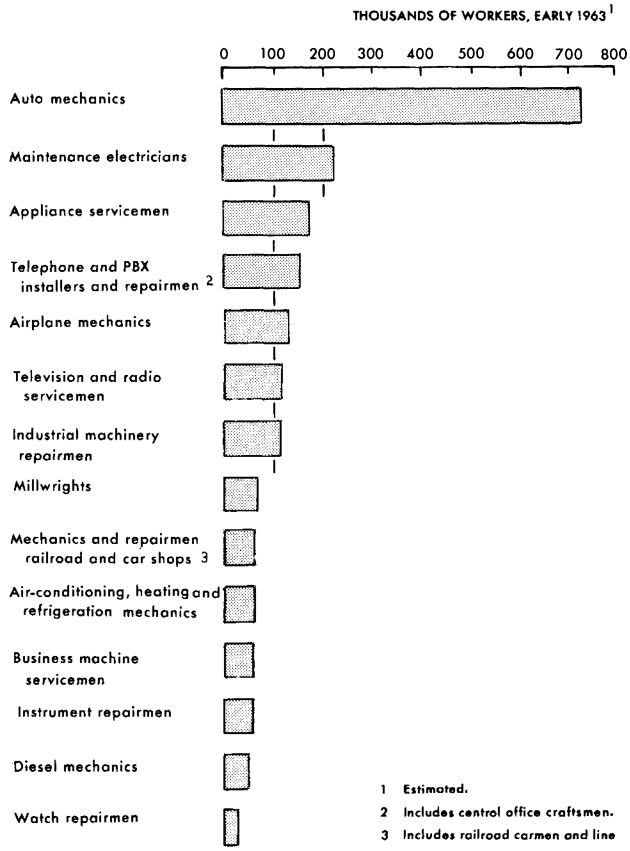
MECHANICS AND REPAIRMEN

Mechanics and repairmen make up one of the largest and fastest growing occupational groups in the Nation's labor force. It is estimated that in early 1963 there were more than 2¾-million mechanics and repairmen. These workers account for about a third of all craftsmen, foremen, and related workers. The more than 200 occupations included in the mechanics and repairmen group vary greatly in size, from those with several hundred thousand workers to those with only a few hundred workers. Automobile mechanics make up the largest occupation, with 700,000 workers—about a fourth of all mechanics and repairmen. Other occupations with more than 100,000 workers each, include maintenance electrican, appliance serviceman, telephone repairman (telephone and PBX installer and repairman and central office craftsman), airplane mechanic, television and radio serviceman, and industrial machinery repairman. (See chart 28.) On the other hand, there are some maintenance and repair specialties with relatively small numbers of workers such as hearing-aid repairman, ski-lift mechanic, electric razor repairman, musical instrument repairman, and X-ray equipment serviceman.

Young men with mechanical aptitude who do not intend to go to college may wish to consider one of the maintenance and repair occupations as a career. Most maintenance and repair jobs present a variety of challenging problems. Many persons find great satisfaction in working with various kinds of equipment to find out why it does not operate properly, and putting it into good working condition. The employment outlook is favorable for maintenance and repair occupations generally, during the remainder of the 1960's and in the longer run. Rapid employment growth is anticipated for several occupations—including instrument repairman, air-conditioning and refrigeration mechanic, television and radio serviceman, and appliance serviceman. In addition to the opportunities resulting from the growth of the occupational group, tens of thousands of job openings will occur annually because of the need to replace experienced workers who transfer to other occupations, retire, or die.

CHART 28

EMPLOYMENT IN SELECTED MAINTENANCE AND REPAIR OCCUPATIONS . . . .



1 Estimated.
2 Includes central office craftsmen.
3 Includes railroad carmen and line and signal maintenance men.

Earnings of mechanics and repairmen compare favorably with those of other manual workers. Opportunities for advancement to supervisory positions are good for workers in many maintenance occupations. Workers in certain maintenance and repair occupations, particularly automobile mechanic and radio and television serviceman, are able to go into business for themselves either on a part-time or full-time basis.

Mechanics and repairmen usually work year-round and generally they are less affected by fluctuations in business activity than other manual workers. Also, they often are able to transfer from one firm or industry to another or from one type of maintenance work to another.

This chapter includes statements on the following maintenance and repair workers: Air-conditioning and refrigeration mechanics, appliance servicemen, automobile mechanics, business machine servicemen, diesel mechanics, industrial machinery repairmen, instrument repairmen, maintenance electricians, millwrights, television and radio servicemen, and watch repairmen. Other maintenance and repair occupations are discussed in other chapters in this *Handbook*. For example, airplane mechanics are discussed in the chapter on Occupations in Civil Aviation; telephone and PBX installers and repairmen and central office craftsmen, in Occupations in the Telephone Industry; and carmen, and line and signal maintenance men, in Occupations in the Railroad Industry. (See index for page numbers.)

Air-Conditioning and Refrigeration Mechanics

Nature of Work

The growing use of air-conditioning and refrigeration equipment throughout the Nation is providing many job opportunities for skilled mechanics who install and repair such equipment in office buildings, factories, homes, food stores, restaurants, and other establishments. (This chapter does not discuss mechanics who work on railroad, truck, automotive, or marine air-conditioning and refrigeration equipment.)

In installing new air-conditioning or refrigeration equipment, the mechanic puts the motors, condensers, and dehumidifiers in proper position, following design specifications. He connects duct work, refrigerant lines and other piping, and then connects the equipment to an electrical power source. He installs electrical controls and checks the electric power entering the motor. After completing the installation and connecting the recording and gaging devices, the mechanic starts the unit and tests it for proper performance and for leaks. He also adjusts the pumps, dehumidifiers, filters, and other components in order to obtain the most efficient performance.

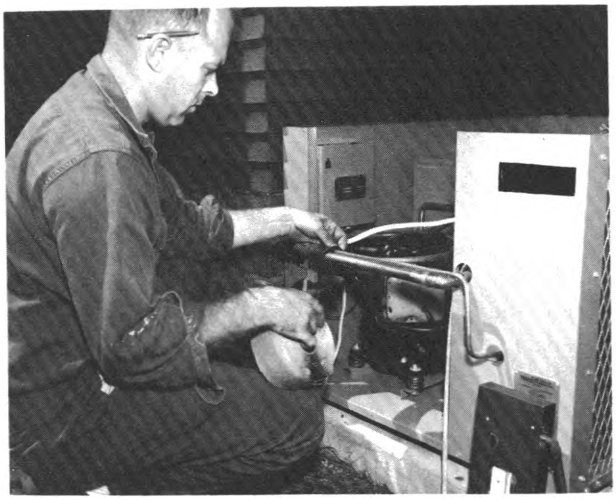
The mechanic may install air-conditioning equipment ranging from small, self-contained units to large central-plant-type systems. On small installations, he may have to prepare his own working diagrams and do simple layout work, such as measuring and cutting pipe. On large installation jobs, the mechanic must read and interpret blueprints or drawings.

Mechanics engaged in maintenance work regularly lubricate machinery, replenish liquid refrigerant, adjust valves, and examine other parts of the equipment to detect leaks and other defects. When air-conditioning and refrigeration equipment breaks down, the mechanic must diagnose the cause and make the necessary repairs. In looking for defects, he may take the motor apart, removing such parts as springs and brushes. After the cause of the trouble has been located and the defected part repaired or replaced, the mechanic reassembles the unit. He also may make electrical repairs in connection with his work. The mechanic uses tools and equipment, such as electric drills, soldering torches, pipe benders, hammers, screwdrivers, pliers, and testing devices, such as leak detectors and test lights.

Sometimes, particularly where the installation or repair of a large air-conditioning or refrigeration system is involved, certain phases of the work may be performed by other craftsmen. On a large central-plant installation, for example, the duct work might be done by sheet-metal workers; the electrical work by electricians; and the installation of piping, condensers, and other components by pipefitters.

Where Employed

A considerable number of air-conditioning and refrigeration mechanics are employed in shops that specialize in the repair and maintenance of commercial, industrial, and home air-conditioning and refrigeration equipment. Others work for construction companies, air-conditioning or



Air-conditioning mechanic insulates refrigerant lines of air-conditioner

refrigeration equipment manufacturers, heating and air-conditioning contractors, and dealers. Some are employed by department stores, hotels, restaurant and food store chains, factories, warehouses, and other establishments large enough to require full-time maintenance men. Many mechanics have opened their own repair shops.

Because of the widespread use of air-conditioning and refrigeration equipment, these workers are employed in all parts of the country. However, they are employed mainly in the large cities where most of the large commercial and industrial establishments are located. New York, Texas, California, Pennsylvania, Ohio, and Illinois lead the number of these workers.

Training, Other Qualifications, and Advancement

Most air-conditioning and refrigeration mechanics start as helpers and acquire the skills of their trade informally by working for several years with experienced craftsmen. Usually the beginner's work consists of lifting, loading, cleaning up, and performing relatively simple tasks such as insulating refrigerant lines. As trainees gain experience, they are given progressively more complicated tasks such as installing pumps and checking electrical circuits.

Mechanical aptitude and the ability to understand and work with electricity are important qualifications for workers in this occupation. Good physical condition is also important because mechanics are often required to lift and move heavy equipment. A growing number of employers prefer to hire high school graduates who have had courses in mathematics, physics, and blueprint reading.

Young persons interested in advancing to higher level air-conditioning and refrigeration jobs as technicians or foremen are frequently advised by training authorities to attend a technical institute. In these schools, students are taught to design and construct, as well as to install, operate, maintain, and repair, all types of air-conditioning and refrigeration equipment. They also take courses in mathematics, physics, electricity, and mechanical drawing. Additional information about air-conditioning and refrigeration technicians appears in the chapter on Technicians. (See index for page number.)

Employment Outlook

A rapid growth in the number of jobs for these mechanics, especially those doing air-conditioning work, is anticipated during the 1960's and in the longer run because of a continuing increase in the use of air-conditioning and refrigeration equipment. In addition, many job openings will also arise as experienced workers retire, die, or transfer to other lines of work.

The use of air conditioning in offices and stores is expected to increase very greatly. The number of centrally installed air-conditioning units in homes, which almost doubled between 1958 and 1962, is also expected to continue to increase rapidly during the next 10 to 15 years. The use of refrigeration as a means of preserving food and other perishable items has grown greatly in recent years. Refrigeration also is becoming increasingly important in the manufacture of such products as synthetic rubber, oil, high-test gasoline, medicine, and drugs.

Earnings and Working Conditions

Earnings for air-conditioning and refrigeration mechanics are not available on a national basis. Information obtained from a small number of employers in late 1962, however, indicated that beginning rates for helpers ranged from $1.25 to $1.75 per hour and the top rates for mechanics ranged from $3 to $3.50 per hour. The rates of pay for trainees and mechanics depended on factors such as their level of skill, the size and type of equipment they worked on, the type of work they did, and the type of establishment in which they were employed. For example, mechanics who installed large commercial refrigeration and air-conditioning systems frequently had higher hourly rates of pay than those who installed small commercial and residential systems.

Although most employers try to maintain the same work force throughout the year, they may have to lay off some mechanics during the winter months. In air-conditioning and refrigeration contractor shops that also install and repair heating equipment, the mechanics may work on heating equipment during the winter months. Most mechanics work a 40-hour week. However, during the summer months they must often work overtime or at irregular hours when refrigeration or air-conditioning equipment breaks down. Overtime work in most shops is paid for at time and one-half the regular rate.

Mechanics are sometimes required to work at great heights while installing new equipment. They may also work in awkward or cramped positions in order to reach motors or other parts of the equipment they are repairing. Common hazards in this trade include electrical shock, torch burns, and those associated with the handling of heavy equipment.

Appliance Servicemen

(D.O.T. 5-83.043)

Nature of Work

When washing machines, refrigerators, kitchen ranges, toasters, vacuum cleaners, and the many other electric and gas appliances used in homes today do not run properly, appliance servicemen repair them. The repair of large and complicated appliances such as refrigerators and washing machines (which may have as many as 30 electrical connections in the control unit alone) is considerably more difficult than the repair of small appliances such as toasters and food mixers. However, all the work performed by appliance servicemen involves finding why appliances are not operating properly and then installing new parts or making adjustments.

To learn why an appliance is not operating properly, appliance servicemen first find out from customers what happened when it was last turned on. They often check the appliance by starting it and listening for loud humming, grinding, or other unusual noises, which might tell them what part of the appliance is not working properly. Sometimes servicemen look specifically for common signs of trouble, such as cracks in rubber hose, or they turn gears or other moving parts of appliances to see if they are jammed or too tight. Appliance servicemen find other causes of trouble by using special tools and testing devices.

After servicemen find what is wrong with appliances, they make the necessary repairs. Frequently, this involves replacing parts, such as electric cords, that receive extra hard wear. Sometimes servicemen clean parts; for example, they remove lint that has clogged a washing machine drain. In removing old parts and putting in new parts, appliance servicemen use not only handtools, such as screwdrivers, pliers, and wrenches, but also special tools designed for particular appliances.

An important part of the work of appliance servicemen is dealing personally with customers. They make service calls to homes and answer customers' questions and complaints about appliances. Appliance servicemen frequently advise customers about the care and use of their appliances, because many breakdowns are caused by improper use. For example, they may remind housewives how many pounds of clothing can be washed at one time in automatic washing machines, or how to stack dishes in dishwashers.

Appliance servicemen have considerable variety in their work. They drive light trucks or automobiles, some of which are equipped with two-way radios. They give estimates to customers on the cost of repair jobs, and keep records of parts used and hours worked on each repair job. Also, they sometimes order parts and sell new or used appliances.

Serviceman installs surface unit in electric range

Where Employed

Approximately 165,000 appliance servicemen were employed in early 1963. They work in almost every city and town because the appliances they repair are used everywhere. A large proportion work in independent repair shops, many of which are owned and operated by appliance servicemen. Another large proportion are employed by appliance dealers, department stores, and other firms that sell and service appliances. A substantial number work for gas and electric utility companies, and a few thousand are employed by appliance manufacturers who operate service centers in most large cities. An increasing number of appliance servicemen are employed by firms that service coin-operated washing machines and, in recent years, coin-operated dry cleaning machines as well.

Training, Other Qualifications, and Advancement

Appliance servicemen are usually hired as helpers and acquire their skills through on-the-job training and work experience. Inexperienced men are given relatively simple work assignments. In some companies, they work for the first few months mainly helping to install appliances in customers' homes, driving service trucks, and learning street locations. In other companies, they begin to learn the skills of appliance servicemen by working in the shop, where they rebuild used parts such as washing machine transmissions. Gradually, trainees learn how motors, gears, and other appliance parts operate. They progress from simple repair jobs, such as replacing a switch, to more difficult jobs, such as adjusting automatic washing machine controls. In addition to practical experience on the job, trainees frequently receive classroom instruction given by appliance manufacturers and local distributors. Many trainees take correspondence courses in basic electricity to increase their skills in appliance repair.

Trainees are usually supervised closely for 6 to 12 months. By this time, most of them can repair several kinds of appliances on their own, and they may be given responsibility for their own service trucks and for expensive stocks of appliance parts and tools. Appliance servicemen usually need up to 3 years' on-the-job experience to become fully qualified. Many experienced servicemen attend training classes (often on company time) and study service manuals to become familiar with new appliances and the best ways to repair them.

Employers generally prefer applicants with mechanical aptitude who are high school graduates and who have had high school or vocational school courses in electricity or physics. They must understand, in a practical way, how to use equipment that measures electricity and how to use such measurements in solving equations or formulas that tell whether electrical currents in appliances are flowing properly. Also important in servicing appliances is a knowledge of wiring diagrams which show electrical connections between appliance parts.

Employers also look for men who can get along well with customers. Employers emphasize that mechanical skills are only part of the qualifications for servicemen's work. Servicemen must be tactful and courteous. Sometimes this is difficult, for example, when explaining to a customer the right way to operate an appliance that has been used incorrectly. Servicemen also are expected to dress neatly and to avoid getting grease or dirt on floors and furniture.

Appliance servicemen can be promoted to foreman, assistant service manager, or service manager. Preference is given to men who have shown ability to get along well with other servicemen and with customers. A general knowledge of bookkeeping and other subjects related to managing a business is also helpful in getting ahead. Servicemen who work for appliance manufacturers may advance to other higher paying jobs. They may teach servicemen to repair new models of appliances. They may also write service manuals. Because of their experience in repairing appliances and dealing with all types of customers, appliance servicemen often become successful appliance salesmen. Experienced appliance servicemen may open their own sales or repair shop.

Employment Outlook

Employment of appliance servicemen is expected to grow rapidly during the remainder of the 1960's and in the longer run. Most new employment opportunities in this expanding occupation will occur because more appliances will be used and many new appliances will be more complex and require greater maintenance and repair. Some job openings will occur each year as a result of the need to replace servicemen who are promoted or who transfer to other fields of work. Other opportunities will arise because of the need to replace workers who die or retire.

Appliances have become an essential and larger part of our daily living. Some homes now have as many as several dozen or more gas and electric appliances. The average American home has many more than 10 or 15 years ago, as increasing numbers of refrigerators, washing machines, kitchen ranges, vacuum cleaners, food mixers, and other standard appliances have been purchased. In addition, appliances not widely used or not even developed a few years ago have become popular, such as room air conditioners, dishwashers, food waste disposers, clothes dryers, dehumidifiers, coin-operated dry cleaning equipment, and electric can openers.

Growing population and increasing numbers of young married couples, who spend large amounts of their incomes for homefurnishings, will continue to stimulate demand for appliances during the next 10 to 15 years. Rising incomes and living standards will lead to increased sales of appliances. Sales will be favorably affected also by the introduction of new appliances and of greater convenience and ease of operation in appliances.

The trend toward greater convenience and more automatic operation of appliances has tended to make them more complicated and to that extent has made appliance repair work more difficult. On the other hand, manufacturers are designing appliances with more durable parts that should need fewer repairs, and appliances that can be taken apart more easily. In addition, appliance manufacturers and other employers are increasing the efficiency of servicemen through more widespread and more effective training. Despite these improvements, large numbers of additional servicemen will be needed each year.

Mechanically inclined young men who are not planning to attend college will find many opportunities in the growing appliance repair field. Appliance servicemen who have a working knowledge of electricity, and especially those who know electronics, will be able to find a variety of good jobs almost anywhere.

Earnings and Working Conditions

Nationwide wage data for some experienced appliance servicemen in unionized shops show that hourly wage rates in 1962 ranged from $1.75 to $3.43. The wide variation in rates is based on differences in type of employing establishment, locality of the job, and other factors. Appliance servicemen employed by gas and electric utilities had a higher wage range, from $2.49 to $3.91 an hour. Many appliance servicemen work more than 40 hours a week and receive higher rates of pay for the overtime hours. They may also receive commissions for sales leads.

Many appliance servicemen working for manufacturers' service centers, gas and electric companies, and other employers receive paid vacations and sick leave, health insurance, and other benefits, as well as credit toward retirement pensions. Some of these companies also sponsor employee savings funds and contribute money to the accounts of employees who participate.

The shops in which appliance servicemen work are relatively quiet, well lighted, and adequately ventilated. While repairing small appliances, servicemen usually sit at benches. Working conditions outside the shop vary considerably. Servicemen sometimes work in narrow spaces, uncomfortable positions, and places that are not clean.

Servicemen who work with large appliances may spend 1 or 2 hours a day driving in all kinds of weather between the shops where they work and customers' homes.

Appliance repair work is generally safe, although accidents are possible while the serviceman is driving, handling electrical parts, or lifting or moving large appliances. Inexperienced men are shown how to use tools safely and instructed in simple precautions against electric shock, such as keeping hands dry while handling electric wires.

The work of appliance servicemen is often performed with little direct supervision. This feature of the job may appeal to many young people.

Where To Go for More Information

Further information about jobs in the appliance service field may be obtained from local appliance repair shops, appliance dealers, gas and electric utility companies, and appliance manufacturers. Local vocational schools which offer courses in appliance servicing, electricity, and electronics also may provide helpful information.

Automobile Mechanics

(D.O.T. 5–81.000 through .999)

Nature of Work

Motor vehicles are kept in good running order by automobile mechanics. These skilled workers maintain and repair mechanical, electrical, and body parts of trucks and buses as well as passenger cars. They may also service other gasoline-powered equipment such as tractors. Automobile mechanics make inspections and tests to determine the causes of faulty operation, and repair or replace defective parts to restore the vehicle to proper operating condition. Typical maintenance and repair jobs done by mechanics are tuning the engine, replacing piston rings, alining the front wheels, and adjusting or relining the brakes.

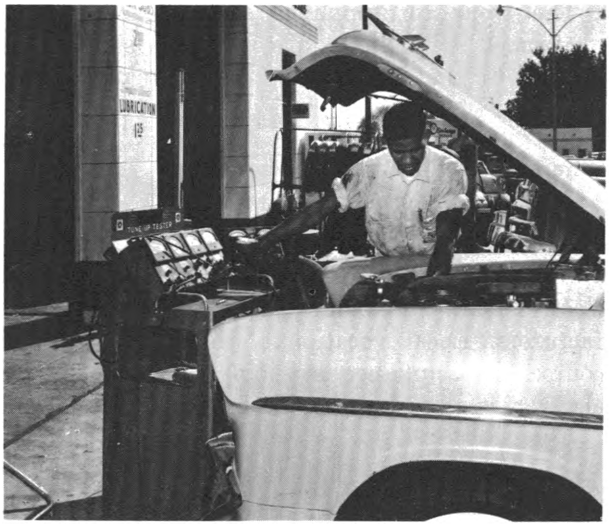
Automobile mechanics in the smaller shops are usually qualified to perform a variety of repair jobs, although a large number of other automobile mechanics specialize in particular types of repair work. For example, some mechanics do only alinement and steering work, or work on certain types of automatic transmissions. These mechanics usually work in shops with different departments or in shops that specialize in particular types of repair. These specialists, however, usually have an all-round knowledge of automotive repair and, occasionally, may be called upon to do other types of work. *Body and fender repairmen* are specialists who do the shaping, finishing, and replacing of sheet metal, and replacing of trim and glass.

In making repairs, the mechanic uses many different kinds of tools and equipment. These may range from simple handtools, such as screwdrivers, wrenches, and pliers, to complicated and expensive machines and equipment which help the mechanic find out why an automobile is not operating properly and assist him in making repairs. Some common examples of such equipment are wheel alinement machines, spark plug testers, engine analyzers, and headlight aimers. In addition to these tools, repair manuals and other technical publications are used to provide instructions for making the more complex repairs.

Mechanics usually work by themselves. In large shops, however, a skilled mechanic may be assisted by a helper or an apprentice, and usually works under the supervision of a foreman or service manager. Before actually doing the work, mechanics in small shops may be required to prepare estimates of the cost of repairs, including materials and labor. In larger shops, the shop foreman, service salesmen, or service manager generally prepares the cost estimate and tells the mechanic what repairs to make.

Where Employed

The estimated 700,000 automobile mechanics employed in early 1963 made up the largest repair occupation. About 40 percent of these workers were employed in repair shops which made all kinds of repairs or specialized in particular types such as ignition repairs, body and fender work, radiator service, and transmission and brake repair work and adjustment. About 25 percent



Automobile mechanic uses testing equipment to tune up engine

were employed in the service departments of new and used car dealers. A considerable number of automobile mechanics were employed in gasoline service stations where they usually made relatively minor repairs and adjustments. Many mechanics worked for organizations that repair and maintain their own fleets of motor vehicles. Included in this group were Federal, State, and local governments, trucking, bus, taxicab, bakery, and dairy companies. Some mechanics were employed by manufacturers of motor vehicles to make final adjustments and repairs at the end of assembly lines.

Most auto mechanics work in shops employing from one to five mechanics. However, some of the largest repair shops employ more than 100 mechanics. Generally, dealers' service departments in large cities have larger staffs of mechanics than independent shops and shops in smaller communities.

Because motor vehicles are used throughout the Nation, automobile mechanics are employed in every section of the country, from the largest cities to the smallest towns. Nearly half worked in the eight States with the largest number of automobiles: California, New York, Texas, Pennsylvania, Ohio, Michigan, Illinois, and New Jersey.

Training, Other Qualifications, and Advancement

Most auto mechanics learn the trade through on-the-job experience. Young men usually start as helpers, lubrication men, car washers, or gasoline service station attendants, and gradually acquire the necessary knowledge and skills by working with experienced mechanics. Although a man can perform the simpler types of repair work after a few months' training and experience, it generally takes him at least 3 or 4 years to become an all-round mechanic. The learning period will depend on the individual's capabilities and the extent of his formal schooling in automotive repair. Additional training is usually required for mechanics who wish to become specialists. However, body repairmen, who do not have to learn to repair the operating parts of the vehicle, may learn their trade in as little as 3 years if they have a knack for handling metal.

One of the best ways for a young man to become an all-round auto mechanic is through an apprenticeship training program, which usually lasts 4 years. Some apprenticeship programs also allow the trainee to specialize in work such as truck or bus repairs, or auto-body repairs.

A large number of young men, who did automotive repair work in the Armed Forces, may be required to attend special training courses or to serve part of an apprenticeship period before they can qualify as fully trained civilian mechanics.

Vocational education agencies, in cooperation with local offices of the U.S. Employment Service, in many parts of the country conduct training programs designed to train men to become automobile mechanics. These programs, which usually last a year, stress basic maintenance and repair work. Although men who complete the program are able to make simple automobile repairs, they must undergo much additional training before they can qualify as all-round mechanics.

Experienced mechanics employed by automobile and truck dealers are sometimes sent to manufacturers' training centers to learn about new features found in automobiles, such as fuel injection, power steering, or air conditioning.

For beginning jobs, employers prefer young high school graduates who have some understanding of automobile construction and operation and who like mechanical work. Courses in science and mathematics are helpful, since they give a young man a better understanding of the operation of the automobile. Shop courses in auto repair which are offered by many high schools and vocational schools are valuable. Practical experience gained from working on automobiles as a hobby is also helpful to a young man who wishes to become a mechanic.

Most mechanics are required to have their own handtools. A beginner is usually expected to accumulate about $100 worth of tools. Experienced mechanics usually have over $500 invested in their tools. Special tools for servicing units like automatic transmissions, and major pieces of test equipment, are ordinarily furnished by the employer.

