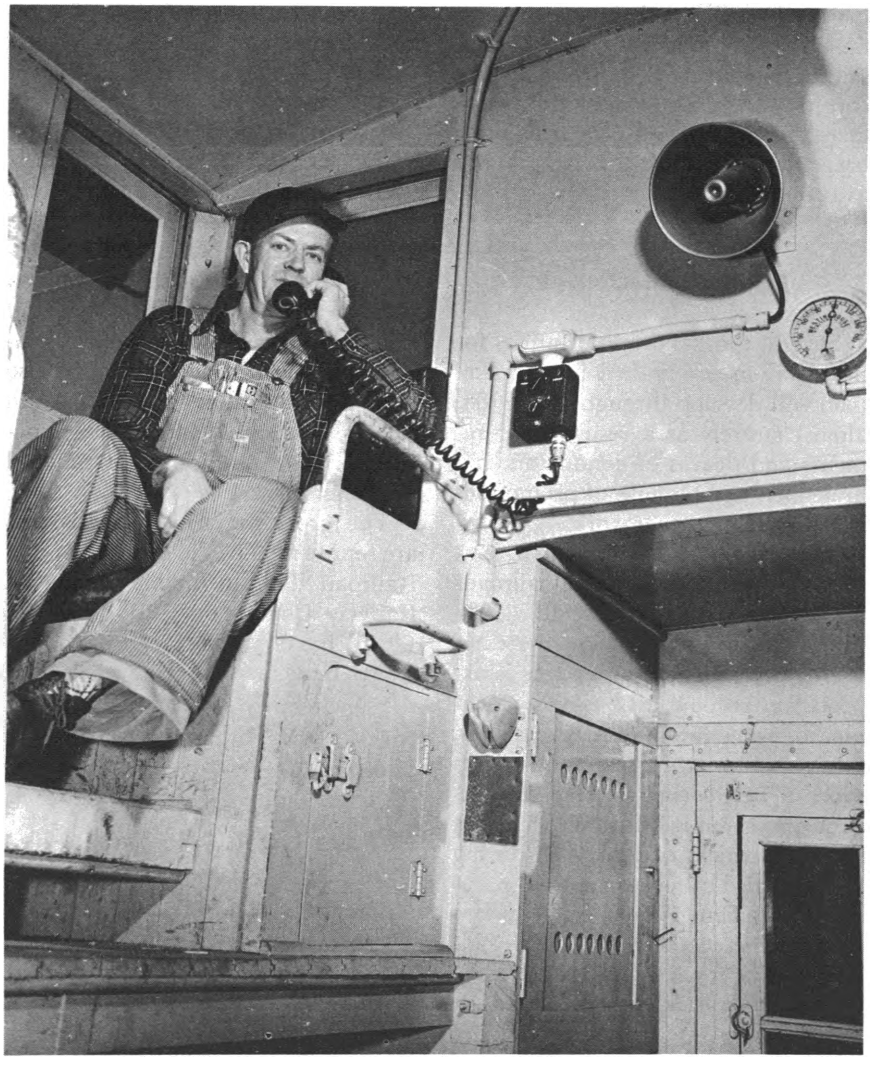
Openings for conductors are filled on a seniority basis by promotion of qualified brakemen. To qualify for promotion, a man usually must have several years' experience as a brakeman, and pass examinations covering signals, air brakes, timetables, operating rules, and related subjects. On some roads, those who have qualified for promotion are first given temporary assignments as conductors while they are still working as brakemen. On other roads, brakemen promoted to conductor positions are put on the extra board where they are given temporary assignments as men are needed. In either case, as regular conductor assignments become available, they are assigned to the men with the greatest seniority.

On most roads, conductors in yard service and in road service have separate seniority lists, and they usually remain in one of these two types of service throughout their careers. A few roads, however, start conductors on yard assignments and then move them to freight service and finally to passenger service.

The conductor is the member of the train crew who has the most direct contact with the public and it is important that he be able to act effectively as the railroad's representative. Conductors who show special ability of this kind may advance to managerial positions such as trainmaster.

Employment Outlook

There will be a moderate number of opportunities for brakemen to be promoted to jobs as conductors during the 1970's. Conductors compose one of the oldest age groups in the Na-



Conductor talks with engineer by radio phone.

tion's work force, and job openings will develop to replace those who retire, die, or leave railroading for some other reason.

The number of conductors on Class I line-haul railroads declined from about 45,200 in 1955 to 38,700 in 1966, owing to the decline of passenger traffic, the trend toward longer freight trains, and the mechanization of yard operations. As more and more yard work is speeded up by the use of the new devices such as electric and electronic car classification systems and communications equipment, little change is expected in the number of conductors during the early 1970's. However, employment in this occupation is expected to increase slightly in the latter part of the 1970's as a result of the anticipated growth in railroad freight traffic.

Earnings and Working Conditions

The type of service in which they are employed and the number of cars in their trains determine the basic earnings of conductors. In 1966, yard conductors employed by Class I line-haul railroads earned an average of $780 a month. In road freight service, conductors averaged $920 monthly. The average for passenger conductors was $915 and for assistant passenger conductors and ticket collectors $800 a month.

In 1966, conductors in yard service worked a basic 8-hour day and 5-day week. For work beyond these hours, they were paid 1½ times their basic wage rates. The pay received by passenger and freight conductors is based on a combination of miles traveled and hours worked. Under this practice these conductors may receive more for a trip than their basic day's pay.

Like all other road crew members, conductors in freight or passenger service are often scheduled to work nights, weekends, and on holidays. Conductors on extra board work often have irregular hours. They may also work less time than conductors with regular assignments and, therefore, earn less.

Conductors on every major railroad are covered by union contracts. Freight and passenger conductors are represented by the Order of Railway Conductors and Brakemen (Ind.) and the Brotherhood of Railroad Trainmen. Yard conductors (or yard foremen) are organized by the Brotherhood of Railroad Trainmen and the Switchmen's Union of North America.

BRAKEMEN

(D.O.T. 910.364 and .884)

Nature of Work

Brakemen work with the conductors as members of the train crews on freight and passenger trains and in the railroad yards. One brakeman (or "flagman") is generally stationed in the rear of each freight and passenger train; his duties include seeing that the proper flags, warning lights, and other signals are displayed at the rear of the train in order to protect it while it is in motion and at stops. Most freight and passenger trains

carry at least one other brakeman stationed in the front end of the train whose duties include setting out signals to protect the front of the train at unexpected stops.

Before a train leaves the station, the brakemen in road service check the air brake equipment on the cars and see that tools and other equipment are in their proper places. During a run, they make frequent visual inspections of their train from positions at both the head and rear end of the train, looking for smoke, sparks or other indications of sticking brakes, overheated car bearings, or other equipment malfunctions. At stops during the run, they make "walking inspections" of the cars in the train and, when necessary, couple and uncouple cars and air hose and assist the conductor in setting out and switching cars at industrial sidings. They are responsible for regulating the air-conditioning, lighting, and heating equipment in passenger cars. Brakemen in passenger service (also known as "trainmen") sometimes assist the conductor by collecting tickets and generally looking after the needs of the passengers. Yard brakemen (frequently called "switchmen" or "helpers") assist in making up and breaking up trains by throwing switches, coupling and uncoupling freight and passenger cars, and applying or releasing handbrakes on cars to control car movement.

Yard brakemen may advance to yard conductors; usually they stay in yard service throughout their railroad careers. On some roads, brakemen in road service may move from freight service to passenger work, usually considered more desirable because it is less strenuous than freight service and sometimes involves shorter working hours.

When they have acquired sufficient seniority brakemen in road service may advance to conductors. Less frequently, they take positions as baggagemen. Conductor positions are nearly always filled by promoting brakemen who have qualified by passing written and oral examinations covering such subjects as signals, timetables, brake systems, and operating rules. Promotions are made according to seniority rules, and it may take up to 10 years or more for a brakeman to get his first assignment as a conductor.

Employment Outlook

Several thousand opportunities for new workers to obtain jobs as brakemen will develop through the 1970's, almost entirely as a result of retirements and deaths of conductors and brakemen and because of promotions and transfers to other work.

The number of brakemen employed by Class I line-haul railroads declined from about 103,000 in 1955 to 76,200 in 1966. During the early 1970's, work in railroads yards is expected to become increasingly mechanized, using automatic car retarders, automatic switching, and other devices. These developments are expected to result in a further decline in the employment of brakemen during this period. However, the total number of brakemen is expected to stabilize or increase slightly by the mid-1970's as a result of the anticipated growth in railroad freight traffic.

Earnings and Working Conditions

The number of cars in the train and the type of service in which he is employed determine the earnings of a freight brakeman. The average monthly earnings of yard brakemen employed by Class I line-haul railroads were $645 in 1966. Brakemen on freight trains averaged $780 a month. The monthly average for passenger train brakemen was $785 in 1966.

In 1966, brakemen in yard service had a 5-day, 40-hour basic workweek, and for work beyond this they were paid 1½ times their regular hourly rates. In addition to their basic day's pay, brakemen in road, passenger, or freight service earned extra pay under certain conditions; for example, when they traveled more than 100 miles on a freight run or 150 miles on a passenger run.

Like other members of train and engine crews, brakemen are often scheduled to work nights, weekends, and holidays. Brakemen who are on the extra board and have been employed by the railroad for only a short time have less steady work and lower earnings than men having regular assignments and they may also work more irregular hours. Yard and freight brakemen face greater accident risks than most other railroad workers.

The great majority of brakemen are represented by the Brotherhood of Railroad Trainmen. The Order of Railway Conductors and Brakemen (Ind.) has organized freight and passenger brakemen on some roads, and the Switchmen's Union of North America has organized some yard brakemen.

TELEGRAPHERS, TELEPHONERS, AND TOWERMEN

(D.O.T. 236.588 and 910.782)

Nature of Work

Telegraphers, telephoners, and towermen control the movement of trains in accordance with instructions issued by the train dispatchers. Telegraphers and telephoners receive train orders from the dispatchers and pass them on to the train crews. Towermen operate the controls which throw track switches and set signals in order to route traffic according to train schedules or special orders. To some extent, the three jobs are interchangeable. For example, many towermen also act as telegraphers and telephoners in transmitting orders, and some telegraphers and telephoners spend part of their

time operating signals. Telegraphers, telephoners, and towermen work either in railroad stations or in towers located in yards, terminals, and other important junction points along the railroad's right of way. Often, at the larger facilities and signal towers, a chief telegrapher, a chief telephoner, or wire chief, or chief towerman (train director) is in charge of the work.

Telegraphers and telephoners may transmit information about train orders, as well as other types of communications relating to the railroad's business, by Morse Code, radio telephone, telephone, and teletype or similar device. Morse Code, once used for this purpose, has generally been replaced by the telephone. At some stations, telegraphers may sell tickets or perform clerical work in addition to their other duties.

Class I line-haul railroads employed about 14,300 workers in the telegrapher, telephoner, and towerman group in 1966. Included in this group were about 1,100 chief telegraphers and telephoners, over 300 train directors, and about 4,600 workers who combined telegraphing and telephoning with clerical duties in stations. Short-line railways employed several hundred more of these workers.

Training, Other Qualifications, and Advancement

Most telegraphers, telephoners, and towermen receive their training on the job, working under the supervision of experienced telegraphers, station agents, or towermen. They are instructed about their future responsibilities, including operating rules, train orders, station operations, and the Morse Code. On most roads, trainees must pass examinations on train operating rules as well as practical tests on other duties relating to their future assignments before they can qualify for telegraphers, telephoners, or towermen.

Most roads place newly qualified workers on the extra board, where they serve on temporary assignments as men are needed and, after acquiring sufficient seniority, bid for regular assignments as telegraphers, towermen, clerk-telegraphers, and station agent telegraphers.

Most railroads prefer applicants for beginning positions to be high school graduates between 21 and 30 years of age. Applicants must pass physical examinations which have strict eyesight and hearing requirements.

A man with the necessary qualifications may advance to station agent or train dispatcher.

Employment Outlook

There will be some opportunities for new workers to become student operators each year through the 1970's. The openings that occur will result primarily from the need to replace experienced workers who retire or die.

Employment of Class I line-haul railroads in the telegrapher, telephone, and towerman group dropped from about 24,400 in 1955 to 14,300 in 1966, but it is expected to increase slightly by the mid-1970's as freight traffic increases. The mechanization of yard operations, the use of dispatcher-to-train radio hookups and other new communications devices, and the extension of centralized traffic control and other automatic signaling systems are reducing the number of workers needed to help control the movement of trains.

Earnings and Working Conditions

The average straight-time hourly earnings of clerk-telegraphers and clerk-telephoners on Class I line-haul railroads in 1966 were $2.89; telegraphers, telephoners, and towermen averaged $2.92. Chief telegraphers and telephoners and train directors averaged, respectively, $3.23 and $3.84 an hour.

Telegraphers worked a basic 40-hour week of five 8-hour days in 1966, with time and one-half paid for overtime. Under Federal law, telegraphers, whose duties involve the movement of trains, are prohibited from working more than 9 hours in any one day, except in emergencies.

Telegraphers, telephoners, and towermen are members of the Transportation-Communication Employees Union.

STATION AGENTS

(D.O.T. 211.468 and 910.138)

Nature of Work

Station agents are the railroads' official representatives in dealing with the public at railroad stations. Most agents work at small stations where they sell tickets, check baggage, calculate freight and express charges, load and unload freight and express packages, and perform many other tasks. They may also serve as telegraphers and telephoners, receiving and delivering train orders and other messages pertaining to the company's business. At stations where supervisory agents are employed, some of this work may be done by railway clerks, telegraphers, and other employees working under the stations agent's supervision. In major freight and passenger stations employing many railroad employees, the duties of the station agent are primarily administrative and supervisory.

About 12,100 station agents were employed by Class I line-haul railroads in 1966. About 10,400 worked in small stations (8,100 of them acting as telegraphers and telephoners in addition to their other duties), and 1,800 had supervisory positions at major stations. The short-line railways employed several hundred other agents, chiefly at small stations.

Training, Other Qualifications, and Advancement

Experienced telegraphers usually become agents in small stations or assistant agents in larger ones. In addition to the necessary seniority, an agent should have a knowledge of train schedules, and routes, rates, bookkeeping methods, and other railroad business transacted at wayside stations.

Station agents may advance from small to larger stations or from assistant agents to agents. They may be promoted to supervisory positions such as stationmaster or inspector.

Employment Outlook

A limited number of opportunities for assignment to station agent jobs will arise each year through the 1970's, principally because of the need to replace agents who retire or die. For several years the number of station agents employed by Class I line-haul railroads has been declining. Between 1955 and 1966, employment dropped from about 19,600 to 12,100, principally because some local passenger and freight services were consolidated or discontinued. It is expected that the railroads will consolidate or discontinue some additional passenger and freight services over the next decade resulting in the employment of fewer station agents.

Earnings and Working Conditions

The earnings of station agents vary. In 1966, agents who also served as telegraphers and telephoners on Class I line-haul roads averaged $2.94 an hour; other agents at small stations who did not act as telegraphers averaged $3.14 an hour. Agents at major stations earned a straight-time average of $3.76 an hour.

Agents are paid either by the hour or by the month; those in nonsupervisory positions had a basic 40-hour workweek, and time and one-half was paid for overtime work. Most agents who handled the business of the Railway Express Agency received, in addition to their regular pay, a commission on the business transacted.

Station agents, except for some supervisory agents, are members of the Transportation–Communication Employees Union.

CLERKS

(D.O.T. 219.388 and .488; 222.368 through .687; 229.368; 231.682; 249.368; 910.368; 910.688; 913.168; and 919.138)

Nature of Work

Railroad clerks handle the huge volume of paper work necessary to keep an account of each piece of rolling stock, and transact business with freight shippers and the traveling public. They work in railroad stations, freight houses, yards, terminals, and company offices. Clerks make up the largest single group of railroad employees—Class I line-haul railroads employed about 98,400 of these workers in 1966 and short-line railways, thousands more.

The majority of railroad clerks—59,900 on Class I line-haul railroads in 1966—do clerical work connected with business transactions such as collecting bills, investigating complaints, adjusting claims, tracing shipments, compiling statistics, selling tickets, and keeping books. Today much of this work is done by clerks who utilize computers and other electronic business machines. In small offices and stations, one man may perform duties related to several of these jobs, but in large offices with many employees, each clerk usually handles a specialized job.

A second group, totaling 17,300 in 1966, consists of secretaries, stenographers, typists, and operators of calculating, bookkeeping, and other kinds of office machines. They perform duties similar to those of workers in the same kinds of jobs in other industries. (Information about the nature of the duties of employees in these clerical jobs may be found elsewhere in the *Handbook*.)

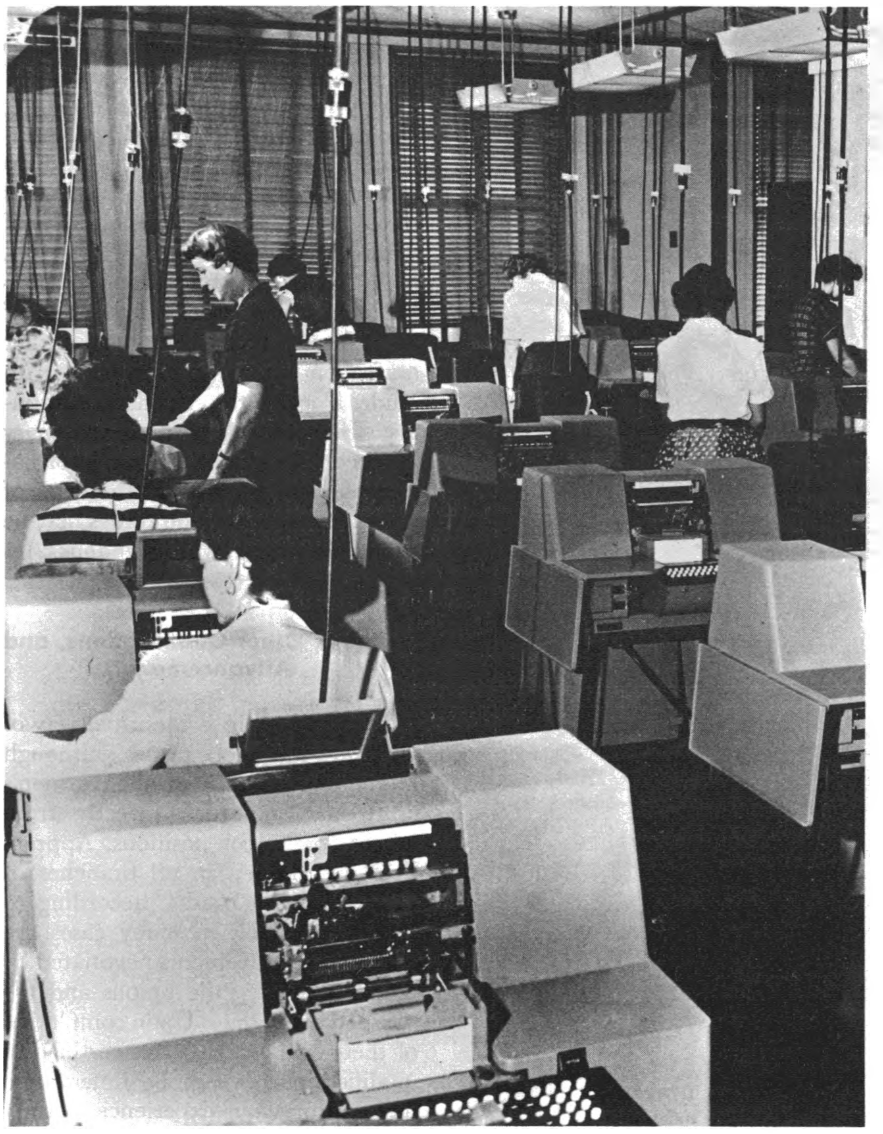
About 9,300 other railroad clerks were in higher grade "senior" jobs involving more responsible or technical work. Some of the clerks in this group prepare the statistics on employment, traffic, and other matters relating to railroad operations, required periodically by the Federal Government. Others, called "cashiers," deal with customers on such matters as uncollected freight bills. Still others do accounting work related to their companies' use of terminals and other facilities owned jointly by several roads.

A fourth group are the supervisory and chief clerks, who numbered about 11,900. They not only supervise the work of other railroad clerks and assume responsibility for the clerical activities of entire departments, but they may be called on to deal with highly complex problems related to the business end of railroad operations.

Training, Other Qualifications, and Advancement

Beginning railroad clerk positions are often filled by hiring newcomers or by promoting workers such as office boys or messengers. A high school education usually is required, and clerical aptitude tests are sometimes given. Railroads prefer workers who have had training or some experience in working with figures. In some clerical positions—yard clerk for instance—beginning workers on some roads are assigned to extra board work, where they work on temporary assignments until such time as regular assignments become available.

In many offices, a railroad clerk may advance to assistant chief clerk, or to a higher administrative position. Some clerks may move from routine jobs to work requiring special knowledge of subjects such as accounting or statistics, and this work may lead



Modern office machines have revolutionized many railroad paperwork operations.

eventually to positions as auditors or statisticians. Railroad clerks may also be promoted to traffic agents, buyers, storekeepers, or ticket and station agents.

Employment Outlook

Several thousand job opportunities for new workers will become available each year through the 1970's. Because this is a large occupational group, retirements, deaths, and transfers to other fields of work will create many openings for new clerical workers.

Employment in this occupational group has been declining. In 1955, Class I line-haul railroads employed about 146,000 railroad clerks; by 1966, their number was 98,400. A continued decrease in the employment of these workers is expected during the early 1970's as electronic business machines do more of the work formerly done by railroad clerks in processing freight bills and recording information about freight car movements and freight yard operations. However, employment of clerical workers is expected to increase slightly in the late 1970's as a result of the anticipated expansion of railroad freight traffic.

Earnings and Working Conditions

Employees of Class I line-haul railroads who had clerical jobs involving work such as billing operations, filing, and inventory control, received average straight-time pay of $2.92 an hour in 1966. Secretaries, stenographers, typists, and office machine operators averaged $2.92 an hour; senior clerks and specialists averaged $3.29 an hour; and supervisory and chief clerks, $3.48 an hour. Railroad clerks in nonsupervisory positions work a basic 8–hour day and 40–hour week, with time and one-half paid for overtime.

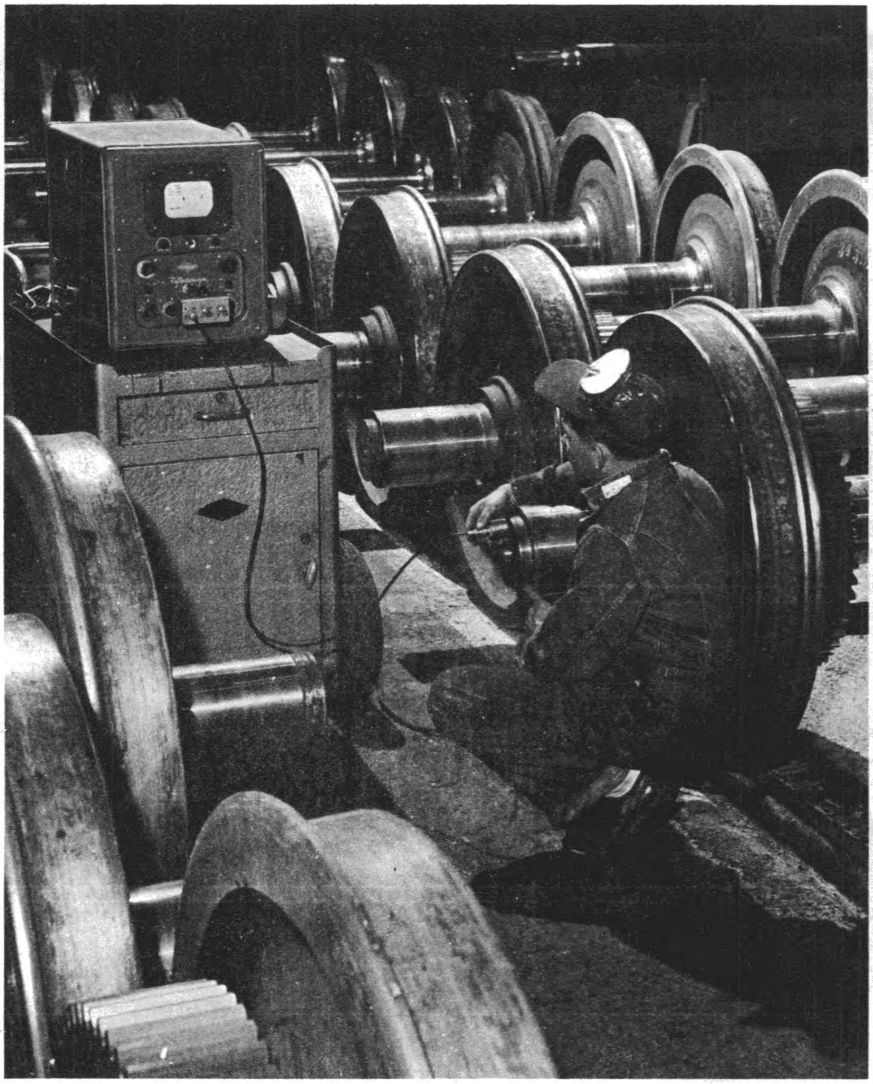
The Brotherhood of Railway, Airlines, and Steamship Clerks, Freight Handlers, Express and Station Employees represents the railroad clerks on all major roads.

SHOP TRADES

Nature of Work

The skilled workers employed by the railroads to build, maintain, and repair rolling stock and other equipment may be classified in six main "shop crafts": *Carmen* (D.O.T. 622.-381), *machinists, electrical workers, sheet-metal workers, boilermakers, and blacksmiths.* They work in railway shops, enginehouses, yards, and terminals.

In 1966, about 94,200 journeymen mechanics in these six crafts were employed by Class I line-haul railways. Working with them were 6,600 gang foremen and leaders, 10,700 helpers, and 3,800 apprentices. Several thousand more workers in the



Shop worker checks for flaws in locomotive axles.

same occupations were employed by short-line railways.

Carmen, who numbered about 52,000 on Class I line-haul railroads in 1966, are by far the largest group of shop craftsmen. They do many different kinds of work, since they build, maintain, and repair railroad freight and passenger cars, and also work on locomotives and on small vehicles such as the motor-driven cars used in transporting workers along the tracks. Some carmen are skilled in carpentry and can use power equipment as well as handtools. A few are skilled only in specialties such as upholstering, car painting, and pattern-making. Many carmen work as car inspectors in the railroad yards and stations, examining cars for defects that might lead to accidents or delays.

Machinists are the second largest group of skilled shop workers. About 19,600 were employed in 1966, doing such work as assembling and dismantling equipment and replacing and repairing parts. *Electrical workers,* who numbered about 12,900 in 1966, install and maintain wiring and electrical equipment in locomotives, passenger cars, and cabooses, as well as in buildings owned by the railroads. (Another group of electrical workers—nearly 2,200 in 1966—employed mainly away from the shop, lay power and communications lines for equipment used by the railroads.) *Sheet-metal workers,* numbering about 6,200 in 1966, install and maintain light sheet-metal parts and do pipefitting on cars, locomotives, and other equipment. *Boilermakers,* of whom there were about 1,800 in 1966, maintain and repair stationary boilers, tanks, and other parts made of sheet iron or heavy sheet steel. Other craftsmen employed in the shops include blacksmiths, molders, stationary firemen, oilers, and stationary engineers (steam). (More information about the nature of the work of most of the above shop trades may be found elsewhere in the *Handbook.*)

Training, Other Qualifications, and Advancement

Apprenticeship is the usual way of entering the shop trades, although many, particularly in the carmen's craft, are upgraded directly from laborer or helper positions. Apprentices are trained in all branches of their respective trades, according to standards which in many cases are included in agreements negotiated by the shopmen's trade unions and the railroad companies. Upon completion of their training, they are certified as qualified journeymen. Beginners, who have no previous experience in their chosen trades, take this training as regular apprentices, generally for a 4-year period. Men who have at least 2 years of previous work experience train as helper apprentices for a 3-year period.

To become a regular apprentice, the applicant must be at least 16 and not over 21 years of age. The railroads prefer that helpers entering the 3-year apprentice training be no older than 30 or 35. On some roads, applicants for regular apprentice training are required to pass mathematical and mechanical aptitude tests.

Workers in the shop trades may advance to supervisory positions as foremen in shops, enginehouses, and powerplants.

Employment Outlook

There will be several hundred opportunities for new workers to obtain jobs either as helpers or as apprentices in the shop crafts each year during the next decade. In 1966, apprenticeship programs operated by Class I line-haul railroads were training about 3,800 new workers, 3,600 of them as regular apprentices.

Openings in the skilled shop crafts will result primarily from the need to replace experienced craftsmen who retire, die, or transfer to other fields of work. The number of journeymen mechanics employed in these crafts declined from about 143,400 in 1955 to 94,200 in 1966 and some further decline appears likely through the 1970's despite the fact that more rolling stock will be needed to handle the anticipated increase in freight traffic. Among the factors which are making it possible for the railroads to handle a given amount of work in the shops with a smaller work force than formerly are the use of assembly line techniques in repair work, greater specialization of labor, and the use of better designed and constructed rolling stock. Fewer equipment maintenance employees are needed, also, because of the practice on some railroads of sending diesel locomotives requiring major overhaul back to the manufacturer for rebuilding or in exchange for more highly powered new, or rebuilt units.

Employment trends for individual shops crafts have not been affected equally by changes in equipment and operating methods, nor are they likely to be in the future. Two extremes in shop craft employment trends are represented by electrical workers and boilermakers. During the 1955–64 period, when the total number of skilled craftsmen in the six principal shop trades decreased by one-third, the number of electrical workers declined about 25 percent. Some increase in employment of electrical workers may occur through the 1970's because of the almost universal use of diesel-electric power and the installation of more complex electrical and electronic equipment in locomotives, railroad cars, and communication systems. On the other hand, the decline that has already taken place in the number of boilermakers employed in the shops—from about 4,300 in 1955 to 1,800 in 1966—is expected to continue, because the skills of these workers are required much less in the repair of diesel locomotives than in the repair of steam locomotives. The decline since 1955 in carmen and machinists who together account for about three-fourths of all journeymen mechanics employed in shop crafts, has been about one-third; some further decline, although less pronounced, is expected through the 1970's.

Earnings and Working Conditions

Straight-time average hourly earnings of journeymen employed by Class I line-haul railroads in the shop trades in 1966 were: Carmen $2.99; machinists $3.06; electrical workers $3.08; sheet-metal workers $3.06; boilermakers $3.06; and blacksmiths $3.04. Straight-time earnings of helpers in all shop crafts averaged $2.73 an hour; regular apprentices, who spend part of their time in classroom instruction and the rest on the job, averaged $2.50 an hour; and helper-apprentices, who also worked on the same basis, averaged $2.77 an hour; gang foremen and gang leaders averaged $3.55 an hour. Most shop workers have a basic 40-hour workweek of five 8-hour days, and are paid time and one-half for overtime.

Major repairs on locomotives and cars are made generally indoors in the enginehouse or car repair shop. Minor adjustments, inspection, and emergency repairs may be performed out-of-doors.

Most shop workers are members of unions. Among the unions in this field are: Brotherhood Railway Carmen of America; International Association of Machinists and Aerospace Workers; International Brotherhood of Electrical Workers; Sheet Metal Workers' International Association; International Brotherhood of Boilermakers, Iron Shipbuilders, Blacksmiths, Forgers and Helpers; and the International Brotherhood of Firemen and Oilers. In collective bargaining, these unions usually negotiate their labor contracts through the Railroad Employes' Department of the AFL–CIO.

SIGNAL DEPARTMENT WORKERS

(D.O.T. 822.281 and .884)

Nature of Work

Workers in railroad signal departments construct, install, maintain, and repair the signaling systems which control the movement of trains and assure the safety of railroad travel.

One group of skilled workers, known as signal maintainers, keep wires, lights, switches, and other controlling devices in good operating condition. The work requires a thorough practical knowledge of electricity and considerable mechanical skill. Work on the newer signaling systems also requires a knowledge of electronics.

A second skilled group, known as signalmen, generally has the same skills and knowledge required of maintainers, but construct and install new signals and signal systems. Signalmen work as members of crews which also include semiskilled workers. The crews travel from one part of the road to another, wherever construction work is underway. In constructing a signal system, crews often build forms for concrete, mix and pour cement, weld metal, and do many other types of work in addition to electrical work.

In 1966, Class I line-haul railroads employed about 12,500 men in this

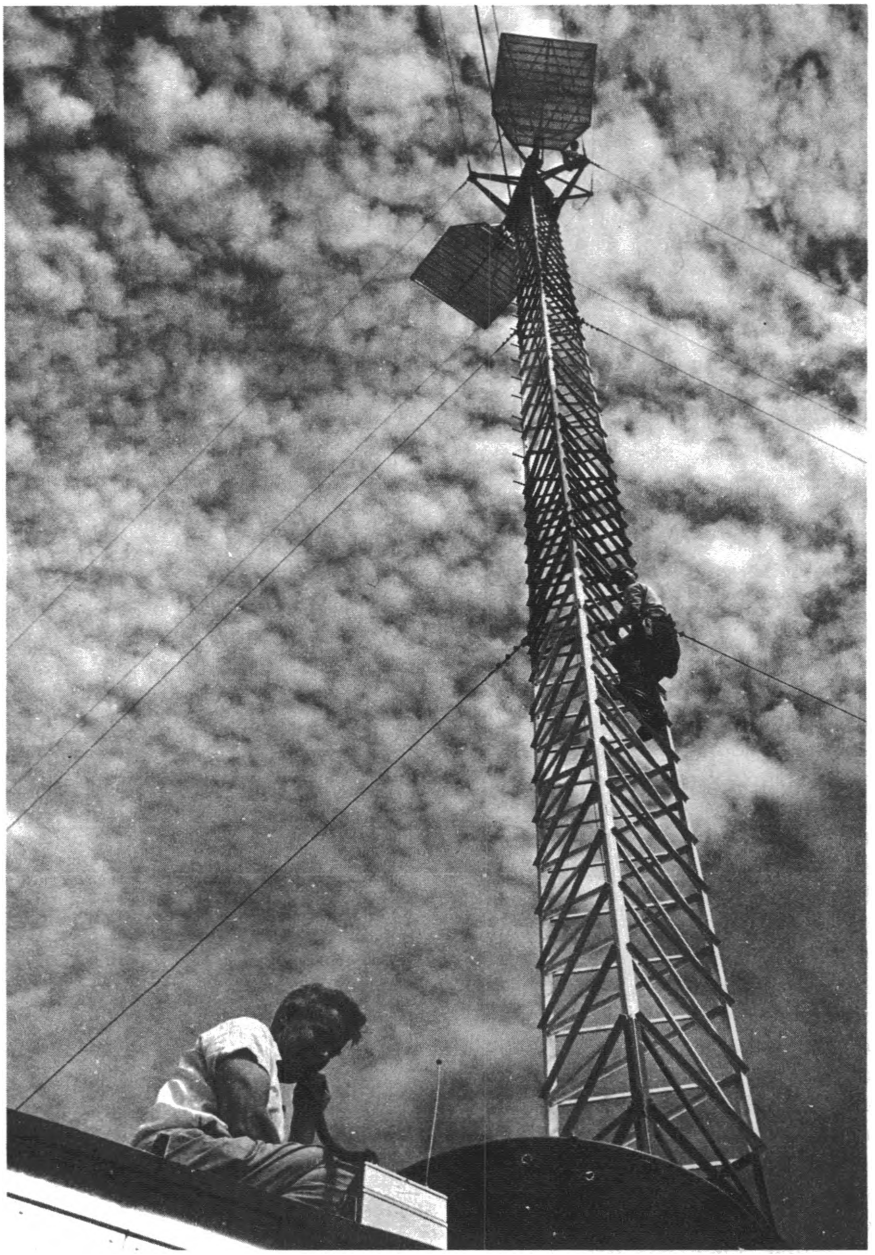
kind of work; included were about 8,400 signalmen and signal maintainers, about 1,200 semiskilled assistants, and 800 helpers. Several hundred workers in these groups also were employed by the short-line railways and by switching and terminal companies.

Training, Other Qualifications, and Advancement

Railroads prefer that applicants for entry jobs in the signal department be between 18 and 35 years of age and have a high school education or its equivalent. Knowledge of electricity and mechanical skill are assets to young men seeking these jobs.

New employees start as helpers doing work under the direction of experienced men, or as assistants, if they have had previous experience in signal work. Helpers, after about 1 year of training on the job, usually advance to assistant. Openings for signalmen and signal maintainers are filled, as they occur, by promoting qualified assistants according to seniority rules. At least 4 years are required usually for an assistant to work up to signalman or signal maintainer.

Both signalmen and signal maintainers may be promoted to more responsible positions such as inspectors or testmen, gang foremen, leading signalmen, or leading signal maintainers. A few may advance to assistant supervisors or signal engineers.



Signal maintainers check signal strength of repeater station.

Employment Outlook

There will be some opportunities for new workers to obtain entry jobs as helpers or assistants during the 1970's. Most of these opportunities will result from the need to replace workers who retire, die, or transfer to other fields of work. Job openings for new workers will be limited because men furloughed in recent years will be recalled before new men are hired.

Employment of helpers and assistants declined from about 4,600 in 1955 to 2,000 in 1966, and the number of skilled signalmen and signal maintainers declined from about 8,800 to 6,900. These occupations are expected to continue to decline in the early 1970's, after which they are expected to increase slightly. The installation of new equipment initially has increased signal work opportunities; maintenance and repair requirements has declined as a result.

Earnings and Working Conditions

The average straight-time hourly earnings of signalmen and signal maintainers employed by Class I line-haul railroads in 1966 were $3.08. Assistant signalmen and signal maintainers averaged $2.74 and helpers $2.63 an hour. Signal workers have a basic 8-hour day and 5-day week, and are paid time and one-half for work beyond 8 hours a day.

Signal maintainers have fairly steady work, because the amount of work required for maintaining railroad signal systems does not change greatly with variations in traffic or with the seasons. Signalmen and other crew members, particularly on some northern roads, may have less work during especially bad weather. In both of these occupations, the work is mostly out of doors, and maintainers must make repairs regardless of the time of day or the weather conditions. Both maintainers and signalmen, when working on signaling devices, must often climb poles and work near high-tension electric wires and unguarded railroad tracks.

Signalmen and other crew members who work on construction and installation frequently work away from their homes; on these occasions, many railroads provide camp cars for living quarters while the men pay for their own food. Signal maintainers generally are able to live at home, since they maintain signals only over a limited stretch of track.

Most signal workers are members of the Brotherhood of Railroad Signalmen.

TRACK WORKERS

(D.O.T. 182.168; 859.883; 869.887; 910.782; and 919.887)

Nature of Work

Trackmen and portable equipment operators construct, maintain, and repair railroad tracks and roadways. Many of them work in section crews which patrol and maintain a limited section of the railroad's right-of-way. Some roads combine the section crews and highly mechanized crews to cover longer stretches of the right-of-way. Still other track workers are employed in "extra" crews. These men perform seasonal maintenance and repair work, such as replacing rails.

Either a member of the section crew, or track workers operating track motorcars, make regular inspections of the right-of-way, looking for cracked rails, weak ties, washed-out ballast, and other track and roadway defects. Trackmen and portable equipment operators working in the crews then make the necessary repairs. Roadway maintenance machines, such as multiple tie tampers, power wrenches, and ballast cleaners, have been displacing gradually the use of such handtools as picks, shovels, and spike hammers. More and more railroads are using roadway machines, which require skilled operators, to do heavy maintenance-of-way work once done by trackmen using hand or pneumatically powered tools.

In 1966, an average of 60,900 track workers were employed by Class I line-haul railroads. They included 40,200 trackmen working in crews, 9,300 portable equipment operators and helpers, and 11,300 gang foremen. Additional thousands of these workers were employed by the short-line railroads. The size of this maintenance-of-way work force varies considerably during the year because many construction and repair jobs are done in the summer months when the weather is best.

Training, Other Qualifications, and Advancement

Most track workers are trained on the job. To acquire the skills neces-

Track workers drive spikes with automatic spikemaster.

sary to become an all-round trackman requires up to 2 years. Machine operating jobs in track maintenance work are assigned to qualified trackmen on the basis of seniority.

Most roads prefer workers between the ages of 21 and 45 for their track work forces. Men seeking work as trackmen must be able to read and write and do heavy work. Applicants often are required to take physical examinations. A high school education is desirable for workers who are seeking to advance to portable equipment operators and gang foremen.

Trackmen and portable equipment operators who have the necessary seniority and qualifications may advance to gang or assistant foreman. A qualified foreman may advance to a supervisory maintenance-of-way position such as track supervisor.

Employment Outlook

Several thousand new workers will be hired each year in track maintenance occupations during the 1970's, mostly for the seasonal rush during the summer months, particularly in northern sections of the country. Comparatively few openings will offer steady year-round employment.

For some years, the use of mechanized equipment and new kinds of materials in roadway construction has been reducing substantially the number of men employed by the railroads in maintenance-of-way work. At the same time, however, the use of mechanized equipment has created a limited number of maintenance-of-way jobs involving the operation of roadway machines. Betwen 1955 and 1966, as the number of trackmen and foremen in section and other kinds of crews dropped from about 136,000 to 51,600, the number of portable equipment workers rose from 7,400 to about 9,300. These trends are expected to continue in the years ahead.

Earnings and Working Conditions

Track workers are among the lowest paid groups in the railroad industry. Men employed in section and other kinds of crews on Class I line-haul railroads had straight-time average earnings of $2.51 an hour in 1966. Portable equipment operators and helpers averaged $2.85 and crew foremen averaged $2.93 an hour in 1966. A basic 5-day, 40-hour week was in force for most classes of track workers. Time worked over 8 hours a day was paid for at time and one-half rates.