Capable and experienced automobile mechanics have several advancement possibilities. A mechanic in a large shop may advance to a supervisory position, such as repair shop foreman, service salesman, or service manager. Many experienced mechanics open their own independent repair shops or gasoline service stations and some mechanics may become car or truck salesmen, or manage a dealer's parts department.

Employment Outlook

Employment of automobile mechanics is expected to increase rapidly during the remainder of the 1960's and in the longer run. In addition to openings resulting from growth of the occupation, many openings will result from the need to replace experienced automobile mechanics who retire, die, or transfer to other fields of work. In this large occupation, retirements and deaths alone will probably account for about 15,000 to 20,000 job openings each year.

The number of automobile mechanics will increase for several reasons. Registrations of motor vehicles in the United States, which increased by about 50 percent between 1952 and 1962, are expected to increase by about a third in the next 10 years because of increases in population, new families, consumer purchasing power, and multicar ownership. Continued farm mechanization is expected to increase the number of tractors and other gasoline-powered farm machines. Also, more new cars are expected to be equipped with features such as air conditioning, power steering, and power brakes. These features make cars more comfortable and easier to operate, but also increase their maintenance requirements. An increase in the number of repairs that a mechanic can do will partially offset the increased number of more complex vehicles. The more widespread use of new and improved automobile servicing equipment will help mechanics to locate and repair defects that cause faulty automobile operation. Greater emphasis on replacement rather than on repair of defective parts, better shop management, specialization in a single type of repair, and better training methods also are expected to contribute toward increasing the amount of work the mechanic can do.

Earnings and Working Conditions

Automobile mechanics (excluding body repairmen) employed by trucking, taxicab, bus, and other establishments that service their own vehicles had average straight-time hourly earnings of about $2.80, according to a survey of 82 areas in late 1961 and early 1962. Average hourly earnings ranged from $2.15 in Chattanooga, Tenn., to $3.38 in San Francisco-Oakland, Calif. These straight-time earnings exclude pay for overtime work.

Most skilled auto mechanics and body repairmen in automobile dealer repair shops are paid a percentage of the labor cost charged to the customer. Each repair job is assigned a fixed labor charge and the most highly skilled mechanics can earn considerably more than the average because they are able to make repairs in less time. This is especially true in body work, in which there are great differences in skill between the very best repairman and the average repairman. Some body repairmen in large cities earn more than $10,000 a year.

Apprentices are paid a percentage of the journeyman's rate. This percentage ranges from 55 percent of the skilled worker's rate in the apprentice's first 6 months of work to between 85 and 90 percent in the last 6 months of the apprenticeship period.

Many automobile mechanics work between 40 and 48 hours each week. Some work more than 48 hours a week.

Modern automotive repair shops are well ventilated, lighted, and heated, but older shops may not have such advantages. Most shops have lifts that raise the vehicle so that work can be done without stooping.

Generally, the mechanic's work is performed inside a shop during the day. However, in cases where breakdowns occur on the road, the mechanic may have to work out of doors. In many jobs, the mechanic must handle greasy tools or dirty parts.

Many auto mechanics are members of labor unions. A large number of unionized mechanics are employed in shops of the larger new car dealers and the maintenance departments of truck and bus companies. Mechanics are highly organized in West Coast cities and in other large cities such as Chicago, Minneapolis–St. Paul, St. Louis, New York City, and Cleveland. Among the unions to which automobile mechanics belong are the International Association of Machinists; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; and the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.).

Business Machine Servicemen

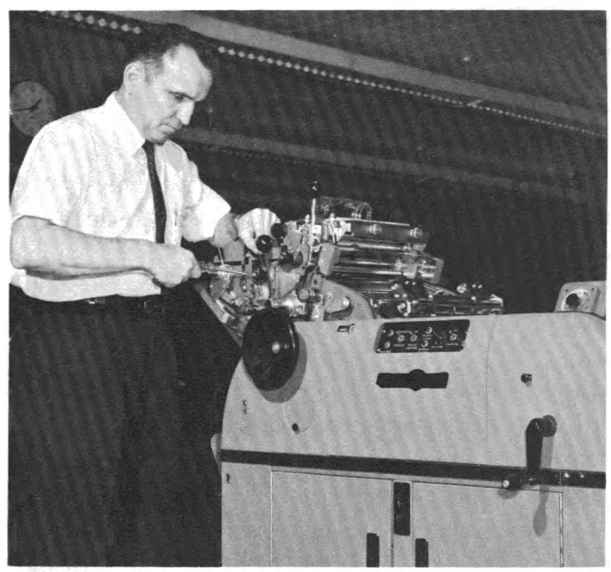
Nature of Work and Where Employed

Business machine servicemen maintain and repair the increasing numbers and types of office equipment used for correspondence, for recording and processing transactions, and for duplicating and mailing information. Equipment used for these purposes includes typewriters and dictating machines; adding machines, calculators, electronic computers, and other data-processing devices; and mailing and duplicating equipment. These predominantly mechanical machines are becoming increasingly complex as electric drive and control components are incorporated in them.

Servicemen do much of their work in the offices where the machines are used. Servicemen may maintain this equipment on a regular basis, returning at frequent intervals to inspect the machines, to clean and oil them, and make minor adjustments or repairs. They may also be called to an office to check a defective machine. On office calls, servicemen usually question the operator about the condition of the machine. They may have to explain to operators how various features of the machines can best be used or how to avoid machine damage.

While inspecting business machines, the serviceman usually checks the operation of various parts of the equipment to make sure that they work properly or to find the source of trouble. For example, he may strike the keys of a typewriter or calculator, rotate the drum of a duplicating machine, or feed punchcards to a tabulator or sorter. In addition, he may check type or photographic devices for alinement, and rollers for dryness or compactness. If necessary, covers of machines may be removed to check levers, gears, belts, or spacing mechanisms. He may make voltage checks of electric or electronic components.

When overhaul or major repair is necessary, small units of equipment are generally brought to the shop of the servicing company. Here, servicemen disassemble the machine; inspect components; remove and replace worn bearings, cams, and other defective parts; and install new belts and feed rolls where necessary. If the machine has electric motors or controls, these also may require adjustment, or replacement of parts.



Serviceman adjusts ink-form roller of duplicating machine

Common handtools such as screwdrivers, pliers, and adjustable wrenches are used. In addition, tools designed for special purposes, and gages, meters, and other test equipment frequently are used.

Business machine servicing offers considerable variety in work assignments. Such work requires analytical ability on a wide range of problems. Many persons find considerable satisfaction in being able to diagnose the cause of the trouble and to put machines back in good working order.

In addition to maintenance and repair responsibilities, servicemen may engage in sales activities. Most commonly, they sell contracts for machine servicing on a regular basis. Some servicemen also are expected to sell supplies such as special paper, ink, and stencils used with particular machines. Generally, commissions or bonuses based on sales are paid, in addition to wages.

Business machine servicemen are employed in several types of firms. Manufacturers of business machines employ more than half of these workers in their sales and service offices throughout the country. Another large proportion of the more than 60,000 business machine servicemen employed in early 1963 worked in local independent establishments; some of these shops specialize in repair work, whereas others combine sales and service. The remainder are employed in large organizations which have enough machines in daily use to justify employing full-time servicemen. The Federal Government, for example, employed about 675 of these workers in early 1961.

Business machine servicemen employed in a manufacturer's branch office usually work on the manufacturer's products exclusively. In the large branch offices of some companies, they may specialize in servicing one or two of the various types of machines sold. In other companies, even in the larger branches, the fully trained men are "combination" servicemen and work on the full line of company equipment. In manufacturers' branches in the smaller cities, where fewer servicemen are needed, most are "combination" servicemen, since the size of the operation makes it impractical to have the men specialize on one type of machine. In these instances, service may also be combined with sales.

Servicemen employed by independent dealers maintain and repair the many makes and models of office machines used in the community. Most dealers sell and service typewriters. Some also sell and service adding machines, dictating machines, and less complex types of duplicating equipment. Other dealers specialize in the sales and service of adding and calculating machines, cash registers, and bookkeeping-accounting machines. Most independent dealers employ fewer than 5 servicemen, although some large dealers may employ as many as 10 or 15.

Business machine servicing jobs are found throughout the country. Even relatively small communities usually have at least one or two shops which repair machines. However, most business machine servicemen work in large cities, especially in those with large numbers of office workers and where most of the calculators, accounting-bookkeeping, and statistical machines are used.

Typewriter Servicemen (D.O.T. 5-83.127). The principal work of the estimated 22,000 typewriter servicemen employed in early 1963 was the maintenance and repair of manual and electric typewriters. Typewriters are the most widely used business machines. They are used in almost every business office, as well as by many individuals in their homes. The operation of electric typewriters and mechanical typewriters differs slightly, but the two types are enough alike that the servicemen who specialize in the repair of mechanical typewriters can usually learn to repair the electric machines, with brief additional training.

Typewriter servicemen are employed both in the sales and service branches of typewriter manufacturers and by local independent dealers. Many servicemen operate their own maintenance and repair shops. Typewriter servicemen are found in almost every sizable community throughout the Nation.

Adding Machine Servicemen (D.O.T. 5-83.122). About 4,500 business machine servicemen were engaged mainly in the servicing of adding machines in early 1963. These machines are less complex than most other office calculating devices. In some cases, servicing of both adding machines and calculators is done by the same employee.

The repair of adding machines and simpler calculating machines often provides experience for advancement to work on more complicated equipment, such as bookkeeping and accounting machines. In some independent shops, adding machines are serviced by men who also repair typewriters.

Adding machine servicemen are employed both in manufacturers' sales and service branches and by independent dealers. Other sources of employment are Federal, State, and local governments, and a few large banks and other firms which use large numbers of adding machines.

Calculating Machine Servicemen (D.O.T. 5–83.123). Almost 5,000 calculating machine servicemen were employed in early 1963. Calculating machines, which have complex mechanisms, add, subtract, divide, multiply, and perform combinations of these operations. In some shops, servicing of calculators is combined with the servicing of other business machines, particularly adding machines and accounting-bookkeeping machines.

Most of the men who service calculators are employed in manufacturers' sales and service branches. Some independent dealers employ men skilled in the maintenance and repair of calculators. Others are employed by the Federal Government and some large business organizations.

Cash Register Servicemen (D.O.T. 5–83.124). Cash register repair and maintenance was the main work of almost 6,000 business machine servicemen in early 1963. Next to typewriters, cash registers are the most widely used business machines. The simplest models merely record transactions, add receipts, and provide a change drawer. The more complicated cash registers simultaneously record several different kinds of information on each transaction (such as identification of the clerk, department, type of merchandise, payment given, and change due), provide printed receipts, and dispense change to the customer.

The great majority of servicemen primarily engaged in repairing cash registers are employed in the sales and service branches of the few manufacturing firms making these machines. Some of the repair work, especially in smaller communities, is done by independent dealers that also maintain and repair other business machines.

Accounting-Bookkeeping Machine Servicemen (D.O.T. 5–83.121). The repair of accounting-bookkeeping machines was the main job of the more than 3,000 business machine servicemen employed in early 1963. These machines perform a variety of operations. Some post entries and some do billing, but others combine the functions of typewriters and computing devices. All models have keyboards, like those on typewriters and adding machines. These machines are used in firms that have a great deal of accounting and bookkeeping work, such as department stores, large retail and wholesale businesses, and banks. Many of the newer models are adjusted to fit the accounting procedures used in an individual customer's office. Servicemen set up the controls or programs for such machines from plans which have been devised by the customers and manufacturers' salesmen.

Most accounting-bookkeeping machine servicemen are employed in the sales and service branches of companies manufacturing this equipment. Very few work in independent repair shops.

Data-Processing Equipment Servicemen. More than 14,000 men were employed in early 1963 to install, modify, and maintain groups of machines (systems) used to process large volumes of accounting-statistical data. These men are the most skilled business machine servicemen. The machines that they service include mechanical and electromechanical devices of varying complexity and highly complicated electronic computers. However, even those machine systems which include the most advanced computers depend to a high degree on associated equipment having electromechanical operating and control mechanisms. This auxiliary equipment feeds information to the computer for data processing and converts the processed data to printed form for immediate use, and to tape and punchcard coding for record keeping and further processing. Machines used in data processing systems include computers, tabulators, card punchers, sorters, collators, converters, tape transports, printers, and numerous other devices.

Servicemen who work on these machines must have a good basic knowledge of electricity, in addition to mechanical skill. In some firms, only men with training in electronics are hired to service these machines. Many of these men have learned electronics in technical schools or in the Armed Forces. In other companies, experienced men who can repair other types of business machines are given training in electronics by their employers.

Data-processing machine servicemen are employed principally by firms which manufacture and service such equipment. They may be assigned by their companies to work anywhere in the United States, but they are usually stationed in the larger cities.

Dictating Machine Servicemen (D.O.T. 5-83.135). About 2,000 men were employed to repair and service dictating machines in early 1963. These machines are used in business offices to record dictation on discs, belts, or tape which can be played back for typing. In addition to standard office dictating machines, servicemen install and maintain central recording and transcribing systems.

Dictating machine servicemen must have a knowledge of electronic fundamentals in order to maintain and repair sound-amplifying components of this equipment. Mechanical skills are essential in maintenance work on drive mechanisms needed to control the movement of the recording disk or belt.

Dictating machine servicemen are employed throughout the country with concentrations in the large business and commercial centers. Most servicemen work in the sales and service branches of business equipment manufacturers or for their distributors. Typewriter and adding machine servicemen employed by some independent dealers also service dictating machines.

Duplicating and Copying Machine Servicemen (D.O.T. 5-83.125). More than 4,500 men were employed in early 1963 to maintain and repair duplicating and copying machines. These machines are used to make one or more paper copies of printed or written information. The processes used in these machines range widely, from highly complex methods for large volume reproduction to relatively simple methods used in desk-top copiers. The equipment used in a single process may also vary considerably from relatively simple hand-operated devices used to make up to five paper copies to highly complicated electromechanical machines having automatic controls which can duplicate several hundred copies quickly.

When maintaining duplicating or copying machines, the serviceman adjusts, oils, repairs, or replaces parts such as rollers, belts, or gear mechanisms. If the equipment has electric or electronic components, he may check voltages to determine the need for adjustment or replacement of parts. He may also clean the machine so that it will function properly and produce clear copy.

Duplicating and copying machine servicemen employed by some companies also service microfilm equipment used in office operations. The maintenance and repair of paper-handling mechanisms used to speed the movement of documents, including drawings, through the photographic equipment is generally similar to that used in duplicating machines. The men who service this equipment, however, must understand the photographic process used in order to properly aline the optical devices so as to produce clear, sharp negatives.

Most duplicating and copying machine servicemen are employed in the branch sales and service offices of manufacturers or by their distributors.

Servicemen of Postage and Mailing Equipment. More than 3,500 servicemen were employed in early 1963 to maintain and repair the many different types of office machines and equipment needed to handle the billions of pieces of mail sent each year by business firms in this country. These office machines included postage meters, addressing and imprinting machines, and folding and inserting equipment. Data processing machines used for tabulating and imprinting account information are also used in addressing operations where the volume of accounts justifies.

Servicemen who work on these predominantly electromechanical machines install the equipment and adjust, oil, clean, and repair or replace components to keep the equipment in working order. As with most paper handling equipment, rollers and other manipulating devices driven by belt or gear mechanisms are the components most frequently requiring maintenance. Since most postage and mailing equipment is electrically powered and an increasing number of machines use electric or electronic controls, the servicemen must have a basic knowledge of electricity and a knowledge of electronic theory is a decided advantage.

Most men who service postage and mailing equipment are employed in the branch offices of equipment manufacturers.

Training, Other Qualifications, and Advancement

Employers prefer applicants for beginning jobs as business machine servicemen to be under 30 years of age. Men up to the age of 40 may be considered by some employers provided they have had applicable training or experience.

Trainees usually are required to have at least a high school education. Applicants who have not completed high school, however, are accepted by some companies if they can demonstrate superior mechanical aptitude or have had qualifying mechanical or electrical experience. Completion of high school is particularly important after the serviceman has acquired his basic skills and is seeking to work on more complex equipment or promotion to supervisor. Applicants interested in servicing complex electromechanical and electronic equipment may be required to have 1 or more years' training or experience in mechanics or electronics, in addition to a high school education, in order to qualify.

Applicants for trainee jobs frequently must pass one or more tests. Mechanical aptitude is the characteristic most frequently tested although, increasingly, knowledge of basic electricity or electronic fundamentals is also tested. Applicants may also be tested for manual dexterity, general intelligence, and abstract reasoning.

Employers look for applicants who have a pleasant, cooperative manner. Most machine servicing is done in customers' offices and a serviceman's ability to do his work with the least interference with office routine is very important. A neat appearance and ability to converse effectively are also desired characteristics.

Young men entering the business machine servicing field generally begin as trainees and acquire their skills through on-the-job training, work experience, and instruction in manufacturers' training schools. Courses in business machine maintenance and repair, conducted by some State and city vocational schools and by private correspondence schools, are available to trainees and others interested in this field of work.

Business machine servicemen who are hired for work in a manufacturer's branch office are trained to service only the company's line of machines. Independent shops, who look for men who can service many makes of machines, will either hire men with previous experience on one or more types of machines or will give a new man informal training on several different makes. Formal training programs lasting from 2 to 4 years are conducted by some manufacturers and independent dealers.

Men hired as trainees in manufacturers' branch offices usually are sent to company schools for periods lasting from several weeks to several months, depending on the type of machine they will service. They then receive from 1 to 3 years of practical experience and on-the-job training before they are considered fully qualified. During this period, they may occasionally go back to factory schools for additional training. Even after becoming skilled workers, they may return to school for special instruction in new business machine developments. In addition to training in company schools, servicemen at manufacturers' branch offices are encouraged to broaden their technical and general knowledge during their nonworking hours. Many companies provide full or partial tuition grants for a variety of courses at academic institutions, as well as for home-study courses in subjects related to the serviceman's work.

Men in independent shops generally learn the trade by working with experienced servicemen who instruct them in the skills of the trade. Occasionally, men employed by an independent dealer who is authorized to sell and service a manufacturer's products will be sent to the manufacturer's school for training. Generally, however, men in independent shops receive little formal training.

Length of training depends on the kind of shop in which a man is employed. In independent shops, the time required to become a skilled serviceman tends to be somewhat longer than in manufacturers' branches, because of the greater variety of machines and the generally informal nature of the training.

The training period also varies in relation to the complexity of the equipment and the serviceman's ability to become thoroughly skilled in the maintenance, repair, and other activities associated with less complicated business machines, such as typewriters, adding machines, and some photocopy equipment. Calculating machines require from 2 to 3 years of training and experience. Cash register repairmen learn their job in from 2½ to 3½ years, the last 6 months of which are usually spent in the company school. Skilled accounting-bookkeeping machine repairmen generally must have at least 3 to 4 years of training and experience. The first 1 or 2 years may consist of servicing adding machines, calculators, or cash registers, since this is considered valuable background for servicing accounting-bookkeeping machines.

Most machines used in data processing systems contain electrical equipment; many have electronic components. The companies which manufacture and service these machines, therefore, usually require that applicants have some knowledge of electricity or electronics. In qualifying for a job in the maintenance of the complex electronic data-processing machines, college or technical institute courses in engineering are helpful, though not essential. Young veterans who have had electronics training in the Armed Forces are specially desired by employers in this field. Men hired as trainees generally spend their first 2 months in on-the-job training. If they prove satisfactory, they are sent to a company school for a period of from 3 to 6 months. After completing the course, they work under supervision until they acquire enough skill to service and repair on their own. This period usually lasts from 12 to 18 months.

Servicemen frequently have the opportunity to move into sales jobs, where their earnings may be greater. In some cases, service and sales work are combined. Many of these men also have the opportunity for promotion to supervisory jobs, such as foreman or service manager, and to serviceman training or product engineering divisions of their companies, if they show exceptional abilities. Experienced men sometimes open their own repair shops; men who work in the branch offices of some manufacturers are sometimes given sales franchises from the company and become independent dealers.

Employment Outlook

The rapidly growing business machine service field will provide several thousand job opportunities for young men each year during the remainder of the 1960's, and in the longer run. Many of these job opportunities will occur because of the need to replace experienced workmen who retire, die, or transfer to other fields of work.

More than 60,000 servicemen were employed in early 1963, more than double the number working during the early 1950's. The greater employment of servicemen has been due to the increasing use of many types of office machines to do all kinds of clerical work in our expanding commercial and industrial establishments. In recent years, there have been many technical changes in long established types of business machines. For example, electrically driven mechanical equipment, such as typewriters and adding machines, is rapidly taking the place of nonelectrical mechanical machines which do the same work. The increasing use of this more complex equipment, which requires additional maintenance, has also increased the need for business machine servicemen, especially those who have good mechanical ability and a knowledge of electricity or electronics.

Opportunities for jobs in the servicing of electronic business machine systems will be particularly favorable in the years ahead. The use of such machines has expanded greatly in recent years, and demand for this equipment is expected to be even greater in the future.

Business machine servicemen have year-round employment—steadier than that in many other skilled trades. The office machines serviced by these men must be maintained continuously, even when business slackens, since business records must be kept, correspondence carried on, and statistical reports prepared. Men who establish themselves in the business machine service field can expect continuing employment for many years.

Earnings and Working Conditions

Information obtained from a number of employers of business machine servicemen in late 1962 indicated that earnings of experienced servicemen generally ranged from $85 to $130 a week depending on the type of machine they serviced, where they were employed, and their length of service with employers. Wages were lowest for men who repair only typewriters, adding machines, or less-complex types of photocopy equipment; the earnings of these workers usually ranged from $85 to $110 a week. Cash registers, calculators, accounting-bookkeeping machines, and nonelectronic accounting-statistical machines require more skill to repair. Consequently, the men who work on them receive somewhat higher pay rates, generally from $90 to $120 a week. Highest rates are paid to men who service electronic data-processing machines. The most highly skilled electronic computer servicemen were earning as much as $175 a week.

Servicemen trainees begin at wages considerably below these levels; they receive pay increases as they become increasingly skilled during the training period. Starting wages generally ranged from $65 to $75 a week. Men with previous electronics training in the Armed Forces or civilian technical schools generally receive somewhat higher beginning wages.

In addition to their salaries, servicemen in some companies receive commissions for selling supplies or service contracts. Many servicemen employed by manufacturers and independent dealers are covered by group life and hospitalization insurance plans, and pension plans.

Servicing of business machines is cleaner and lighter work than the work in most other mechanical trades. Servicemen generally wear business suits and perform most of their work in the offices where the machines are used. The occupation is comparatively free from the danger of accident. Many of these jobs involve considerable traveling within the area served by the employer. For this reason, many employers require that servicemen own or have the use of a car. The serviceman generally is reimbursed for company use of his car on a mileage basis. Work tools usually are supplied by the employer.

Diesel Mechanics

(D.O.T. 5-83.931)

Nature of Work

Diesel mechanics keep bulldozers, tractors, and other diesel-powered equipment that is widely used on highways, on farms, and in industry, in good operating order. Many diesel mechanics specialize in maintenance and repair of diesel equipment; others specialize in rebuilding engines. Those who do maintenance and repair work perform the periodic cleaning, adjusting, and tuneups that are necessary for efficient operation of diesel engines. When diesel equipment is not operating properly, these mechanics (or their supervisors) determine the cause of the trouble. The mechanics then repair or replace broken or wornout parts or make necessary adjustments. In addition to engine maintenance and repair, diesel mechanics may work on other parts of diesel-powered machinery. For example, some mechanics who repair diesel-powered trucks and buses work on brake and steering systems.

Mechanics who specialize in rebuilding diesel engines that have been operated for many hours or miles, take the entire engine apart, examine all of the parts for defects, and repair or replace defective parts. They then reassemble and adjust the engine.

Many of the men who repair the larger diesel engines, such as those used to run locomotives or electric generating equipment in industry, are specifically trained for this type of work. However, smaller diesel engines such as the type used in buses, trucks, and farm equipment are often repaired by workers who have had previous training or experience in the repair of automobile and truck gasoline engines because the basic parts of the diesel engine and the gasoline engine are similar. (See statement on Automobile Mechanics, p. 405.)

Diesel mechanics use handtools such as pliers, wrenches, and screwdrivers in their work. In addition, they may use complex electronic testing equipment such as the dynamometer, which measures engine power, and mechanical lifting devices such as hoists. They may also use machine tools, such as grinders, drills, and lathes, to make replacement parts for diesel-powered equipment.

Where Employed

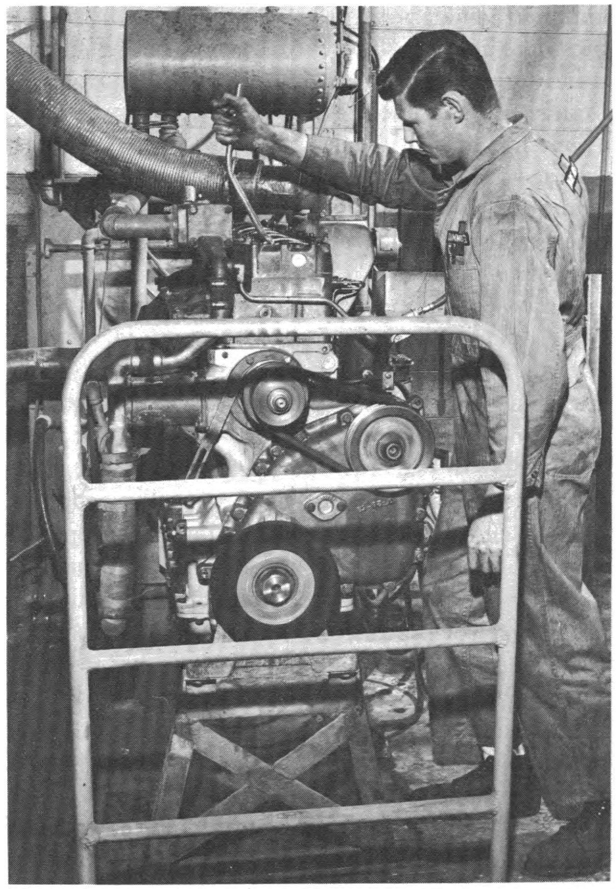
Many diesel mechanics are employed in the service departments of distributors and dealers that sell diesel-powered farm and construction equipment and trucks. Diesel mechanics are also employed by companies and government agencies that repair and maintain their own fleets of diesel-powered equipment. This group includes local and intercity buslines, construction companies, trucking companies, shipping lines, electric powerplants, and Federal, State, and local governments. (Railroads classify workers who repair diesel locomotives as machinists or electricians.)