Since most section men inspect and maintain only a few miles of track, they usually live at home. However, the section crew is rapidly giving way to the mechanized "floating" crew. Trackmen and portable equipment operators who work in "floating" crews usually travel from place to place and generally live in camp cars or trailers provided by the railroads. They pay for their own food.

Most maintenance-of-way workers are members of the Brotherhood of Maintenance of Way Employes.

BRIDGE AND BUILDING WORKERS

Nature of Work

These workers construct, maintain, and repair tunnels, bridges, stations, railway shops, and a variety of other structures owned by the railroads. In 1966, Class I line-haul railroads employed in this kind of work about 9,400 skilled craftsmen, 2,600 helpers, and 2,300 foremen. Among the skilled craftsmen were about 5,500 carpenters working as all-round mechanics in a variety of construction trades in addition to carpentry; about 2,800 masons, bricklayers, plasterers, and plumbers; and about 700 painters and 400 ironworkers. The short-line railways employed several hundred more workers in the same occupations. (Information about the nature of the work done by these craftsmen can be found elsewhere in the *Handbook*.)

Training, Other Qualifications, and Advancement

New employees usually receive their training as helpers. As openings occur in skilled mechanics' jobs, they are filled by helpers who have qualified for promotion and have the necessary seniority.

Skilled workers with the necessary experience may advance to positions as foremen, inspectors, or bridge and building supervisors.

Employment Outlook

A small number of job openings in the bridge and building work force will arise each year during the next 10 years. Retirements, deaths, and transfers to other fields of work will provide some job opportunities for new workers. Most of the jobs available will be as beginners or helpers, where turnover rates are relatively high.

Employment by Class I line-haul railroads of skilled craftsmen, helpers, and foremen on bridge and building work decreased from about 27,300 in 1955 to 14,400 in 1966. This trend is expected to continue because the increased use of power tools and other laborsaving equipment, and of new materials which require less maintenance and repair, will cut down further on the number of men needed for construction and maintenance work. However, increased railroad freight activity projected for the early 1970's may cause employment of these workers to increase slightly.

Earnings and Working Conditions

The average straight-time hourly earnings of carpenters employed by Class I line-haul railroads in bridge and building work in 1966 were $2.82. Masons, bricklayers, plasterers, and plumbers averaged $2.99, ironworkers

$3.02, painters $2.86, helpers $2.67, and foremen $3.17 an hour in 1966. Bridge and building workers work a 5-day, basic 40-hour week and are paid time and one-half for work beyond 8 hours a day, and may receive double time for work over 16 continuous hours.

Bridge and building men usually are away from home during their workweek. On these occasions, they usualy live in camp cars supplied by the railroads. While living in camp cars, they pay for their own food.

The Brotherhood of Maintenance of Way Employes represents the bridge and building workers on most roads.

TELEPHONE INDUSTRY OCCUPATIONS

As our population and economy grow, and as technology advances, the need for communication increases. More than 385 million telephone calls are made daily in the United States, both locally and for long distances to different parts of the country and overseas. Approximately 800,000 employees were required to provide this service in early 1967.

The telephone industry offers men and women many employment opportunities for steady, year-round work in many different jobs. Some of the jobs, such as telephone operator and file clerk, can be learned in a few weeks; other jobs, such as installer and repairman, take many more months to learn.

More than half of all telephone workers are women. They are employed primarily as telephone operators or clerical workers. Men usually are employed in installing, repairing, and maintaining telephone equipment.

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. About 100 million telephones were in use in the United States in 1967.

Telephone jobs are found in almost every community in the United States. Most telephone workers, however, are employed in large cities with concentrations of industrial and business establishments. Nearly three-fifths of them work in the 10 States which have the largest number of telephones: New York, California, Pennsylvania, Illinois, Ohio, Texas, Michigan, New Jersey, Massachusetts, and Indiana.

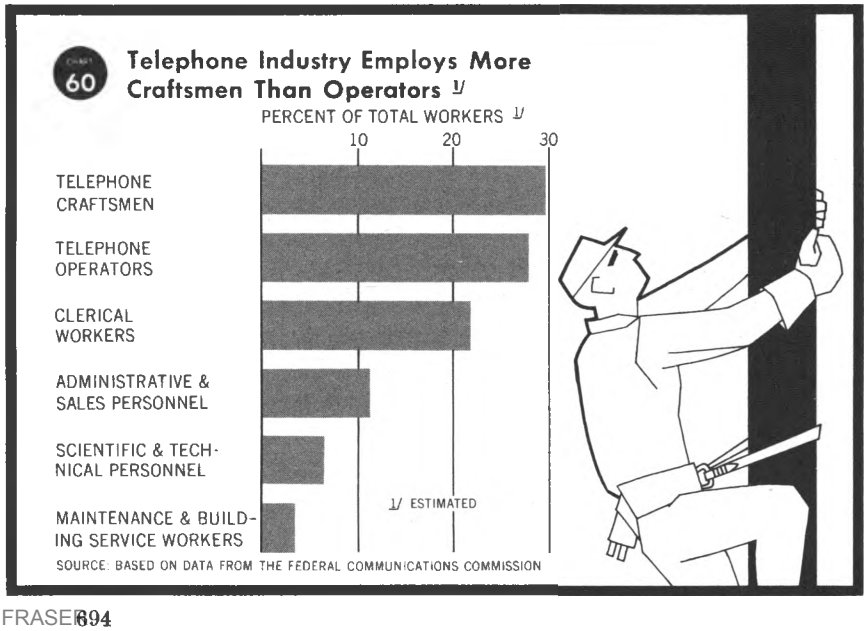
The nerve center of the local telephone system is the central office containing the switching equipment through which any telephone may be connected with any other telephone. Every telephone call made, whether by dialing direct or signaling the operator, travels from the caller through wires and cables 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. To join the caller's telephone to the telephone he is calling, connections are made automatically, mainly by electro-mechanical switching equipment. Manual connections may also be made by the operator in the few remaining manually operated switchboards, or in unusual situations.

Long-distance calls are dialed by the customer or an operator and connected through switching equipment with the telephone called. By early 1967, about 85 percent of all telephone users could dial long-distance calls directly. Information needed to bill the customer may be recorded automatically or, on operator handled calls, is entered on a ticket by the operator.

Some customers make and receive more calls than can be handled on a single telephone line. For these calls, a system somewhat similar to a miniature central office may be installed on the subscriber's premises. This system is the private branch exchange (PBX), usually found in such places as apartment and office buildings, hotels, department stores, and other business firms.

A new type of service is called CENTREX, in which incoming calls can be dialed direct to any extension without an operator's assistance, and outgoing and intercom calls can be dialed direct by the extension users. The equipment for this service can be located either on telephone company premises or on the customer's premises.

Other communication services provided by telephone companies in-



clude 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 the vast network of cables and radio-relay systems for comunication 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 operate teletype and private-wire services which they lease to business and government offices.

The domestic telephone network is made up of two ownership groups—the Bell System and the independent telephone companies. Bell, through its associated companies, serves about 5 of every 6 of the Nation's telephones. The independents serve the remainder. There are approximately 2,300 independent telephone companies in the United States.

Telephone Occupations

The telephone industry requires workers in many different occupations. Chart 60 shows the percentage distribution of telephone employment by occupational group.

Nearly 3 of every 10 workers in the industry are telephone craftsmen and about the same proportion are telephone operators. Telephone craftsmen install, repair, and maintain telephones, cables, switching equipment, and message accounting systems. These workers can be grouped by the type of work they perform: (1) Line construction men place, splice, and maintain telephone wires and cables; (2) installers and repairmen place, maintain, and repair telephones and private branch exchanges (PBX) in homes and in offices and other places of business; and (3) central office craftsmen test, maintain, and repair equipment in central offices. The duties of the operators include making telephone connections; assisting customers on specialized types of calls, for example, reverse-charge calls; and giving telephone information. Telephone craftsmen are discussed in detail later in this chapter. A detailed discussion of telephone operators and operators of private branch exchanges (PBX operators) is presented in a separate statement elsewhere in the *Handbook*.

When central office equipment is purchased by a telephone company, it is usually installed by employees of the equipment manufacturers. A few central office equipment installers work for telephone companies or private firms specializing in installation work. Although most of these skilled workers are not employed in telephone operating companies, they are discussed in this chapter because their work is so closely connected with the Nation's telephone system.

Many other occupations in the telephone industry, such as clerical, administrative, scientific, and custodial jobs, are found in other industries as well. They are described in detail elsewhere in the *Handbook*, in the sections covering individual occupations.

More than a fifth (22 percent) of all telephone industry employees are clerical workers, such as stenographers, typists, bookkeepers, office machine operators, cashiers, receptionists, file clerks, accounting and auditing clerks, and payroll clerks. Among their other duties, these clerical workers, most of whom are women, keep records of services, make up and send bills to customers, and prepare statistical and other reports. A small but growing amount of this recordkeeping and statistical work is being done by electronic data-processing equipment.

About 11 percent of telephone company employees are business office and sales representatives who handle orders for new telephone services and administrative and professional workers, such as accountants, attorneys, personnel specialists, purchasing agents, public relations employees, training specialists, and statisticians.

A small but increasing proportion (6 percent) of the industry's employees are scientific and technical personnel; for example, engineers and their assistants and draftsmen. Most of these workers plan and design the construction of new buildings and the expansion of existing ones, and solve engineering problems that arise in the day-to-day operations of the telephone system. Some engineers are employed in sales development work. Many top supervisory and administrative jobs are held by men with engineering backgrounds. Basic research in comunications systems and the development of new and improved telephone equipment are not done by employees of telephone operating companies, but mainly by those employed in affiliated laboratories specializing in such work.

About 4 percent of the telephone industry's workers maintain buildings, offices, and warehouses; operate and service motor vehicles; and do many other maintenance and service jobs in offices and plants. Skilled maintenance craftsmen include stationary engineers, carpenters, painters, electricians, and plumbers. Other workers employed by the telephone industry are janitors, porters, watchmen, elevator operators, and guards.

Employment Outlook

Tens of thousands of new workers will be required by telephone operating companies each year during the remainder of the 1960's and throughout the 1970's, mainly to replace the large numbers of women telephone operators and clerical workers who leave the industry to marry, rear a family, or for other reasons. Some of these new workers, however, will be needed for craft jobs, to replace skilled workers who die, retire, or shift to other work. Job turnover will also create openings for administrative, sales, professional, technical, and scientific personnel.

Despite an anticipated growth in the amount and types of telephone service, total employment in the telephone industry is expected to grow at only a slow rate. This is because technological improvements are permitting more calls to be made without any assistance from an operator. However, operators will continue to be needed to handle the more complex calls. Clerical workers and many of the skilled craftsmen are also being affected by technological changes expected to restrict the total number of workers required for efficient telephone service. Occupational groups in which employment is expected to grow as the volume of business increases are sales, administrative, professional, technical, and scientific personnel.

Part of the expansion in telephone service will result from expected increases in the number of households, and the number of business and industrial establishments. The remaining one-seventh of households in the United States without telephones will be another factor in the demand for telephone service, especially as family incomes rise.

Other factors are also expected to increase the demand for telephone services. For example, the popularity of extension telephones in private homes, and of telephones of different styles and colors, is increasing. A recent development is the touch-tone instrument on which a set of buttons replaces the dial. This instrument enables the user to make a call in half the time required for a dial call and has the potential to be used to provide many new services, including the transmission of data, remote control of appliances or remote access to electronic computers. Also, there is growing use of specialized equipment on telephone instruments, such as volume controls that compensate for impaired hearing, and loudspeakers that permit "hands free" conversation. For industrial and commercial users, high speed transmission of large quantities of computer-processed and other data via telephone, teletypewriter, telephotograph, or facsimilie are types of special services which are becoming more important. With high speed data transmission, for example, it is possible to publish the same newspaper almost simultaneously in two widely separated cities. To meet the increasing demand for overseas communications, transoceanic service will continue to expand as more undersea cables are laid and communications satellites come into wider commercial use.

Earnings and Working Conditions

Since wage rates in the telephone industry are geared to those for comparable work in the locality, earnings of telephone workers depend not only on the type of job and the worker's previous training and experience, but also on location and character of the community. Because of differences in rates among regions and communities, considerable variation exists in the rates paid for any given telephone occupation. In general, telephone wage rates are highest in the Pacific and Middle Atlantic States, and lowest in the Southeast.

For the Nation as a whole, average basic hourly wage rates in December 1965 for all telephone employees, except officials and managerial assistants, were $3.04. Rates for these workers ranged from an average of $1.82 an hour for telephone operator trainees and $2.17 for experienced telephone operators, to $5.31 for professional and semiprofessional workers. Clerical workers in nonsupervisory positions averaged $2.35 an hour. Construction, installation and maintenance employees averaged $3.45 an hour.

A telephone employee usually starts at the minimum wage for his particular job. Advancement from the starting rate to the maximum rate generally takes from 5 to 6 years and involves from 10 to 14 pay grades.

More than two-thirds of the workers in the industry, mainly telephone operators and craftsmen, are members of labor unions. The Communications Workers of America represents the largest number of workers in the industry, but many other employees are members of the 16 independent unions which form the Alliance of Independent Telephone Unions. Others are members of the Independent Brotherhood of Electrical Workers.

Wage rates, wage increases, and the amount of time required to advance from one step to the next are governed for most telephone workers by union-management contracts. The contracts also call for extra pay for work beyond the normal tour of 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.

Travel time between jobs is counted as worktime for craftsmen under some contracts. Overtime work is sometimes required in the telephone industry, especially during emergencies, such as floods, hurricanes, or bad storms. During an "emergency call-out," which is a short-notice request to report to work during nonscheduled hours, workers are guaranteed a minimum period of pay at the basic hourly rate.

In addition to these provisions which affect the pay envelope directly, other benefits are provided. Periods of annual vacations with pay are granted to workers according to their length of service. Usually, contracts provide for a 1-week vacation for 6 months to 1 year of service, 2 weeks for 1 to 10 years, 3 weeks for 10 to 20 years, and holidays range from 6 to 11 days a year depending on locality. The majority of telephone workers are covered by paid sick plans and group insurance plans which usually provide sickness, accident, and death benefits, and retirement and disability pensions.

The telephone industry has achieved one of the best safety records in American industry: The number of disabling injuries has been consistently well below the average.

Where To Go for More Information

Additional information about jobs in the telephone industry may be obtained from the local telephone company or from local unions with telephone workers among their membership. If no local union is listed in the telephone directory, information may be obtained from the following:

Alliance of Independent Telephone Unions.
Room 302, 1422 Chestnut St., Philadelphia, Pa. 19102

Communications Workers of America.
1925 K St., N.W., Washington, D.C. 20006.

International Brotherhood of Electrical Workers.
1200 15th St., N.W., Washington, D.C. 20005.

Telephone Craftsmen

Nearly a third of the employees of the telephone industry are craftsmen engaged in construction, installation, and maintenance activities necessary to operate the vast amount of mechanical, electrical, and electronic equipment vital to the far-reaching network of our modern communications systems. About 1 in every 8 of these workers are foremen many of whom have advanced to supervisory positions from a craft job.

CENTRAL OFFICE CRAFTSMEN

Nature of Work

Central office craftsmen test, maintain, and repair mechanical, electrical, and electronic switching equipment and other central office equipment. They keep this equipment in operating condition and locate potential trouble before service is affected. Telephone companies employed about 76,000 central office craftsmen in early 1967, including, for example, approximately 17,000 testboardmen and 56,000 central office repairmen, helpers, and framemen.

Frameman (D.O.T. 822.884) is usually the beginning job from which a worker may advance to a more skilled central office craft job. Framemen run, connect and disconnect wires representing individual subscriber lines between cable and central office terminals according to plans prepared by *line assigners,* another small group of workers.

Central office repairmen (D.O.T. 822.281), often called *switchmen,* maintain and repair switching equipment and automatic message accounting systems in central offices. They check switches and relays, using special tools and gages. They also locate and repair trouble on customers' lines in central office equipment as reported by testboardmen.

Testboardmen (D.O.T. 822.281) make periodic checks of customers' lines to prevent breakdowns or interference in telephone service. They work at special switchboards made up of electrical testing instruments and test for, locate, and analyze trouble spots reported on customers' lines. If repairs are needed and the breakdown is outside the central office, they direct the repair activities of line and cable crews or installer-repairmen or of central office repairmen (if the trouble is inside).

Training, Other Qualifications, and Advancement

The telephone companies usually hire inexperienced men to train for skilled jobs in central offices. Applicants for these jobs must have at least a high school or vocational school education. A knowledge of the basic principles of electricity and electronics is generally desired. Telephone training and experience in the armed services or technical training beyond the high school level may be helpful in obtaining jobs as telephone company craftsmen; men with such training may be brought in above the entry level. Preemployment aptitude tests usually are given to prospective employees.

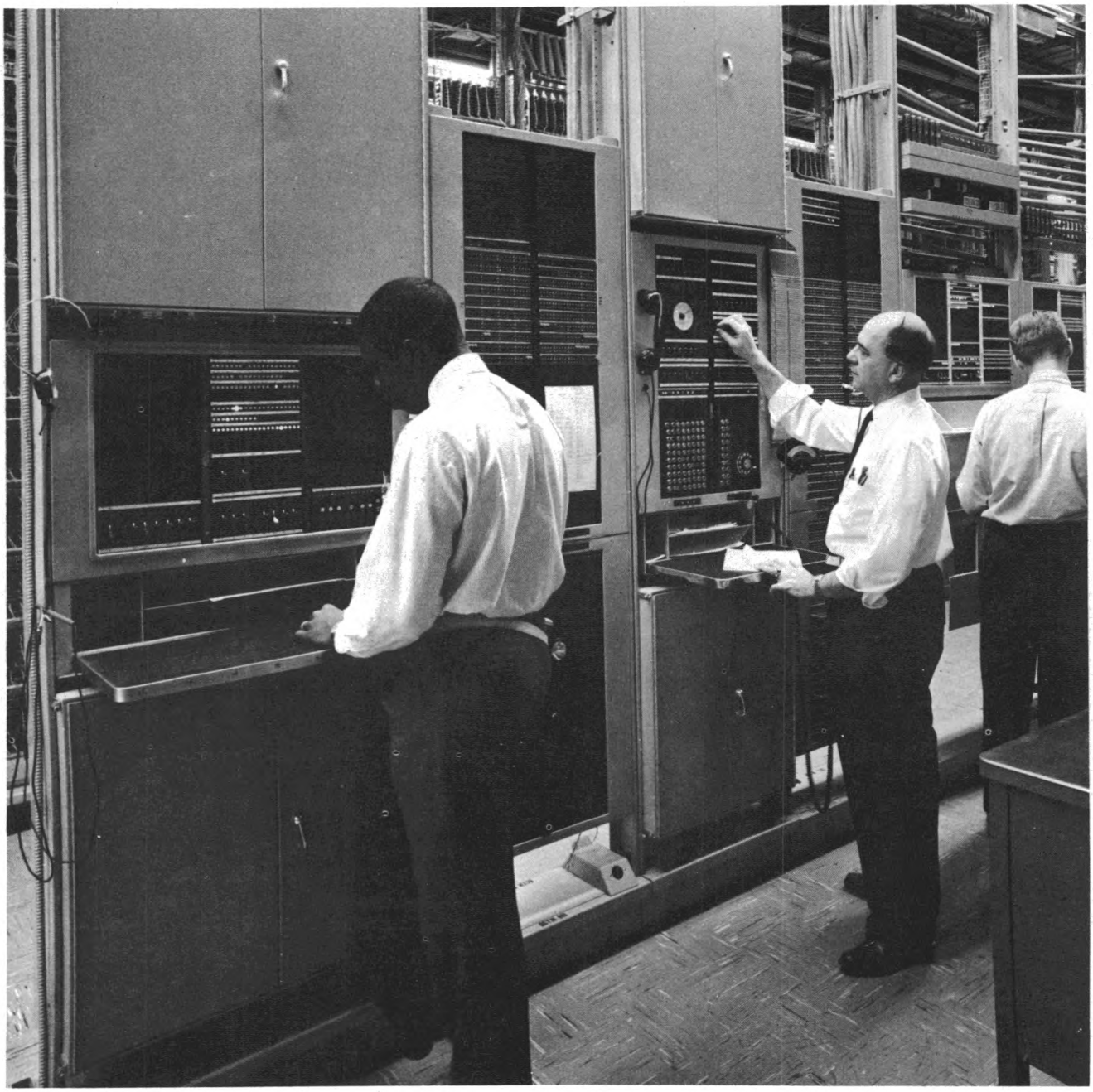
Most telephone companies have regular programs for training new employees in central office craft jobs. A new worker may be given classroom instruction as well as on-the-job training. Usually, he is assigned to the starting job of frameman and works with experienced framemen under the direction of a supervisor or foreman. As the frameman gains skill and experience, he may advance to central office repairman or testboardman receiving such additional classroom instruction or other training as may be required for the new job. Instruction includes courses such as the principles of electricity and electronics, as well as special courses in the maintenance of the particular type of central office equipment used by the company.