Because diesel engines are widely used in American industry and commerce, diesel mechanics are employed in all parts of the country. However, large numbers of these workers are employed in California, New York, Illinois, and Texas, which have extensive construction programs and farming activities requiring great numbers of diesel-powered machines.

Training, Other Qualifications, and Advancement

Diesel mechanics learn their skills in several different ways. Most young men who become diesel mechanics first work as mechanics repairing gasoline-powered automobiles, trucks, and buses. They usually start as helpers to experienced gasoline engine mechanics and become skilled by working with them for 3 to 4 years. When employed by firms that use or repair diesel-powered equipment, they are given 6 to 18 months' additional training in the maintenance and repair of such equipment. While learning to fix diesel engines, many of these men find it helpful to take courses in the repair and maintenance of diesel equipment, offered by vocational, trade, and correspondence schools.

Some diesel mechanics, such as those employed by diesel engine manufacturers, learn their trade through formal apprenticeship programs. These programs, which generally last 4 years, give trainees a combination of classroom training and practical experience in fixing the particular types of diesel engines used by their employers. Apprentices receive classroom instruction in blueprint reading, hydraulics, welding, and other related subjects. In their practical training, they learn about valves, bearings, injection systems, starting systems, cooling systems, and other parts of diesel engines.



Diesel mechanic adjusts rebuilt engine

Other young men learn the trade through less formal training programs. Generally, they are hired as trainees by employers who use or repair large quantities of diesel-powered equipment. These trainees are taught to do all kinds of diesel repair jobs by experienced mechanics.

Experienced diesel mechanics employed by companies that sell diesel-powered equipment are sometimes sent to special training classes conducted by diesel engine manufacturers. In these classes, mechanics learn to maintain and repair the latest diesel engines, using the most modern equipment.

Employers generally look for diesel mechanic trainees and apprentice applicants who have a high school education. Young men who have taken courses in physics, machine-shop work, and mathematics are given preference in hiring because they are likely to have a better understanding of the operation of diesel equipment. Courses in automobile repair, which are offered by many high schools and vocational schools, are also valuable. Employers also look for young men who have both mechanical aptitude and an interest in the accurate work required to make precise adjustments of diesel engines.

Many diesel mechanics are required to have their own handtools. A beginner is usually expected to accumulate $100 worth of tools. Experienced mechanics usually have over $500 invested in their tools.

There are several advancement possibilities for capable and experienced diesel mechanics. Those who work for organizations that operate or repair large fleets of diesels, such as buslines or diesel equipment distributors, may advance to supervisory positions of master mechanic or service manager. Some diesel mechanics who are in charge of the engine departments of ships may become marine engineers. To be licensed as a marine engineer by the U.S. Coast Guard, the diesel mechanic must have 3 years' experience in the operation and maintenance of diesel engines on ships, pass a written examination, and meet other requirements.

Employment Outlook

An increasing number of diesel mechanics will be needed in the remainder of the 1960's and in the longer run to maintain and repair the growing number of diesel engines used in American industry, commerce, and agriculture. In addition to the new jobs expected to develop because of the more widespread use of diesel engines, many job openings will result as diesel mechanics retire, die, or transfer to other fields of work.

The use of diesel engines to power farm and construction machinery, electric generators, trucks, buses, trains, and ships has increased rapidly in the past and will continue to increase in the next 10 to 15 years. For example, the number of diesel-powered trucks and buses in the United States doubled between 1956 and 1962. It is expected that the economic advantages of the diesel engine as a source of power will result in its increasing use. Most industries which use diesel engines in large numbers are expected to expand their activities considerably in the years ahead. The Federal Government's vast highway development program will require large numbers of additional diesel-powered bulldozers, cranes, and other construction machinery. Farm mechanization is expected to continue, resulting in the use of many new harvesters, tractors, and other diesel-powered machines. The number of diesel-powered trucks and buses will increase. In addition, diesel-powered taxicabs, which are in limited use today, are expected to be used on a larger scale.

Most new job openings in this field will be filled by mechanics who have had experience in repairing gasoline engines. Companies that are replacing gasoline engine equipment with diesel-powered equipment usually retrain their experienced mechanics to service the diesel equipment. Companies which buy additional diesel engines to meet expansion needs usually hire experienced diesel mechanics. Men who have had school training in diesel repair but no practical experience may be able to find jobs only as trainees.

Earnings and Working Conditions

National wage data are not available for diesel mechanics. However, wage data collected from a few employers and union-management contracts indicate that these workers earned from about $2.50 to $3 an hour in late 1962 and early 1963. Workers who repair diesel locomotives were paid approximately $2.75 an hour in mid-1962.

The weekly work schedule of diesel mechanics ranges from 40 to 48 hours a week. Many of them work nights or on weekends, particularly if they work on buses, or diesel engines used in electric light and powerplants, or other diesel equipment used in serving the public. Diesel mechanics generally receive a higher rate of pay when they work overtime hours, evenings, or weekends.

Many diesel mechanics also receive vacations and holidays with pay. In addition, they may receive health and life insurance benefits which are at least partially paid for by their employers.

Most of the larger repair shops are pleasant places in which to work, but some of the small shops have poor lighting, heating, and ventilation. Occasionally, diesel mechanics who work for buslines or construction companies make repairs outdoors where the breakdowns occur. If proper safety precautions are not taken, there is some danger of injury when repairing heavy parts which are supported on jacks or hoists. In most jobs, the mechanics handle greasy tools and engine parts. It is often necessary for them to stand or lie in awkward or cramped positions for extended periods of time.

Many diesel mechanics belong to labor unions. Some of the unions to which they belong are the International Association of Machinists; the Amalgamated Association of Street, Electric Railway and Motor Coach Employes of America; The Sheet Metal Workers' International Association; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; and the International Brotherhood of Electrical Workers.

Industrial Machinery Repairmen

(D.O.T. 5-83.641)

Nature of Work

The great variety of machinery and equipment used in American industry is kept in good operating condition by industrial machinery repairmen (often called maintenance mechanics). When breakdowns occur, repairmen determine the cause of the trouble and make the necessary repairs. They may completely or partly disassemble a machine in order to repair or replace defective parts. After the machine is reassembled, they make the necessary mechanical adjustments to insure its proper operation.

Much of a repairman's time is spent in preventive maintenance. By regularly inspecting the equipment, oiling and greasing machines, and cleaning and repairing parts, he prevents trouble which could cause a breakdown of the machinery. He also may keep maintenance records of the equipment he services.

The types of machinery on which industrial machinery repairmen work depend to a great extent on the particular industry in which they are employed. For example, in the apparel industry, these skilled workers may be employed to repair industrial sewing machines. They may take sewing machines apart in order to repair belts, adjust treadles, or replace motor bearings. In printing and publishing establishments, skilled industrial machinery repairmen may maintain and repair equipment such as printing presses and folders.

Repairmen often follow blueprints, lubrication charts, and engineering specifications in maintaining and repairing equipment. They may also use parts catalogs to order replacements for broken or defective parts. Occasionally, repairmen may sketch a part which is to be replaced by the plant's machine shop.

Industrial machinery repairmen use wrenches, screwdrivers, pliers, and other handtools, as well as portable power tools. They also may use welding equipment in repairing broken metal parts.

Where Employed

Industrial machinery repairmen work in almost every industrial plant that uses large amounts of machinery and equipment. However, a majority of the more than 100,000 repairmen estimated to be employed in early 1963 worked in the following industries: Food and kindred products, primary metals, machinery, chemicals, fabricated metal products, and transportation equipment. Many repairmen were also employed in the paper, textile, and rubber industries.

Because industrial machinery repairmen work in a wide variety of industrial plants, they are employed in every section of the country. The largest numbers of these workers are in New York, Pennsylvania, California, Ohio, Illinois, Michigan, New Jersey, Massachusetts, and other heavily industrialized States.

Training and Other Qualifications

Most workers who become industrial machinery repairmen start as helpers and pick up the skills of the trade informally through several years of experience. Others learn the trade through for-

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mal apprenticeship programs, and this method of entering the occupation will become more important as machinery becomes more complex. Apprenticeship training usually lasts 4 years and consists of both on-the-job training and related classroom instruction. Apprentices learn the use and care of the tools of the trade, and the operation, lubrication, and adjustment of the machinery and equipment which they will maintain. Classroom instruction is given in shop mathematics, blueprint reading, safety, hydraulics, welding, and other subjects related to the craft.

Mechanical aptitude and manual dexterity are important qualifications for workers in this trade. Good physical condition and agility also are necessary, because industrial machinery repairmen are sometimes required to lift heavy objects or do considerable climbing in order to repair equipment located high above the ground.

Employment Outlook

Many thousands of industrial machinery repairmen will be needed during the 1960's and in the longer run. The anticipated use of more machinery and equipment such as machine tools and assembling equipment in manufacturing industries will result in continued growth in the employment of industrial machinery repairmen. Also, as automatic equipment becomes more widespread and is used to make continuous production lines, breakdowns will lead to greater losses of production and make repair work and preventive maintenance more essential.

In addition to the many new job openings for industrial machinery repairmen that will be created by industrial expansion, a few thousand new workers will be needed annually to replace those who transfer to other fields of work, retire, or die.

Earnings and Working Conditions

Average straight-time hourly earnings of industrial machinery repairmen employed by a wide variety of manufacturing and nonmanufacturing establishments in 79 areas in 1961–62 ranged from $2.15 in Greenville, S.C., to $3.32 in Charleston, W. Va. More than half of the repairmen covered by these surveys earned at least $3 an hour.

Industrial machinery repairmen are not usually affected by seasonal changes in production. During slack periods, when production workers are laid off, repairmen are often retained; many companies use machine repairmen to do major repair and overhaul jobs during such periods.

Because motors and other parts of machines are not always readily accessible, maintenance mechanics may work in stooped or cramped positions close to the floor or from the tops of ladders. Industrial machinery repairmen are subject to common shop injuries such as cuts and bruises. However, accidents have been reduced by the use of goggles, metaltip shoes, metal helmets, and other safety devices. Repairmen must frequently work on dirty and greasy equipment. Lighting and ventilation are usually good.

Most industrial machinery repairmen belong to labor unions. Some of the unions to which these workers belong are the United Steelworkers of America; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the International Association of Machinists; and the International Union of Electrical, Radio and Machine Workers. Most employer-union contracts covering industrial machinery repairmen provide for fringe benefits such as paid holidays and vacations, health insurance, life insurance, and retirement pensions.

Instrument Repairmen

(D.O.T. 5–83.456, .971, .972, .975, and .980)

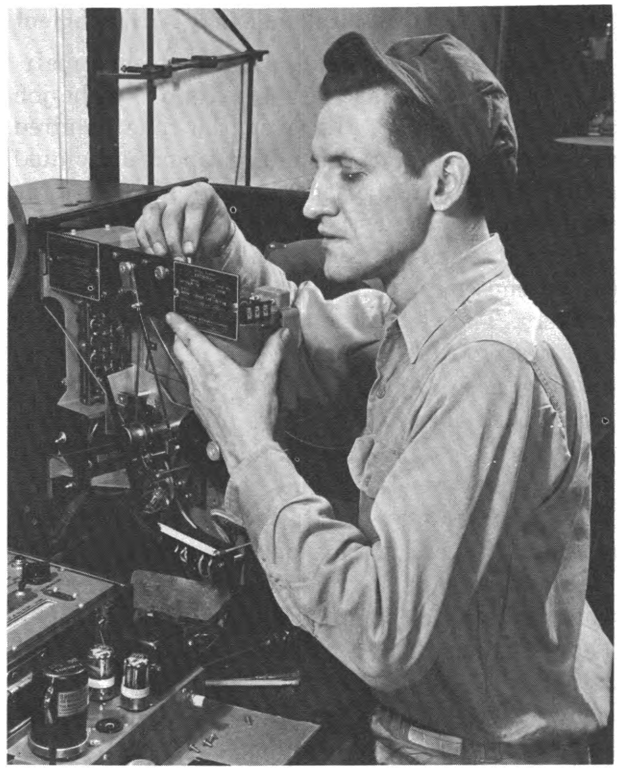
Nature of Work

Instrument repairmen install and service the complex industrial and scientific instruments that make possible precise measurement and control of heat, pressure, flow of liquids, chemical composition, and other variables. Instruments serviced by these workers are used in refining oil, guiding airplanes and missiles, generating electricity, conducting laboratory experiments, manufacturing steel, and in hundreds of other activities. Automatic pilots which keep airplanes on course and voltmeters which measure electricity, are examples of common instruments. A chromatograph which analyzes the components of a gas is an example of a less common, modern instrument. Instrument repairmen (also called instrument mechanics, instrument maintenance men, instrument men, and instrument technicians) sometimes specialize in particular kinds of instruments. For example, they may service either electronic, hydraulic, or pneumatic instruments.

To locate instrument trouble, repairmen first confer with the workers reporting defective instruments to make sure that the trouble is in the instrument and not in other equipment. They visually inspect the instruments for frictional wear, loose parts, corrosion, and other causes of reduced instrument accuracy, or malfunction. They use testing equipment such as pressure and vacuum gages, speed counters, and electrical measuring instruments; for example, voltmeters, ammeters, and potentiometers. They compare the readings shown on such testing equipment with the reading that would be shown if the instruments were operating properly. They also look for electrical leaks, short circuits, and worn wires.

Instrument repairmen repair instruments at the site of the trouble or in specially equipped shops. They may replace worn or damaged parts or make minor repairs such as resoldering loose connections. They use handtools such as screwdrivers, wrenches, and pliers. They also use bench tools such as jewelers' lathes, pin vises, small buffer grinders, and ultrasonic cleaners for small metal parts. In some companies, instrument repairmen operate drill presses, grinders, polishers, and other machine tools to make new parts or to change standard parts to fit particular instruments. When repairing complex electronic instrument systems, repairmen use testing equipment to locate the trouble. The defective component is then replaced. As guides in their work instrument repairmen frequently use instruction books that describe how to install, operate, and maintain instruments. They also use schematic diagrams, assembly drawings, and blueprints. When instruments are reassembled, repairmen give them final checks for accurate operation.

Instrument repairmen also try to prevent trouble. On a regular schedule they look for and correct defects which could cause breakdowns resulting in production losses. They also clean, lubricate, and adjust the instruments.



Instrument repairmen are becoming more important with the increase in use of instruments

Some highly skilled instrument repairmen install and test new instruments and advise operators on how to use and care for them. Sometimes they modernize older instruments by putting in new parts. Other highly skilled instrument repairmen assist scientists and engineers in research and development laboratories. They select and arrange instruments for tests and experiments. They also modify instruments to meet special requirements or to get better results.

Where Employed

More than 60,000 instrument repairmen were employed in early 1963 by gas and electric utilities; by petroleum and chemical plants; by manufacturers of instruments, pulp and paper, metals, rubber, missiles, and automobiles; and by airlines. Several thousand of these repairmen work for Federal Government agencies, mainly the Air Force, Navy, and Army.

Training, Other Qualifications, and Advancement

To become a fully qualified instrument repairman usually takes at least 4 years of on-the-job training and study. However, the time required varies considerably, depending upon individual ability, previous experience and training, and the complexity of the instruments being serviced.

Some instrument repairmen are hired as trainees or chosen to be trainees from among plant workers. They learn their trade either informally by working with experienced men or in formal training programs. In addition to actual work experience, formal training programs include specialized courses such as instrumentation theory, mathematics, and blueprint reading. These courses may be taken by correspondence or at local schools during or after working hours.

Some young men train for instrument repair work in technical institutes and junior colleges. The programs offered by these schools last about 2 years and emphasize basic engineering fundamentals—science and mathematics. As instruments become more complex, technical school training will become increasingly important and young men with this training will have a better chance for advancement.

A few instrument repairmen start as apprentices. Apprenticeship programs, which generally last 4 years, emphasize on-the-job training in repairing and maintaining instruments. Apprentices also study mathematics, physics, electronics, chemistry, blueprint reading, and instrumentation theory.

Armed Forces technical schools also offer training in instrument servicing. Young men who expect to enter the Armed Forces may wish to investigate opportunities for training and work experience while in military service. Skills acquired in this trade in the Armed Forces often qualify men for civilian jobs as instrument repairmen and for other maintenance occupations.

Several instrument manufacturers offer specialized training to experienced instrument repairmen employed by companies which buy their products. These training courses last from 1 week to 9 months, depending upon the number and complexity of the instruments which the workers are learning to service. Courses are given in theory, maintenance, and operation of instruments produced by these manufacturers. Students learn to check instruments step by step. They also learn where to find information about instrument servicing.

Men hired as trainees or apprentices generally must be high school graduates. Courses in algebra, trigonometry, physics, chemistry, electricity, electronics, machine shop practice, and blueprint reading are considered particularly useful. Some employers give tests to applicants to determine their mechanical or electrical aptitude. Building and maintaining a ham radio station, or hi-fi sets, is good experience for a young man planning to become an instrument repairman.

Instrument repairmen who meet the public are expected to be neat in appearance and to get along well with people. Other important qualifications are ability to work alone with little supervision, and good hand-eye coordination which is needed while handling delicate instrument parts.

Very skilled instrument repairmen may advance to positions of increasing responsibility. They can become group leaders or foremen in maintenance departments. They can advance to jobs as service representatives in branch offices of instrument manufacturing companies. Some instrument repairmen become engineering assistants. Because the use of electronic components in instruments will increase, a basic knowledge of electronics will help young men advance in the instrument field.

Employment Outlook

The number of instrument repairmen—more than 60,000 in early 1963—is expected to increase by a few thousand a year during the remainder of the 1960's and in the early 1970's. In addition to job openings resulting from the relatively rapid growth in employment, many job opportunities will arise from the need to replace experienced repairmen who transfer to other lines of work, retire, or die. Deaths and retirements alone will result in about a thousand job openings annually.

More instrument repairmen will be needed because the use of instruments in industry will increase rapidly in the years ahead. Instrumentation will increase as manufacturing becomes more mechanized. As our population increases, more instruments will also be needed to help produce and distribute larger quantities of gas, fuels, and electricity. Our expanding space program will require many kinds of new, complex instruments. More research laboratories with greater numbers of instruments are expected in the future. It is anticipated that hospitals will increasingly use instruments to supply diagnostic information to medical specialists.

Earnings and Working Conditions

Information obtained from a number of union-management agreements in the pulp, paper, and paperboard industry and from several instrument, chemical, and petroleum companies indicates that most instrument repairmen in 1962 earned between $3 and $3.40 an hour. Some highly skilled instrument repairmen earned more than $3.70 an hour. Instrument repairmen employed by Federal Government agencies in Washington, D.C., in 1962 received from $2.95 to $3.29 an hour, about the same rates received by nongovernment repairmen.

Most instrument repairmen work a 40-hour, 5-day week. Those employed in petroleum refineries and chemical plants, which operate 24 hours a day and 7 days a week, may work on any of three shifts or rotate among shifts. They may also be called to work on Sundays and holidays with emergency crews. They receive premium pay for night and holiday work. Most companies provide holiday and vacation pay. Many provide additional benefits, such as life insurance, hospitalization, medical and surgical insurance, sickness and accident insurance, and retirement pensions.

Instrument repairmen may service instruments on factory floors amid noise, oil, and grease. They may also work at benches in quiet, clean, well-lighted repair shops. In some industries, such as chemical, petroleum and steel, repairmen may be required to work outdoors in all kinds of weather. Those employed by instrument manufacturers may have to travel often.

Many instrument repairmen belong to unions, including the International Association of Machinists; International Brotherhood of Electrical Workers; International Brotherhood of Pulp, Sulphite, and Paper Mill Workers; International Chemical Workers Union; International Union of Electrical, Radio and Machine Workers; International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; Oil, Chemical and Atomic Workers International Union; and Utility Workers Union of America.

Where To Go for More Information

For more information on this occupation, write to:

Instrument Society of America,
530 William Penn Pl., Pittsburgh, Pa., 15200.

Scientific Apparatus Makers Association,
20 North Wacker Dr., Chicago, Ill., 60606.

Inquiries concerning positions with the Federal Government should be made at the regional offices of the U.S. Civil Service Commission.

Maintenance Electricians

(D.O.T. 4–97.420)

Nature of Work

Maintenance electricians (electrical repairmen) are skilled workers who maintain and repair many different types of electrical equipment. In addition, they sometimes modify and install electrical equipment. Maintenance electricians work on equipment such as motors, transformers, generators, circuit breakers, controls, and lighting equipment used in industrial, commercial, and public establishments. A large part of a maintenance electrician's work consists of periodically inspecting equipment to detect and repair defective equipment before breakdown occurs. When trouble does develop, the electrician must quickly find and repair the faulty circuit or equipment in order to prevent production losses and inconvenience. In emergencies, it also is his responsibility to advise management whether immediate shutdown of equipment is necessary, or if continued operation would be hazardous.

In his daily work, the maintenance electrician performs many different jobs. For example, he may make repairs by replacing units or parts such as wiring, fuses, transformers, coils, or switches. While doing repair or installation work, the electrician may connect wires by splicing or by using mechanical connectors. He may measure, cut, bend, thread, and install conduits through which wires are run to outlets, panels, and boxes. He also may adjust equipment controls and check and adjust instruments.

In testing electrical equipment and wiring, the maintenance electrician uses such devices as test lamps, ammeters, volt-ohm meters, and oscilloscopes. He sometimes works from blueprints and other specifications when doing repair or installation jobs. He may make mathematical computations relating to load capacities and connections of electrical wiring and equipment. The many different tasks performed by maintenance electricians call for the use of a variety of handtools and power tools, such as pliers, screwdrivers, drills, reamers, and conduit bending and threading tools.

Although all of these craftsmen possess the same basic skills and use the same tools, the nature of their work depends largely on the size of plant and the particular industry in which they are employed. In large plants, for example, these workers may specialize in the maintenance and repair of electrical machinery such as transformers, motors, and welding machines. In small plants, the electrician usually is responsible for all types of electrical work. The maintenance electrician in manufacturing plants usually repairs or maintains the electrical equipment operated in connection with the production of a specific item. For example, steel mills and aluminum plants require a large number of electricians to keep their rolling mills, heavy cranes, and other electrical and electronic equipment in good working order.

Maintenance electrician repairs connections on control panel

In large office buildings or apartment houses, skilled electricians are needed to maintain or repair wiring used in lighting or other electrical equipment and fixtures, and motors and compressors used, for example, in the operation of air-conditioning systems.

Where Employed

About 200,000 maintenance electricians were employed throughout the country in early 1963. More than 110,000 of these craftsmen were engaged in servicing the equipment and machinery used in manufacturing plants. Of these workers about 18,000 were employed by manufacturers of primary metal products; 31,000 in factories producing transportation equipment; 8,000 in chemical and allied products plants; 9,000 in factories producing nonelectrical machinery; 5,000 in plants producing food products; and the remainder were widely distributed among other manufacturing industries.

Of the maintenance electricians in nonmanufacturing establishments, about 35,000 were in transportation, communications, and public utility firms; 8,000 in wholesale and retail trade establishments; and 9,000 in mines. Other nonmanufacturing establishments, and Federal, State, and local governments employed the remainder of these skilled workers.

Maintenance electricians are employed in every State. Large numbers work in heavily industrialized States such as California, New York, Pennsylvania, Illinois, and Ohio.

Skilled workers in this trade have the advantage of being able to transfer to maintenance electrician jobs in many different industries. With some additional training they may also qualify for construction electrician jobs.

Training, Other Qualifications, and Advancement

Maintenance electricians can learn the skills of their trade through formal apprenticeship programs, or by informal on-the-job training, accumulating experience through a series of jobs in their trade. However, training authorities generally agree that apprenticeship programs give the worker more thorough knowledge of the trade and greater job opportunities during his working life.

The apprenticeship program for maintenance electricians usually lasts about 4 years. Apprentices are given on-the-job training and related technical classroom instruction in subjects such as mathematics, electrical and electronics theory, and blueprint reading. Training may include motor repair; wire splicing; commercial and industrial wiring; installation of light and power equipment; installation and repair of electronic controls and circuits; and welding, brazing, and burning.

A young man employed in a plant as a helper to a skilled maintenance electrician may gradually acquire the skills of this craft by observing the skilled worker and working under his instructions. Other electricians learn the trade by working in the maintenance department of a plant and picking up some of the job fundamentals. By moving from job to job over a long period of time, they eventually acquire sufficient experience to qualify as skilled craftsmen.

A young man interested in becoming a maintenance electrician should include courses in mathematics (such as algebra and trigonometry), physics, electricity, and basic science in his high school or vocational school curriculum. Because electrical work is subject to constant change, many experienced electricians must continue to acquire technical knowledge and learn new skills. For example, some maintenance electricians who entered the trade some years ago now must learn basic electronics in order to service the new electronic equipment being introduced in the Nation's industrial establishments, and large commercial and residential buildings.

In selecting apprentice applicants or trainees, employers look for young men who have manual dexterity and who are interested in learning how electrical equipment functions. These young men need good color vision because electrical wires are frequently identified by their different colors. Although great physical strength is not essential, agility and good health are important.

Some maintenance electricians must be familiar with local building codes. In addition, a growing number of cities and counties require these craftsmen to be licensed. A maintenance electrician can obtain a license by passing a comprehensive examination which tests his knowledge of electricity.

Skilled maintenance electricians may become foremen who supervise the work of other maintenance electricians or other maintenance personnel. Occasionally, they may advance to jobs such as plant maintenance superintendent.

Employment Outlook

The number of maintenance electricians jobs is expected to increase by a few thousand each year in the remainder of the 1960's and in the longer run, as a result of the anticipated industrial growth of the country and the long-term trend toward increased use of electrical and electronic equipment. Many of the new job opportunities for these workers will occur in the primary metal, fabricated metal, machinery, and chemical industries. Thousands of additional workers also will be needed to replace electricians who retire, die, or transfer to other fields of work. Retirement and deaths alone may result in about 4,000 new job openings a year during the next 10 to 15 years.

Earnings and Working Conditions

In general, the earnings of maintenance electricians compare favorably with those of other skilled workers. The average straight-time hourly earnings of maintenance electricians in establishments in 78 cities and areas in 1961–62 ranged from $2 in Greenville, S.C., to $3.46 in Birmingham, Ala. In most of the cities surveyed, however, average straight-time hourly earnings for these craftsmen ranged from $2.70 to $3.35.