Central office craftsmen receive training throughout their careers with the telephone company. As new types of equipment and tools are introduced and new maintenance methods are developed, these men may be sent to school for short periods of instruction. Usually it takes at least 6 years for workers to reach the top pay rate for central office repairmen or testboardmen.

Many workers move into central office craft jobs from other types of telephone work. For example, some men start as telephone installers or linemen and many, with additional training, transfer to jobs as central office craftsmen. Promotional opportunities for central office craftsmen include, in addition to the jobs of central office foremen, jobs such as those of engineering assistants and administrative staff workers.

Employment Outlook

Young men will find many opportunities for steady employment as



Central office repairmen at test frames check functioning of switching equipment.

central office craftsmen during the remainder of the 1960's and the 1970's. The opportunities will result from the need to replace workers who retire, die, transfer to other telephone jobs, or leave the telephone industry. Retirements and deaths alone may result in several thousand job openings each year.

The total number of central office craftsmen is expected to increase moderately during the 1967–80 period, mainly as a result of increasing demand for telephone service and data communication systems. However, recent technological developments, such as electronic switching and various automatic testing devices, will tend to restrict employment growth.

Earnings and Working Conditions

Central office craftsmen are among the highest paid skilled workers in the telephone industry. In December 1965, average basic hourly rates of

pay in large telephone companies in the United States were $3.43 for testboardmen and $3.25 for central office repairmen; average basic hourly rates ranged from $3.36 to $3.83 for testboardmen and from $3.11 to $3.40 for central office repairmen, depending on locality and length of service.

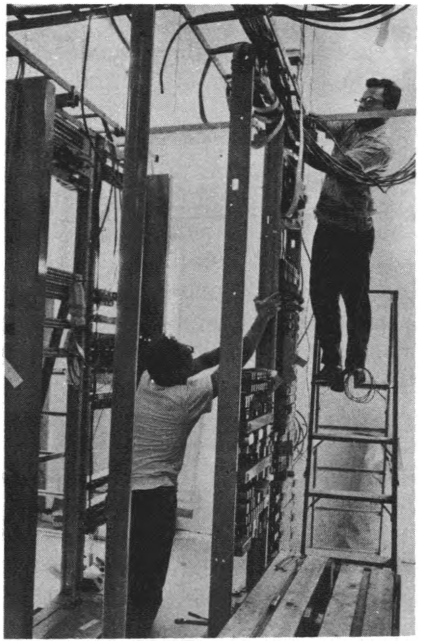
Earnings increase considerably with length of service in central office jobs. According to a 1966 union-management contract in one of the higher pay scale cities, craft employees start at $90.00 for a 40-hour week. Framemen can work up to a maximum of $134.00 after 5 years. If a vacancy occurs and the worker is qualified, a frameman can move into the job of central office repairman or testboardman with a higher pay schedule. Central office repairmen and testboardmen can earn a maximum of $160.00 a week after 6 years of periodic increases. Craftsmen who qualify for engineering assistant jobs can earn a maximum of $172.50 a week after 6 years.

Since the telephone industry gives continuous service to its customers, central offices operate 24 hours a day, 7 days a week. Some central office craftsmen, therefore, have work schedules for which they receive extra pay. Central office craftsmen are covered by the same provisions governing overtime pay, vacations, holidays, and other benefits that apply to telephone workers generally. (See discussion earlier in this chapter.) Employees in central offices work in clean and well-lighted surroundings.

CENTRAL OFFICE EQUIPMENT INSTALLERS

Nature of Work

Central office equipment installers set up complex switching and dialing equipment in central offices of local telephone companies. They assemble, wire, adjust, and test this equipment



Central office installers raise frame for dialing equipment.

making sure that it conforms to the manufacturer's standards for efficient and dependable service. These jobs may involve installing a new central office, adding equipment in an expanding local office, or modifying or replacing outmoded equipment.

About 22,000 installers were employed in early 1967. Unilke the other craftsmen discussed in this chapter, most installers work for manufacturers of central office equipment rather than for the telephone companies. A few installers work directly for telephone operating companies, including about 1,500 in the New England area, and some are employees of private contractors who specialize in large-scale telephone installation jobs.

Central office equipment installers are generally assigned to specific areas which may include several States; they must travel to central offices of local telephone companies within these areas. On a small job, such as installing a switchboard in a central office in a small community, an installer may be teamed with only one or two other installers. On a large job, such as installing a long-distance toll center in a big city, he may work with hundreds of other installers.

Training, Other Qualifications, and Advancement

Young men who wish to become installers must have a high school or vocational school education. Men with some college education, especially those with engineering training, are often hired for these jobs. Preemployment tests are generally given to determine the applicant's mechanical aptitudes, and a physical examination is required.

New employees receive on-the-job training and classroom instruction. They attend classes for the first few weeks to learn basic installation methods and then start on-the-job training under experienced installers. After several years of experience, they may qualify as skilled installers. Training on the job, however, continues even after they become skilled workers. Additional courses are given from time to time not only to improve their skills but also to teach them new techniques of installing telephone equipment. Installers may advance to engineering assistant jobs, especially those workers who have had some technical training beyond the high school level.

Employment Outlook

During the remainder of the 1960's and through the 1970's, several hundred job openings a year are expected to become available for young men to replace central office equipment installers who transfer to other work, retire, or die. The total number of installers, however, will remain at about the present level for several reasons. Installation of automatic dialing equipment for long-distance calls will continue at about the current rate; eventually such equipment will be installed in all parts of the country. Some new central offices will have to be constructed during the

years ahead and existing ones modified or enlarged to meet the growing needs of a population that is expanding and shifting to the suburbs. The amount of such work may be somewhat less than in recent years, however, because many new central offices have been built recently and will not need replacement for some time. On the other hand, increasingly complex central office and toll equipment, including advanced types of PBX systems, as well as data and computer networks, will require manpower with more and higher skills in electronic work.

Installers, perhaps more than other craftsmen connected with the telephone industry, are subject to possible employment fluctuations in the short run because of changes in business conditions. When the business outlook is depressed, there is less likelihood that new central offices will be built or existing ones enlarged or modernized. When business is prospering, installations, additions, and modifications of central offices may occur at an above-average pace.

Earnings and Working Conditions

As of late 1966, the straight-time average hourly rate of pay for installers was $3.15. According to a major union contract in effect for this occupation in late 1966, inexperienced installers start at $2.00 to $2.19 an hour, depending on locality. The contract provides for periodic increases and employees may reach rates of $3.22 to $3.96 an hour after 6 years of experience. Employees may also receive merit increases above these rates, based on job performance plus length of service, bringing the top rates up to $3.49 to $4.25 an hour. Time and a half is paid for work in excess of 8 hours a day or 40 hours a week, and double time is paid for work on Sundays and holidays. Travel and expense allowances are also given. Installers receive 7 to 12 paid holidays a year, depending on locality. Paid vacations are provided according to length of service.

The majority of central office equipment installers, including most of those servicing the Bell System, are represented by the Communications Workers of America. Some installers employed by manufacturers supplying the non-Bell or independent segment of the telephone industry, and some employed by large installation contractors, are represented by the International Brotherhood of Electrical Workers. Installers employed directly by telephone operating companies in the New England area are members of the International Brotherhood of Telephone Workers, which is affiliated with the Alliance of Independent Telephone Unions.

LINEMEN AND CABLE SPLICERS

Nature of Work

The vast network of wires and cables that connect telephone central offices to the millions of telephones and switchboards in customers' homes and buildings is constructed and kept in good operating order by linemen and cable splicers and their helpers. Telephone companies employed over 40,000 such workers in early 1967—16,000 linemen, 20,000 cable splicers, and 4,000 helpers, laborers, and other workers.

In constructing new telephone lines, *linemen* (D.O.T. 822.381) place wires and cables leading from the central office to customers' premises. They use power-driven equipment to dig holes and set in telephone poles which support cables. Linemen climb the poles to attach the cables, usually leaving the ends free for cable splicers to connect later. In cities where telephone lines are below the streets, linemen place cables in underground conduits. Construction linemen usually work in crews of two

to five men. A foreman directs the work of several of these crews.

Much of the lineman's work is repairing and maintaining existing lines. When wires or cables break or when a pole is knocked down, linemen are sent immediately to make emergency repairs. The line crew foreman keeps in close contact with the testboardman who directs him to trouble locations on the lines. Some linemen are assigned sections of lines in rural areas which they inspect periodically. During the course of their work, they make minor repairs and line changes.

After linemen place cables on poles or in underground conduits, *cable splicers* (D.O.T. 829.381) generally complete the line connections. Splicers work on aerial platforms, in manholes, or in basements of large commercial buildings. They connect individual wires within the cable by matching colors of wires so as to keep each circuit continuous. Cable splicers also rearrange pairs of wires within a cable when lines have to be changed. At each splice, they either wrap insulation around the wires and seal the joint with a lead sleeve or cover the splice with some other type of closure. Sometimes they fill the sheathing with gas under pressure to keep out moisture. Cable splicers also maintain and repair cables. The preventive maintenance work that they

do is extremely important because a single defect in a cable may result in a serious interruption in service. Many trouble spots are located through electric and gas pressure tests.

Training, Other Qualifications, and Advancement

Telephone companies hire inexperienced men to train for jobs as linemen or cable splicers. Applicants for these jobs must have a high school or vocational school education and must pass a physical examination. Knowledge of the basic principles of electricity, and especially electronics, is helpful. Preemployment tests are often given to help determine the applicant's aptitudes. Some line and cable work is strenuous, requiring workers to climb poles and lift lines and equipment. Applicants for these positions must be physically qualified for such work. Manual dexterity and the ability to distinguish color are also important qualifications. Men who have received telephone training and experience in the armed services frequently are given preference for job openings and may be brought in above the entry level.

For these jobs, telephone companies have training programs which include classroom instruction as well as on-the-job training. Classrooms are equipped with actual telephone apparatus, such as poles, cable supporting clamps, and other fixtures to simulate working conditions as closely as possible. Trainees learn to climb poles and are taught safe working practices to avoid contact with power wires and falls.

After a short period of classroom training, some trainees are assigned to a line crew to work on the job with experienced men under the supervision of a line foreman. About 6 years are required for linemen to reach the top pay for the job. Other trainees acquire the skills of the trade by working with experienced cable splicers to whom they are assigned.

Line construction craftsmen continue to receive training throughout their careers to qualify for more difficult assignments and to keep up with technological changes in the industry. Those with the necessary qualifications find many additional advancement opportunities in the telephone industry. For example, a lineman may be transferred to telephone installer and later to telephone repairman or other higher rated jobs.

Employment Outlook

Employment of linemen and cable splicers is expected to increase only at a slow rate despite anticipation of a continuing high level of activity in line and cable installation, maintenance, and repair. However, hundreds of job openings for these craftsmen as a group are expected to become available during the 1960's and throughout the 1970's because of the need to replace workers who transfer to other jobs, retire, or die.

Employment trends will differ among individual occupations. Very small growth is expected in the number of cable splicers because of technological developments that increase worker efficiency, such as devices that permit splicing of cables without the need to remove insulation; instruments for identifying types of wires in cables; and use of gas-filled cables whose failure can be pinpointed by detecting devices located in the central office. These developments, furthermore, are expected to reduce drastically the need for cable splicers' helpers, continuing the rapid decline in employment in this occupation in recent years. The number of linemen is not expected to increase significantly because of the increasing use of mechanical improvements, such as trucks with derricks and pole-lifting equipment, earth-boring tools, lightweight ladders, and "sky buckets," which has eliminated much of the physical work of the line crews, and is causing a substantial reduction in the regular size of a line crew.

Earnings and Working Conditions

Cable splicers have higher earnings than linemen. In December 1965, in the United States as a whole, cable splicer's basic rates averaged $3.39 an hour, and linemen's rates averaged $2.64. Average hourly rates ranged from $3.27 to $3.65 for cable splicers and from $2.12 to $3.09 for linemen, with variations in earnings depending on locality.

Pay rates within the jobs also depend to a considerable extent upon length of service. For example, according to a 1966 union-management agreement, new workers in line construction jobs in one of the higher pay scale cities begin at $90.00 for a 40-hour week. Linemen can reach the maximum of $150.00 after 6 years of service. The maximum basic weekly rate for cable splicers is $160.00 based upon a combined total of at least 6 years of work in a plantcraft job, as a helper and as a splicer, or in related craft jobs. Linemen and cable splicers are covered by the same contract provisions governing overtime pay, vacations, holidays, length of service and other benefits that apply to telephone workers generally. (See discussion earlier in this chapter.)

Linemen and cable splicers work outdoors. They must do a considerable amount of climbing. They also work in manholes, often in stooped and cramped positions. Safety standards, developed over the years by telephone companies with the cooperation of labor unions, have greatly reduced the hazards of these occupations. When severe weather conditions damage telephone lines, linemen and cable splicers may be called upon to work long and irregular hours to repair damaged equipment and to restore service. Because of the nature of their work, some linemen and cable splicers, by the time they reach their midfifties, transfer to other jobs, such as installers and repairmen or central office craftsmen.

TELEPHONE AND PBX INSTALLERS AND REPAIRMEN

Nature of Work

Telephone and private branch exchange (PBX) installers and repairmen (sometimes called servicemen) install and service telephone and PBX systems on the customers' property and make necessary repairs on the equipment when trouble develops. These workers travel to customers' homes and offices in trucks equipped with telephone tools and supplies. When telephone customers move or request new types of service, installers relocate telephones or make changes on customers' existing equipment. For example, they may install a PBX system in an office or change a two-party line to a single-party line in a residence. Installers may also fill a customer's request to add an extension in another room or to replace an old telephone with a newer model.

Telephone and PBX installers and repairmen are the largest group of telephone craftsmen; about 85,000 were employed in early 1967. The bulk of these men mainly install telephones or private branch exchanges and about 18,000 of them repair and maintain this equipment. The jobs of installing and repairing telephones and PBX systems are discussed below as separate jobs, but many telephone companies combine two or more of these jobs.

Telephone installers (D.O.T. 822.381) install and remove telephones in homes and places of business. They connect newly installed telephones to outside service wires which are on nearby buildings or poles. Installers often must climb poles to make these connections. Telephone installers are sometimes called *station installers.*

PBX installers (D.O.T. 822.381) perform the same duties as telephone installers but they specialize in more complex switchboard installations. They connect wires from terminals to switchboards and make tests to check their installations. Some PBX installers also set up equipment for radio and television broadcasts, mobile radiotelephones, and teletypewriters.

Telephone repairmen (D.O.T. 822.281), with the assistance of testboardmen in the central office, locate trouble on customers' equipment and make repairs to restore service. Sometimes the jobs of telephone repairmen and telephone installers are combined and the workers are called *telephone installer-repairmen.*

PBX *repairmen* (D.O.T. 822.281), with the assistance of testboardmen, locate trouble on customers' PBX systems and make necessary repairs. They also maintain associated equipment, such as batteries, relays, and power plants. Some PBX repairmen maintain and repair equipment for radio and television broadcasts, mobile radiotelephones, and teletypewriters. Sometimes the jobs of PBX installers and PBX repairmen are combined into the job of PBX *installer-repairmen.*

Training, Other Qualifications, and Advancement

Telephone companies hire inexperienced men and train them for telephone and PBX installation and repair jobs. Since much of the work requires personal contact with customers, applicants who have a pleasing appearance and the ability to deal effectively with people are preferred. Applicants for these skilled jobs must have a high school or vocational school education. Preemployment tests usually are given to help determine applicants' aptitude.

New workers are given classroom instruction in addition to on-the-job training. Classrooms are equipped with telephone poles, lines and cables, and terminal boxes, as well as models of typical residential construction to simulate actual working conditions. Trainees practice installing telephones and making connections to service wires just as they would in the field. After a few weeks of such training, new workers accompany skilled installers and continue to learn the job of installing by watching and helping these experienced men.

Telephone and PBX installers and repairmen continue to receive training throughout their careers with the telephone company to qualify for more difficult and responsible work. Since technological changes in the telephone industry are occurring constantly, telephone companies send their craftsmen to training schools for further instruction. Well qualified workers will have many additional advancement opportunities in this industry. For example, after a telephone installer has worked a few years, he may be transferred to the higher paying job of PBX installer. Similarly, a telephone repairman may be promoted to PBX repairman, one of the highest paying craft jobs. Another new worker may start as a lineman and then transfer to the job of installing or repairing telephones, later moving to either PBX installer or PBX repairman.

Employment Outlook

Young men will find many opportunities for steady employment as telephone and PBX installers and repairmen during the remainder of

this decade and throughout the 1970's. Primarily, these opportunities will result from the need to replace workers who transfer to other telephone jobs, leave the industry, retire, or die. Retirements and deaths alone may result in about 1700 job openings each year during the 1967–80 period. Some job openings created by turnover may be filled by workers transferring from other telephone craft jobs, such as linemen and cable splicers, but many will be open to new employees.

The total number of telephone and PBX installers and repairmen is expected to increase at a slow rate during the rest of the 1960's and through the 1970's. Some additional jobs may become available because of a gradual changeover to electronic switching equipment in central offices that has begun recently. Also, some expansion is anticipated in the volume of service handled by these craftsmen, because of the expanding number of telephones to be serviced and repaired, the growing popularity of extension phones, the increased use of specialized types of phone equipment, and the development of improved but more complex equipment. The employment increase will be slight because recent technological changes have increased the efficiency of individual installers or repairmen. Examples of such changes include improved designs for telephone instruments, wires, and cables; the development of removable components which can be returned to factory or service shop for repair.

Earnings and Working Conditions

In December 1965, the average basic hourly rate for PBX repairmen was $3.54 and the rate for telephone and PBX installers was $3.32. Average hourly rates ranged from $3.26 to $3.66 for PBX repairmen and from $3.00 to $3.52 for telephone and PBX installers, with variations in earnings depending on locality and length of service.

The effect of length of service on wage rates is illustrated by a 1966 union management agreement in one of the higher pay scale cities. Under this agreement, telephone installers and repairmen have a starting rate of $90.00 for a 40-hour week with periodic pay increases until a maximum of $150.00 a week is reached after about 6 years. PBX installers and repairmen also have a starting rate of $90.00 and progress to $160.00. Installers and repairmen are covered by the same provisions governing overtime pay, vacations, holidays, and other benefits that apply to telephone workers generally. (See discussion earlier in this chapter.)

Telephone and PBX installers and repairmen work indoors and outdoors in all kinds of weather. Outdoor work includes climbing poles to place and repair telephone wires leading from poles to customers' premises. Installers and repairmen may be called upon to work extra hours when breakdowns in customers' lines or equipment occur.

CONSTRUCTION INDUSTRY

The activities of the construction industry touch nearly every aspect of our daily lives. The houses and apartments we live in; the factories, offices, and schools in which we work; and the roads we travel upon; are examples of some of the products of this important industry. The industry encompasses not only new construction projects, but includes also additions, alterations, and repairs to existing structures.

In 1966, about 3.3 million persons were employed in the contract construction industry. An additional 1.3 million workers are estimated to be either self-employed—mostly owners of small building firms—or are State and local government employees engaged in building and maintaining our Nation's vast highway system. The contract construction industry is divided into three major segments. About half of the work force is employed by electrical, air-conditioning, plumbing, and other special trade contractors. Another one-third work in the general building sector where most residential, commercial, and industrial construction is carried on. The remaining workers, one-fifth, are engaged in building dams, bridges, roads, and similar heavy construction projects.

As illustrated in the tabulation on p. 706, workers in all blue-collar occupations made up nearly four-fifths of the construction industry employment in 1966. Craftsmen and foremen alone account for more than one-half of the total employment in this industry—a much higher proportion than that of any other major industry. Most of these skilled workers are employed as carpenters, painters, plumbers and pipefitters, construction machinery operators, and bricklayers, or in one of the other construction trades. Laborers are the next largest occupational group, and account for 1 of 6 workers. They provide material, scaffolding, and general assistance to the craftsmen at the worksite. Semiskilled workers such as truck drivers, welders and apprentices (operatives and kindred workers) represent about one-tenth of the industry's total work force. Managers, officials, and proprietors—mostly self-employed—also account for about the same share of employment. Professional and technical workers make up slightly less than 5 percent of the work force employed in construction. Engineers, together with technicians such as draftsmen and surveyors account for most of the employment in this occupational group. Clerical workers, largely women working as stenographers, typists and secretaries, and in general office work, made up another 5 percent of the industry's employment.

For the remainder of this decade and through the mid-1970's, employment requirements are expected

Major occupational group	*Estimated employment, 1966 (percent distribution)*
All occupational groups	100
Professional, technical, and kindred workers	5
Managers, officials, and proprietors	11
Clerical and kindred workers	5
Sales workers	(1)
Craftsmen, foremen, and kindred workers	52
Operatives and kindred workers	11
Service workers	1
Laborers	16

[1] Less than 0.5 percent.

to rise in the construction industry. As the national economy expands, as population increases, and as personal and corporate incomes rise, the demand for contract construction activities are expected to undergo a substantial increase. Likewise, the number of construction workers employed by State and local highway departments is also expected to increase because of the need to meet the demands of the country's expanding highway systems. Even though employment in the construction industry is likely to grow, the increasing application of the latest technology in tools, material, and work methods, together with the rising skill level of the work force, will make it possible to increase the level of construction activity without a correspondingly large increase in employment.

Contract construction is the major source of employment for such skilled craftsmen as bricklayers, painters, carpenters, and others who are discussed more fully eleswhere in the *Handbook*. For information on these and similar construction occupations, see the Building Trades chapter of the *Handbook*. For information on occupations which are found in many other industries see the index in the back of book.

FINANCE, INSURANCE, AND REAL ESTATE

Nearly every individual or organization makes extensive use of the diverse and complex services provided by the finance, insurance, and real estate industry. Financial institutions—banks, savings and loan associations, consumer credit organizations, and others—make banking and credit facilities available to individuals and businesses. The types of services they offer range from providing simple financial services such as personal checking and savings accounts to acting as the broker and salesman in the buying and selling of stocks and bonds needed by giant corporations for investment capital. Insurance firms provide protection against unexpected losses due to fire, accident, sickness, and death, and for many other contingencies. Real estate organizations act as the intermediary or broker in the sale of houses, buildings, and other property, and often operate and manage large office and apartment buildings.

In 1966, nearly 3.1 million workers were employed in the finance, insurance, and real estate industry. Finance made up the largest sector, employing nearly 1.3 million persons in 1966. The next largest concentration of employment was in the insurance sector, where over 1.1 million workers were employed. The remaining workers—about one-fourth of the total—were employed in the real estate sector.

Finance, insurance, and real estate firms are a major source of job opportunities for women workers. Women made up over half of the industry's work force in 1966, and their proportion ranged from roughly 35 percent of employment in real estate to over 60 percent of employment in banking.

This industry employs a very high proportion of white-collar workers. As shown in the following tabulation, nearly 9 out of 10 workers in the industry held white-collar jobs in 1966. Clerical workers made up 45 percent of the industry's work force, accounting for half of the white-collar employees. Many clerical workers are employed in specialized banking and insurance occupations such as bank-teller, checksorter, and insurance claims adjuster. Other large clerical occupations include stenographer, typist, secretary, and office machine operator—occupations also found in most other industries. Sales workers, who account of nearly one-fifth of the workers in this industry, are especially important in the insurance and real estate sectors, where insurance and real estate agents and brokers make up over one-third of the total work force. Stock and bond salesmen and brokers are also an important occupation in the finance sector. Managers and officials—bank officials, office

managers, and others—made up roughly one-fourth of the industry's work force in 1966.

A majority of the very small number of professional, technical, and related workers in this industry are employed by financial institutions.

Major occupational group	*Estimated employment, 1966 (percent distribution)*
All occupational groups	100
Professional, technical, and kindred workers	3
Managers, officials, and proprietors	23
Clerical and kindred workers	45
Sales workers	18
Craftsmen, foremen, and kindred workers	3
Operatives and kindred workers	1
Service workers	5
Laborers	2

Accountants and auditors, programmers, and business research analysts make up the greater part of these highly trained workers.

Employment in the finance, insurance, and real estate industry is expected to increase moderately through the mid-1970's. Population growth, increasing business activity, and rising personal incomes are among the important factors expected to generate a rapidly expanding demand for financial, insurance, and real estate services. However, the increasing use of computer technology in performing the routine clerical and record-keeping functions that are so common in this industry may limit employment growth to some extent. In the financial sector, employment is expected to increase more rapidly than any other sector within the major industry group. On the other hand, the insurance and real estate sectors will experience only modest employment gains over the same time period.

In addition to the opportunities that will arise because of employment growth, many thousands of job openings will result as women leave the field to assume family responsibilities. Replacements also will be needed to fill vacancies created by deaths and retirements and by transfers of workers out of the industry.

The statements that follow cover major occupations in the banking and insurance fields. More detailed information about occupations that exist in many industries appear elsewhere in the *Handbook*. (See index in the back of the book.)

Occupations in Banking

Banks have been described as "department stores of finance" because of the great variety of financial services they offer. Their services range from convenient individual checking accounts to letters of credit that may be used to finance world trade. They safeguard money and valuables; administer trusts and personal estates; and lend money to retail merchants, large industrial concerns, and farmers. In addition, banks make loans to individuals for the purchase of homes, automobiles, and household items, as well as to meet unexpected expenses and other personal financial needs. Banks strive to introduce new services to meet the needs of their customers. In recent years, for example, they have offered customers revolving check credit plans, credit cards, travel services, facilities for handling charge accounts for retail stores, and "drive-up" windows for their banking convenience.

Banks and Their Workers

To provide these and many other services, banking organizations employed about 850,000 people in early 1967; more than half were women. Approximately 800,000 of these bank employees worked in commercial banks, where a wide variety of services are offered; the banking occupations discussed in this statement are generally those which are found in banks of this type. Other bank employees, many of whom are in the same occupations, work in mutual savings banks, which offer a more limited range of services—mainly savings deposit accounts, safe-deposit rentals, trust management, mortgage loans, and other banking services such as money orders, travelers checks, and passbook loans. Still others are 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 to those employed in banking, many people who do similar work are employed in savings and loan associations, credit unions and other personal credit institutions, and other related financial institutions.

In 1966, commercial banks processed more than 20 billion checks and handled an enormous amount of other paperwork. The clerical employees who do this work account for two-thirds of all bank employees. Many of these clerical workers are in jobs which are unique to banks; they are either tellers or bank clerks who process the thousands of deposit slips, checks, and other documents which banks handle daily. Also employed are many secretaries, stenographers, typists, telephone operators, receptionists, and others whose duties are much the same in banks as in other types of businesses.

Bank officers are the second largest occupational group within the industry. Approximately 1 out of 6 bank workers is an officer—a president, vice president, treasurer, comptroller, or other official. Other, much smaller, occupational groups are accountants and auditors, lawyers, statisticians, economists, and other professional workers, as well as guards, elevator operators, cleaners, and other service workers who protect and maintain bank properties.

This chapter gives information about three large groups of workers in occupations unique to banking—bank clerks, tellers, and bank officers. Some of the other occupations mentioned which are common to banks as well as other institutions are described elsewhere in the *Handbook*.

Where Employed

In early 1967, there were more than 30,000 commercial banks and branch banks, and more than 900 mutual savings banks and branches. Bank employment is concentrated, to a considerable extent, in a relatively limited number of very large banks and their branches. In early 1966, the 392 largest commercial banks in the country, each with total deposits of $100 million or more, employed more than one-half of all commercial bank employees, whereas nearly 9,700 small commercial banks (with total deposits of $10 million or less) employed only about one-seventh of all commercial bank workers.

Bank employees work mainly in heavily populated areas. Approximately half of all bank employees are located in five states: New York, California, Illinois, Pennsylvania, and Texas. New York City, the financial capital of the Nation, has far more bank employees than any other city.

Training

Bank workers include thousands of professional and managerial employees who usually have completed college. A high school diploma is adequate preparation for entry into most clerical jobs in banks; other workers, such as building service workers and guards, are in jobs which can be filled by persons with a high school education or less. Most newly hired employees undergo some form of in-service training so that they may become familiar with bank policies and procedures. Bank employees have numerous opportunities which are provided by their employers to

broaden their knowledge and skills. Besides the on-the-job training opportunities they may have, employees are often encouraged to further their education off the job. (Additional information about the educational requirements which apply to bank clerks, tellers, and bank officers, and the training given them, is provided in the statements that follow).

Bank employees are encouraged to prepare themselves for better jobs by enrolling in courses offered by the American Institute of Banking in many cities throughout the country. Local Institute chapters set up study groups and offer students correspondence courses which cover many subjects. These include accounting, finance and credit, commercial law, investments, banking operations, trusts, letter writing, public speaking, and English, as well as courses in other areas.

Many banks encourage their employees to take courses at local colleges and universities. In addition, there are more than 60 individual banking schools sponsored by the American Institute of Banking in cooperation with colleges and universities throughout the country. These schools are designed to assist bank employees at all levels to assume greater responsibilities in their bank. Many banks pay all or a part of the tuition for those who successfully complete the courses in which they enroll.

Employment Outlook

Employment in banks is expected to rise very rapidly during the rest of the 1960's and through the 1970's. New jobs resulting from employment growth, as well as jobs that must be filled as employees retire or stop working for other reasons, may account for about 70,000 openings each year. Still other openings will occur as employees leave their positions to enter other types of employment.

Most of these openings will be in clerical occupations. In addition, an increasing number of trainee jobs, which may eventually lead to officer positions, will probably become available for college graduates. Openings for professional and specialized personnel, such as lawyers, accountants and auditors, economists, statisticians, actuaries, and electronic computer personnel will occur in greater numbers.

Population growth and the accompanying rise in production, sales, and national income are expected to produce a steady growth in the number of business and financial transactions which banks will handle. As a result, total employment may rise to more than a million workers by 1980. The number of branch banks has been increasing for many years and will probably continue to do so as banks seek to make their services more accessible both in cities and in new and expanding suburban business centers. More jobs will also be created as banks continue to expand other services. The anticipated services are many, including among others, facilities for handling charge accounts for retail stores, special savings plans for travel and education, estate planning and administration, "in-plant" banking facilities for employed workers, and the management of employee pension funds. The estimated 943 banks which had electronic computer installations in 1966 provided conventional banking services to other banks and financial institutions without computers and, to business corporations, such services as account reconciliation, payroll preparation, sales analysis, inventory control, and customer billing.

The increasing number of additional workers needed to handle the anticipated increase in banking activities may be offset somewhat by the continued conversion of many major banking activities to electronic data-processing. Even so, the very rapid growth in employment which has characterized the banking industry in recent years is expected to continue, but at a somewhat slower pace. Electronic data-processing is likely to bring about important changes in the pattern of occupations in banking, however, substantially reducing the number of workers needed in some occupations and at the same time creating other jobs which are new to banks. The effect of these developments will vary from one occupation to another, as indicated in the statements on specific banking occupations which follow.

Bank employees can anticipate steadier employment than workers in many other fields, because they are less likely to be affected by layoffs during periods when the general level of business activity is low. Even when a bank is sold or merged with another bank, it usually continues to do business, and there is little likelihood that workers will lose their jobs. When bank officials find it necessary to curtail employment, they usually do so by not replacing employees who retire or leave their jobs for other reasons. Although this reduces the number of openings for new employees, it avoids the necessity of laying off experienced personnel.

Earnings and Working Conditions

Earnings of bank clerks, tellers, and officers are discussed in the statements which follow. In addition to their salaries, bank workers receive fringe benefits which are generally somewhat more liberal than those provided by other types of businesses. For example, most banks offer their workers some type of profit sharing or bonus plan; sick leave; paid holidays ranging from 5 to 12 a year; and vacations with pay, generally 2 weeks for those who have completed 1 year of service, 3 weeks after 10 to 15 years of service, and 4 weeks after 20 to 25 years of service. In addition, group plans that provide life insurance, hospitalization and surgical benefits, and retirement income are commonplace fringe benefits for many bank employees. Sometimes free or preferred banking services, such as checking accounts, safe deposit boxes, installment loans, and traveling services are also provided.

Scheduled hours in banks are generally 40 or less a week; in a few localities, a work week of 35 hours is fairly common. Tellers and some other types of employees may work in the evening at least once a week when banks remain open for business; and overtime work may be necessary for some bookkeeping department employees during peak periods, often at the end of each month. Workers who do some kinds of check processing may be employed on evening and night shifts, as are many operators of electronic computing equipment.

Generally, bank work is done in modern, clean, well-lighted, and air-conditioned offices. Few jobs require strenuous physical exertion.

Where To Go for More Information

Local banks and State bankers' associations can furnish specific information about job opportunities in local banking institutions. General information on banking occupations, training opportunities, and about the banking industry itself is available from:

American Bankers Association, Personnel Administration and Management Development Committee,
90 Park Ave., New York, N.Y. 10016.

National Association of Bank Women, Inc.,
National Office, 60 East 42d St., New York, N.Y. 10017.

Information on career opportunities in consumer finance can be obtained from:

The National Consumer Finance Association,
1000 16th St., NW., Washington, D.C. 20036.

BANK CLERKS

Nature of Work

Bank clerks handle the paperwork associated with depositors' checking and savings accounts, loans to individuals and business firms, and other bank business. Because of the nature of banking, some of their work differs from the work in other kinds of business offices. (Secretaries, office machine operators, receptionists, and other clerical workers whose jobs are much the same in banks as in other businesses are discussed in the chapter on Clerical and Related Occupations.)

The specific duties that must be performed in a particular bank depend on the size of the bank and the extent and scope of the services offered. In a small bank, for example, one clerk may be required to perform a variety of work such as sorting checks, totaling debit and credit slips, and preparing monthly statements for mailing to depositors. However, in a large bank, each clerk usually is assigned one kind of work and frequently has a special job title.

Bank clerks known as *sorters* (D.O.T. 219.388) separate bank documents—checks, deposit slips, and other bank items—into different

Modern banks rely on electronic computers to process millions of bookkeeping entries daily.

groups and tabulate each "batch" so they may be charged to the proper account; often they use canceling and adding machines in their work. Many banks also employ *proof machine operators* (D.O.T. 217.388) who use equipment that, in one operation, sorts items and adds and records the amount of money involved.

The bookkeeping workers who keep records of depositors' accounts and of bank transactions such as loans to business firms or the purchase and sale of securities are the largest single group of bank clerks. *Bookkeeping machine operators* (D.O.T. 215.388) in this group use either conventional bookkeeping machines or electronic posting machines especially designed for bank work; in most other respects, their work is similar to that of bookkeeping machine operators in other types of establishments. In banks, these workers are sometimes known as *account clerks, posting machine operators, or recording clerks. Bookkeepers* (D.O.T. 210.388) are also employed in banks, usually to keep special types of financial records. Banks employ very few *general bookkeepers* (D.O.T. 210.388) who maintain complete sets of books. The job titles of many bank bookkeepers are related to the kinds of records on which they work—among them, *Christmas club bookkeeper, discount bookkeeper, interest-accrual bookkeeper, trust bookkeeper,* and *commodity loan clerk*. Thousands of *bookkeeping and accounting clerks* (D.O.T. 219.488) are also employed in bookkeeping departments to do routine typing, calculating, and posting related to bank transactions. Included in this group are *reconcilement clerks,* who process statements from other banks in order to expedite the auditing of accounts; and *trust investment clerks* who post the daily investment transactions of bank customers.

Other clerical employees whose duties and job titles are unique to banking include *country collection clerks* (D.O.T. 219.388) who sort the thousands of pieces of mail which come in daily to a city bank and determine which items must be held at the main office and which should be routed to branch banks or out-of-city banks for collection. Also employed are *transit clerks* (D.O.T. 217.388) who sort bank items such as checks and drafts on other banks, list and total the amounts involved, and prepare the documents so that they can be mailed for collection; *exchange clerks* (D.O.T. 219.388) who service foreign deposit accounts and determine charges for cashing or handling checks drawn against such accounts; *interest clerks* (D.O.T. 219.388) who maintain records relating to interest-bearing items which are due to or from the bank; and *mortgage clerks* (D.O.T. 209.388) who type legal papers affecting title to real estate upon which money has been loaned, and maintain records relating to taxes and insurance on such properties.

New clerical occupations which have been created by the introduction of electronic data-processing, and which are unique to banks, include those of the *electronic reader-sorter operator* who operates electronic check sorting equipment, the *check inscriber or encoder,* who operates machines that print information on checks and other documents in magnetic ink to prepare them for machine reading, and the *control clerk* who keeps track of the huge volume of documents flowing in and out of the computer division. Other occupations include *card-tape converter operator, coding clerk, console operator, data typist, data converting machine operator, data examination clerk, high speed printer operator, tape librarian, teletype operator,* and *verifier operator.* Workers in these occupations are employed only in the relatively small number of banks that use this kind of equipment.

Banks employed more than 400,000 clerical employees of all kinds in early 1967, about 7 out of every 10 of whom were women.

Training, Other Qualifications, and Advancement

High school graduation is adequate preparation for most beginning clerical jobs in banks. For the majority of jobs, courses in bookkeeping, typing, and business arithmetic are desirable. Courses in office machine operation are also helpful. Job applicants may be given short employment and clerical aptitude tests. These tests are designed to determine the specific ability to work rapidly and accurately, and to communicate effectively with others.

Beginners may be hired as file clerks, bookkeeping clerks, transit clerks, clerk-typists, or for other related work. Some are trained by the bank to operate proof, bookkeeping, and other office machines. A few start as pages or inside messengers.

An employee in a routine clerical job may eventually be promoted to a minor supervisory position, or to a job as teller or credit analyst, and eventually to a senior supervisory position. Opportunities for advancement to bank officer positions also exist for outstanding clerical employees, although they are more likely to attain such positions if they have had college training or have taken specialized courses offered by the banking industry. Additional education obtained while employed—particularly the courses offered by the American Institute of Banking—may be helpful in preparing workers for advancement. (See introduction to this chapter for further information on the Institute's educational program.)

Employment Outlook

Employment of bank clerks is expected to increase moderately during the rest of the 1960's and through the 1970's, creating many openings. New jobs created by growth, as well as jobs that must be filled as employees retire or stop working for other reasons, may result in more than 25,000 openings each year. Turnover is relatively high in banks, as in other in-

dustries which employ many women in clerical positions. Jobs for clerks will arise as established banks expand their services and as new banks and branch banks are opened. In those banks which install modern electronic equipment, however, decreases may be expected in the employment of workers such as check sorters and bookkeeping machine operators. Most employees affected by the changeover will probably be retrained and reassigned, either to new jobs created by the change in equipment and processing methods, or to other duties related to the many new functions and services which banks will introduce. Overall, the growth in the volume of work created by new bank facilities and services is expected to be so great that the total number of clerical workers will continue to rise for some years to come, although much less rapidly than in the recent past. The sharpest increases in employment are expected in occupations related to electronic data processing.

Earnings

Average earnings of nonsupervisory bank workers—most of them in clerical jobs—were about $82.14 per week in 1966. The most recent information on the earnings of specific clerical occupations is from a 1964 survey of banks in 27 metropolitan areas throughout the country. In these areas, average weekly earnings for women proof-machine operators employed in banks ranged from $56.50 in Louisville to $77 in the San Francisco–Oakland area. The lowest and highest average weekly earnings for women Class A bookkeeping machine operators—generally experienced employees who worked on relatively difficult assignments—were $61 in Providence and $89.50 in Chicago. For women Class B bookkeeping machine operators, doing more routine work, average weekly earnings ranged from $55.50 in Providence to $71 in the San Francisco-Oakland area.

Clerical workers in banks are covered under provisions of the Fair Labor Standards Act, a Federal law which provides for minimum wages. In 1967, the minimum was $1.40 an hour; thus, a clerk who worked a 40-hour week would earn at least $56.

See introductory section of this chapter for information on Where Employed, Earnings and Working Conditions, and Where To Go for More Information, and for additional information on Training and Employment Outlook.

TELLERS

(D.O.T. 212.368)

Nature of Work

Every bank, no matter how small, has at least one teller to receive and pay out money and record these transactions. In a very small bank, one teller—often known as an *all-around teller*—may handle transactions of all kinds, but in large banks different kinds of transactions are usually taken care of by different tellers. A *Christmas Club teller* accepts and records deposits made to Christmas Club savings accounts, for example, and a *note teller* handles certain transactions for clients making loans on securities. Other tellers who have special job titles include *commercial* (or *paying and receiving*), *savings, foreign exchange, payroll, discount,* and *securities tellers.*

Approximately 180,000 tellers of all kinds were employed in early 1967. A considerable number worked only part time, and about 7 out of 10 were women.

Commercial tellers, with whom most people deal when they transact business at banks, are mainly occupied with cashing customers' checks and handling deposits and withdrawals from checking and savings accounts during the hours the bank is open to the public. Before he cashes a check, the teller must verify the identity of the person to whom he makes payment, and be certain that funds in the account against which the check is drawn (or the payee's account) are sufficient to cover the payment. When he accepts a deposit, he checks to see whether the amount of money has been correctly itemized on the deposit slip and enters the total in a passbook or on a deposit receipt. Tellers may use machines to make change and total deposits. A teller handling savings accounts may use a "window" posting machine which prints a receipt, or records in the customer's passbook, and simultaneously posts the transaction in the bank's ledger.

Teller returns customer's passbook after entering deposit.

After public banking hours, the teller counts the cash on hand, lists the currency-received tickets on a settlement sheet, and balances his day's accounts. He may also perform other incidental tasks such as sorting checks and deposit slips, filing new account cards, and removing closed account cards from files. A paying and receiving teller may supervise one or more clerks assigned to assist him.