In establishments which operate an apprenticeship program, apprentices start at about 60 percent of the journeyman's basic hourly pay rate. They receive increases every 6 months, moving up to 85 to 90 percent of the journeyman's rate during the last year of their apprenticeship.

During a single day, an electrician employed in a plant may repair electrical equipment both in a clean air-conditioned office and on the factory floor, surrounded by the noise, oil and grease of machinery. Maintenance electricians may be called upon to climb ladders, work on scaffolds, or work in awkward or cramped positions when installing or replacing electrical equipment and performing other repair jobs.

Because they often work around high-voltage industrial equipment, maintenance electricians must be alert and accurate in carrying out their duties. Errors in wiring installations could have dangerous consequences both to the electrician and the operating employees. The safety principles which are now part of all training programs have greatly reduced the frequency of accidents. Maintenance electricians are taught to use protective equipment and clothing, to respect the destructive potential of electricity, and how to handle small electrical fires.

Various labor unions have maintenance electricians in their membership. Many of these craftsmen are members of the International Brotherhood of Electrical Workers. Among other unions to which maintenance electricians belong are the International Union of Electrical, Radio and Machine Workers; the International Association of Machinists; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; and the United Steelworkers of America. Most of the labor-management contracts covering maintenance electricians provide major benefit programs which may include paid holidays and vacations; hospitalization, medical, and surgical insurance; life insurance; and retirement pensions.

Where To Go for More Information

The National Joint Apprenticeship and Training Committee for the Electrical Industry,
1200 18th St. NW., Washington, D.C., 20036.

The State Supervisor of Trade and Industrial Education or the local Director of Vocational Education in the State and/or city in which a person wishes to receive training will have lists of training institutions.

Millwrights

(D.O.T. 5-78.100)

Nature of Work

Millwrights are skilled workers who move and install heavy industrial machinery and other equipment. These workers must have a thorough knowledge of the complex industrial equipment on which they work because they frequently take apart, move, put together, and aline this equipment. Millwrights use hoists, cranes, jacks, crowbars, wood blocking, and other rigging devices to move heavy equipment. In assembling machinery, millwrights fit bearings, aline gears and wheels, connect belts, and attach motors. In doing this work, they use wrenches, screwdrivers, pliers, hammers, and other handtools. After moving and erecting equipment, millwrights secure it firmly at the new site. To aline and level equipment, they use measuring devices such as micrometers, calipers, squares, plumb bobs, and levels. Millwrights often work from blueprints when preparing platforms on which machines are to be mounted or when laying out or installing plant equipment.

In addition to moving and installing equipment, millwrights sometimes repair and maintain conveyors, cranes, hoists, scaffolds, pumps, blowers, and other industrial equipment. Such work may include oiling and greasing machinery, replacing worn or broken belts, and welding metal parts. Millwrights sometimes work as part of a maintenance team of pipefitters and machinery repairmen in keeping a production line operating.

Where Employed

About half of the estimated 70,000 millwrights employed in early 1963 worked in the steel, paper, machinery, and automobile manufacturing industries. Most of the remaining millwrights were

Courtesy of U.S. Department of the Navy

Millwrights guide section of grinding machine into position

employed in the construction, lumber, chemicals, and fabricated metal products industries.

Some millwrights are employed by companies that specialize in moving and installing industrial machinery on a contract basis. Others work for machinery manufacturers who employ millwrights to install their products in customers' plants.

Millwrights work in every State. However, about half of them are employed in the heavily industrialized States of Michigan, Ohio, Pennsylvania, Illinois, New York, and Indiana.

Training and Other Qualifications

Millwrights learn the trade by picking up the skills informally or through apprenticeship programs. Those workers who pick up the trade work as helpers to skilled millwrights over a period of years until they acquire sufficient knowledge and experience to be classified as skilled workers. However, most training authorities agree that apprenticeship programs give young persons a more thorough preparation for their skilled trade. Apprenticeship programs generally last 4 years. Apprectices in this trade are given shop training in dismantling, moving, erecting, and repairing machinery and other equipment. They are also trained in floor layout, the installation of machinery and other equipment, rough carpentry, welding, and the use of structural steel, wood, and concrete. The apprenticeship program includes related classroom instruction in shop mathematics, blueprint reading, hydraulics, electricity, and safety. Many companies require that apprentice applicants be high school graduates between the ages of 18 and 26.

High school courses in mathematics, mechanical drawing, and machine shop practice are useful to young men interested in becoming millwrights. Because millwrights often put together and take apart complicated machinery, mechanical aptitude is important to young men entering the trade. Strength and agility are other important qualifications for millwright work, which often requires considerable lifting and climbing.

Employment Outlook

Employment of millwrights is expected to increase moderately during the 1960's and in the longer run. The building of new plants, the addition of new machinery, changes in plant layouts, and the maintenance of increasing amounts of heavy and complex machinery and other equipment are factors which are expected to increase employment of millwrights.

The paper and pulp industry is an example of an industry which is expected to expand and further mechanize its operations. Millwrights will be needed in greater numbers in this industry to install, move, and maintain papermaking machines, cranes, conveyors, and other industrial equipment.

In addition to new job openings that will be created by industrial expansion and increased mechanization, several thousand workers will be needed annually to replace millwrights who transfer to other lines of work, retire, or die. Retirements and deaths alone will probably result in about 1,500 to 2,000 job openings annually.

Earnings and Working Conditions

The earnings of millwrights depend mainly upon the city where they are employed and the type of business in which their employer is engaged. Average straight-time hourly earnings of millwrights employed in manufacturing and nonmanufacturing industries in 47 areas surveyed in 1961–62 ranged from $2.39 in Providence–Pawtucket, R.I., to $3.39 in Houston, Tex. More than 50 percent of these workers earned at least $3.20 an hour.

Millwrights employed by companies doing contract installation work and by construction companies usually have higher hourly wage rates than those employed in manufacturing industries. For example, the union minimum average hourly wage rates for millwrights working in the building trades in 53 cities, as of July 1, 1962, ranged from $3.25 an hour in Charlotte, N.C., to $5.05 in New York City.

Wage rates for apprentices generally start at approximately 50 percent of the skilled worker's rate and progress to the full rate by the end of the training period.

Millwrights, most of whom work in factories, ordinarily work year-round. Those who work for construction companies and for companies that manufacture and install machinery, or move and install machinery on a contract basis, may have periods of unemployment between jobs. These workers may frequently be assigned to jobs away from their homes.

The work of millwrights involves certain hazards. For example, there is danger of being struck by falling tools or other objects or by machinery that is being moved. There also is the danger of falling from high work places. In addition, millwrights are subject to the usual shop hazards, such as cuts and bruises. Accidents have been reduced by the use of protective devices, such as safety belts, metal hats, and shoes with metal toes. Millwrights must frequently work on dirty and greasy equipment.

Most millwrights belong to labor unions. Among the unions to which these workers belong are the International Association of Machinists; United Brotherhood of Carpenters and Joiners of America; United Steelworkers of America; International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; International Brotherhood of Pulp, Sulphite and Paper Mill Workers; and the International Union of Electrical, Radio and Machine Workers. Employer-union contracts covering millwrights usually include provisions for benefits, such as paid vacations; hospitalization, medical, and surgical insurance; life insurance; sickness and accident insurance; and retirement pensions.

Television and Radio Servicemen

Nature of Work

Young persons who are interested in the rapidly growing field of electronics and who, for various reasons, will not attend college will find many opportunities for employment as television and radio servicemen. These skilled workers use their knowledge of electrical and electronic parts and circuits to install and repair a growing number of electronic products. Of these, television sets are by far the most prominent; other major electronics products are radios (including home, automobile, and 2-way mobile radios), phonographs, high-fidelity sound equipment, tape recorders, and public address systems. Many servicemen specialize in repairing one kind of equipment, for example, color television sets or automobile radios.

Most of the skilled work done by television and radio servicemen involves diagnosing trouble in equipment and making necessary repairs. Equipment may operate poorly, or break down completely, because of faulty tubes, transistors, resistors, connections, and other components or dirt, moisture and other basic troubles that affect all electronic equipment. When servicemen turn on television sets or other equipment that needs repair, signs of poor performance, e.g., absence, or distortion, of picture or sound, may tell them what is wrong. Their job is to check and eliminate each possible cause of trouble, beginning with the simplest and most common cause—tube failure. In other routine checks, they look for loose or broken connections and for parts that are charred or burned (a sign that too much electricity is passing through the parts).

When simple, routine checks do not locate causes of trouble, servicemen use meters and electronic test equipment to trace the flow of electricity through wires and other parts. They work back from the point where trouble appears, measuring voltage, for example, until an unusual or irregular measurement indicates that part of the set causing trouble. A commonly used meter is the vacuum tube voltmeter. Multimeters, oscilloscopes, signal generators, and other specialized instruments also are used.

On service calls, servicemen advise customers what is wrong with sets and whether sets must be taken to shops for repair. They explain, in general, what must be done to fix sets and estimate the cost of repairs. After sets are repaired on the customers' premises, or returned from shops, servicemen explain what has been done. They may further adjust the equipment to put it in good operating condition.

Work usually done by television and radio servicemen in homes or other places where equipment is used includes making simple electrical checks with a voltmeter, changing tubes, and making adjustments such as focusing the picture or correcting the color balance on a color set. Servicemen who make customer service calls carry tubes and other components that are replaced frequently. Apprentices or less experienced television servicemen may also install antennas on roofs or in attics and run wires from antennas to sets.

Radios and other equipment small enough to be carried to shops by customers usually are repaired by servicemen in the shops. Television sets are repaired in shops when they develop troubles which appear only after sets have been operating for a few hours, or when the troubles can be located only with test equipment ordinarily kept in shops. Television and radio servicemen in shops often refer to wiring diagrams and instruction books (service manuals) that list parts, show connections within sets, and describe causes of trouble associated with unusual symptoms.

Television and radio servicemen use soldering irons, wire cutters, long-nosed pliers, wrenches, screwdrivers and, sometimes, magnifying glasses when they remove, adjust, or replace parts, components, or complete equipment such as car radios. Such work may be time-consuming and may require patience as well as care to avoid damage.

Servicemen use schematic diagram and modern test equipment to check television receiver

Where Employed

Approximately 110,000 television and radio servicemen were employed in early 1963. Many were self-employed. Others worked in local service shops, in stores that sell and service consumer electronic products, and in factories and service branches operated by manufacturers of these products.

Although television and radio servicemen are employed in almost every city, most of them work in large cities where large numbers of television sets, radios, and other electronic equipment are used and manufactured.

Training, Other Qualifications, and Advancement

School training in electronics is required to become a highly skilled television and radio serviceman capable of working on various types of equipment. Vocational or trade school training in electronic subjects has helped many men to qualify as expert television and radio servicemen. Home study (correspondence school) courses also may be helpful. Young men who enter military service may wish to investigate opportunities to get training and work experience in servicing electronic equipment, because such experience often is valuable in civilian electronics work, including television and radio servicing. From 2 to 3 years' combined training and on-the-job experience are required to become a qualified television and radio serviceman. Men without previous training may be hired as helpers or apprentices if they show aptitude for the work or, like the amateur ("ham") radio operator, have a hobby in electronics.

An important part of servicemen's training is provided by many manufacturers and employers who conduct training programs when new models or new products are introduced and as part of a continuing effort to keep servicemen abreast of the latest technical servicing and business methods. Servicemen also keep up with technical developments by studying manufacturers' instruction books and technical magazines covering electronics service work.

Television and radio servicemen need a good background in mathematics and physics in order to understand the equipment they work on. They must know how electronic components work, and why they function as they do. They must be able to understand technical publications. Television and radio servicemen must also be tactful and courteous in dealing with customers.

Other essential qualifications of television and radio servicemen are ability to manipulate small parts and tools, good hand-eye coordination, normal hearing, and good eyesight and color vision. Often these servicemen work with delicate wires and parts that are identified only by color codes.

Servicemen may advance within the service field and become foremen or service managers. They may also be promoted to other higher paid work, such as technical writing, sales engineering, design, and training. Many become owners of independent television and radio service shops. Others may combine a sales and service business.

Young persons interested in advancing to higher level positions as electronic technicians or supervisors can improve their opportunities by taking trade school, correspondence, or technical institute courses, or other types of advanced courses in electronic engineering, television engineering, automatic controls, engineering mathematics, and other subjects related to electronics.

Frequently, television and radio servicemen are able to obtain jobs as electronics mechanics or technicians in manufacturing industries or government service.

Employment Outlook

Television and radio servicemen will continue to have good employment opportunities during the remainder of the 1960's and in the longer run. A few thousand job openings probably will become available each year. Most of these openings will occur because of the growing number of electronic products in the home. Other job opportunities will result from replacement of servicemen who transfer to other jobs, are promoted, or who retire or die.

In 1962, about 9 out of every 10 households had television sets. As population increases, the number of television sets will also increase. In addition, the number of homes with two or more television sets and radios is expected to continue to grow. Greater use of non-entertainment television sets is also expected in business and industry, and schools and other institutions. For example, by using closed circuit television (television receivers showing pictures sent by wire from one or more cameras set up in several different locations), a factory guard can check several places at the same time, or a nurse can watch patients in several different rooms at once. The increasing number of stereo high fidelity sets and small portable transistor radios will also add to the need for competent servicemen.

Most automobiles and many taxicabs and trucks are equipped with radios. Two-way radios are often used by companies to keep in touch with drivers. Growing numbers of motor vehicles thus will result in increasing demand for radio service work.

In recent years, improvements in television sets and radios (such as the use of transistors in place of tubes) have tended to reduce the amount of service this equipment requires, but have increased the care, skill, and technical knowledge needed to repair such equipment. Similar developments in the future may tend to slow down the employment growth expected to result from increasing use of consumer electronic products. In the long run, however, technological developments will increase employment opportunities for those television and radio servicemen who have theoretical as well as practical knowledge of electronic circuits, and know how to use the latest test equipment. The servicing of television sets, radios, and related electronic equipment is a changing field, with constant technological advances. Servicemen will have to keep their training up to date to cope with such changes.

Earnings and Working Conditions

According to limited information, most full time employed skilled television and radio servicemen in 1962 earned from $100 to $115 a week, but some earned as much as $150 a week. Starting pay was about $65 to $75 a week.

Television and radio servicemen employed in local service shops or dealer service departments commonly work a 6-day, 48-hour week. In large shops, including manufacturers' service branches, they usually work a basic 40-hour week. Servicemen often work at night and on weekends, and for more than 8 hours a day. Usually they receive extra pay for overtime or night work.

Television and radio service is performed in shops and homes where working conditions are usually pleasant. Inside (shop) servicemen work at benches provided with stools. Outside servicemen may spend an hour or more a day driving between shops and customers. Some physical strain is involved in lifting and carrying sets. Perhaps the greatest hazard is the risk of falling from roofs while installing antennas. Electrical shock is another hazard, but it has rarely caused serious injury.

Some employers of television and radio servicemen provide paid vacations and holidays after a specified number of years' service. Many also provide or help pay for health and insurance benefits.

Where To Go for More Information

Additional information about jobs in television and radio servicing may be obtained from local servicemen, local dealers who sell and service television sets and other electronic equipment, local television service associations, and manufacturers of television sets who provide training for servicemen. Local vocational schools which offer courses in television or electronics may also provide helpful information.

Watch Repairmen

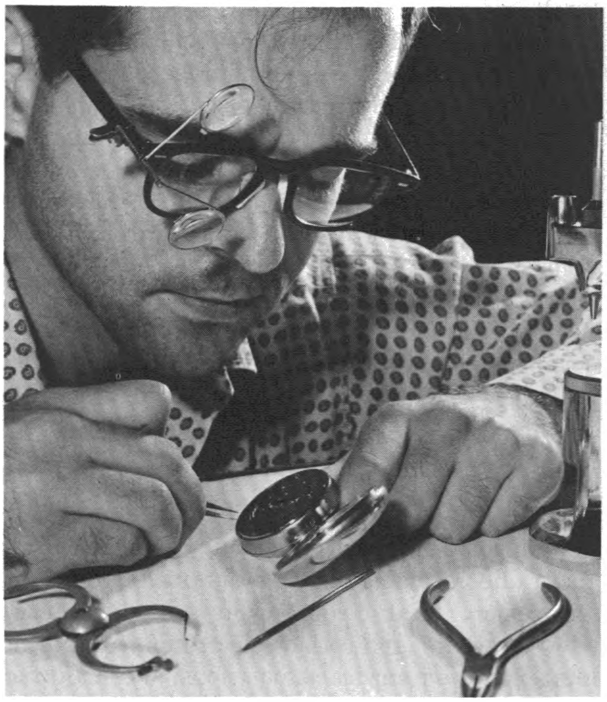
(D.O.T. 4–71.510)

Nature of Work

Watch repairmen or "watchmakers" repair, adjust and regulate watches, clocks, chronometers, and electromechanical and other timepieces. This work is precise and delicate. First, the movement of the watch is removed from the case and the working parts, such as hands, dial, and balance wheel assembly, are examined with the aid of a magnifying eyeglass (called a "loupe"). The repairman may then replace the mainspring, hairspring, balance and other wheels, escapements, pivots, or broken jewels, and adjust improperly fitted wheels and other parts. The parts may also be cleaned and oiled before the dials, hands, crystal, and wristband are reassembled. The repairman must have a keen ability to diagnose accurately the cause of trouble, which may often be very difficult to locate.

The development of interchangeable mass-produced parts has decreased the need for making parts by hand, but factory-made parts sometimes must be adjusted to insure a "true" fit. In their work, watch repairmen use small lathes and handtools such as tiny pliers and screwdrivers. The repair of electric and electronic watches and clocks requires the use of electrical meters and, frequently, an oscilloscope.

Watch repairmen who own or work in retail jewelry stores also do minor jewelry repairing and may sell watches, jewelry, silverware, and other items such as china and lamps. They may also hire and supervise salesclerks, other watch repairmen, jewelers, and engravers; arrange window displays; purchase goods to be sold; and handle other managerial duties. As supervisory and managerial duties increase, the self-employed watch repairman tends to spend less of his time doing benchwork.



Watch repairman inspects pocket watch

Where Employed

Employment of watch repairmen was estimated to be more than 25,000 in early 1963. Most watch repairmen, including several hundred women, worked in retail stores. They were about equally divided between those who were in business for themselves as managers of leased departments in jewelry or department stores or, most often, as proprietors of many of the Nation's 24,000 retail jewelry stores, and those who worked as employees in these stores. Smaller jewelry stores, in particular, are likely to be operated by watchmakers who do their own repair work. Several thousand watch repairmen operated their own trade shops (not usually open to the public) which specialize in watch repairs for retail stores. Wholesale establishments, including importers of complete watch movements, employed a few hundred watchmakers. A few hundred more were employed as watchmakers in other manufacturing plants, such as those which make precision timing instruments and electronic equipment. Several thousand trained watchmakers used their skills in jobs such as instrument maker, repairman, or assembler; laboratory technician; or microminiaturization specialist, in research, development, and engineering laboratories, and in Federal, State, and local government agencies. Some watch repairmen were instructors in vocational schools.

Jewelry stores, which employ most watch repairmen, are widely scattered throughout the country. The heaviest concentration of these stores is in large commercial and industrial centers such as New York City, Chicago, or Detroit.

Training, Other Qualifications, and Advancement

A few States—Florida, Iowa, Indiana, Kentucky, Louisiana, Minnesota, Oregon, Tennessee, and Wisconsin—require watch repairmen to obtain a license to work at the trade. To obtain a license, they must pass an examination designed to test their skill with tools and their knowledge of watch construction and repair. Watch repairmen in all States, however, can demonstrate their ability by passing an examination given by the American Watchmaking Institute. The certificate awarded watch repairmen who pass this examination is widely recognized by employers as an indication of an acceptable standard of skill.

Many young people prepare for this trade through courses given in private watch repair schools. Some enter through public vocational high school or post-high school training. Others are trained in 3- to 4-year watch and clock repairing formal apprenticeship or other on-the-job training programs.

Watch repair schools generally have no specific educational requirements for entrance, although most students are high school graduates. The length of time required to complete the course—usually 18 months to 2 years—is determined by its content, the ability of the individual student, and whether attendance is full or part time. In most watch repair schools, a considerable amount of time is spent taking apart various types of watch movements and reassembling them, truing hairsprings, removing and replacing balance staffs and balance wheels, learning how to use a watchmaker's lathe, and cleaning watches. Some schools offer courses in the repair of unusual types of timepieces, for example, chronographs, calendars, timers, and new-type electric or electronic watches. Students are required to furnish their own hand tools in most schools. Training in instrument repair work in the armed services can be helpful for those who wish to become watch repairmen.

Students or watchmakers interested in employment outside of the jewelry store or trade shop may require some training in related subjects such as basic electronics, instrument repair, or microminiaturization technology. Such training is provided on-the-job in many industries.

Important qualifications for success in this field are mechanical aptitude, finger dexterity, a sensitive touch, good vision (with or without glasses), and patience. For those interested in owning or working in a retail store, salesmanship and a good business sense are required. Such people should also have knowledge of business practices, accounting, and public relations.

Beginners with sufficient funds—about $2,000 to $3,000 is needed to purchase a watch-timing machine and other tools and equipment—may open their own watch repair shops. However, it is the usual practice to work for an experienced watch repairman for a while before starting out in one's own business. Some of the watch repairmen gradually extend their services to include the sale of various items of jewelry and eventually establish retail jewelry stores. Such stores require a sizable financial investment.

Employment Outlook

Employment opportunities will continue to be good through the 1960's and in the longer run for experienced watch repairmen who have established reputations for doing high quality work. Graduates from good watch repairing schools will also have many opportunities for employment, but job openings for other beginners are likely to be somewhat limited, particularly in jewelry stores and trade shops.

A few new jobs will become available, particularly in small cities where business activities are expanding and in newly established shopping centers in the suburbs of large cities. In addition, there will be a growing demand for well-trained but inexperienced watchmakers to use their watch repair skills to work on miniature devices, especially in industries producing scientific instruments and electronic equipment. Nevertheless, most openings will probably continue to arise from the need to replace repairmen who transfer to other fields of work, retire, or die. These openings should number several hundred each year in this small occupation.

Employment of watchmakers is likely to rise slightly over the long run. Factors that will tend to increase the demand for watchmakers will be partially offset by other factors that will operate to decrease it. For example, the number of watches in use will undoubtedly rise as population and family incomes increase. In addition, the trends toward owning more than one watch, wearing watches as costume jewelry, and buying more children's watches are expected to continue. The popularity of small watches, which need repair more frequently than large ones, and the introduction of more complicated timepieces—chronographs, calendar watches, and self-winding watches—will also help maintain a large volume of repair work. On the other hand, sales of inexpensive watches which can be replaced at a price as low as the cost of repairing them will probably continue to grow; competition from persons employed in other fields who repair watches in their spare time is expected to continue; and new types of watches are being developed which will require less repair. In addition, electric and electronic battery-powered watches, recent innovations, may eventually reduce the amount of watch repair work. Increased demand for miniaturized consumer goods such as transistor radios, television sets, and hearing aids, and the trend in the missile, aircraft, instrument, and computer industries towards smaller and lighter weight components and assemblies, is expected to result in further increase in the demand for individuals with watchmaker training.

Earnings and Working Conditions

Salaries of most beginning watchmakers ranged from about $60 to $90 a week in early 1963, depending on individual ability and the type and place of employment. Experienced journeymen employed in retail stores generally received from $90 to $150 for a 40-hour week, and supervisors or managers of large repair departments earn up to $200 a week. In addition, watchmakers in retail stores sometimes receive commissions based on sales of watches as well as other items in the store. Watch repairmen who are in business for themselves usually earn considerably more than those working for a salary. Earnings of the self-employed depend on the amount of repair work done and, in the case of watchmakers who own retail jewelry stores, the volume of sales.

Watchmakers frequently work longer than the standard 40-hour week. Those who are self-employed or located in small communities usually work a 48-hour week or as long as necessary. There may be some tendency toward eye strain, but the work involves little physical exertion. This light, sedentary work is frequently recommended to certain handicapped and disabled workers.

Where To Go for More Information

Information on schools giving training courses acceptable to the trade, as well as on watch repairing as a career, may be obtained from:

American Watchmakers Institute,
18465 James Couzens Highway, Detroit, Mich., 48235.

Information on watch repair job opportunities in retail stores can be obtained from:

Retail Jewelers of America, Inc.,
711 14th St. NW., Washington, D.C., 20005.

MACHINING OCCUPATIONS

Almost every product of American industry contains metal parts or is manufactured by machines made of metal parts. Many of these metal parts are made by machining workers, who make up the largest occupational group in the metalworking trades. In early 1963, more than a million workers were employed as all-round machinists, machine tool operators, tool and die makers, instrument makers, setup men, and layout men.

Machining workers are one of the most important groups of workers in the labor force because they shape many of the tools and much of the equipment used to produce other products. They use machine tools to form metal to desired shapes and sizes with great accuracy. Metal parts which must fit together exactly are first shaped by casting, forging, rolling, or stamping, and then finished to more precise measurements by machining.

Nature of Work

The principal job of machining workers is to operate machine tools. A machine tool is a power-driven machine which holds firmly both the piece of metal to be shaped and a cutting instrument, or "tool," and brings them together so that the metal is cut, shaved, ground, or drilled. In some cases, the cutting tool is moved and the metal is held stationary; in others, the metal is moved against a stationary tool.

The most common types of machine tools are lathes, grinding machines, drilling machines, milling machines, cutoff machines, polishing and buffing machines, boring mills, shapers, and planers. Lathes turn and shape metal against a sharp cutting tool. Grinding machines smooth metal parts by means of power-driven abrasive wheels. Boring mills and drilling machines make holes in metal. Milling and broaching machines cut or remove excess metal with tools which have several cutting heads. Shapers and planers are machine tools which produce flat surfaces.

Accuracy is very important in metal machining work. Metal parts sometimes are machined to within 10 millionths of an inch. Metal products usually are made of separate parts which must be interchangeable and thus easily assembled by mass-production processes.

Machining workers follow directions generally given in drawings or blueprints that specify exact dimensions of finished parts. They frequently use micrometers and other precision-measuring instruments to check the accuracy of their work against these specifications.

Besides operating machine tools, skilled machining workers also lay out and assemble metal parts. They use chisels, scrapers, files, and other small handtools in chipping, filing, and polishing the parts so that they will fit together exactly.

The all-round machinist is a skilled worker who can operate most types of machine tools. The largest number of machining workers are skilled and semiskilled machine tool operators who run lathes, drilling machines, milling machines, grinders, and other machine tools. Unlike all-round machinists, machine tool operators commonly work with only one kind of machine tool.

A highly skilled machining job is that of tool and die maker who specializes in making dies for use with presses and die casting machines, devices to guide drills into metal, and special gages to determine whether the work meets specified tolerances. Another highly skilled machining job is that of instrument maker who machines, with great accuracy, instrument parts made of metal or other materials. He often assembles and tests instruments.

Setup men and layout men are skilled specialized workers employed in plants which produce large amounts of metal products. Setup men adjust machine tools so that semiskilled machine tool operators can run the machines. Layout men mark machining directions on metal so that an operator can perform the proper machining operations. (Detailed discussions of the types of work

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performed by workers in each of these machining occupations are presented later in this chapter.)

Since continuous attention is required when machine tools are in operation, the work may be rather tedious, especially on simple and repetitive machining jobs. However, where the work is varied and complex and standards of accuracy are high, a worker can experience the satisfaction which comes to a capable and conscientious craftsman in a highly skilled trade.

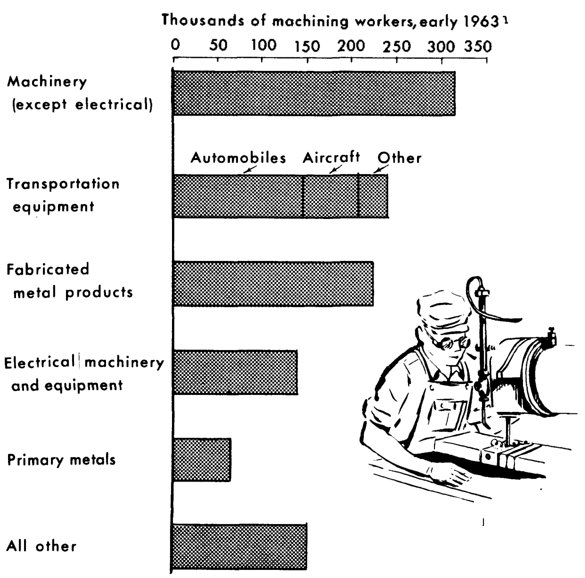
Location of Machining Work

An estimated 570,000 machine tool operators; 360,000 machinists, layout men, and instrument makers; 150,000 tool and die makers; and 40,000 setup men were employed in machining jobs, in early 1963. More than four-fifths of these workers were employed in the metalworking industries, mostly in plants that manufacture machinery, transportation equipment such as automobiles and aircraft, fabricated metal products, and electrical machinery and equipment. (See chart 29.)

Many thousands were employed in nonmetalworking establishments such as repair shops of railroads and maintenance shops of factories which make textiles, paper, glass, or chemicals.

CHART 29

INDUSTRIES EMPLOYING MACHINING WORKERS ......



[1] Estimated.

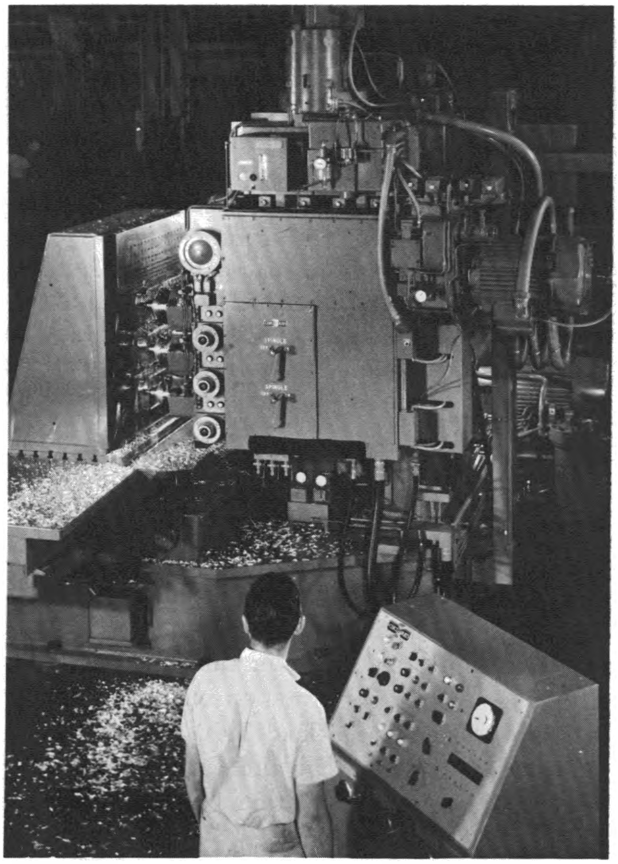
A small number worked in industrial and university research laboratories and shops that fabricate models of new products.

Machining workers are employed in every State and in almost every city in the country. More than half of all machining workers are employed in California, Ohio, New York, Michigan, Illinois, and Pennsylvania. Other States with large numbers of machining workers are: New Jersey, Massachusetts, Indiana, Connecticut, Wisconsin, and Texas. Most instrument makers are employed in New York City, Chicago, and a few other large cities.

Training, Other Qualifications, and Advancement

The common method of entering skilled machining occupations is through apprenticeship—a period of formal on-the-job training during which the new worker learns all the aspects of his trade. He is taught to operate machine tools, and to use handtools and measuring instruments. In addition to shop training, the apprentice is given classroom instruction in blueprint reading, mathematics, and other related subjects. In choosing apprentices, employers usually prefer young men who have a high school or trade school education. Some companies use aptitude tests to determine whether apprentice applicants have the necessary mechanical ability and the temperament suited to perform this exacting work. Machining workers must also have good vision, and superior judgment of depth and distance.

Most machine tool operators and some machinists, tool and die makers, and instrument makers have "picked up" the skills of their trade informally through experience on several jobs. They generally start in the less skilled machining jobs and gain "know-how" while working with experienced craftsmen. They gradually advance to more skilled jobs as they acquire experience and knowledge. Some of these workers improve their qualifications for the more skilled trades by taking courses in blueprint reading, electronics, hydraulics, and shop mathematics in vocational schools. An increasing number of machining workers are participating in intensive training programs provided by machinery manufacturers. These programs train machining workers to



Machine tool operator monitors numerically controlled milling machine

maintain and repair the numerically controlled machine tools being installed in a growing number of establishments.

Because machining work is not physically strenuous, women are sometimes employed as machine tool operators. Relatively few women, however, are employed in skilled machining occupations.

Skilled machining workers have several advancement opportunities. For example, many can advance to supervisory positions such as foreman. Individuals with extensive machine shop experience may, with specialized training, become programers who prepare the coded paper tapes used to operate numerically controlled machines. Tool and die makers and instrument makers can advance to technical positions such as tool designer. Skilled machining workers also can open their own tool and die shops or machine shops.

Employment Outlook

There will be thousands of job openings for machining workers in the remainder of the 1960's and in the longer run. Most of these openings will result from the need to replace workers who transfer to other fields of work, or who retire or die.

A moderate increase in the number of machining workers is expected to result from the growing demand for consumer products such as appliances, and for industrial goods such as machinery. Employment opportunities for machining workers also will be favorably affected by defense spending. Many military products will be new products, involving new metals or alloys and requiring special machining skills.

Employment in the individual machining occupations is expected to increase at different rates. For example, the number of instrument makers is expected to increase rapidly while only a moderate rise is expected in the employment of machine tool operators. Technological changes are expected to slow the employment growth of most machining occupations.

A new technological development is the use of automated machining lines in which machine tools are linked together for automatic production operations. Cutting speeds are also increasing. Increasing mechanization and growth in nonmetalworking industries have expanded needs for maintenance machinists who keep mechanical equipment in good condition. Machining workers employed in maintenance shops tend to have fairly steady employment over the years, because the amount of work they must do is not wholly dependent on changes in the volume of production. Maintenance work continues even when production declines.

The numerical control of machine tools is another technological advance which will affect machining workers. The use of numerically controlled machine tools broadly involves the following sequence of operations: Engineers or draftsmen translate part dimensions and tolerances, cutter shapes and sizes, cutting paths and sequences, and other data into numbers or codes representing numbers. These numbers are punched on tapes or cards which are inserted into electronic devices that translate numbers into motions or actions such as drilling or cutting. The machine tool operator simply installs the tool, inserts and removes the workpiece, and changes the tapes or cards.

Specific future effects of numerically controlled machine tools on the employment of machining workers could not be determined in early 1963. However, numerical controls may greatly simplify the jobs of many machining workers and increase their production efficiency.

In addition to the moderate rise expected in machining employment, the need to replace experienced workers will create thousands of openings. Retirements and deaths alone will provide about 25,000 job openings annually. Replacements will be a particularly important factor in the skilled machining occupations, which have a relatively high proportion of older workers. Also, in the less skilled occupations, shifting into other occupations is fairly common, and many openings will arise in this way.

Earnings and Working Conditions

The earnings of skilled machining workers generally compare favorably with those of other skilled industrial workers. Tool and die makers and instrument makers are the highest paid workers in the machining group, and among the highest paid skilled workers in manufacturing. Earnings information for most of the individual machining occupations is presented later in this chapter.

Most machine shops are fairly clean, well lighted, and free from dust. Safety instructions are an important part of job training. Because they work with high speed machine tools and sharp cutting instruments, workers in these occupations need good safety habits. Persons working around machine tools are prohibited from wearing loose fitting clothing and frequently wear protective goggles.

Machining work is not physically strenuous. The machine tools do the actual cutting while the machining worker sets the machine, watches the controls, and checks the accuracy of the work. The workers, however, usually stand at their jobs most of the day and move about frequently.

Companies that employ machining workers generally provide paid holidays and paid vacations. Life insurance, hospitalization, medical and surgical insurance, sickness and accident insurance, and pensions also are often available to machining workers.

The great majority of machining workers are members of unions. Among the labor organizations in this field are the International Association of Machinists; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the International Union of Electrical, Radio and Machine Workers; the United Steelworkers of America; and the Mechanics Educational Society of America.

Where To Go for More Information

The National Machine Tool Builders Association, 2139 Wisconsin Ave., Washington, D.C., 20007—whose members build a large percentage of all machine tools used in this country—will, on request, supply information on career opportunities in the Machine Tool Industry.

The National Tool, Die and Precision Machinery Manufacturers Association, 907 Public Square Building, Cleveland, Ohio, 44113, offers information on apprenticeship training, including Recommended Apprenticeship Standards for Tool and Die Makers, certified by the U.S. Department of Labor's Bureau of Apprenticeship and Training.

Many local offices of the State employment service, affiliated with the U.S. Employment Service, offer free aptitude testing to persons interested in determining their capacity to acquire the skills necessary for the all-round machinist and tool and die making trades. The State employment service also refers applicants for apprentice programs to employers. In many communities, applications for apprenticeship are also received by labor-management apprenticeship committees.

Apprenticeship information also may be obtained from the following international unions (which have local offices in many cities):

International Association of Machinists,
1300 Connecticut Ave. NW., Washington, D.C., 20036.

International Union, United Automobile, Aerospace and Agricultural Implement Workers of America,
8000 East Jefferson Ave., Detroit, Mich., 48214.

All-Round Machinists

(D.O.T. 4–75.010 and .120)

Nature of Work

The all-round machinist is a skilled metal worker who makes metal parts with machine tools. A machinist can set up and operate most types of machine tools. His wide knowledge of shop practice and the working properties of steel, cast iron, aluminum, brass, and other metals, and his understanding of what the various machine tools do, enable him to turn a block of metal into an intricate part meeting precise specifications.

Variety is a key characteristic of the work of an all-round machinist. He plans and carries through all operations needed in turning out machined products. He may switch from one kind of product to another. An all-round machinist selects the tools and material required for each job and plans the cutting and finishing operations in order to complete the finished work according to blueprint or written specifications. He makes standard shop computations relating to dimensions of work, tooling, feeds, and speeds of machining. He often uses precision-measuring instruments such as micrometers and gages to measure the accuracy of his work to thousandths and even millionths of an inch. After completing machining operations, he may finish the work by hand, using files and scrapers, and then assemble the finished parts with wrenches and screwdrivers. The all-round machinist also "heat treats" cutting tools and parts to improve machinability.

Machinists employed in maintenance departments to make or repair metal parts of machines and equipment also have a broad knowledge of mechanical principles. They sometimes adjust and test the parts they have made or repaired for a machine.

All-round machinist operates milling machine

Where Employed

Almost every factory using a substantial amount of machinery employs all-round machinists to keep its mechanical equipment operating. However, most of the more than 300,000 all-round machinists employed in early 1963 worked in the following industries: Machinery, other than electrical; fabricated metal products; primary metals; electrical machinery; and transportation equipment. Among the other industries employing substantial numbers of these workers were the railroad, chemical, food processing, and textile industries. The Federal Government also employed all-round machinists in Navy yards and other installations.

Some all-round machinists worked in the production departments of metalworking factories where large quantities of identical parts are produced; others worked in machine shops where a limited number of varied products were made.

An important advantage of this occupation is that machinists can be employed in almost every locality and industry because their skills are required to maintain all types of machinery.

Training, Other Qualifications, and Advancement

According to most training authorities, a 4-year apprenticeship is the best way to learn the machinist trade. Many machinists, however, have qualified without an apprenticeship by picking up the trade over years of varied experience in machining jobs. Several companies have training programs which qualify some of their employees as machinists in less than 4 years.

A young person interested in becoming a machinist should be mechanically inclined and temperamentally suited to do highly accurate work that requires concentration as well as physical effort. A high school or vocational school education is desirable preparation for machinist training and is required by many employers. Courses in mathematics and physics and some knowledge of electronics and hydraulics may be helpful both during and after apprenticeship training. Some companies require their experienced machinists to take courses in mathematics and electronics, at company expense, so these workers can operate the numerically controlled machine tools coming into greater use. In addition, equipment builders generally provide training in the electrical, electronic, hydraulic, and mechanical aspects of machine-and-control systems.

A typical machinist apprentice program lasts 4 years and consists of approximately 8,000 hours of shop training and about 570 hours of related classroom instruction. Shop training includes the learning of proper machine speeds and the operation of the various types of machine tools. The apprentice also is taught chipping, filing, hand tapping, dowel fitting, riveting, and other hand operations. In the classroom, the apprentice studies blueprint reading, mechanical drawing, shop mathematics, and shop practices.

A machinist who has just finished his apprentice training often is assigned the job of operating a single type of machine tool. With additional experience, he may be assigned jobs requiring him to operate several types of machine tools as well as to perform hand operations. Some journeymen machinists, however, remain machine tool specialists and do highly skilled work with one type of machine tool.

Numerous promotional opportunities are available to all-round machinists. Many advance to foreman of a section or to other supervisory jobs. With additional training, others may become tool and die makers or instrument makers. A skilled machinist has excellent opportunities to advance into other technical jobs in process planning, machine programing, and tooling. Machinists can also open their own machine shops.

Employment Outlook

A moderate increase in the number of all-round machinists is expected during the remainder of the 1960's and in the longer run, as a result of the anticipated expansion of metalworking activities. However, most job openings will arise from the need to replace experienced machinists who transfer to other fields of work, or who retire or die. In this large occupation, retirements and deaths alone will result in about 7,000 job openings annually.

The employment of machinists is expected to increase, especially in maintenance shops, as industries continue to use a greater volume of complex machinery and equipment. Skilled maintenance machinists are needed to prevent costly breakdowns in highly mechanized plants where machine tools often are linked together by transfer equipment. In such plants, a breakdown of one machine may stop many other machines.

Earnings and Working Conditions

The earnings of all-round machinists compare favorably with those of other skilled factory workers.

Maintenance machinists employed in various manufacturing industries in 62 areas surveyed in 1961–62 received average straight-time hourly earnings ranging from $1.96 in Greenville, S.C., to $3.49 in Birmingham, Ala. Average straight-time hourly earnings of maintenance machinists employed in the following cities were:

Atlanta	$2.81
Birmingham	3.49
Chicago	3.28
Cincinnati	3.01
Detroit	3.37
Greenville	1.96
Houston	3.21
Los Angeles–Long Beach	3.26
Milwaukee	3.32
Minneapolis–St. Paul	3.18
New York	3.27
Portland, Oreg.	3.18
Rockford, Ill.	2.78
San Francisco–Oakland	3.38
Worcester	2.75

Machinists must follow strict safety regulations when working around high-speed machine tools. The greater use of safety goggles and other protective devices in recent years has reduced the accident rate for these workers.

See introductory section of this chapter for a discussion of nonwage benefits received by machining workers, unions that organize these workers, and where to go for more information.

Machine Tool Operators

(D.O.T. 4-78.000 through .589 and 6-78.000 through .589)

Nature of Work

Machine tool operators shape metal to precise dimensions by the use of machine tools. Although some operators can operate several tools, most can operate only one or two machine tools. Many operators are essentially machine tenders who perform simple, repetitive operations which can be learned quickly. Other machine tool operators, however, are much more skilled and can perform complex and varied machining operations.

The work of skilled machine tool operators is similar to that of all-round machinists, except that often it is limited to a single type of machine and involves little or no hand fitting or assembly work. (By contrast, all-round machinists can operate almost every machine tool.) The skilled machine tool operator plans and sets up the correct sequence of machining operations in accordance with blueprints, layouts, or other instructions. He adjusts speed, feed, and other controls and selects the proper cutting tools for each operation. Adjustments may be necessary during machining operations, and changes in setup also may be required. Therefore, the skilled operator must be able to use all the special attachments of his machine. Upon completing his work, he checks measurements with micrometers, gages, and other precision-measuring instruments to see whether they meet specifications. The skilled machine tool operator also may select cutting and lubricating oils used to cool metal and tools during machining operations.

The majority of machine tool operators are much less skilled than the operators described above. A typical job of a semiskilled operator is to place rough metal stock in a machine tool on which the speeds, feeds, and operation sequence have already been set by a skilled worker. The operator watches the machine and calls his supervisor when anything unusual happens. Special, easy-to-use gages help him to measure work quickly and accurately. The operator with limited training may make minor adjustments to keep his machine tool operating, but he depends on skilled machining workers for major adjustments.

Lathes, drill presses, boring machines, grinding machines, milling machines, and automatic screw machines are among the machine tools used by machine operators. Both skilled and semiskilled operators have job titles based upon the kind of machine they operate, such as engine lathe operator, milling machine operator, and drill press operator.

Where Employed

Machine tool operators are primarily employed in factories that manufacture fabricated metal products, transportation equipment, and machinery in large quantities. Skilled machine tool operators work in production departments, maintenance departments, toolrooms, and job shops. Because of their limited training, few semiskilled operators work in maintenance departments or in job shops.

Training, Other Qualifications, and Advancement

Most machine tool operators learn their skills on the job. A new worker usually starts by observing a skilled operator at work. When the learner first operates a machine, he is supervised closely by a more experienced worker. The new worker learns how to use measuring instruments and to make elementary computations needed in shop work. He gradually acquires experience and learns to operate a machine tool, read blueprints, and plan the sequence of machining work.

Individual ability and effort largely determine how long it takes to become a machine tool operator. Semiskilled machine tool operators generally learn their jobs within a few months. A period of 1½ to 2 years of on-the-job training and experience generally is required to become a skilled machine tool operator. Some skilled machine tool operators' jobs are filled by men who have completed machinists' apprenticeships. Some companies have formal training programs to acquaint new employees with the details of machine tool operation and machining practice.

Although there are no special educational requirements for semiskilled operator jobs, young persons seeking these jobs can improve their job opportunities by completing courses in mathematics and blueprint reading. In hiring unskilled operators, employers often look for persons who have mechanical aptitude and some experience working with machinery.

Skilled machine tool operators can advance to jobs as all-round machinists and tool and die makers. They may also advance to process planning, machine programing, and maintenance jobs.

Employment Outlook

Employment of machine tool operators is expected to rise moderately during the remainder of the 1960's and in the longer run. Most job opportunities, however, will arise from the need to replace experienced workers who transfer to other jobs, retire, or die. Retirements and deaths alone may result in about 12,000 job openings each year.

Technological developments will affect both the number and skill requirements of machine tool operators. The continued development and use of faster and more versatile automatic machine tools will result in greater output per operator. Future widespread use of numerically controlled machine tools would also slow employment of machine tool operators. (See discussion on page 435.) Workers with thorough backgrounds in machining operations, mathematics, blueprint reading, and good working knowledge of the properties of metals will be better able to adjust to future technological changes and to transfer to new jobs in the machining field.

Earnings and Working Conditions

Machine tool operators are paid on an hourly rate or incentive basis, or on the basis of a combination of both methods of wage payments. Operators employed in production shops are usually classified as class A, class B, and class C operators, according to their skill level. Class A operators are the most highly skilled and usually are paid the highest rates. In 21 selected areas surveyed in March–June 1962, class A machine tool operators had average straight-time hourly earnings ranging from $2.43 in Dallas, Tex., to $3.26 in St. Louis, Mo. The average earnings of class B operators in a majority of the areas were at least 30 cents an hour lower than the earnings of class A operators. Similarly, the hourly earnings of class C operators were at least 30 cents below the level of class B operators in a majority of the areas. Average straight-time hourly earnings for class A drill press, engine lathe, and milling machine operators were as follows:

	Drill press operators, radial, class A	*Engine lathe operators, class A*	*Milling, machine operators class A*
Baltimore	$2.85	$2.49	$3.03
Boston	2.79	2.73	2.80
Buffalo	------	2.68	2.76
Chicago	2.93	2.98	2.96
Cleveland	2.94	2.83	3.02
Dallas	2.24	2.50	2.43
Denver	2.93	------	3.21
Detroit	3.23	3.30	3.29
Hartford	2.71	2.71	2.80
Houston	2.62	2.88	2.77
Los Angeles–Long Beach	2.80	2.91	2.82
Milwaukee	3.04	2.92	3.06
Minneapolis–St. Paul	2.71	2.71	2.78
Newark–Jersey City	2.91	2.78	2.81
New York City	2.83	2.79	2.82
Philadelphia	2.76	2.86	2.78
Pittsburgh	2.77	3.11	3.02
Portland (Oreg.)	2.95	3.01	3.01
St. Louis	2.85	------	-------
San Francisco–Oakland	3.19	3.14	-------
Worcester	2.43	2.54	2.61

Machine tool operators are required to wear protective goggles and to avoid wearing loose-fitting garments when working around high speed machine tools. Increasing emphasis upon these and other safety regulations has reduced the accident rate for these workers.

See introductory section of this chapter for a discussion of nonwage benefits received by machining workers, unions that organize these workers, and where to go for more information.

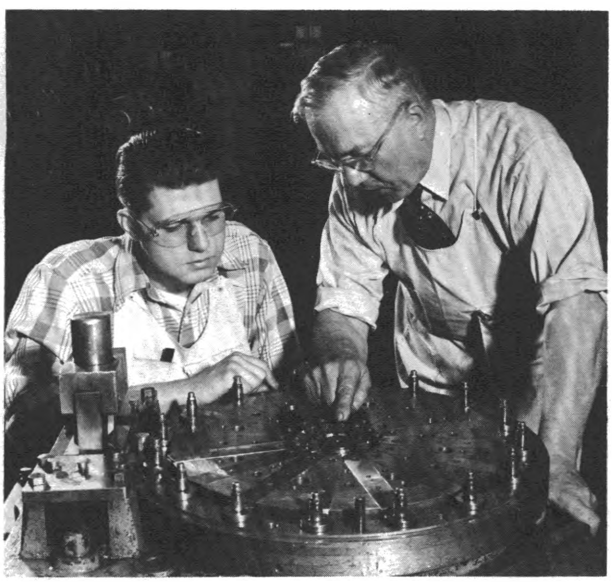
Tool and Die Makers

(D.O.T. 4-76.010, .040, and .210)

Nature of Work

Tool and die makers are highly skilled, creative workers whose products—tools, dies, and special guiding and holding devices—are the basis of mass production in metalworking industries. Tool makers specialize in producing jigs and fixtures (which are devices required to hold metal while it is being shaved, stamped, or drilled). They also make gages and other measuring devices which are used in manufacturing precision metal parts. Die makers construct metal forms (dies) which are used in stamping and forging operations to shape metal. They also make metal molds used in die-casting and in molding plastics. Tool and die makers also repair dies, gages, jigs, and fixtures. Some tool and die makers help design tools and dies.

In comparison with most other machining workers, tool and die makers have a broader knowledge of machining operations, shop practices, mathematics, and blueprint reading, and can work to closer tolerances and do more precise handwork. Tool and die makers use almost every type of machine tool and precision-measuring instrument. They work with all metals and alloys commonly used in manufacturing.



Apprentice receives pointers from experienced tool and die maker

Where Employed

More than 150,000 tool and die makers were employed in early 1963. The largest numbers were employed in plants making industrial, construction, and farm machinery and equipment. The automobile, aircraft, and other transportation equipment industries also employed large numbers of tool and die makers. Several thousand of these craftsmen worked in small tool and die jobbing shops, making tools, dies, and other machine tool accessories for use in metalworking factories. Companies manufacturing electrical machinery and fabricated metal products were other important employers of tool and die makers. Many nonmetalworking industries also employed tool and die makers.

Training, Other Qualifications, and Advancement

Tool and die making requires several years of varied training and experience which can be obtained through formal apprenticeship or equivalent on-the-job training. Since this work is highly skilled, persons planning to enter the trade should have a good working knowledge of mathematics and physics as well as considerable mechanical ability, finger dexterity, and a liking for painstaking work. In selecting apprentices, most employers prefer young men with high school or trade school education. Some employers test apprentice applicants to determine their mechanical aptitudes and their abilities in mathematics.

A tool and die apprenticeship ordinarily lasts 4 or 5 years. Most of the time is devoted to practical shop training, but some classroom work also is part of the training program. During shop training, the apprentice learns to operate major machine tools, such as lathes and milling machines. He learns to use handtools in fitting and assembling tools, gages, and other mechanical equipment. Tool and die maker apprentices study heat treating and other metalworking processes. Classroom training in shop mathematics, shop theory, mechanical drawing, tool designing, and blueprint reading also is given to apprentices. After apprenticeship, several years' experience often is necessary to qualify for more difficult tool and die work. Some companies have separate apprenticeship programs for toolmaking and diemaking.

Many metal machining workers have become tool and die makers without completing formal apprenticeships. These men, after years of experience as machine tool operators or as machinists and after vocational or correspondence school training, have developed into all-round workers who can skillfully perform almost any metal machining operation, including tool and die making.