Training, Other Qualifications, and Advancement

In hiring tellers, employers prefer high school graduates experienced in

related clerical positions. They regard personal characteristics such as maturity, neatness, tact, and courtesy particularly important because customers, who deal with tellers far more frequently than with other bank employees, often judge a bank's services principally on their impressions of the tellers. Since tellers handle large sums of money, they must be able to meet the standards established by bonding companies. In filling new positions, most banks give preference to their employees who have demonstrated the necessary qualifications.

Newly hired tellers usually learn their duties by first observing experienced workers for a few days and then, under close supervision, doing the work themselves. Training periods may last from a few days to 3 weeks or longer. A new teller's first assignment is usually to a combination job as a savings and commercial teller; or, in those banks which are large enough to have a savings teller's "cage," the beginner may start as a savings teller.

After gaining experience, a competent teller in a large bank may advance to the position of head teller, in which he supervises the bank's staff of tellers. Eventually, experienced tellers may qualify for promotion to bank officer positions, particularly if they have had college training or have taken specialized courses offered by the banking industry. (See introduction to this chapter for information about the educational program of the American Institute of Banking.)

Employment Outlook

The number of bank tellers is expected to increase very rapidly during the rest of the 1960's and through the 1970's, as banks continue to expand their services for the growing urban population. An increasing proportion, however, will be part-time tellers employed during peak hours to accommodate those customers who transact business during the noon hour and in the evenings. More than 18,000 openings are expected each year as a result of the increase in employment and the need to replace tellers who retire or stop working for other reasons. Turnover is relatively high among the thousands of women who work as tellers.

Although increased use of mechanical and electronic equipment can be expected to eliminate some of the routine work now done by many tellers, and to speed other work they now perform, it is unlikely to affect greatly the total number employed.

Earnings

The most recent information on the earnings of tellers is from a 1964 survey. In 27 metropolitan areas, earnings of bank tellers having less than 5 years' experience ranged from a low of between $45 and $50 a week to a high almost three times as great. The lowest and highest average weekly earnings for men and women employed in specific teller positions for less than 5 years are given in the accompanying tabulation.

Average weekly earnings, 1964

	Lowest	*Highest*
All-round tellers:		
Women	$55.50 (Louisville)	$75.50 (Cincinnati)
Men	66.00 (Washington and Providence)	90.00 (Chicago)
Commercial tellers:		
Women	66.00 (Boston and Dallas)	89.50 (New York)
Men	65.00 (Dallas)	89.00 (New York)
Savings tellers:		
Women	59.50 (Baltimore)	79.50 (San Francisco-Oakland)
Men	62.50 (Newark-Jersey City)	87.00 (San Francisco-Oakland)
Note tellers:		
Women	63.50 (Philadelphia)	89.00 (New York and San Francisco-Oakland)
Men	74.00 (Miami)	98.50 (Milwaukee)

The average salaries of tellers with 5 years or more of service were from $6 to $24 a week more than the averages listed above for tellers with less experience. Bank tellers are covered under provisions of the Fair Labor Standards Act, a Federal law which provides for minimum wages. In 1967, the minimum was $1.40 an hour; thus, tellers who worked a 40-hour week would earn at least $56.

According to the limited information available, part-time tellers, many of whom are employed in branch banks, earn $2 or $3 an hour for a workweek of 20 or 25 hours.

See introductory section of this chapter for information on Where Employed, Earnings and Working Conditions, and Where To Go for More Information, and for additional information on Training.

BANK OFFICERS

(D.O.T. 186.118, .138, .168, and .288; 161.118; 189.118 and .168)

Nature of Work

Practically every bank has a president who exercises general direction over all operations; one or more vice presidents who either act as general managers or have charge of bank departments such as trust, credit, and investment; and a comptroller or cashier who (unlike cashiers in stores and other businesses) is an executive officer generally responsible for all bank property. Large banks may also have treasurers and other senior officers, as well as assistant officers, to supervise the various sections within different departments. Banking institutions employed more than 140,000 officers in early 1967; women represented about one-tenth of the total.

A bank officer makes decisions within a framework of policy set by the board of directors. His job requires a broad knowledge of business activities, which he must relate to the operations of the particular department for which he is responsible. For example, the loan officer must exercise his best judgment in considering applications for loans, bearing in mind general business conditions and the nature of the collateral offered. He

The number of women employed as bank officers is growing.

must evaluate carefully the reports of credit analysts on the individual or business firm applying for a loan, and balance the favorable and unfavorable elements in reaching a decision. Similarly, the trust officer must have a thorough understanding of the provisions of each trust which he is administering and the knowledge necessary to manage properly the fund or estate involved; he must invest wisely in order to manage trust funds which were established for purposes such as supporting families, sending young people to college, or paying pensions to retired workers. Besides supervising financial services, bank officers are frequently called upon to advise individuals and businessmen and to participate in many different kinds of community projects.

Because of the great variety of services offered by banks, a wide choice of officer careers in different areas of the bank is available for those who wish to specialize. For example, in the lending area, the *loan officer* must be familiar with the principles of economics, production, distribution, and merchandising, as well as the fundamentals of commercial law. He must also have the ability to analyze financial statements and have some knowledge of the operations and customs of businesses to which the bank expects to extend credit. Careers in the lending area include: Installment loan officer, commercial loan officer, credit department loan officer, real estate mortgage loan officer, and agricultural loan officer. In the trust services area, the *trust officer* is responsible for the management of assets belonging to individuals, families, corporations, and charitable and educational institutions. Trust management requires specialization in such fields as financial planning, investment, administration, taxes, and business and real estate management. Specialized careers in the trust management area include, for example, estate administration, individual and institutional trust administration, and investment research positions. The *operations officer* plans, coordinates and controls the work flow, updates systems, and strives for more efficient operations of a bank. He must be able to train and supervise a large number of people since most of a bank's staff works in operations. Career opportunities in the bank operations area include the following: Customer services, electronic data processing services, and internal services. Other career specialities for bank officers include *correspondent bank officer* who is responsible for relations with other banks, *branch bank manager* who has full responsibility for all aspects of a branch office, and *international officer* who is financial advisor to customers in the United States and abroad. A working knowledge of a foreign language and knowledge of a foreign country's geography, politics, history, and economic growth can be very helpful to those interested in careers in international banking. Other career fields for bank officers are auditing, economics, personnel administration, public relations, and operation research.

Training, Other Qualifications, and Advancement

Bank officer positions may be filled by promoting either experienced clerical bank employees or management trainees. Outstanding individuals may be selected for promotion even though their academic background is limited, but college graduation is the usual requirement for young people who enter as trainees. A business administration curriculum with a major in finance or a liberal arts curriculum including accounting, economics, commercial law, political

science, and statistics are considered excellent preparation for trainee positions. Valuable experience may be gained in the summer employment programs recently initiated by some large city banks for college students.

Most large city banks have well-organized officer-training programs. Usually these range from 6 months to 1 year in length. Trainees may start as credit or investment analysts, or be rotated among various jobs in several bank departments so that they get the "feel" of banking and so that bank officers may be better able to determine the position for which each employee is best suited. Many banks which are too small to operate formal officer-trainee programs nevertheless provide some form of training program which enables trainees to gain an understanding of bank operations.

Advancement to officer positions may come slowly in small banks where the number of such positions is limited. In large city banks with special training programs, initial promotions may come more quickly. For a senior officer position, however, many years of experience are usually necessary before an employee can acquire the necessary knowledge of the bank's operations and customers and of the community.

Although experience, ability, and leadership qualities receive great emphasis when bank employees are considered for promotion to officer positions, advancement may also be accelerated by special study. Courses in every phase of banking are offered by the American Institute of Banking, a long-established, industry-sponsored school. (See introduction to this chapter for more information on the Institute's program and other training program sponsored jointly by universities and local bankers' associations.)

Employment Outlook

The number of bank officers is expected to increase rapidly during the rest of the 1960's and through the 1970's. Many new positions will be created by the expected expansion of banking activities. Others will develop because the increasing use of electronic computers enables banks to analyze and plan banking operations more extensively and to provide new kinds of services. In addition, because bank officers are somewhat older, on the average, than most employee groups, a large number of additional officers will be needed each year to replace those who retire, or leave their jobs for other reasons. More than 10,000 workers will probably be needed annually because of employment growth and the replacement of bank officers who retire or stop working for other reasons. Many other openings will rise as bank officers transfer to other types of employment.

Most of the officer positions which become available will be filled by promoting people who have already acquired experience in banking operations. Competition for such promotions is likely to remain keen, particularly in large banks. College graduates who meet the standards for executive trainees should find good opportunities for entry positions, however.

Earnings

According to a private survey conducted in 1966, large banks, insurance companies, and other financial institutions paid salaries generally ranging from $514 to $549 or more a month to new executive trainees who were college graduates having majors in business administration or in the liberal arts.

The salaries of senior bank officers may be several times as great as these starting salaries. For officers, as well as for other employees, salaries are likely to be lower in small towns than in big city banks.

See introductory section of this chapter for information on Where Employed, Earnings and Working Conditions, and Where To Go for More Information, and for additional information on Training.

OCCUPATIONS IN THE INSURANCE BUSINESS

Insurance is a multibillion dollar business which offers many employment opportunities for young people just out of high school or college and for experienced workers.

There are about 1,700 life insurance companies and more than 3,000 property and liability (sometimes called property and casualty) insurance companies. They conduct their business in main offices, commonly called "home" offices, and in thousands of local sales offices in cities and towns throughout the country. Local offices may be branches operated by an insurance company or they may be operated by independent agents and brokers.

Nature of the Business

Insurance policies are classified into two broad categories: life insurance, and property and liability insurance. Most companies specialize in one of these types. However, companies in both fields sell health insurance.

Life insurance companies sell policies which provide not only basic life insurance protection, but also several other kinds of protection. Under some policies, for example, policyholders receive an income when they reach retirement age or if they become disabled and stop working; other life insurance policies may help to meet the costs of educating children when they reach college age, or may give extra financial protection when the children are young. Life insurance companies may also sell accident and health insurance, which assists policyholders in meeting medical expenses and may provide other kinds of benefits to policyholders when they are injured or ill.

Policies sold by property and liability insurance companies provide financial protection against loss or damage to the policyholders' property and protects the policyholder when he is responsible for injuries to others or damage to other people's property. This insurance field includes protection against hazards such as fire, theft, and windstorm, as well as workmen's compensation and other liability insurance.

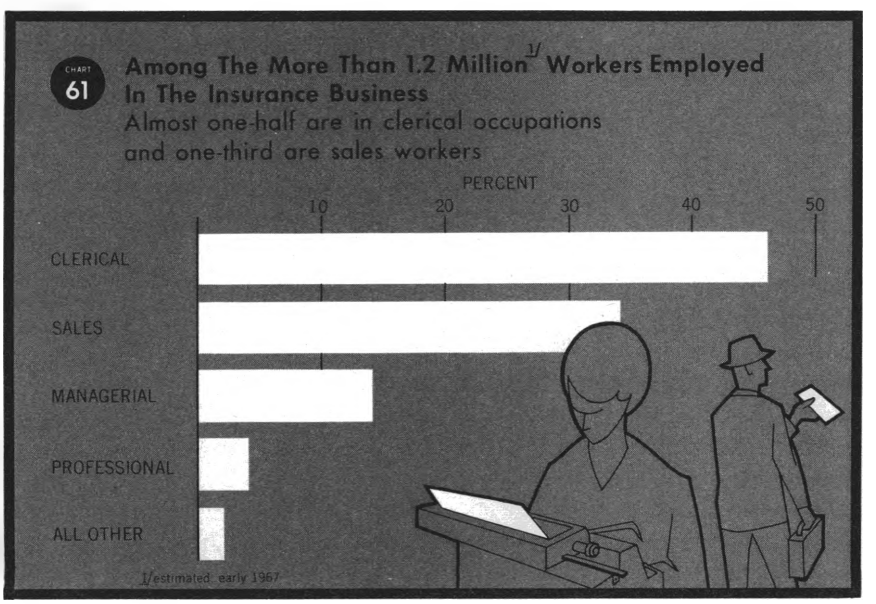
Many policies sold by life insurance and by property and liability insurance companies are written to cover groups of people—anywhere from a few individuals to many thousands. Group policies are usually issued to employers for the benefit of their employees. They most often provide retirement income, life insurance, or health insurance and they have gained great popularity in recent years. Group policies providing life insurance, for example, protected more than 60 million workers in 1965, and the number of policies in force was almost three times the number 10 years earlier.

Insurance Workers

The insurance business provided jobs for more than 1.2 million people in 1967. The great majority were clerical and sales workers. (See chart 61.)

Salesmen are a key group of employees in insurance companies. About one-third of all insurance employees are sales workers—chiefly agents, brokers, and others who sell policies directly to individuals and business firms. Agents and brokers are usually responsible for finding their own customers or "prospects," and for seeing that each policy they sell provides the special kind of protection required by the policyholder. (A statement on Insurance Agents and Brokers is included in the chapter on Sales Occupations.)

The various types of insurance policies offered by companies in both the life and property-liability fields must be carefully planned so that they are financially sound and conform to legal requirements. After a policy is



sold, the insurance company must deal with claims made by the policyholder. Insurance companies also must keep records of premium payments made by policyholders and services and benefits rendered to them. Most of the planning, record-keeping, and other behind-the-scenes work is done in home offices and requires the services of company officials and other in managerial positions, professional and technical employees, and clerical workers.

About 1 out of 7 insurance workers is in a managerial position. Managers in charge of local offices, through which most insurance policies are sold, often spend part of their time in sales work. Others, who work in home offices, are company officials or administrators in charge of policy issuance, accounting, investments, loans, and other important office work. The large-scale investment activities of many insurance companies make financial administration a particularly important area of employment.

Working closely with the managerial personnel in insurance companies are specialists who study insurance risks and coverage problems, analyze investment possibilities, prepare financial reports, and do other professional work. Professional workers, employed mainly at home offices, represent about 1 out of 25 insurance workers. Included among them is the actuary, whose job is unique to the insurance field. Actuaries make statistical studies relating to various kinds of risks and, on the basis of these studies, determine how large the premium rate on each type of policy should be. Another specialist is the *home-office underwriter* (D.O.T. 169.188), who reviews insurance applications in order to evaluate the degree of risk involved. Underwriters decide whether to accept or reject the insurance policy; they also determine which premium rate should apply for each policy issued. The work of most other professional employees in insurance companies is fundamentally the same as in other industries. Accountants, for example, deal with insurance company records and financial problems relating to premiums, investments, payments to policyholders, and other aspects of the business. Engineers work on problems connected with policies covering industrial work accidents, damage to industrial plants and machinery, and other technical matters. Lawyers interpret the regulations which apply to insurance company operations, handle the settlement of some kinds of insurance claims, and do other legal work. Investment analysts evaluate real estate mortgages and new issues of bonds and other securities, analyze current investments held by their companies, and make recommendations on when to hold, buy, or sell. As more electronic computers are installed to handle office records, increasing numbers of programers are being employed. Many companies also employ editorial, public relations, sales promotion, and advertising specialists.

Keeping track of millions of policies involves a vast amount of paperwork and occupies the time of hundreds of thousands of clerical workers. Almost half of all insurance company employees are in jobs classified as clerical—a much larger proportion than in most other industries.

Insurance companies employ many people in data processing jobs.

The majority are secretaries, stenographers, and typists; operators of bookkeeping and other kinds of office machines; or general office clerks. They do much the same kind of work in insurance companies as in other types of business enterprises. Other clerks, employed mostly in home offices, have specialized jobs found only in the insurance business. Among them are typists known as *policy writers* (D.O.T. 203.588) who copy onto policy forms, from approved insurance applications, the name and address of the policyholder, amount of the policy, premium rate, and other information. *Policy change clerks* (D.O.T. 219.388) enter changes in beneficiaries and coverage on policies, in accordance with the instructions given by agents. *Insurance checkers* (D.O.T. 219.488) check the information entered on policies by other clerical workers, to be certain that the work is accurate.

Other workers who are classified as clerical occupy positions of considerable responsibility which require extensive knowledge of one or more phases of the insurance business. This group includes *claim adjusters* (D.O.T. 241.168) who decide whether insurance claims are covered by the customer's insurance policy, see that any payment due the policyholder is made on each claim, and when necessary, investigate the circumstances which gave rise to the claim. Claim adjusters for life insurance companies hold home office positions; those in the property and liability business are generally field personnel.

In addition to the four major groups of employment discussed above, insurance companies employ thousands of repairmen, janitors, and others who do maintenance and custodial work similar to that required in other large business organizations. These employees account for about 1 out of 50 workers in the insurance business.

Additional information about many of these occupations is contained in this *Handbook* in the chapter on Clerical and Related Occupations and the statements on Actuaries, Accountants, Engineers, Lawyers, Programers, and Maintenance Electricians.

Where Employed

Relatively large numbers of insurance workers are employed in Connecticut, Massachusetts, New Jersey, New York, and Texas, where the home offices of some of the largest insurance companies are located. Many insurance workers also are employed in agencies, brokerage firms, and other sales offices in cities and towns throughout the country. Almost all sales personnel work out of local offices, whereas the majority of professional and clerical workers are employed in company home offices.

More than half of all insurance workers are employed by life insurance companies and agencies; included in this group are some large companies with thousands of employees. Companies which deal mainly in property and liability insurance, although more numerous than the life insurance companies, generally have fewer employees. Many local agencies and sales offices are also small, regardless of the type of insurance they handle.

Training, Other Qualifications, and Advancement

Insurance offers job opportunities for people with very different educational backgrounds and talents. Some positions require a great deal of managerial and administrative experience and ability; others require college training in mathematics, accounting, and engineering; but still others involve only routine duties which can be learned on the job.

Graduation from high school or business school is regarded as adequate preparation for most beginning clerical positions. Courses in typing, business arithmetic, and the operation of office machines may be valuable. These special skills are often required for jobs in insurance company offices, and this kind of training provides a background of information which helps employees advance to more responsible positions. Some legal training in a college or university may also be helpful for the position of claim adjuster.

Engineering, accounting, and other professional positions in insurance companies usually require the same kinds of college training as they do in other business firms. College-trained people are also preferred for managerial positions, many of which are filled by promotion from within. In professional and managerial work requiring contact with the public, as well as in sales work and claim adjusting, it is important that the employee have a pleasant disposition and outgoing personality and be able to inspire confidence in his ability to protect the customer's interests.

Insurance companies and associations of companies and agents offer several kinds of training programs to help employees prepare for better jobs. The Insurance Institute of America, for example, furnishes study guides relating to the fundamentals of property and casualty insurance, and awards certificates to those who pass the Institute's examinations. Some national, State, and local insurance associations offer home study training or evening courses in various aspects of the insurance business. Other courses, especially designed to help clerical employees gain a better understanding of life insurance and life insurance company operations, deal with the organization and operation of both home and field offices. They are given under the auspices of the Life Office Management Association which also provides programs for the development of supervisory and managerial personnel.

Employment Outlook

During the rest of the 1960's and through the 1970's, employment in the insurance industry is expected to rise slowly. New jobs to be filled, plus openings that occur as employees retire or stop working for other reasons, are expected to total more than 50,000 a year. Turnover is particularly high in this industry because of the many young women in clerical jobs who work for only a few years and then leave to care for their families. Still other openings will have to be filled as insurance workers leave their jobs for employment in other industries.

The expected increase in employment will result mainly from a rapidly increasing volume of insurance business. With population growth, there will be more individuals who purchase life insurance as well as insurance which provides retirement income and funds for their children's education. Others who do not presently have insurance may become policyholders; for example, advances in medical science are making life insurance available to persons who were formerly rejected as poor insurance risks. The need for property and liability insurance will also increase as a rising standard of living enables more individuals and families to own one automobile or more, buy homes, and make other major purchases which are usually insured. In the business world also, more insurance of this kind will be required 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 workmen's compensation laws is broadened, more employers may need workmen's compensation insurance.

Insurance employment probably will rise at a somewhat slower rate than the volume of business handled by insurance companies. It is becoming more common for companies to issue "multiple-line" policies, which cover a variety of insurance risks formerly covered in separate policies, thus reducing the workload of sales personnel in local offices and clerical employees in home offices. The probability that more companies will install electronic computers and other equipment to process some of the routine paperwork now done by clerks is also likely to bring about changes in insurance company employment. The total number of insurance company clerical jobs is likely to continue to rise, especially those jobs such as machine operators, which require special training, but the proportion of routine jobs probably will decline.

Insurance workers have better prospects of regular employment than workers in many other industries. Most businessmen regard property and liability insurance as a necessity both during economic recession and in boom periods, and private individuals also attempt to retain as much basic financial protection as possible, even when their incomes decline.

Earnings and Working Conditions

A 1965–66 survey of nonsupervisory employees of insurance companies, banks, and related businesses showed a wide range of salaries among the individuals in the companies surveyed. Some clerical workers in beginning, routine jobs earned less than $40 a week; some experienced employees in more responsible positions earned up to four times that amount. Women employed in beginning jobs as junior file clerks averaged $59.50 a week and office girls, $60.50. Switchboard operators, a fairly large group of women employees, averaged between $76.00 and $85.00 depending upon skill and experience. General stenographers averaged $74.50 a week and senior stenographers averaged $86.50 a week. Typists, the largest of any women's group covered in the survey, averaged $65.50 for beginning jobs and $77.50 for experienced workers. The average for women accounting clerks ranged from $71.50 to $91.50 depending on experience and skill. The earnings of men in office occupations averaged somewhat higher than those of women doing similar work.

To some extent, these differences in salary levels may be due to differences in the specific job duties of the employees involved and in the firms for which they worked. Salary levels in different parts of the country also vary; earnings are generally lowest in southern cities and highest in the western metropolitan areas. (See chapter on Clerical and Related Occupations for additional information about the earnings of workers in other office occupations found in insurance companies.)

Starting salaries for professional workers are generally comparable with those for similar positions in other industries and businesses. It is not uncommon for specialists with several years of experience in the insurance business to receive annual salaries of well over $10,000. The earnings of agents and brokers, unlike those of salaried professional workers, depend on commissions from the policies they sell. (See the statement on Insurance Agents and Brokers.)

Except for agents and brokers, who must sometimes extend their working hours to meet the convenience of prospective clients, insurance company employees usually work between 35 and 40 hours a week. The number of paid holidays is somewhat greater than in many other industries. Two-week paid vacations are generally granted employees after 1 year of service; in most companies, vacations are extended to 3 weeks after 15 years and, in some, to 4 weeks after 20 years. Practically all insurance company workers share in group plans providing hospitalization, life, sickness and accident, and surgical insurance, as well as retirement pensions.

Where To Go for More Information

General information on employment opportunities 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.

For additional information on the salaries of clerical workers in finance industries, including insurance, see:

Wages and Related Benefits, Part II: Metropolitan Areas, United States and Regional Summaries, (BLS Bulletin 1385–82, June 1965). Superintendent of Documents, Washington, D.C. 20402. Price 70 cents.

MINING

The mining industry is a major supplier of the basic raw materials and energy sources required for industrial and consumer use. Metal mines provide iron, copper, gold, and other ores. Quarrying and other nonmetallic mining produce many of the basic materials such as limestone, gravel, and fire clay needed to build the country's schools, offices, homes, and highways. Petroleum, natural gas, and coal are the primary sources of nearly all our energy, both for industrial and personal use. Few of the products that are extracted from mines reach the consumer in their natural state. Nearly all require further processing in one or several of the manufacturing industries.

Mining is the smallest major industry division, employing 630,000 wage and salary workers in 1966. Nearly one-half of these workers are employed in the exploration and extraction of crude petroleum and natural gas. Coal mining and quarrying and nonmetallic mineral mining each account for about one-fifth of the industry's work force; the remaining workers, about 1 out of 8, are employed in mining metal ores.

The mining industry employs only a small number of women workers; few are engaged directly in the actual mining operations; most are in clerical positions.

Nearly three-fourths of all workers in mining are employed in blue-collar jobs, primarily as operatives and kindred workers. Included in the operative group are miners and mine laborers; mining machinery operators such as drilling and cutting machine operators, crusher operators, conveyor operators, oil well drillers; and most other workers engaged in underground mining operations. Also included, and especially important in surface mining, are truck and tractor drivers.

Skilled craftsmen and foremen account for the second largest occupational group. Mechanics and repairmen maintain the complex equipment and machinery used throughout the various mining industries. Many heavy equipment operators such as excavating, grading, and power shovel operators are employed in open pit mining operations. Large numbers of pumpers, gagers, and enginemen are needed in the production and transportation of petroleum and natural gas. Foremen, needed to supervise the mine work crews, also constitute an important part of the industry's work force.

The industry's white-collar workers are divided nearly equally among three major occupational groups—

professional and technical, clerical, and managerial. Taken together, these three groups account for the remaining one-fourth of overall industry employment. Professional, technical, and kindred workers make up slightly less than one-tenth of the work force and are concentrated largely in the crude petroleum and natural gas extraction industry. Most are employed in occupations such as engineer, geologist, and technician, and are engaged in the exploration and research activities that are so important to the discovery of oil and gas fields and new uses of petroleum products. Clerical workers and managers, officials, and proprietors each account for one-tenth of the employment. Two out of every three clerical employees work in the petroleum and gas extraction industry. Most are secretaries, office machine operators, and typists needed to support the large number of professional, technical, and managerial workers employed in the petroleum industry. The following tabulation shows the estimated distribution of occupational employment in the mining industry:

Major occupational group	*Estimated employment, 1966 (percent distribution)*
All occupational groups	100
Professional, technical, and kindred workers	8
Managers, officials, and proprietors	9
Clerical and kindred workers	9
Sales workers	(1)
Craftsmen, foremen, and kindred workers	26
Operatives and kindred workers [2]	47
Service workers	2
Laborers	.....

[1] Less than 0.5 percent.

[2] Includes mine laborers.

NOTE.—Because of rounding, sums of individual items may not equal total.

Little or no change in employment is expected in the mining industry through the mid-1970's, despite an anticipated substantial increase in mining output. The increased demand for mining products will be met largely through the use of more and improved equipment that will be operated by a more highly skilled work force. Even though employment in the industry as a whole is expected to remain stable, some shifts are likely within the industry. For instance, employment in coal mining has declined steadily throughout the 1950's and 1960's, and further decreases are expected during the 1970's, although at a slower pace than in the past. On the other hand, employment in quarrying and nonmetallic mining has been growing and is expected to continue to rise over the 1970's. Population growth, rising incomes and business activity, together with the increasing need for construction materials, are likely to bring about a growing demand for manpower in quarrying and nonmetallic mining.

Employment in the remaining sectors of the mining industry—for examplefi metal mining, and petroleum and natural gas extraction—will undergo little change through the 1970's.

The statement that follows provides information on employment opportunities in the petroleum and natural gas extraction industry. More detailed information about occupations that are found in mining as well as other industries appears elsewhere in the *Handbook.* (See index in back of book.)

PETROLEUM AND NATURAL GAS PRODUCTION OCCUPATIONS

Nature of Work

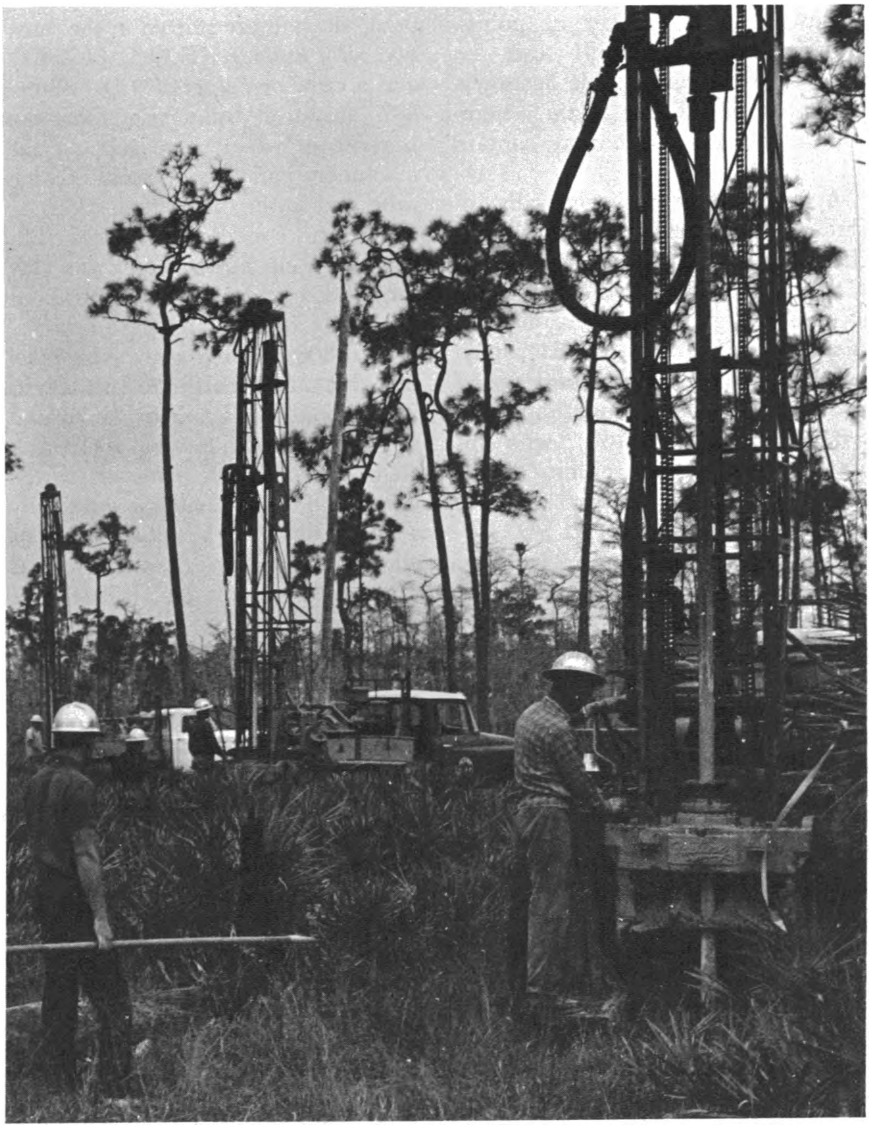
Workers in the petroleum production branch of the oil industry explore for crude oil and natural gas, drill wells, and operate and maintain them. These activities require workers with a wide range of education and skills. (In this section, references to oil include natural gas.)

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 composition of the earth. Geologists seek clues to the possibility of oil traps by examining types of rock and rock formations on and under the earth's surface. Besides making detailed, foot-by-foot surveys, petroleum geologists depend on aerial exploration for a broad picture of the surface and sub-surface features of the area being explored; they also may obtain rock samples from the bottom of the sea in their search for clues to oil-bearing formations. Geologists can determine the age of rocks by measuring their radioactivity. Sub-surface evidence is collected by making test drills and bringing up samples of the rocks, clays, and sands that form the layers of the earth. From these examinations, geologists can draw a cross-section map of the underground formations being surveyed in order to pinpoint areas where oil may be located.

Many geologists work in district offices of oil companies or exploration firms where they prepare and study geological maps. They also study core samples collected by exploration parties to find any clue to the presence of oil.

Exploration parties may include, in addition to the geologist, *paleontologists* (D.O.T. 024.081), who study fossil remains in the earth in order to locate oil-bearing sands; and *chemists* (D.O.T. 022.081) and *mineralogists* (D.O.T. 024.081), who study physical and chemical properties of minerals and rock samples. *Planetable operators* (D.O.T. 018.188), *draftsmen* (D.O.T. 010.281), and *rodmen* (D.O.T. 018.587) assist in surveying and mapping operations.

Another way of searching for oil is through the science of geophysics—the study of the inner characteristics of the earth's structure. About 90



Geophysical crew searches for oil.

percent of geophysical exploration is done by seismic prospecting. The seismograph is a sensitive instrument which records natural and manmade earthquakes. Manmade earthquakes in petroleum exploration are commonly made by exploding small charges of dynamite in the ground. The time it takes for sound waves to reach an underground rock layer and to return indicates the depth of the layer. The seismograph records such information by wavy lines on a chart. Increasingly, this information is recorded on magnetic tape which is then placed in a computer and analyzed automatically. By setting off explosions at a number of points, underground formations can be mapped with considerable accuracy, thus providing a clue to the whereabouts of traps which may contain oil.

A seismograph crew generally includes 10 to 20 persons, led by a party chief who is usually a *geophysicist* (D.O.T. 024.081). Other members of the seismograph crew may include *computers* (D.O.T. 010.168), who prepare maps from the information recorded by the seismograph; *observers* (D.O.T. 010.168), who operate and maintain seismic equipment; *prospecting drillers* (D.O.T. 930.782) and their *helpers* (D.O.T. 930.886), who operate portable drilling rigs to make holes into which explosive charges are placed; and *shooters* (D.O.T. 931.381), who are in charge of placing and detonating explosive charges.

Once the oil company has decided where to drill, it must obtain permission to use the land. The *landman* or *leaseman* (D.O.T. 191.118) makes necessary business arrangements with owners of land in which his company is interested.

Another important job in oil exploration is that of the *scout* (D.O.T. 010.168). He keeps his company informed of all exploring, leasing, drilling, and production activity in his area.

Drilling. Despite all the petroleum exploration methods that have been developed, there is no device that will actually find petroleum. Only by drilling can the presence of oil be proved. Overall planning and supervision of drilling are usually the responsibilities of the *petroleum engineer* (D.O.T. 010.081). He helps to prepare drilling sites and to select the methods of drilling. He directs workers in installing the drilling rig and machinery. He advises drilling personnel on technical matters and may stay on the site until drilling operations are completed.

There are two methods of drilling a well—rotary drilling and cable-tool drilling. No matter which method is used, all wells are started in the same way. *Rig builders* (D.O.T. 869.884) and a crew of *helpers* (D.O.T. 869.-887) install a drilling rig, the main purpose of which is to support the machinery and equipment which raise and lower the drilling tools.

The rotary method is used for drilling deep wells through rock and clay formations and accounts for about one-half of the drilling rigs in use.

In rotary drilling, a revolving steel drill bit, with cutting teeth at its lower end, bores a hole in the ground by chipping and cutting rock. The bit is attached to a string of jointed pipe (drill stem), which is rotated by a steam, diesel, or gasoline engine or an electric motor. As the bit cuts through the earth, the drill stem is lengthened by the addition of more pipe which is screwed on at the upper end. A stream of mud is continuously pumped through the hollow pipe. This mixture of clay and water cools the drill bit, plasters the walls of the hole to prevent cave-ins, and floats the cuttings to the surface.

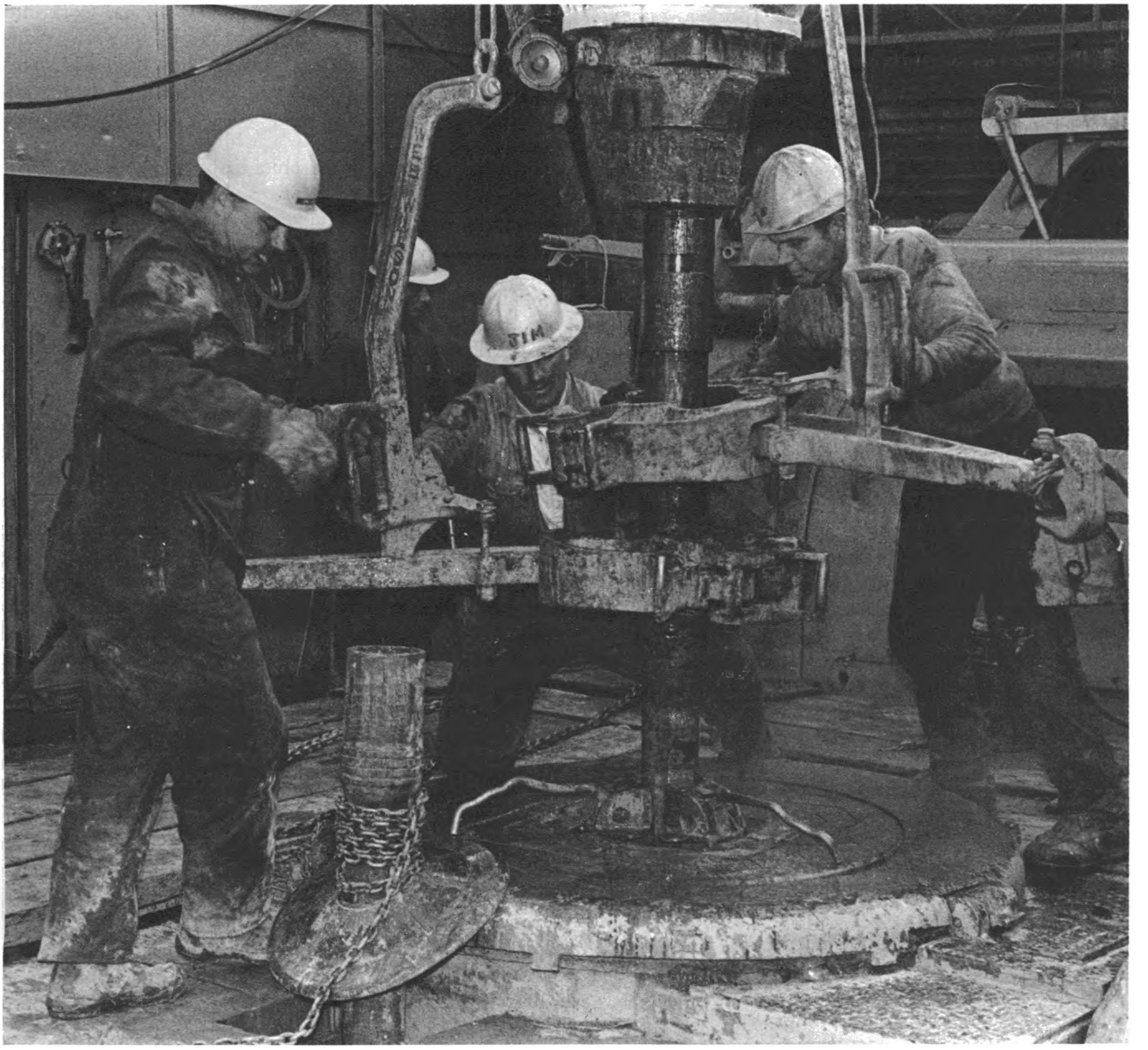
A typical rotary drilling crew consists of a rotary driller and four or five helpers. From 15 to 20 workers, divided into three crews, generally are required to operate a rig 24 hours a day, 7 days a week. A *rotary driller* (D.O.T. 930.782) is in charge of the work of the crew during his tour of duty. His major duties include operating the drilling machinery which controls drilling speed and pressure. He also selects the proper drill bit and keeps a record of operations. He must be ready to meet any emergency, such as breakdown of equipment or problems caused by unusual geological formations. A *derrickman* (D.O.T. 930.782), second in charge of the crew, works on a small platform high on the rig. When a drill bit becomes dull and has to be replaced, he catches the upper ends of the pipe sections and guides them over to a rack beside his platform. He often has several miles of drill pipe racked up before the worm bit is brought to the surface.

Other members of a typical rotary drilling crew include *rotary floormen* (D.O.T. 930.884), who guide the lower end of the pipe to and from the well opening and connect and disconnect pipe joints and drill bits. Helpers, called *roughnecks* (D.O.T. 930.-884), assist floormen in their duties. A *fireman* (D.O.T. 951.885) (if steam is used) or *engineman* (D.O.T. 950.782) (if diesel or electric power is used) operates the engines which provide power for drilling and hoisting.

An important oilfield worker is the *tool pusher* (D.O.T. 930.130), who acts as foreman of one or more drilling rigs. He also is in charge of supplying rig builders and drilling crews with needed materials and equipment. *Roustabouts* (D.O.T. 869.884), or general oilfield laborers, are not considered part of drilling crews but are used to do odd jobs, such as cleaning derrick floors and pipes or constructing and maintaining roads in oilfields.

In cable-tool drilling, a hole is broken through rocks by continuously raising and dropping a heavy, sharpened bit attached to the end of a cable. Cable-tool drilling is used mainly to drill shallow wells in soft rock formation. Most of it is done in Kentucky, Ohio, West Virginia, Pennsylvania, and certain areas of Texas and Oklahoma.

A cable-tool drilling crew usually consists of a driller and a tool dresser. The *cable-tool driller* (D.O.T. 930.-



Rotary drilling crew lowers section of drill pipe.

280) is in charge of all operations during his tour of duty and maintains a detailed record of drilling activity. He controls the force with which the drilling bit strikes the rocks at the bottom of the well. He also supervises and helps in setting up the machinery and derrick. The *cable-tool dresser* (D.O.T. 639.781), whose job is related to that of a blacksmith, assists the driller and maintains the equipment.

Well Operation and Maintenance. Production is ready to begin when oil is found and the producing equipment installed. Drill pipe and bit are pulled from the well and casing and tubing are lowered. The upper end of the tubing is fastened to a system of valves and controls, called a "Christmas tree." Pressure in the well forces crude oil to the surface, through the Christmas tree, and into storage tanks. If natural pressure is not great enough to force the oil to the surface, pumping or other methods are used to produce an artificial flow.

Petroleum engineers generally have charge of overall planning and supervision of the operation and maintenance of wells. One of their principal duties is to prevent waste by deciding which production method to use and how fast the oil should flow. Some companies hire assistants to the petroleum engineer. These engineering

aides perform routine duties such as making elementary calculations, running tests, and keeping records.