The increasing complexity of modern machinery and metalworking equipment is raising the technical requirements for tool and die making. A knowledge of mathematics, the basic sciences, electronics, and hydraulics will give young persons entering this occupation greater opportunities to further their careers.

An early investment in thorough training for this occupation may lead to better paying jobs in the future. Men who have had tool and die training often advance to supervisory and administrative positions in industry. Many tool and die makers become tool designers. Some open their own tool and die shops.

Employment Outlook

An increasing number of tool and die makers will be needed during the 1960's and in the longer run, as a result of the anticipated expansion of metalworking activity. In addition, many openings may become available as experienced tool and die makers transfer to other fields of work, retire, or die. Retirements and deaths alone will provide about 3,500 job openings annually.

The anticipated long-range expansion in the missile and spacecraft, machinery, electrical equipment, and other metalworking industries will result in a continued increase in the employment of tool and die makers. Their skills will be needed to make the tools and dies used to produce the large numbers of identical metal parts required in these industries. They will also be needed to help put many technological developments into effect. However, numerically controlled machining operations may require fewer of the special tools and jigs and fixtures which are now made by tool and die makers. (See page 435 for a discussion of numerical control and other technological changes.)

Tool and die makers, as a group, have a longer working life than many other workers in the labor force. Their jobs require extensive skill and knowledge which can be acquired only after years of experience. For this reason, companies are reluctant to lay off tool and die makers, even when production is decreased. Furthermore, tool and die makers have greater occupational mobility than other workers. They can transfer to jobs as instrument makers or machinists, or find jobs in other industries.

Earnings and Working Conditions

Tool and die makers are among the highest paid metal machining workers. In March–June 1962, average straight-time hourly earnings of tool and die makers in machinery manufacturing job shops in the following cities were:

Baltimore	$2. 73
Boston	2. 98
Buffalo	3. 00
Chicago	3. 64
Cleveland	3. 14
Detroit	3. 63
Hartford	2. 83
Los Angeles–Long Beach	3. 29
Milwaukee	3. 40
Minneapolis–St. Paul	3. 26
Newark–Jersey City	3. 05
New York City	2. 99
Philadelphia	3. 18
St. Louis	3. 61

Tool and die makers in various manufacturing industries in 58 areas surveyed in 1961–62 were paid average straight-time hourly earnings ranging from $2.62 in Miami, Fla., to $3.65 in San Francisco–Oakland, Calif.

Because tool and die makers do precision work, the areas in plants or shops where they work are generally clean and well-lighted. Tool and die makers stand part of the time when they are operating machine tools. At other times they do handwork at benches. Sometimes they operate machines to test tools and dies they have made.

Good safety habits are necessary for tool and die makers because they work with high-speed machine tools and sharp cutting instruments. The use of safety devices has reduced the injury rate for machining workers.

See introductory section of this chapter for a discussion of nonwage benefits received by machining workers, unions that organize these workers, and where to go for more information.

Instrument Makers (Mechanical)

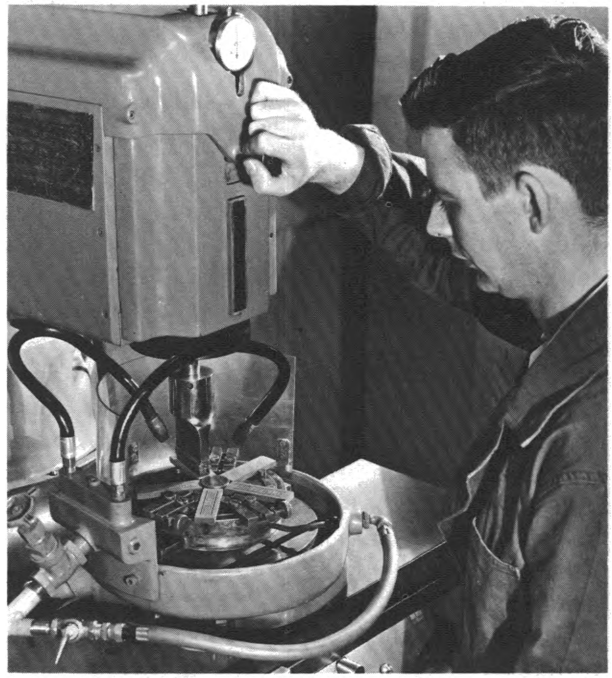
(D.O.T. 4-75.130)

Nature of Work

The increasing use of instruments in production, research, development, and testing work in industry and Government, is making the job of the instrument maker increasingly important. Instrument makers (also called experimental machinists and modelmakers) work closely with engineers and scientists in translating designs and ideas into experimental models, special laboratory equipment, and custom instruments. They also modify existing instruments for special purposes. Experimental devices constructed by these craftsmen are used, for example, to regulate heat, measure distance, record earthquakes, and control industrial processes. The mechanical instrument parts and models made by these workers range from simple gears to intricate parts of navigation systems used in guided missiles. Some instrument makers (who are not discussed in this brief) specialize in installing electric and electronic instrument components.

Instrument makers fabricate metal parts by operating machine tools such as lathes and milling machines, and by using handtools such as files and chisels. Because accuracy is important, they measure finished parts with micrometers and standard optical measuring instruments.

Instrument makers usually work from rough sketches, verbal instructions, or ideas rather than detailed blueprints. Thus, in making parts, they frequently use considerable imagination and ingenuity. Instrument makers sometimes work on parts which must not vary from specifications by more than ten millionths of an inch. To meet these standards, instrument makers commonly use special equipment or precision devices, such as the electronic height gage, which are used only infrequently by other machining workers. They occasionally work with a variety of materials, including plastics and rare metals such as silver and platinum.



Instrument maker uses ultrasonic machine tool

An instrument maker may construct instruments from start to finish—making and assembling all the parts and testing finished instruments for proper operation. However, in large shops or where electrical or electronic components are to be incorporated into an instrument, an instrument maker frequently works with other instrument makers, such as electronic specialists, each making a part of a complicated instrument.

Because they usually work on their own and have highly developed manual skills and reasoning abilities, instrument makers have considerable prestige among their fellow employees.

Where Employed

Many instrument makers are employed by firms which manufacture instruments. Research and development laboratories also employ instrument makers to make the special devices required in scientific research. The Federal Government employed about 1,200 instrument makers in early 1963.

The main centers of instrument making are located in and around a few large cities, particularly New York City, Chicago, Los Angeles, and Washington, D.C.

Training, Other Qualifications, and Advancement

Most instrument makers advance from the ranks of machinists or skilled machine tool operators. These craftsmen, working at first under close supervision and doing the simpler jobs, usually need at least 1 or 2 years of instrument shop experience to qualify as instrument makers.

Other instrument makers learn their trade through instrument-maker apprenticeships which generally last 4 or 5 years. A typical 4-year instrument maker apprenticeship program consists of approximately 8,000 hours of shop training and about 570 hours of related classroom instruction. The apprentice's shop training emphasizes the use of machine tools, handtools, and measuring instruments, and the working properties of various materials. Classroom instruction covers related technical subjects such as mathematics, physics, and blueprint reading. The apprentice must learn enough shop mathematics to enable him to plan his work and use handbook formulas. A basic knowledge of mechanical principles is needed in solving gear and linkage problems.

For apprenticeship programs, employers generally prefer applicants who have a high school education, including courses in algebra, geometry, trigonometry, science, and machine shop work. Further technical schooling in electricity and electronics is often desirable, and may make possible future promotions to technician positions.

A young man interested in becoming an instrument maker should have a strong interest in mechanical subjects and a better-than-average ability to work with his hands. He must have initiative and resourcefulness, because instrument makers often work alone and almost always under minimum or no supervision. Since the instrument maker often faces new problems, he must be able to develop original solutions. The instrument maker frequently must visualize the relationship between individual parts and the complete instrument. He must understand how the instrument is used and the principles of its operation. Because of the nature of his work, the instrument maker has to be very conscientious and take considerable pride in creative work.

As the instrument maker's skill improves and as he broadens his knowledge, he may advance to increasingly responsible positions. About 10 years' experience is required to rise to the top skill level in instrument making. With additional training beyond the high school level in subjects such as physics and machine design, some instrument makers may advance to technician jobs. In these jobs, technicians plan and estimate time and material requirements for the manufacture of instruments, or provide specialized support to professional personnel. Others may become supervisors of less skilled instrument makers and help in their training.

Employment Outlook

The employment of instrument makers is expected to continue to increase rapidly during the 1960's and in the longer run, but the number of new openings in any one year will be limited by the size of the occupation. Probably not more than 40,000 workers were employed in this relatively small occupation in early 1963.

Growing numbers of instrument makers will be needed to make models of new instruments that may be mass-produced in the future, and also to make custom or special purpose instruments that are not needed in large numbers. Many devices made by these craftsmen will be needed in the expanding fields of atomic energy, guided missiles, and industrial "automation" (the use of instruments to direct and control manufacturing processes). Also, many new precision instruments, which will be even more versatile and sensitive than those in current use, can be expected to emerge from growing research and development programs of universities, Government agencies, private laboratories, and manufacturing firms. New instruments are needed to solve many technical and scientific problems. For example, scientists who work with atomic reactors need better control systems for handling radioactive materials, as well as improved "thermometers" which can measure temperatures in the millions of degrees.

In addition to new job opportunities which will result from expanded industrial and scientific requirements, there will be several hundred new openings annually for these craftsmen as a result of promotions to technican positions, transfers to other fields of work, and retirements and deaths.

Earnings and Working Conditions

Earnings of instrument makers compare favorably with those of other highly skilled metalworkers. Wage data obtained from a small number of instrument manufacturers indicate that wages of these craftsmen in late 1962 generally ranged from $2.80 to $3.55 an hour. Instrument makers employed by the Federal Government in Washington, D.C., were receiving from $3.13 to $3.52 an hour.

Instrument shops usually are not as noisy as some other places where machining workers are employed. Generally, the machines do not run continuously and many of the machine tools are quite small.

Serious work accidents are not common among instrument makers, but machine tools and flying particles sometimes cause finger, hand, and eye injuries. Safety rules generally require the wearing of special glasses, aprons, tightly fitted clothes, and shirts with elbow-length sleeves; the wearing of neckties is prohibited.

See introductory section of this chapter for a discussion of nonwage benefits received by machining workers, unions that organize these workers, and where to go for more information.

Setup Men (Machine Tools)

(D.O.T. 4–75.160)

Nature of Work

The setup man, often called a machine tool job setter, is a skilled specialist employed in plants and machine shops that do machining in large volume. His main job is to set up machine tools—that is, to get machine tools ready for use by semiskilled operators. He may also explain to these workers the operations to be performed, and show them how to check the accuracy of their work. Usually a setup man is assigned a number of machine tools, which often are one type, such as turret lathes. However, he may set up several different machine tools such as milling machines and automatic screw machines. Working from drawings, blueprints, written specifications, or job layouts, he determines the rate at which the material is to be fed into the machines, operating speeds, tooling, and operation sequence. He then selects and installs the proper cutting or other tools, and adjusts guides, stops, and other controls. He may make trial runs and adjust the machine and tools until the parts produced conform to specifications. The machine is then turned over to a semiskilled operator. After the machine tool has been running a while, the setup man may make additional adjustments to maintain accurate production.

Where Employed

Most setup men employed in early 1963 worked in factories that manufacture fabricated metal products, transportation equipment, and machinery. These workers usually were employed by large companies which employed many semiskilled machine tool operators. They usually were not employed in maintenance shops or in small jobbing shops.

Training and Other Qualifications

To become a setup man, a worker usually must qualify as an all-round machinist or skilled machine tool specialist. A setup man must be thoroughly trained in the operation of one or more machine tools. He must read blueprints and make computations in selecting speeds and feeds for machine tools. He also must be able to explain to a semiskilled machine tool operator how to perform machining operations and how to check machining accuracy. Above all, a setup man must be skilled in selecting the sequence of operations so that metal parts will be made exactly to specifications. Jobs for setup men usually are filled from within a shop by promotion or reassignment.

Employment Outlook

Employment of setup men is expected to increase moderately during the remainder of the 1960's and in the longer run. This small occupation will provide relatively few job opportunities for new workers. Most of these openings will result from the need to replace setup men who transfer to other jobs, are promoted, or who retire or die.

The growing use of numerically controlled machine tools is a major factor which is expected to limit employment growth in this occupation. (See discussion on page 435.) The use of these machines may also change the duties of setup men. Setup men then may only preset tools, instruct operators, and check the first few parts that are produced. Since setup men are skilled workers, their chances for advancement or transfer into other jobs will remain good.

See introductory section of this chapter for a discussion of nonwage benefits received by machining workers, unions that organize these workers, and where to go for more information.

Layout Men

(D.O.T. 4–75.140)

Nature of Work

The layout man is a highly skilled specialist who marks metal castings, forgings, or metal stock to indicate where and how much machining is needed. His work enables other workers to use machine tools simply by following his lines, points, and other instructions. He uses many instruments, such as the scriber, with which he marks lines on the surface of the metal; the center punch, to indicate the centers on the ends of metal pieces to be machined or drilled; the keyseat or box rule, for drawing lines and laying off distances on curved surfaces; dividers, for transferring and comparing distances; L- or T-squares for determining right angles; and calipers and micrometers for accurate measurement. Not only must the layout man work with extreme accuracy, but he also must be familiar with the operation and capabilities of standard machine tools.

Where Employed

Layout men work primarily in the mass-production metalworking industries employing large numbers of machine tool operators. Most layout men work in plants producing fabricated metal products, machinery, and transportation equipment.

Courtesy of U.S. Department of the Navy

Layout man marks lines and reference points with surface gage to guide machine tool operator

Training and Other Qualifications

From 6 to 10 years' training and experience are needed to develop the skill for this occupation. Required training includes a machinist apprenticeship, or an equivalent knowledge of machine tools, machining qualities of metals, and the proper sequence of machining operations. Layout men must learn to visualize the sequence of machining operations so they can correctly prepare detailed work plans for less skilled workers. A layout man must be well trained in mathematics and blueprint reading, and be able to use various precision-measuring tools. Mechanical ability and a liking for painstaking work are other important qualifications for layout men.

These skilled jobs usually are filled from within an establishment by promotion or reassignment.

Employment Outlook

Employment is expected to increase slightly in this small occupation during the 1960's and in the longer run. Anticipated growth in metalworking industries—particularly in plants employing large numbers of machine tool operators—will cause employment of layout men to increase. Replacement needs, however, will provide most of the job opportunities for skilled machinists to be promoted to jobs as layout men.

The increasing use of numerically controlled machine tools is a major factor which is expected to limit employment growth in this occupation. (See discussion on page 435.) However, correct positioning of metal stock and tools will continue to be important, and layout men will be needed to mark accurate reference points. In addition, layout men can easily transfer to other work such as process planning, which will become more important with further technological development.

See introductory section of this chapter for a discussion of nonwage benefits received by machining workers, unions that organize these workers, and where to go for more information.

FORGE SHOP OCCUPATIONS

Forging is one of the principal methods of working and shaping metal, others being machining, casting, rolling, and stamping. In the forging process, metal is first made glowing hot in special types of furnaces and then shaped through pounding and squeezing by hammers and presses. Shaping metal by forging has been done for centuries by blacksmiths, but the modern forge shop, by substituting heavy power equipment and precision die blocks for the blacksmith's hand hammer and anvil, can do it much more rapidly and accurately.

Forged metal is strong and is used for many products which must withstand great stress. Examples of forged articles include automobile crankshafts, gears, screwdriver blades, pliers, wrenches, scissors, and many parts for aircraft, missiles, and spacecraft. Most forged products are made of steel, but aluminum, brass, bronze, and other metals are also forged. Some forgings weigh less than a pound, but others weigh many tons.

This chapter describes the major kinds of forging occupations found in forge shops; it does not discuss machining, maintenance, custodial, or other workers who may be employed in forge shops but who are not directly engaged in the forging process. (For a detailed description of the duties, working conditions, and job prospects for blacksmiths, who do work similar to that of many forge shop workers, see the statement on blacksmiths, p. 482.)

Nature of Work

Before metal can be shaped by hammers and presses, workers known as heaters must first heat it in intensely hot furnaces. Then drop hammer operators, hammersmiths, press smiths, upsettermen, and other workers manipulate the glowing hot metal between a pair of metal forms, called dies. These dies are attached to power hammers or presses which pound or squeeze the metal with tremendous but controlled force to form it into the shape desired. Finally, trimmers, chippers, grinders, and other workers remove rough edges, excess metal, and other imperfections from completed forgings, and perform other finishing operations.

Two kinds of dies are used for forging—the closed die, which has a hollow space shaped to the form of the metal part to be forged, and the open die, which is flat and more closely resembles the blacksmith's hammer. Closed dies are used where the need for large quantities of identical forgings (for example, automobile crankshafts) justifies their expense. Open dies are used to produce relatively small numbers of forged parts, or to forge an object too large for closed dies.

The basic equipment used by forge shop workers consists of various types of power hammers, power presses, dies, and furnaces, and also hand hammers, tongs, and measuring devices such as calipers and rules. Forging equipment is generally operated by crews of 2 to 10 men, who usually specialize on a particular kind of hammer or press. Duties of the more important forge shop occupations are as follows:

Hammersmiths (D.O.T. 4–86.120) are skilled workers who operate power hammers, equipped with open dies, that pound pieces of hot metal called blanks or stock into desired shapes. The precision of parts forged with flat open dies is greatly dependent on the skill of the hammersmith. He interprets blueprints, drawings, and sketches to determine how to work the metal under the hammer. He determines the force of the hammer so that the piece being forged will be shaped to specifications. He decides whether the metal being worked needs additional heating. He may use various forming tools under the hammer to produce angles and curves.

He supervises a crew consisting of a hammer driver (also called hammer runner) whose main duty is to operate controls of the hammer to regulate the force of the forging blow; a crane-man, who transfers metal blanks from furnace to hammer and manipulates metal under the hammer; a heater, who heats metal to correct forging temperatures; and one or more helpers.

Drop hammer operators (D.O.T. 4–86.110), often called drop hammermen or drop forgers, are skilled forgemen whose work differs from that of the hammersmith in that they operate power hammers equipped with closed rather than open dies. Generally, the larger the drop hammer and the larger or more intricate the shape of the metal object to be formed, the greater the skill required of the drop hammerman. With the assistance of helpers and heaters, the drop hammerman performs such duties as setting dies in the drop hammer, controlling the force of the forging blow, positioning and manipulating metal under the hammer, and determining whether additional heat may be needed for the metal being forged.

Press smiths (D.O.T. 4–86.125), also called forging press operators, operate huge forging presses equipped with either open or closed dies. Their work differs from that of the hammersmith or the drop hammer operator mainly in that they shape and form hot metal by pressing or squeezing rather than by hammering or pounding. They must know how to control the heating of metals, regulate the pressure of their machines, and position metal stock between the dies. Their duties may also include setting up dies in the presses.

Skills of operators of open die forging presses are similar to those of hammersmiths. Both types of workers manipulate metal blanks between two open dies; both must be able to understand blueprints, drawings, or sketches in order to transform heated metal into finished forgings; and both may supervise crews composed of an assistant operator, a craneman, a heater, and several helpers.

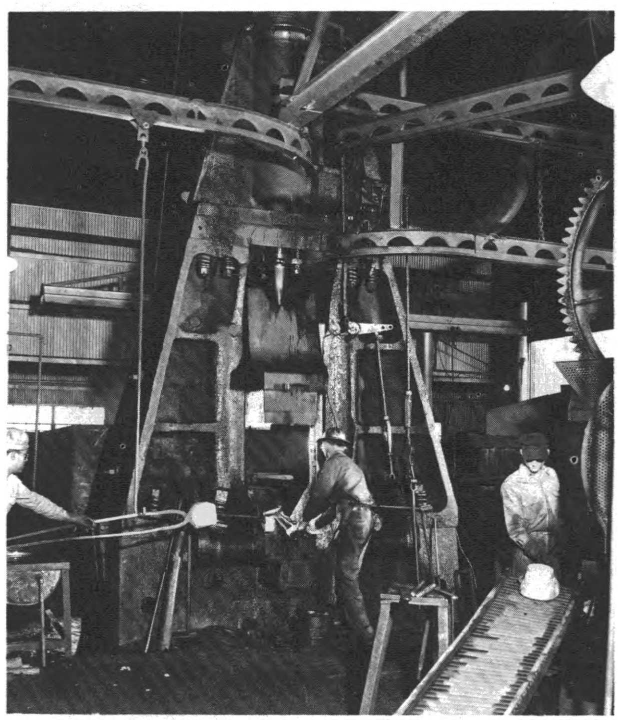
Closed die press operators work to more exacting specifications than press smiths using open dies, but do not need as much manipulating skill because the closed dies determine the shape of the forging. The closed die press operator may supervise a small crew or may work alone.

Upsettermen (D.O.T. 4-86.125) operate upset machines, which shape hot metal by applying pressure through the horizontal movement of one closed die against another. This process differs from that of forging hammers and presses, which shape metal by dropping or pressing an upper die down on a lower one.

With the help of a small crew of a heater and helpers, the upsetterman performs such duties as aligning dies, positioning metal stock between the dies, adjusting the machine's pressure on the metal stock, and controlling the heating of the metal. Deep-socket wrenches, aircraft engine cylinders, bolts, and valves are examples of products made in large quantities on upset machines.

Heaters (D.O.T. 4–88.081) control the supply of fuel and air in furnaces in order to obtain the correct temperature for the kind of metal and object being forged. Temperature gages and observation of the metal's color help the heater determine when the correct temperature has been reached. The heater's duties also include transferring, with tongs or mechanical moving equipment, heated metal from furnace to hammer or press, and keeping furnaces clean.

Inspectors (D.O.T. 4–86.162) check forgings for size, shape, quality, and other specifications. Some inspectors examine forged pieces for flaws



Drop hammerman, heater, and helper forge metal in closed-die power hammer and faulty workmanship while the forgings are still hot; others inspect forgings after they have been trimmed and cleaned. Inspection may be done visually or with micrometers, calipers, and other measuring devices. Checking for flaws may also be done with machines which test for strength and hardness, electronic testing devices, and other equipment.

Die sinkers (D.O.T. 4–76.010) are highly skilled workers who make the closed dies that are used on some forging hammers and presses. Working from a blueprint or drawing, a die sinker traces the outline of the object to be forged on two matched blocks of steel. He then carves the shape of this object in the steel blocks, using drill presses and other machine tools. He smooths and finishes the die cavity, using small files and other handtools. Finally, he makes a sample casting from the completed dies and checks all measurements with a micrometer and other precision measuring instruments.

Many forge shop workers are employed to clean and finish forgings. For example, *trimmers* (D.O.T. 6–88.717) remove excess metal from forged pieces with presses or hammers equipped with trimming dies. *Chippers* (D.O.T. 8–78.10) use power hammers to remove imperfections. *Grinders* (D.O.T. 8–77.10) remove rough edges from completed forgings with mechanically powered abrasive wheels. *Sandblasters* and *shotblasters* (D.O.T. 6–82.720) operate sandblasting or shotblasting equipment to clean and smooth forgings. *Picklers* (D.O.T. 8–74.13) dip forgings in an acid solution to remove surface scale and reveal surface defects. *Hardeners* or *heat treaters* (D.O.T. 4–87.220) heat and cool forgings under controlled conditions, to make them last longer. They produce forgings of specified degrees of hardness and strength by cooling them in the air or in baths of water, oil, or brine.

Where Employed

Approximately 70,000 workers were employed in forge shops in early 1963. About three-fourths of these worked in independent shops, that is, shops that produce forgings for sale. The rest were employed in forging departments of automobile, steel, farm machinery, handtool, structural and ornamental metal products, and other types of plants which use forgings in their final products.

Employment of forge shop workers is concentrated mainly in Ohio, Pennsylvania, Michigan, and Illinois. Forge shops are usually located near steel producing centers which provide steel for forgings, as well as near metalworking plants which are the major users of forged products.

Training and Other Qualifications

Most forge shop workers learn their skills through on-the-job training and work experience. They generally join a hammer or press crew as a helper, or, in some plants, as a heater. As they acquire experience, they progress to more skilled jobs. Advancement to the skilled job of hammersmith, for example, requires 4 or 5 years of on-the-job training and experience.

A few forge shops offer apprentice training programs for crafts such as die sinker, heat treater, drop hammer operator, hammersmith, and press smith. The programs, which generally last 4 years and in the case of die sinkers from 4 to 8 years, give the apprentice a combination of classroom training and practical experience in using the tools and equipment of the trade. For example, hammersmith apprentices learn about the properties of metals and how to operate power hammers and furnaces, use handtools and welding equipment, and read blueprints.

Training requirements for inspectors vary. Those who inspect rough forgings visually or with simple gages can usually perform their jobs after on-the-job training lasting only a few weeks. Those who examine parts forged to more exact specifications and operate more complicated testing equipment may be required to have some technical background in blueprint reading and mathematics and may be given several months of on-the-job training.

Employers usually require no more than a grammar school education for helpers and heaters, but high school graduates are preferred. Young men interested in preparing themselves for the more skilled forge shop jobs and for supervisory positions should complete high school and include mathematics, drafting, and shopwork in their studies.

Because much forge shop work involves lifting and moving heavy forgings and dies, workers must be strong. However, cranes are used for moving very large objects. Forge shop workers must have the stamina to work under very hot and noisy conditions for an entire working day.

Employment Outlook

A few thousand young people each year will have opportunities to get jobs in forge shops during the remainder of the 1960's and in the longer run. Most of these openings will arise because workers who retire, die, or transfer to other fields of work will have to be replaced. Other opportunities will result from a slight growth expected in the total number of forge shop workers.

A slight rise in forge shop employment is anticipated over the next 10 or 15 years because industries which use forgings in their final products—particularly the aircraft, missile, and spacecraft, industrial machinery, and automobile industries—are expected to expand. Growth in forge shop employment may be limited, however, by competition from new materials and metals which are not forged, by the use of metal castings to replace some forged parts, and by the wider use of more modern equipment.

Earnings and Working Conditions

Average earnings of production workers are higher in forge shops than in manufacturing as a whole. During 1962, production workers in iron and steel forging plants earned an average of $126.48 a week or $3.10 an hour, compared with $96.56 a week or $2.39 an hour in all manufacturing industries.

In many forge shops, earnings of hammer and press smiths are determined by the number of forgings they produce. Other members of hammer or press crews are paid a percentage of the operators' pay.