The job of pumper is numerically the largest occupation in the oilfield. *Pumpers* (D.O.T. 914.782) and their *helpers* (D.O.T. 914.887) operate and maintain motors, pumps, and other equipment used to force an artificial flow of oil from wells. Their chief duty is to regulate the flow of oil according to a schedule set up by the petroleum engineer. Generally, a pumper operates a group of wells. *Switchers* work in fields where oil flows under natural pressure and does not require pumping. They open and close valves to regulate the flow of oil from wells to tanks or into pipelines. *Gagers* (D.O.T. 914.381) keep track of the amount of oil flowing into tanks or pipelines. They measure and record the contents of storage tanks and take samples of the oil to check its quality. *Treaters* (D.O.T. 541.782) make tests of crude oil for water and sediment. They remove these impurities from oil by opening a drain at the base of the tank or by using special chemical or electrical equipment. In many fields, pumping, switching, gaging, and treating operations are performed by automatic controls. One operator who monitors these instruments can control the flow of oil from several wells into different pipelines.

Many workers are employed in maintenance operations in oilfields. Welders, carpenters, electricians, and machinists repair and install pumps, gages, pipes, and other oilfield equipment. Roustabouts perform various field and well-maintenance jobs which require little skill, but often involve heavy, hazardous work.

Other Oilfield Services. Companies which offer oilfield services (other than exploration and drilling) on a contract basis provide another important source of employment. Employees in these companies perform many services, including cementing and cleaning wells, and building foundations at well locations. 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 side walls of the well 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 pierce holes in drill pipes or casings by using subsurface "guns" to make passages through which oil can flow; *sample-taker operators* (D.O.T. 931.781), who obtain samples of soil and rock formations from wells to help geologists determine the presence of oil; and *well puller* (D.O.T. 930.883), who remove pipes and casings from wells for cleaning and repairing equipment or for salvaging.

Offshore Operations. Most exploration, drilling, and producing activities are done 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. Some wells have been drilled more than 100 miles from shore and in water up to 1,000 feet deep. These offshore operations require the same types of drilling crews as are employed on land operations. In addition, offshore operations require employment of radio men, able-bodied seamen, cooks, mess boys, 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 the individual occupations. See index for page numbers.)

Training, Other Qualifications, and Advancement

Exploration. Most workers in nonprofessional jobs with an exploration crew begin as helpers and work into one of the specialized jobs after gaining experience. Their period of training on the job may vary from several months to several years. New workers usually are hired in the field by the party chief or by local company representatives. For many nonprofessional jobs, companies hire young men with a high school or vocational school education and with training or aptitude in mathematics, drafting, and mechanics. College students majoring in physical or earth sciences or in engineering often are hired for part-time or summer work with an exploration crew. This may be a means of working into a full-time job after graduation.

For entry into professional occupations such as geologist, geophysicist, chemist, or engineer, college training with at least a bachelor's degree is required. Professional workers usually start at junior levels and, after several years of experience in field surveys, are eligible for promotion to the job of party chief. After field survey experience, they may take a position of responsibility in an area or division office and then perhaps in the central office. Scientists and engineers with research ability, preferably those with advanced graduate degrees, may move to research or consulting work.

Drilling. Members of drilling crews usually begin work in the industry as roughnecks. As they acquire experience, they may advance to more skilled jobs. In rotary drilling, for example, a worker may be hired as a roughneck, advance to the job of floorman, and eventually to derrickman. After several years, he may become a driller. He may then be promoted to the job of tool-pusher, in charge of one or more drilling crews. Some drilling companies hire high school and college students for jobs during the summer months.

Drilling requires men capable of performing heavy physical labor. Drilling crew members usually are between the ages of 20 and 40. Some

companies, however, report that their best drillers are over 50 and even in their sixties, for the job of driller requires good judgment combined with practical experience.

Well Operation and Maintenance. Companies generally hire persons who live near operating wells for well operation and maintenance jobs. They prefer men with mechanical ability and a knowledge of oilfield processes. Because this type of work is less strenuous and offers the advantage of a fixed locale, members of drilling crews or exploration parties who prefer not to travel often transfer to well operation and maintenance jobs.

New workers may start as roustabouts and advance to jobs as switchers, gagers, or pumper helpers, and later to pumpers. Training usually is acquired on the job; at least 2 years of experience are needed to become a good all-round pumper.

The preferred educational qualification for a petroleum engineer is a college degree with specialization in courses dealing with the petroleum industry. However, college graduates with degrees in chemical, mining, or mechanical engineering, or in geology or other related sciences, sometimes are hired for petroleum engineering jobs. Petroleum engineering aids frequently are former roustabouts or pumpers who are given several months of specialized on-the-job and classroom training.

Employment Outlook

Employment in petroleum and natural gas production during the 1970's is expected to continue the slow decline which began during the late 1950's despite anticipated increases in oil and gas production. The use of data-processing equipment and improved seismic techniques is expected to reduce the number of crews needed in petroleum exploration. The employment level in oil and gas field production should decline also because of the increasing use of automatic equipment to control production activities.

About 5,000 new workers in crude petroleum production operations will be hired each year during the next decade. These job openings will result primarily from the need to replace workers who retire, die, or transfer to other fields of work. Although some untrained workers will be hired for less skilled jobs, the greatest demand will be for workers with electrical and mechanical training and/or experience. These skills are becoming more necessary to maintain and repair the increasingly complex equipment used in oil and gas field production.

Most of the job opportunities created by turnover in petroleum production will be concentrated in the 10 States which together account for over 85 percent of oilfield jobs—Texas, Louisiana, Oklahoma, California, Kansas, Illinois, New Mexico, Wyoming, Mississippi, and Colorado. Offshore activities have accounted for only a small portion of total production employment. However, offshore drilling activities are expected to increase greatly during the 1970's, particularly off the coasts of Texas, Louisiana, California, Alaska, Washington, and Oregon.

Earnings and Working Conditions

Earnings of oilfield workers are among the highest in American industry. In late 1966, earning of nonsupervisory employees averaged $124.49 a week, or $2.95 an hour for a 42.4-hour workweek.

The work schedule for most oilfield workers is 40 hours a week. Drilling operations are carried on 24 hours a day, with a complete crew for each 8-hour shift. Generally, workers in these crews receive 8 cents more an hour for work on the second shift and 16 cents an hour more for the third shift. Most establishments provide 8 paid holidays annually. Paid vacations are granted according to length of service—generally 2 weeks after 1 year of service, 3 weeks after 10 years, and 4 weeks after 20 years.

The majority of oilfield employees do most of their work outdoors and are exposed to all kinds of weather. Although some fields may be near cities, they are more often far from sizeable communities and are sometimes located in swamps or deserts. 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 personnel move even more frequently. They may be away from home for weeks or months at a time, living in a trailer or tent. Workers in well operation and maintenance often remain in the same location for long periods.

In offshore operations, earnings usually are higher than those in land operations. Except for drilling activity that is close to shore, workers living quarters are on platforms held fast to the ocean bottom or on ships anchored nearby.

NATURAL GAS PROCESSING OCCUPATIONS

Nature of Work

A natural gas processing plant performs several functions. Raw natural gas is processed to extract natural gas liquids, and impurities, such as chemical compounds, sand and water. The natural gas liquid compounds—propane, butane, ethane, and natural gasoline—have important uses; for example, as raw materials for the chemical industry and oil refineries, and as a fuel in rural areas. In addition, natural gas may be compressed, for delivery to pipeline transportation companies or for use by oil well operators to force oil out of the ground.

More than 50 percent of the workers in the larger natural gas processing plants are employed in operating or maintaining processing equipment. Operators, numerically the largest plant occupation, have duties very similar to those of the oil refinery workers. 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,* or *gasoline-plant engineer* (D.O.T. 950.782), operates equipment which extracts natural gasoline from natural gas. The *compressor-station operator,* or *compressor-station engineer* (D.O.T. 914.-132) operates a compressor which raises the pressure of the gas for transmission in the pipelines. The *gas-compressor operator* (D.O.T. 950.782), assists either of the last two employees named above. The *gas plant operator* or *stillman, gas plant* (D.O.T. 540.-280), operates the unit which removes sulfur from the gas.

As in oil refineries, many workers in the larger natural gas processing plants are employed in maintenance activities. However, the equipment in such plants is subject to less corrosion and wear than that in oil refineries, and it is generally more automated. As a result, the instrument repairman and the electrician are two key workers needed to maintain the instruments that control the automatic equipment. The welder and his helper also do much maintenance work in the processing plant. Other workers, whose jobs include maintenance functions, are engine repairman and laborer.

Clerical, administrative, professional, and technical workers are a smaller proportion of employment in the larger gas processing plants than in oil refineries.

In the numerous smaller natural gas processing plants, many workers have multiple skills—usually combining the skills of operator and maintenance man. In addition, there are many very small plants which are so highly automated that they are virtually unattended. Either they are checked by maintenance workers at periodic intervals, or they are monitored continuously by instruments which automatically report malfunctions and shut down the plant if an emergency develops.

Training, Other Qualifications, and Advancement

Information on occupational training, qualifications, and advancement in natural gas processing plants is similar to that for occupations in petroleum refining, discussed on page 580.

Employment Outlook

Employment in natural gas processing plants is expected to show little or no change during the 1970's, even though the demand for natural gas and natural gas liquids is expected to increase faster than for other petroleum products. Continued application of technological improvements in processing methods, which will lead to greater output per worker, is expected to offset the effect of growing demand.

Only a small number of job openings are expected in these plants each year during the 1970's. These will result from the need to replace workers who retire, die, or transfer to other industries. The greatest demand will be for workers who can repair, rebuild, and maintain the highly automatic plant equipment. Increasing numbers of technically trained employees, including engineers, are being used on these jobs.

Earnings and Working Conditions

Production workers in natural gas processing plants, in late 1966, received wages that compared very favorably with the average hourly wage of $2.77 for production workers in manufacturing industries. Generally, production workers in these plants receive the same benefits, vacations, and shift differentials as workers in petroleum refining. (See p. 581.)

Most workers in natural gas processing plants and oil refineries have similar working conditions. Only a moderate amount of physical effort is involved. Some workers are required to open and close valves, to climb stairs and ladders to considerable heights, and to work 1 of 3 shifts. The plants are relatively safe places in which to work.

Some workers in particular natural gas processing plants have unusual working conditions. They are responsible for maintaining several

small, unattended automated plants in widely separated, isolated locations. They make periodic trips, of 1-day duration or more, to check these automated plants. They travel over rough, unpaved terrain and are exposed to all kinds of weather. These maintenance jobs may be very satisfying to those who like working outdoors and alone.

Workers in many of the larger gas processing plants are union members. Many are members of the Oil, Chemical and Atomic Workers International Union. Some have been organized by other unions affiliated with the AFL–CIO, and others are members of local, unaffiliated unions.

TECHNICAL APPENDIX

This appendix is designed for readers who wish more information on the procedures followed in developing the conclusions on employment outlook than is presented in the preceding reports on individual occupations and industries. Also included in this appendix is a brief explanation of how the D.O.T. numbers (from the *Dictionary of Occupational Titles* prepared by the Bureau of Employment Security of the U.S. Department of Labor) given in the occupational reports fit into the *Dictionary's* occupational classification system.

Employment Outlook Conclusions

The sections on employment outlook in the occupational reports present conclusions based not only on information compiled from many sources but also on extensive economic and statistical analyses. Although the sources used and the methods of analysis differed among occupations and industries, the same general pattern of research was followed in all of the outlook studies.

In preparing the employment outlook studies overall projections of the economy to 1980 were developed to insure that individual occupational and industry studies were consistent. This general analytical framework included projections of the population, labor force, gross national product, average weekly hours of work, employment in major industries, and related economic measures. All studies of separate occupations and industries were tied in with the projections of the entire economy. The projections are based on the assumption of a relatively full-employment economy.

Many individual occupational and industry studies were based heavily on an analysis of past and prospective population trends, including the changes expected in population of school and college age, in numbers of older people, in employment of women, and in the concentration of population in urban and suburban areas. In fields such as teaching, the health professions, and many personal services, population factors have a direct and obvious influence on employment requirements. They are also of great importance in many industries—for example, residential construction, baking, telephone communications, apparel, and retail trade.

Many factors besides the size and composition of the population may affect the volume of business and employment in a given industry. Consumer purchasing patterns change with shifts in preference from one type of product to another, and with the development of new products which cut into the market for old ones. A general rise in income levels can create new markets for more expensive items. Technological developments not only bring changes in the raw materials and equipment needed in production, but also influence the size of the required work force and the kinds of occupations and skills needed. Government policies, such as the size of the defense and space programs, and expenditures for research and development, also bring about changes in the types of occupations required.

In studying the outlook in each industry, the factors having the greatest influence were analyzed and projections were made of demand for the industry's products or services. These projections were then translated into estimates of the numbers and kinds of workers required to produce the indicated amounts of products or services, taking into account the numbers currently employed in different occupations, productivity trends, possible further reductions in the workweek, and other factors. Past trends in employment also were given much weight in arriving at conclusions about probable future trends.

The basic data on population and labor force trends, used for the overall employ-

ment projections and for the studies of individual occupations and industries, are from the decennial Censuses of Population, and from the monthly labor force surveys conducted by the Bureau of the Census for the Bureau of Labor Statistics.[1] Data also were drawn from the Censuses of Manufactures and Business conducted by the Census Bureau.

Information also was utilized from a variety of sources such as licensing agencies, labor unions, professional and trade associations, and special surveys.

Equally essential to the studies of employment trends in major industries were the statistics on employment in nonagricultural establishments, compiled by the Bureau of Labor Statistics. These estimates provide monthly data on employment, hours of work, earnings, and labor turnover, based on reports from a sample of industrial, commercial, and governmental establishments which together employ about 26 million workers. They are available for a great number of different industries for the past quarter-century or more.[2]

Another Bureau program which contributed to the analysis of future employment trends was its series of studies of productivity and technological developments. In converting the projections of demand for the products of a given industry into estimates of the number of workers who will be needed in that industry, allowances were made for anticipated productivity trends and technological changes. Information on employment of scientists and engineers in research and other activities, obtained from surveys conducted by the Bureau in cooperation with the National Science Foundation, also has been utilized extensively.

Still another Bureau project which had a major role in the development of estimates of future employment requirements in different occupations is the Occupational Industry Matrix. The matrix consists of a set of tables for 116 industry sectors which represent the entire economy of the United States. For each industry sector, the tables show a percentage distribution of employment among about 160 of the most important occupations and among the major occupational groups. The matrix was valuable in appraising the effects of changing employment levels in different industries on employment in specified occupations. It also was useful in estimating the numbers of workers currently employed in each occupation.

Conclusions based on the analysis of information from these many sources generally indicate increases in employment and, hence, openings for new workers. Expected gains in employment, however, are by no means an adequate indication of the total numbers of job openings that will need to be filled. In most occupations, more workers are needed yearly to fill positions left vacant by those who leave the occupation (to enter other occupations or because of retirement or death) than are needed to staff new positions created by growth of the field. Rarely do occupations grow fast enough so that the reverse is true. Consequently, even occupations which are declining in size may offer employment opportunities to many young people.

In estimating the number of openings likely to arise in an occupation, use has been made of Bureau of Labor Statistics studies of occupational mobility among selected groups of workers, and of tables of working life, also developed by the Bureau. The tables, which are similar to the actuarial tables of life expectancy used by insurance companies, provide a basis for assessing future rates of replacements resulting from deaths and retirements. The latter is affected by differences in sex and average age of the workers in various occupations. In occupations where men constitute the great majority of workers, the rate of replacement for death and for retirement is generally between 1 and 4 percent. The rate is usually somewhat higher in women's occupations, however, because so many women leave paid employment to get married and assume family responsibilities; for example, the replacement rate among school teachers is at least 8 percent a year.

The types of information mentioned so far in this section all relate to the demand for workers. In order to appraise the prospective employment opportunities in an occupation, it is also important to have information on the probable future supply of personnel. The statistics on high school and college enrollments and graduations compiled by the U.S. Office of Education are the chief source of information on the potential supply of personnel in the professions and other occupations requiring extensive formal education. Data on numbers of apprentices from the U.S. Department of Labor's Bureau of Apprenticeship and Training provide some information on new entrants into skilled trades.

Many of the statistical sources and analytical approaches referred to above have been developed within comparatively recent years. The reader should bear in mind that economic forecasting is still in an early stage of development and that at best, it is difficult and uncertain. It is necessary to keep in mind also the basic assumptions underlying the forecasts (enumerated on p. 4). The Bureau believes that, within this general framework of assumption, the basic trends affecting employment can be discerned with sufficient accuracy to meet the needs of young people preparing for careers.

D.O.T. Classification Numbers

The reports in this *Handbook* have been grouped in the manner that seemed most appropriate in view of the needs of the users and the realities of the industrial world. The arrangement followed does not conform to any one established system of classifying occupations. Provision has been made, nevertheless, to meet the needs of those persons who wish to relate the occupations discussed to an established classification system. The occupations covered in the *Occupational Outlook Handbook* are organized according to the occupational classification system developed by the Bureau of Employment Security of the U.S. Department of Labor and published in the third edition of the *Dictionary of Occupational Titles*. The *Dictionary* provides a code number (the so-called D.O.T. number) for each occupation included in it. In this *Handbook*, the code numbers have been shown either in the occupational heading or in the body of the text.

The third edition of the *Dictionary* is published in two volumes. Volume I contains job definitions arranged alphabetically; Volume II provides two arrangements of titles, one primarily for placement and one primarily for counseling. All jobs are classified by a new code structure using six-digit numbers; the system can be used as a filing system for occupational information.

[1] Special Labor Force Report No. 49, "Labor Force Projection for 1970–80"; available on request as long as the supply lasts from the U.S. Department of Labor, Bureau of Labor Statistics, Washington, D.C. 20210.

[2] See *Employment and Earnings and Monthly Report on the Labor Force* described on page 758.

Index to Occupations and Industries

BLS Occupational Outlook Service for Counselors

To help the professional community concerned with youth keep up to date on occupational developments that have significant implications for young people, and to assist counselors in making occupational information available to their clients, the Bureau of Labor Statistics supplements the *Occupational Outlook Handbook* with the following publications:

OCCUPATIONAL OUTLOOK QUARTERLY: *Handbook* users will want to consult the *Occupational Outlook Quarterly* to make sure they have up-to-date, authoritative occupational information between editions of the *Handbook*. Published four times during each school year, the *Quarterly* presents the latest occupational outlook studies by the Bureau of Labor Statistics and interprets the guidance implications of Government and other authoritative research in the economic, educational, demographic, and technological fields. A 2-year subscription for the *Occupational Outlook Quarterly* is $2.50 domestic, $3.50 foreign; 1 year is $1.25 domestic and $1.75 foreign; single copies are 35 cents each. Order from Superintendent of Documents, Washington, D.C. 20402. See order form, page 760.

OCCUPATIONAL OUTLOOK REPRINT SERIES: The reports in the *Handbook* are reproduced in this series of reprints, each of which covers a single occupation, an industry, or a group of related occupations. The reprints enable counselors to make occupational information available to more students interested in specific careers. Teachers can use these reprints as motivational aids in relating school subjects to earning a living. Librarians who keep a file of occupational information will find these reprints helpful in extending their resources to greater numbers of young people. Single reprints of a full set of 119 reprints can be ordered. A list of reprints, with prices, is available from the Occupational Outlook Service, Bureau of Labor Statistics, U.S. Department of Labor, Washington, D.C. 20212.

FREE OCCUPATIONAL OUTLOOK PUBLICATIONS: These include wall charts and reprints of articles from the *Quarterly*. Wall charts emphasize graphically the salient facts about various occupations and industries. Reprints from the *Quarterly* deal with the employment outlook in new occupational areas, the impact of technological changes, and other subjects of interest to young people and counselors and teachers. Free publications are announced in the *Quarterly,* and many of these are distributed automatically to schools, organizations, and individuals on the occupational outlook mailing list. Write to the Occupational Outlook Service, Bureau of Labor Statistics, U.S. Department of Labor, Washington, D.C. 20212, to request the List of Free Occupational Outlook Publications and to have your name placed on the mailing list.

COUNSELOR'S GUIDE TO OCCUPATIONAL AND OTHER MANPOWER INFORMATION, AN ANNOTATED BIBLIOGRAPHY OF SELECTED GOVERNMENT PUBLICATIONS: This bibliography, as the title suggests, lists the major occupational and other manpower publications of Federal and State government agencies that will be useful to counselors and others interested in trends and developments that have implications for career decisions. The bulletin, No. 1421 (currently being revised), is available from the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402; 50 cents a copy.

Other BLS Publications Useful to Counselors

Information on employment, unemployment, occupation trends, earnings, and other labor force developments can be obtained from the following publications:

EMPLOYMENT AND EARNINGS AND MONTHLY REPORT ON THE LABOR FORCE: Monthly reports featuring timely analysis of current developments in employment, unemployment, hours, and earnings for the Nation. Contains statistics on employment, earnings, hours of work, and labor turnover by industry for the Nation and by industry division for each State and 202 metropolitan areas. Also, contains detailed statistics on the labor force including characteristics of the employed and unemployed, such as age, marital status, color, industry, and occupational attachment. Statistics for earlier years are contained in *Employment and Earnings Statistics for the United States* (BLS Bulletin 1312–5), price $4.75 and *Employment and Earnings Statistics for States and Areas* (BLS Bulletin 1370–4), price $5.

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