The following tabulation, based on examination of several labor-management agreements in commercial forge shops, provides a rough indication of approximate straight-time hourly wage rates in late 1962 for selected forge shop occupations. Wage ranges shown for the occupations reflect differences in experience and skill of workers in the occupation and also differentials in wages paid in various plants and sections of the country.

Die sinkers	\$4.28–\$4.48
Press smiths and upsettermen	2.67– 2.97
Hammer operators	2.02– 2.97
Inspectors	2.07– 3.17
Cranemen	2.29– 2.86
Trimmers and finishers	2.34– 2.39
Sandblasters and shotblasters	2.33– 2.77
Grinders	2.09– 2.77

Most forge shop workers are union members. Many are members of the International Brotherhood of Boilermakers, Iron Shipbuilders, Blacksmiths, Forgers and Helpers. Others are members of the United Steelworkers of America; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the International Association of Machinists; and the International Die Sinkers' Conference (Ind.). Many forge shops have union-management contracts which provide insurance and pension plans, paid vacations, and other nonwage benefits.

Although forge shops typically are hot and noisy, working conditions have been improved in recent years. Many firms have installed large ventilating fans and have attempted to reduce machine concussion and vibration.

The injury-frequency rate in forge shops is higher than in many other types of factory work. Employers and unions have contributed to the reduction of accidents in forge shops by promoting greater use of protective goggles, metal-toe shoes, metal helmets, and machine safety guards.

Where To Go for More Information

Drop Forging Association,
55 Public Square, Cleveland, Ohio, 44113.

International Brotherhood of Boilermakers, Iron Shipbuilders, Blacksmiths, Forgers and Helpers,
8th at State Ave., Kansas City, Kans., 66101.

DRIVING OCCUPATIONS

About 2.4 million employees were engaged in moving passengers and goods over highways and city streets in 1962. (Chart 30 shows percent of employment by individual occupation.) They transported thousands of products used in homes, schools, and factories, and also transported millions of people every day. In 1962, over 12 million private and commercial (for-hire) motor trucks were registered, including over 11 million privately owned trucks operated by stores, dairies, farmers, or industrial firms. Of the 1 million trucks available for hire, about one-third handled intercity freight and the remainder did local hauling. Federal, State, and local governments owned about 600,000 trucks. Of the 280,000 buses registered in 1962, more than 200,000 were schoolbuses and 80,000 were commercial vehicles. Of the latter, about 50,000 were used for local transit work, 26,500 for intercity passenger traffic, and the remainder for sightseeing, charter, and other services.

Some drivers, like the over-the-road truckdrivers, the intercity busdriver, the local busdriver, and the taxicab driver, spend practically all of their working time driving. Others, like the local truckdriver and delivery man, spend considerable time in loading and unloading goods, making pickups and deliveries, and collecting money. Still others, like the routeman, spend a good deal of their time selling. This chapter deals only with employment opportunities for those whose principal occupation is driving intercity and local trucks and buses and taxis. It does not cover schoolbus drivers, chauffeurs, part-time taxi drivers, or employees whose driving is incidental to their regular duties.

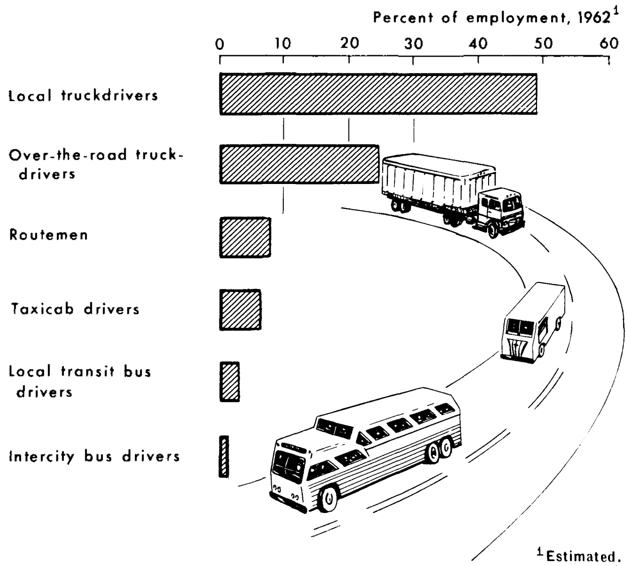
Many driving jobs require a high degree of responsibility. Drivers, for the most part, operate large and expensive equipment which they must drive carefully, obeying safety regulations and traffic laws, to deliver their passengers and freight safely. These men are on their own, away from direct supervision.

During the remainder of the 1960's and in the longer run, employment of local and over-the-road truckdrivers is expected to expand as a result of increases in the freight moved by motor carrier. Employment in other driving jobs is not expected to change much in the years ahead. Normal turnover in this large occupational field will also provide many job opportunities each year.

Driving jobs offer excellent opportunities for young men who are not planning to attend college and who have no interest in or aptitude for craft or technical occupations. The pay of most drivers is relatively high and working conditions are fairly good. Many young men will also enjoy the freedom from close supervision and the frequent contacts with people, which are characteristic of most of these jobs.

CHART 30

TRUCKDRIVERS MAKE UP THREE-FOURTHS OF WORKERS IN DRIVING JOBS.....



[1] Estimated.

Over-the-Road Truckdrivers

(D.O.T. 7-36.240)

Nature of Work

The men at the wheel of the big trucks on highways and turnpikes are generally the top professional drivers. They drive the largest and most expensive equipment and receive the highest wages of all drivers. They are on their own practically all the time and have a great deal of responsibility. The work requires a good deal of initiative, as they must transport goods and materials of great value which must be delivered safely and on time.

Most over-the-road drivers operate gasoline or diesel powered tractor-trailers. (The tractor is the short-chassis vehicle that draws the trailer which contains the freight.) They deliver goods usually over long distances—frequently driving at night.

Unlike the local truckdriver who spends considerable time in loading and unloading, the over-the-road driver (sometimes called intercity, line-haul, or long-haul driver) spends practically all of his working time in driving. He may sometimes handle the freight. Some drivers, for example, may have to unload the goods they deliver to stores at night when receiving crews are not available. Drivers of long-distance moving vans generally have to load or unload their cargoes, with the assistance of local helpers.

The truckdriver must back up big trailers to loading platforms; this requires the ability to maneuver the trailers while driving in reverse. He must also be able to judge distances accurately while driving around corners or through narrow passageways.

Because the over-the-road truckdriver spends most of his time driving, safe driving practices and courtesy are of the utmost importance. Every one has seen the emergency warning signals set out by a driver near his disabled truck on the edge of the highway. Many motorists have noted the courtesy of truckdrivers who pull off to the shoulder of the road at the top of a hill to allow the accumulated traffic to pass.

Interstate Commerce Commission (ICC) regulations require drivers to inspect their trucks before and after trips and make out reports on the condition of the vehicle at the end of the run. Drivers are also required to keep a daily log of their activities. If a driver has an accident, he must make out a detailed report. ICC also prescribes special safety precautions concerning packing and loading flammable, explosive, or otherwise hazardous materials, and over-the-road driving of trucks containing these materials.

Where Employed

About 600,000 over-the-road drivers were employed throughout the United States in 1962. Many work out of large cities such as Chicago and Los Angeles; however, some large companies have their operating headquarters in fairly small towns.

Over-the-road drivers are employed by private and for-hire carriers. Private carriers are companies, such as chain food stores or manufacturing plants, which use their own or leased trucks to transport their own goods. For-hire carriers are either common carriers (trucking companies serving the general public) or contract carriers (trucking firms hauling goods under contract for certain companies). While the drivers of the big tractor-trailers on long intercity runs are more often employed by common carriers, an increasing number of drivers in recent years have been working for private or exempt (from ICC regulation) carriers, or for specialized carriers handling large pieces of machinery, explosives, or missiles. On shorter hauls, many drivers are employed by contract and common carriers to make deliveries of machinery, food, petroleum products, household appliances, and other items, from plants to warehouses and from warehouses to large volume purchasers.

Training, Other Qualifications, and Advancement

Regulations of the Interstate Commerce Commission establish minimum qualifications for over-the-road drivers. The driver must be at least 21 years of age, able-bodied, with good hearing and vision of at least 20/40 with or without glasses. He must be able to read and speak English, have at least 1 year's driving experience (which may include driving private automobiles), and a good driving record. Most States require truckdrivers to have a chauffeur's license, which is a commercial driving permit obtained from State Motor Vehicle Departments.

These minimum standards apply to all over-the-road drivers. Most fleet operators, however, have higher standards. Many firms will not hire drivers under age 25; some specify height and weight limitations. Many require at least a grade school education; others require 2 years of high school. Some companies employ only applicants who have had several years of experience in handling vehicles of the type they would be required to drive.

The standards for over-the-road drivers are generally higher than those for local truckdrivers. Furthermore, these standards are more strictly adhered to than those for local drivers, whose standards may be lowered when there are not enough applicants for jobs.

The tractor-trailer often seen on highways probably costs as much as $25,000 and the load inside may be worth more than $100,000. The owners of this equipment, therefore, employ drivers with a know-how based on years of driving experience, who also can accept great responsibility.

Many training authorities and employers recommend that young men interested in becoming professional drivers should take the driver-training courses offered by many high schools. If such a course is not available, the professional driving schools which operate in most large cities are recommended. A high school course in automotive mechanics is also very helpful.

Long-haul driving is considered a senior driving job and most such drivers have had previous experience in local trucking. Usually they enter this occupation by first driving a small, light truck; then, after gaining experience, they move to the larger and more complicated trucks. A young man may also begin as a helper to a local truckdriver, assisting him in loading and unloading the truck, and occasionally doing some relief driving.

Another type of experience considered very desirable by employers is a combination of intercity bus and local truckdriving. This experience may be gained by working for an intercity bus company during the spring and summer months and for a local trucking company during the fall and winter months. Thus, the driver gets the road experience with the bus company and learns how to handle a tractor-trailer with the local trucking company.

All employers are interested in obtaining good, safe, reliable drivers, but the methods of selection and training vary. Some companies have formal tests and training programs. Others hire on the basis of personal interviews, and have training programs consisting of a "break-in" period during which the new employee observes and works with an experienced driver.

Applicants for jobs as over-the-road drivers are required to pass a physical examination which is usually paid for by the employer. Many firms also give written traffic and driving knowledge tests. Some employers give tests to measure such factors as sharpness and field of vision, reaction time, ability to judge speed, and emotional stability. The last step in the selection of drivers is the road test. The applicant is expected to demonstrate his ability to handle, under a variety of driving conditions, a vehicle of the type and size he will operate in regular service.

A new driver may be given a brief indoctrination course covering company policy and the preparation of various forms he will use on the job. He will then make one or more training trips with an instructor or an experienced driver.

Drivers employed by common carriers frequently start on the "extra board," bidding for regular runs on the basis of seniority as vacancies occur. (The extra board is a list of men, assigned in rotation, who substitute for regular drivers or who make extra trips when necessary.) Drivers for private carriers are more likely to begin with assigned regular routes.

Promotional opportunities in this occupation are limited. A few drivers may advance to jobs as safety supervisors, driver supervisors, and dispatchers. Most drivers, however, can only expect runs which will give them higher earnings.

Employment Outlook

A substantial increase in the employment of over-the-road truckdrivers is anticipated during the remainder of the 1960's and in the longer run, as a result of increased industrial activity, continued decentralization of industry, and the movement of population to the suburbs. A large number of job openings will also be created by transfers from this field of work. Many long-haul truckdrivers return to local truckdriving jobs. Approximately 8,000 to 10,000 additional job openings are expected each year as a result of deaths, and retirements, and the number may be increased somewhat by the trend toward earlier retirements.

Freight carried by over-the-road trucks has been increasing as a result of the general economic growth of the Nation. Trucks have been hauling an increasing share of the total freight, and this trend is expected to continue. Many factories, warehouses, and stores are being located at great distances from each other in suburban or semirural areas where rail facilities are nonexistent or extremely limited. The intercity highway building program has aided the trucking industry in this regard. Furthermore, the growth of chain stores, and the trend to small inventories and decentralization of factories require daily coordination of shipping which can best be handled by trucks.

Improvements in trailer design have also contributed to more over-the-road trucking, by making it possible to ship certain kinds of freight for longer distances. For example, some refrigerated trailers now provide temperatures down to 20 degrees below zero, and new livestock trailers feature controlled ventilation, nonskid floors, and interior walls designed to avoid bruising and other injury to the animals.

Demand for trucking services may increase as a result of new trucking methods which promise reduced handling and shipping time and, therefore, reduced freight costs for small loads. One example is the introduction of "double bottoms" —two relatively small trailers hitched in tandem to a tractor. These trailers can be unhitched at the truck terminal, and promptly delivered to the customers, thus eliminating the need to unpack a large trailer, separate its contents, and repack on local delivery trucks. On a smaller scale is the practice of packing all freight destined for a single customer or area into large containers or cargo cages which can be handled at the truck terminal more conveniently and quickly than individual packages.

Some recent freight transportation innovations will limit somewhat the anticipated increase in trucking business and driver employment. For example, the movement of highway trailers on railroad flat cars ("piggyback"), which saves the cost of driver, fuel, and tractor, appears to have prospects for considerable expansion, although it accounts for only a small share of total freight shipped at present. Employment expansion may also be limited by the increasing use of trailer-carrying ships ("fishyback"), recently introduced for transporting loaded trailers for long distances, and the use of large containers on ships and cargo aircraft ("birdyback"). To compensate for job displacement that may arise from such innovations, there is a growing practice under labor-management agreements to provide for retirement at an earlier age.

Further limitations on employment expansion among over-the-road drivers include changes in State laws. State limitations on truck weight, size, and speed are becoming less restrictive as a result of the construction of better highways and improved travel arteries inside the cities. The movement of bigger loads at higher average speeds could result in a need for fewer drivers than would otherwise be required to move the greatly increased over-the-road tonnage anticipated in the years ahead.

In the long run, however, the total volume of goods shipped and the convenience and mobility of motor transport is expected to be great enough to insure continued growth of driver employment in trucking.

The over-the-road driver has a better chance of remaining employed during business recessions than workers in many other occupations. Although the total tonnage moved may temporarily decline, over-the-road trucking is less affected than other means of transportation. It gets a larger share of any shrinking transportation business because manufacturers and merchants who are unable to buy merchandise in railroad carload lots can reduce inventories and still maintain their diversified stock by small daily shipments by truck. Small lots are still handled primarily by trucks.

Earnings and Working Conditions

Most over-the-road drivers earned at least $125 to $150 a week in 1962 and the majority made far more. Drivers employed by class I common carriers of general freight (carriers with gross operating revenues of $1 million or more a year) had annual average earnings in excess of $8,300 in 1961, the most recent year for which such data are available. Better, experienced over-the-road drivers can earn $12,000 a year or more. The rates paid to over-the-road drivers are fairly uniform because this is a highly unionized field and union-employer contracts are generally master agreements covering all employers within a region—an area including a number of States. Furthermore, regional contracts tend to be quite uniform because drivers working under different contracts often travel the same routes. The earnings of an individual driver are affected by such factors as mileage driven, number of hours worked, type of equipment driven or the weight of the loads carried, type of "run" (whether or not pickup or delivery enroute is required), and the nature of the cargo carried, with premium rates paid for transporting flammable or otherwise hazardous commodities.

Drivers on the longer runs are generally paid on a mileage basis for actual driving time. For all other time during which the driver is required to be on duty, he is paid at an hourly rate. This includes waiting time, delay time owing to breakdown of equipment or impassable highways, layover time (time spent at a terminal away from home beginning at some designated hour after his run ends), and time spent in making pickups or deliveries enroute. Regular drivers are usually assured minimum pay for a certain number of hours—generally 8 hours a day.

Some private carriers pay their drivers on the same basis as their other employees—a monthly, weekly, or daily wage. Generally, such a wage is for a specified number of hours and if the driver works beyond that he receives extra pay.

In recent years, more than 100,000 motortrucks—a third of all used in intercity freight hauling—were operated by carriers subject to the Interstate Commerce Commission regulations governing hours of work and other matters. ICC regulations limit the hours of work of over-the-road drivers in order to be certain the driver has a reasonable amount of rest. For example, no driver may be on duty for more than 60 hours in any 7-day period, but for carriers operating every day of the week, the driver may remain on duty for a maximum of 70 hours in any period of 8 consecutive days. The regulations also provide that no driver may drive more than 10 hours without first having an off-duty period of at least 8 hours. For drivers who drive less than 10 hours, but perform other work for the motor carrier in a garage, warehouse, or other place, the regulations prohibit resumption of driving after any combination of driving time and other on-duty work which totals 15 hours, unless the driver has first had at least 8 hours off duty. Many drivers, particularly on the very long runs, work fairly close to the maximum permitted. A workweek of at least 50 hours is very common.

Most drivers receive pay for 6 or more national, State, and local holidays. They also have paid vacations, usually from 1 to 4 weeks, depending upon their length of service. Health, insurance, and pension plans, almost invariably paid for by the employers, are very common.

Over-the-road truckdrivers are often required to spend time away from home—particularly when they drive long runs. The driver often starts out in the evening and arrives at the terminal in the other city the following morning. There, the company provides lodging for him either in a company dormitory or a hotel. In the evening, he starts on his return trip and arrives at the home terminal the following morning. He may make two or three such round trips a week. If the trips are part of a relay operation, another driver is working a similar schedule starting from the other end of the run.

Some companies use two-man sleeper teams on their very long runs. One drives while the other sleeps in a bunk behind the cab. The vehicle goes straight through to the end of the run where there may be a layover before the return trip. Two periods of 4 hours of resting or sleeping in a berth in the truck meet the ICC requirement of 8 hours off duty following 10 hours of driving. This means that the drivers on a run may remain with the truck in some cases for over 100 hours.

Although earnings on sleeper runs are the highest in this field of work, few drivers stay with this type of run very long. The work is very tiring and requires being away from family and friends for days and even weeks. However, many drivers go back to sleeper runs after they have had a rest or have done some relay driving for a while. The earnings of drivers of long-distance moving vans are also quite high, but their hours are long and the work is strenuous. They drive more miles than the average over-the-road driver and also work more hours in loading and unloading goods.

Largely because of intensive safety programs and drivers' skill, the accident rate in over-the-road trucking is low. Injuries occur less frequently than in other forms of motor transportation.

Driving the big over-the-road trucks does not involve the physical effort most people associate with truckdriving. The physical strain of such driving has been reduced by more comfortable seating, better highways, and more stringent safety regulations. Sitting in one place for hours at a time, however, is tiring and the nervous strain of sustained driving at night is also fatiguing.

Most over-the-road drivers are members of the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.). Some drivers of private carriers belong to unions representing the plant employees of the companies for which they work.

Where To Go for More Information

Information on career opportunities may be obtained from:

American Trucking Associations,
1616 P St. NW., Washington, D.C., 20036.

Local Truckdrivers

(D.O.T. 7-36.200 through .299)

Nature of Work

Much of the food, clothing, and other products required by consumers are transported by trucks. The men who move these goods from terminals, warehouses, and factories to wholesalers, retailers, and consumers in the local area must be skilled drivers to avoid accidents on congested city streets. They must also be able to maneuver big trucks or tractor-trailers into tight parking spaces, through narrow alleys, and up to loading platforms. (Telephone linemen, repairmen, and many thousands of other workers for whom driving is incidental to their primary duties are not included in this discussion.)

When the local truckdriver reports to work at the terminal or warehouse, he receives his assignment to make deliveries, pickups, or both. He also receives the delivery forms he will need and checks the condition of his truck. His truck is generally loaded for him by platform men. If he does the loading himself, however, and must make many deliveries, he arranges the items in proper sequence so that there will be a minimum of handling. At the customer's place of business, the driver generally loads and unloads the merchandise himself. If he has heavy loads such as machinery or if he has many deliveries to make during the day, he may have a helper to assist him. The driver of a moving van usually has a crew of helpers to assist him in loading and unloading household or office furniture.

At the delivery points, the driver gets customers to sign receipts and freight bills, and he sometimes collects money for freight, c.o.d. deliveries, and other charges. At the end of his day he turns in all receipts and cash collected and records his time and the deliveries made. He also reports whatever maintenance or repair is needed before his truck is used again.

Some of these workers drive special types of trucks, such as dump or oil trucks, which require the operation of mechanical levers, pedals, or other equipment. For example, if they drive dump trucks, they operate levers inside the cab or at the side of the truck in order to set the dumping mechanism in motion. If they haul heavy machinery, they operate mechanical hoists to load and unload the machines.

Where Employed

An estimated 1.2 million workers were employed as local truckdrivers in 1962, mostly in and around large metropolitan areas. They work in all localities, however, including the smallest villages.

A large majority of local drivers work for businesses which deliver their own products and goods—such as department stores, meatpackers and other food processors, wholesale distributors, petroleum companies, grocery chains, and construction companies. Many others are employed by local for-hire operators—trucking companies which serve the general public or specific companies under contract. Some are employed by the Federal Government including, in particular, the Post Office Department, and by States and municipalities. A large number are in business for themselves.

Training, Other Qualifications, and Advancement

Qualifications for local truckdrivers vary considerably, depending upon factors such as the type of equipment to be operated and the nature of the employer's business. Generally, applicants must be 21 years of age or older. Some employers prefer applicants who have completed grade school or, better, 2 to 4 years of high school. The applicant must be physically able to lift heavy objects and otherwise be in good health. He should have good hearing and good vision (with or without glasses). Since a driver often deals directly with the public, employers look for men who are tactful and courteous.

An applicant must have or get a chauffeur's license, which is a commercial driving permit. Familiarity with traffic laws and safety measures is necessary, and some previous experience in driving a truck is helpful. A young man may obtain such experience by working as a truckdriver's helper. Employers also give consideration to driving experience gained in the Armed Forces.

Since he will be responsible for costly vehicles and cargo, a truckdriver must be cautious, alert, and able to judge distances and to coordinate his reactions to avoid accidents in congested traffic. To demonstrate these qualifications, an applicant's driving ability will be tested, and he may have to pass a written examination as well as a general physical examination. Employers generally will check applicants for traffic and police records.

Training given to new drivers is often informal and may consist only of riding with and observing an experienced driver on the job. Additional training may be given if they are to drive a special type of truck. Some companies give a brief indoctrination course which lasts 1 or 2 days and covers general duties, the efficient operation and loading of a truck, company policies, and the preparation of delivery forms and company records.

Although most new employees are immediately assigned to regular driving jobs, some start as extra drivers, taking over the routes of regular drivers who are ill or on vacation, or making extra trips when necessary. They receive regular assignments when openings occur.

Local truckdrivers may get jobs as dispatchers or advance to jobs as terminal managers, or supervisors, or to traffic work, i.e., planning delivery schedules. However, these jobs are relatively few. For the most part, advancement for a local truckdriver consists of earning higher hourly wages by driving heavy or special type truck loads instead of light trucks, or by transferring to over-the-road truckdriving.

An experienced truckdriver who has some business ability and ambition can start his own trucking company when he has sufficient capital to purchase expensive trucking equipment and meet other business expenses. Truckers who own one or two vehicles continue to account for a sizable proportion of local for-hire trucking business.

Employment Outlook

A moderate rise in the employment of local truckdrivers is anticipated during the remainder of the 1960's and in the longer run, because of the expected increase in volume of freight. Many new workers will also be needed to replace drivers who transfer to other fields of work, retire, or die. Retirements and deaths alone will result in about 15,000 job openings each year for local truckdrivers.

The rise in total business activity anticipated in the years ahead will increase the volume of freight. Since trucks carry virtually all freight for local distribution and do not compete for hauling with other types of carriers, this anticipated increase in total intercity and local freight volume will expand local trucking business and, thereby, truckdriver employment. The continued growth of suburban areas will contribute to the employment of more drivers. The increasing volume of "piggybacking" will also tend to expand employment opportunities for local truckdrivers.

Some recent developments may offset somewhat the growth in the number of local truckdrivers that would otherwise occur with an increase in freight volume. For example, the trend toward larger deliveries to relatively fewer retail outlets is the result of the growth of chain stores and shopping centers. (On the other hand, as suburban areas expand, local truckers tend to service a wider area, increasing the travel time per truck. Thus, more trucks may be needed to handle the growing volume of goods.) The introduction of new equipment may also affect the number of drivers who will be needed to deliver large and heavy loads. For example, the greater use of trucks equipped with power tailgates that can be raised or lowered to platform or ground level will reduce the time needed for deliveries. Innovation in local trucking will continue to be limited, however, by narrow city streets and heavy traffic, although urban renewal and urban highway building projects may improve driving conditions.

Earnings and Working Conditions

On the average, hourly union wage scales were $2.89 for local truckdrivers and $2.55 for driver-helpers on July 1, 1962, according to a survey in 53 large cities. Average hourly pay scales for drivers ranged from $2.34 in Washington, D.C., to $3.35 in the San Francisco–Oakland area. However, wage scales vary, even in the same city, depending on the type of trucking service (such as general freight drayage or local moving and storage), the type of product hauled, and the size and type of truck operated.

As a rule, local truckdrivers are paid by the hour and receive extra pay for working overtime, usually after 40 hours. Some drivers are guaranteed minimum daily or weekly earnings. Local truckdrivers frequently work 48 hours or more a week and thus often drive 6 days a week. Although daytime work is customary, nightwork or early morning work is sometimes necessary, particularly for drivers handling foodstuffs for chain grocery stores, produce markets, or bakeries. Most drivers deliver over regular routes or runs, although some may be assigned different routes when they report to work each day.

Local truckdrivers generally have paid vacations of 1 or 2 weeks after a year of service and up to 4 weeks after 18 or even fewer years. In addition, they usually receive pay for 6 or more national, State, and local holidays.

A majority of local truckdrivers belong to unions. Most of them belong to the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.). Some local truckdrivers employed by private carriers are members of unions representing the plant workers of their employers.

Practically all unionized local truckdrivers and their helpers are covered by life and health insurance and pension plans which are almost always paid for by the employer. When uniforms are required, the cost is usually paid for entirely or partly by the employer, who may also provide for their upkeep.

Local truckdrivers, because they drive in heavy traffic through narrow city streets, are subject to nervous strain. The actual operation of a truck has become less physically demanding because of improvements such as power steering, and more comfortable seating. However, when local drivers make many deliveries during a day, their work can be exhausting. Some drivers may develop physical disorders, such as back strain and hernia. Local truckdrivers do, however, have certain work advantages. For the most part, they have steady employment. Unlike over-the-road drivers, they usually work a regular daytime schedule and return home in the evenings.

Routemen

(D.O.T. 7-35.100)

Nature of Work

Routemen are as much salesmen as they are drivers. In fact, they are sometimes known as driver-salesmen or route-salesmen. They must, through their selling ability, increase sales to existing customers and obtain new business by canvassing potential customers within their territories. Routemen drive panel or light trucks over an assigned route, selling and delivering goods, or providing services such as collecting and delivering laundry and dry cleaning, to retail establishments (wholesale routemen) or directly to the public (retail routemen). Wholesale routemen usually drive heavier trucks. These trucks are refrigerated when dairy products or frozen foods are carried.

Before starting on his daily route, the routeman loads or supervises the loading of his truck. The amount of merchandise in his truck is generally checked by another employee. Some routemen deliver merchandise previously ordered and obtain orders for future delivery. Others make immediate sales from the stock in the truck. In either case, they must collect payments and keep records of their transactions. When they check in at the plant after completing their routes, they empty their truck and turn in their collections to the cashier. The retail routemen serving homes make from 5 to 10 times as many stops as the wholesale routemen who serve stores and other business establishments.

Routemen's work varies according to the industry in which they are employed, the type of routes they have (retail or wholesale), and the company employing them. Some specific examples, however, may indicate in a general way what most routemen do. A typical day for a drycleaning routeman begins when he picks up cleaned garments at the processing plant and loads his truck, which is equipped with carrying racks. He delivers the garments to homes or business establishments and picks up soiled clothing. He marks the articles picked up so they may be identified at the plant. Sometimes, he makes notes of the types of stains or of special processes to be used such as waterproofing. Each cleaned garment has an itemized bill attached, so that he can collect the amount of money due.

Routeman delivers dairy products

Although all routemen must be able to get along well with people, it is particularly important for the drycleaning and laundry routeman. His reaction to complaints and requests for special services may be the difference between increasing business or losing customers. Periodically, he calls at homes and business establishments along his route which are not using his company's services to try to get their trade.

A good example of a wholesale routeman is the man who delivers bakery products to grocery stores. His truck is loaded the night before or early in the morning, and he checks to see whether he has the proper variety and quantity of products before starting on his route. He stops at from 10 to 50 grocery stores. At each stop he brings the orders of bread and other bakery products into the store, and arranges them on the display racks, in the best possible display space he can secure. Together with the store owner or manager, he checks the merchandise he has delivered. He also credits the store for the value of the stale bread and cakes left over from the previous delivery.

The routeman prepares a list of products he plans to deliver the next day. This represents his estimate of the amount of bakery products that will be sold by the grocery stores. From time to time, he calls on grocers along his route, who are not his customers, and tries to get orders from them.

Where Employed

Nearly 200,000 routemen worked for a wide variety of businesses in 1962. Since most of them were employed by companies which distributed food products or provided personal services, they worked in small towns as well as in large cities throughout the country. The greatest concentration of employment, however, was in the large cities in dairies (about 80,000), bakeries (about 60,000), and in drycleaning plants (about 40,000).

Some were engaged in wholesale distribution of goods and services to stores and other business establishments, although the majority distributed goods and services to homeowners and apartment dwellers. Many companies employed both wholesale and retail routemen.

Training, Other Qualifications, and Advancement

In addition to being a good driver, a routeman must have sales ability. To induce people to buy, he must have a thorough knowledge of the product or service he is selling and a persuasive personality. Other important sales qualifications are a pleasant voice, ability to speak well, and a neat appearance. He also needs to have self-confidence, initiative, and tact.

He must be able to work without direct supervision, do simple arithmetic, and write legibly. In most States, a routeman is required to have a chauffeur's license, which is a commercial driving permit. Information regarding this license can be obtained from State Motor Vehicle Departments.

Most employers require their routemen to be high school graduates, preferably 25 years of age or older. Many large companies give applicants aptitude and other psychological tests to determine whether they will make good salesmen and safe drivers. Those who handle a great deal of money may be required by employers to be bonded.

High school courses in salesmanship, public speaking, driver-training, bookkeeping and business arithmetic, and school-work programs in retail and wholesale merchandising are helpful to a person interested in entering this occupation. Immediately following high school, valuable experience may be obtained as a sales clerk in a store or in some other type of selling job.

Another method of entering this occupation is to get a job as a *routeman helper* (D.O.T. 9-35.10). For this job, employers usually hire boys 18 years of age or over who have a driver's license. The helper assists the routeman by loading the truck at the beginning of the day, and carries deliveries from the truck to the customer's home or store. He may collect payments or obtain receipts and may sometimes drive to relieve the routeman. Helpers are not likely to be used in the dairy industry, however. Still another way of becoming a routeman is to get a job (plant or office) in a bakery, dairy, laundry, or drycleaning establishment. After learning something about the business, a young man may get a job as a routeman when an opening occurs.

Most companies give their routemen on-the-job training which varies in length and thoroughness. Many large companies have classes in salesmanship. Some companies assign newly hired routemen for brief periods to jobs in the different departments of the plant to familiarize them with all the processing operations, so they can answer customers' questions intelligently and be better salesmen. New employees are then trained for a short time on routes working with supervisors. The first week, the routemen usually observe and assist the supervisors; later, they take over the operation under the direction of the supervisors.

Routemen may be promoted to route foreman or sales supervisor, but these jobs are relatively scarce. Advancement is usually limited to moving from a retail to a wholesale route where earnings are generally higher. However, some routemen obtain better paying sales jobs as a result of the experience gained in route selling.

Employment Outlook

The number of routemen is expected to increase slightly during the remainder of the 1960's and in the longer run, although job opportunities will vary among different types of employers. There will be a few thousand additional openings for new workers each year as experienced workers transfer to other fields of work, retire, or die.

The number of retail routemen declined in the decade following World War II, particularly among drivers handling milk and dairy products. However, the decline appears to have run its course, and some employment upturn is likely. The convenience of home delivery to suburban families consuming large quantities of milk and dairy products makes such service popular, despite the growth of local shopping centers. For laundry and drycleaning retail routemen, the outlook is for an increase in employment, in line with population growth, especially in areas with a large concentration of apartment houses. The increasing number of married women working outside the home will also result in more laundry or cleaning work being done commercially.

Employment of wholesale routemen probably will remain at about present levels or rise slightly. Although large supermarkets have been replacing small neighborhood stores, more supermarkets are being built in the suburban areas. To serve the expanding population, the new supermarkets will require substantially more dairy products, fresh, canned, and frozen foods, and other products. The number of routemen will not increase correspondingly, however. There has been a growing trend toward larger delivery trucks. Moreover, in recent years, some manufacturers and wholesale food companies have replaced their routemen with salesmen who cover assigned territories by automobile and truckdrivers who make the deliveries.

In the long run, population expansion and shifts to the suburbs, and the growing tendency for housewives to take outside employment, will create a continuing need for the door-to-door services of retail routemen. The demand for wholesale routemen will increase because of larger sales of traditional products and the introduction of new items. New lines of frozen foods, for example, are often introduced and marketed by wholesale routemen.

Earnings and Working Conditions

Most routemen are paid a salary plus a percentage of the sales or collections they make. Earnings vary considerably according to the product sold and also among routemen selling the same product. To a considerable extent, the earnings of routemen may be determined by their selling ability and the amount of time they spend in canvassing. Wholesale routemen generally earn more than retail routemen because, although they receive a lower percentage of sales, they handle much larger quantities of products.

Retail milkmen making home deliveries in large eastern and midwestern cities earned from about $115 to $130 a week in early 1963, usually based on a minimum guarantee plus sales commissions. The weekly earnings of milkmen on regular wholesale routes in these same areas were somewhat higher, generally ranging from $150 to $200 a week, although some workers made considerably more.

According to a recent survey of baking firms in 13 Eastern States, driver-salesmen for both wholesale and home-service bakeries had minimum weekly salaries ranging from $72.50 to $98. They can increase their earnings by selling more bakery products to their customers and by increasing the number of customers on their routes.

The number of hours worked by routemen varies. Some work only about 30 hours a week; others may work as much as 60 or more hours a week. It depends, to some extent, on whether the individual has a well-established route or whether he is trying to build up a new one; whether he has a retail or a wholesale route; and how ambitious he is. For some, the hours of work generally are limited by union-management contract. In other cases, the contract specifies merely the earliest hour that work may begin and the latest quitting time. The hours may also vary according to seasonal peaks and lows. During the spring cleaning season, for example, drycleaning routemen may work about 60 hours a week; in the winter, they may work less than 30 hours a week.

Many companies require routemen to wear uniforms. Some employers pay for the uniforms and for keeping them clean.

Most routemen receive paid vacations, generally ranging from 1 to 4 weeks, depending upon length of service, and 6 or more paid holidays a year. Many employers provide hospitalization and medical benefits; some have pension plans.

The routeman is on his own to a great extent. He does not work under strict supervision and, within certain broad limits, may decide how fast he will work and where and when he will have his lunch or rest period. This freedom of action and the daily meeting and dealing with people on the route, appeal to many young men. On the other hand, a retail routeman has to make deliveries in bad weather, and do a great deal of lifting, carrying, and walking up and down stairs. He may also have to work unusual hours. For example, retail routemen delivering milk generally work in the very early morning hours.

Many routemen, particularly those delivering bakery and dairy products, are members of the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.). Some belong to the unions which represent the plant workers of their employers.

Intercity Busdrivers

(D.O.T. 5-36.010)

Nature of Work

The drivers of the big buses which travel between cities are selected on the basis of their driving skill, emotional stability, and courtesy. A driver's duties generally begin when he takes charge of the bus. Before beginning his scheduled trip, he inspects the bus carefully at the terminal or garage. He checks the fuel, oil, water, and tires, and makes certain that the bus is carrying safety equipment, such as fire extinguishers, first-aid kits, flags, and flares. The driver also picks up the tickets, change, report blanks, and other items needed for his trip. He receives a listing of the express and mail to be carried.

Unless the driver is to take over an already loaded bus on the highway from another driver, he moves his empty bus from the terminal or garage to the proper loading platform, where he takes on his passengers. He collects fares—tickets usually—from the passengers as they board the bus, and announces the destination, route, time of arrival, and other information concerning the trip. The driver also loads or supervises the loading of baggage and package express into the baggage compartment. He checks the loading plan so that the baggage can be unloaded at the proper destination with minimum effort. He also collects cash fares from passengers who board the bus between stations where tickets are sold.

The driver operates the bus carefully at speeds which will enable him to arrive at and leave regular bus stops according to established time schedules. On most runs, he also stops momentarily at other designated points to discharge or

Driver welcomes passengers aboard intercity bus pick up passengers, and load or unload baggage and package express wherever necessary. He announces regular stops and rest or lunch stops. Before continuing the trip he counts the passengers to make certain all have reentered the bus. The driver also regulates lighting, heating, and airconditioning equipment for the passengers' comfort. In an emergency, he is sometimes required to make minor road repairs such as changing tires, for which he generally receives extra pay.

Upon arriving at his final destination, the driver unloads or supervises the unloading of the remaining baggage and turns in the lists of packages or mail carried. He prepares reports on mileage, time, and fares, as required by company rules. He also keeps a log of hours as required by the Interstate Commerce Commission. The driver must make out a complete report if an accident or unusual delay occurs.

Where Employed

Approximately 27,000 intercity busdrivers were employed by about 1,500 bus companies in 1962. About 17,500 of these drivers worked for the 155 large class I intercity companies—those with annual revenues of over $200,000. Although many bus drivers work out of the larger cities, some are employed in smaller cities and towns.

Training, Other Qualifications, and Advancement

All intercity busdrivers are required to meet minimum age, health, and experience qualifications established by the Interstate Commerce Commission. The ICC minimum age requirement is 21 years. The applicant must be able-bodied and have good hearing and at least 20/40 eyesight with or without glasses. He must have at least 1 year's driving experience (through all four seasons) with a good driving record, and must be able to read and speak English.

Although many intercity bus companies use these standards, other companies have higher requirements. Most of these companies prefer applicants to be at least 23 years of age with a high school education or its equivalent. Applicants are often given comprehensive examinations to determine their driving skill, intelligence, temperament, and personality. Some large companies do not accept applicants who wear glasses.

Young persons interested in becoming busdrivers should have good foot, hand, and eye coordination, be able to judge distances accurately, and react quickly. An even temperament and emotional stability are other important qualifications because busdrivers work under considerable tension when they operate large vehicles in heavy and swiftly moving traffic. Since they represent their companies in dealing with passengers, busdrivers must also be courteous and tactful.

Although previous experience in the operation of a truck or bus is not required, it is preferred by some employers. In most States, the law requires that a trainee for a busdriver's job must have or obtain a chauffeur's license, which is a commercial driving permit.

Most intercity bus companies conduct training programs for beginning drivers. These programs, which usually last from 2 to 6 weeks, but can extend to 3 months, include both classroom and driving instruction. In the classroom, the trainee is instructed in company and Interstate Commerce Commission rules; State and municipal regulations; safe driving practices; rates, schedules, and timetables; and how to deal with the public. He is also taught how to keep clerical records, check supplies, inspect the bus, and make minor emergency repairs.

The trainee then rides with a regular driver to observe correct driving practices and other aspects of the job. He also makes trial runs, without passengers, to demonstrate his driving skill. After satisfactorily completing the training, which generally includes final driving and written examinations, the new driver begins a "break-in" period. During this period, working under strict supervision, he makes regularly scheduled trips with passengers.

New workers start out on the "extra board," which is a list of drivers on call who are given temporary assignments. While on the extra board, the new driver may substitute for a regular driver who is ill or on vacation, drive a second or overload section, make an extra trip if necessary, or drive chartered buses. Extra drivers may have to wait several years before they have the necessary seniority to receive a regular assignment. In almost all companies, it is necessary for a beginning employee to serve a probationary period lasting, as a rule, from 30 to 90 days.

Opportunities for promotion are generally somewhat limited, particularly in small companies. An experienced driver may be promoted to a job as dispatcher, supervisor, sales representative, terminal manager, or regional manager. (Virtually all people in these jobs were once drivers.) For most drivers, advancement consists of receiving better assignments with higher earnings, as their seniority increases.

Employment Outlook

The upward trend in the employment of intercity busdrivers in recent years is expected to continue. The number of these drivers is expected to rise moderately in the immediate future and in the longer run as a result of further increase in intercity bus travel. Several hundred additional openings will also be available each year in this relatively small occupation as a result of transfers to other fields of work, retirements, and deaths.

Population growth and higher consumer incomes during the years ahead should result in more travel generally, a portion of which is expected to be by bus. Some other factors which are expected to increase travel by bus are: More new and improved highways, which will probably cut scheduled running time; increasing numbers of larger and more comfortable buses; and more deluxe express buses offering hostess services, refreshments, and other conveniences. Bus traffic will also be favorably affected by touring and charter services and by bus delivery of package express and first-class mail which have become important sources of revenue in the past several years. The further curtailment or elimination of railroad passenger service in many areas is also increasing intercity bus traffic.

Earnings and Working Conditions

Drivers (including extra men) employed by class I intercity bus companies, averaged $6,733 in 1961. Many regular drivers employed by these companies earned considerably more than $7,000 a year.

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The wages of intercity busdrivers are typically computed on a mileage basis. Rates ranged from about 7 to more than 12 cents a mile in 1962. Most regular drivers are guaranteed specified wages in terms of miles or hours per pay period. For all work other than their regular assignment or "tour of duty," they receive additional pay, customarily at premium rates.

Extra drivers are usually paid by the hour when they are on call but are not driving, and are paid the regular mileage rate when actually driving. Drivers usually start at a minimum rate and receive increases at intervals of 6 months or a year. The maximum rate is generally reached at the end of 2 years. Extra men generally earn slightly less than regular drivers but, if enough work is available, they may earn as much or more than regular drivers. Extra drivers receive a weekly or biweekly guarantee either in minimum hours, mileage, or earnings. Trainees are usually paid a flat daily rate.

Most drivers who work for the large companies average between 32 and 36 hours work a week. Work schedules may range from 6 to 10 hours a day and from 3½ to 6 days a week. For example, a driver on the run between Washington, D.C., and New York City may either make one 10-hour round trip a day for 3 days a week, drive part way and return each day for 6 days, or have the run split in some other way.

Interstate Commerce Commission regulations limit the hours of work of intercity busdrivers. According to ICC regulations, intercity drivers may drive no more than 10 consecutive hours, after which they must have at least 8 hours off. Drivers are also limited to 60 hours of "on duty" time in a 7-day period. "On-duty" is the period from the time the driver is required to report for work until he is relieved. For those who drive less than 10 hours but perform other work for the bus company, the regulations prohibit resumption of driving after any combination of driving and other on-duty time which totals 15 hours, unless the driver has first had at least 8 hours off duty.

Most intercity busdrivers belong to the Amalgamated Association of Street, Electric Railway and Motor Coach Employees of America. The

Brotherhood of Railroad Trainmen, and the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.) have also organized intercity busdrivers in a few areas.

Labor-management contracts covering many intercity busdrivers provide for health and life insurance paid for by the employer, while pension plans under such agreements are usually financed jointly by the workers and their employers.

Drivers are given vacations with pay ranging from 1 to 4 weeks, depending on the company for which they work and their length of service. Many also receive 6 paid holidays. When away from home terminals overnight, drivers employed by some companies receive pay for food and lodging. Drivers must usually pay for their own uniforms at the start of employment. However, most companies provide free uniforms as a bonus for safe driving during the previous 12-month period.

Driving an intercity bus is not usually physically burdensome, but is demanding and requires steady nerves. The busdriver is given a great deal of independence in his job, and is solely responsible for the safety of the passengers and bus. Many drivers enjoy working without direct supervision and take pride in assuming these responsibilities. Some drivers enjoy the opportunity to travel and to meet the public.

Among the less desirable aspects of this job are weekend and holiday work and the necessity of being away from home for varying periods. Also, extra drivers are on call at all hours and may be required to work at any time on very short notice. In addition, drivers with little seniority may sometimes be laid off when business declines.

Where To Go for More Information

For information regarding job opportunities for an intercity busdriver, a young man should apply to intercity bus companies or the local office of the State employment service.

Local Transit Busdrivers

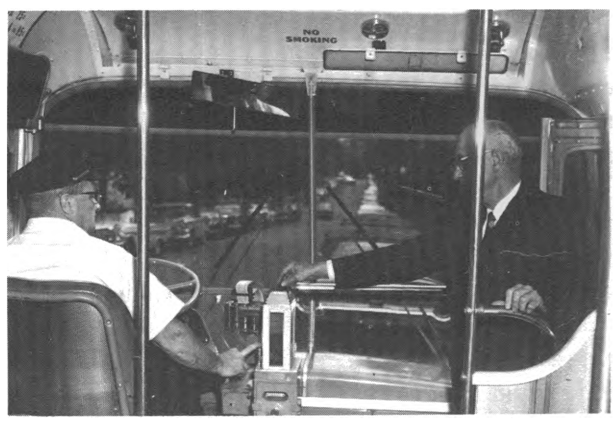
(D.O.T. 5-36.010)

Nature of Work

Local busdrivers transport millions of Americans to and from work, schools, and homes, every day. These drivers follow definite time schedules and routes over city and suburban streets in order to get passengers to their destinations on time.

The local busdriver's workday begins when he reports to the terminal or garage where he is assigned his bus. He receives his change, tokens, transfers, passes, and any other items needed. Before starting the run, the driver is usually required to check the tires, brakes, and lights. Some very small local bus companies may also require him to check the water, oil, and fuel.

On most runs, the driver makes regular stops every block or two, where he operates the controls of the bus doors to enable passengers to enter and leave the vehicle. As the passengers board the bus, the driver collects cash fares, tokens, tickets, or transfers, and also issues transfers, sells tokens, and makes change. The local busdriver often answers questions concerning schedules, routes, transfer points, and street numbers, and is sometimes required to call out the name of the street at each regular bus stop. He also regulates heating, air conditioning, and lighting equipment to keep the passengers comfortable.



Local busdriver collects fare

At the end of his day's run, the busdriver turns in a trip sheet which usually includes a record of fares received, trips made, and any delays in schedule. In case of accident or an unusual delay, the driver must make out a comprehensive report on its nature and cause.

Where Employed

In 1962, about 70,000 busdrivers were employed by the local transit bus industry. Approximately one-fourth worked in cities where the transit system was municipally owned, such as Boston, Chicago, Cleveland, Detroit, Los Angeles, New York, St. Louis, and San Francisco. In addition to those employed by the local transit bus industry, some local drivers work for charter and sightseeing lines, government agencies, and for companies which specialize in operating schoolbuses. (There are also 15,000 to 25,000 full-time schoolbus drivers and perhaps as many as 150,000 more part-time drivers.) A few drivers are employed by Federal, State, and local governments.

Although many drivers work in major metropolitan areas such as New York, Chicago, and Detroit, some are employed in almost every community in the Nation.

Training, Other Qualifications, and Advancement

Applicants for busdriver positions should be between the ages of 21 and 40, of average height and weight, and have good eyesight—with or without glasses. The applicant must be in good health, with no physical disabilities, and must be able to pass the written and physical examinations given by most employers. He must be able to judge distances accurately; have good foot, hand, and eye coordination; and have quick reflexes. Because the driver often works under pressure and deals with many different personalities, an even temperament and emotional stability are important. Although educational requirements are not high, many employers prefer applicants with a high school education or its equivalent.

A motor vehicle operator's permit and, generally, 1 or 2 years of driving experience on some type of motor vehicle are basic requirements. Most States require busdrivers to have a chauffeur's license which permits the holder to operate commercial motor vehicles. This license may be obtained either during or immediately after the driver's training period. Some employers prefer drivers who have had experience operating a truck or bus. Because the applicants will be transporting passengers and an accident could seriously injure many people, good driving records are essential. An applicant who has had a serious traffic violation or accident may be disqualified.

Most local transit companies conduct training courses which may last several weeks and include both classroom and driving instruction. In the classroom, the trainee is taught company rules, safety regulations, and safe driving practices. He is taught how to keep records, and how to deal tactfully and courteously with passengers.

The trainee makes several trips without passengers, under the direct supervision of an experienced driver. After he becomes familiar with the operation of the bus, the company's routes, and other details of his work, he makes, under supervision, several trips over a regular run with passengers. At the conclusion of his training, the new driver is often required to pass a written and final driving examination before he goes out on a run.

After passing the examinations, he is placed on the "extra" list. While on this list, he takes over the runs of regular drivers who are ill or on vacation and also makes extra trips in the morning or evening rush hours. He also may drive charter and sightseeing runs, and other extra runs such as special service buses for public meetings and sporting events. In almost all companies it is necessary for a beginning employee to serve a probationary period—generally lasting for 30 to 90 days. He remains on the extra list until he has the necessary seniority to obtain a regular run. It may take from several months to several years before he is assigned a regular run.

Promotional opportunities in regular driving jobs are generally limited. Experienced drivers may advance to jobs as instructor, dispatcher, road supervisor, and, sometimes, executive. Promotion in municipally owned bus systems is usually by examination. The opportunities for advancement of most drivers are limited to assignments to more desirable runs. Only after acquiring sufficient seniority do the drivers receive these assignments.

Employment Outlook

There will be a small number of opportunities for new workers to enter this occupation each year during the remainder of the 1960's and in the long run, even though the long term decline in employment of local busdrivers is expected to continue. These openings will result from the need to replace drivers who transfer to other fields of work, retire, or die. Retirements and deaths may account for more than 1,500 openings each year.

In recent years, there has been a considerable decline in the volume of passenger traffic handled by the local transit bus industry. The main cause of this decline has been the rapid rise in the number of private automobiles and their increasing use in both city and suburban areas. Another factor has been the rapid growth of suburbs, most of which have a wide variety of stores, theaters, restaurants, and other services. Because most suburban shopping centers have good parking facilities and are easily reached by automobile, many suburban residents have found it unnecessary to use public transportation for shopping or other activities. In addition, increasing traffic congestion and parking problems in most downtown sections have led to the decline of many central business districts. This, in turn, has resulted in some curtailment of downtown bus service between rush hours.

As local transit bus traffic declined steadily in recent years and bus schedules and routes were curtailed or entirely eliminated, the employment of busdrivers also declined. The decline in employment was limited, however, partly because transit companies are not completely free to curtail or eliminate unprofitable routes, since the companies are usually regulated by State or municipal authorities.

Employment of local transit busdrivers is expected to continue to decline during the years ahead, but at a somewhat slower rate. The population shift to the suburbs will continue to be responsible for a moderate drop in employment. No sharp decline is expected because downtown traffic congestion and parking problems will continue to limit the use of automobiles in downtown areas. Factors which will slow the downward trend in busdriver employment are the replacement of streetcars by buses, and the increased need for schoolbuses in the suburbs. An increase in the number of municipally owned companies might also favorably affect busdriver employment, since such companies, even more than privately owned companies, may provide service in the public interest on unprofitable routes.

To alleviate the increasingly acute downtown traffic congestion and urban parking problems, Federal legislation was introduced in early 1963 which would encourage further combining of all types of local public transportation—subway, motorbus, trolley, and railway—into one coordinated and expanded system, involving reduced fares on commuter railroads and suburban motorbus lines. Such programs have already been started in some communities. However, it is too early to determine the effect that these programs and legislative proposals will have on employment of local transit busdrivers.

Earnings and Working Conditions

Local transit busdrivers are usually paid by the hour, and earnings vary according to locality, length of service, size of company or city, and length and type of run. Nearly all companies pay the maximum job rate after 12 months' service. According to a survey of minimum hourly wage scales set by union contracts for busdrivers in 53 large cities, the average hourly rate was $2.54 on July 1, 1962. For more than half of the busdrivers covered by the contracts, scales ranged from $2.35 to $2.75 an hour. Hourly scales were highest in the larger cities in the Great Lakes, Pacific, New England, and Middle Atlantic regions. Among the cities surveyed, the hourly pay scales for experienced busdrivers ranged from $1.70 in Knoxville, Tenn., to $2.77 in Boston, Mass. Wage scales for beginning drivers were generally 5 to 15 cents an hour less.

Most busdrivers have a standard work schedule of 8 hours a day, 40 hours a week. For additional work, drivers usually receive 1½ times their hourly rates. In many companies, drivers often work in excess of their standard work schedule, thereby increasing their weekly earnings. Drivers on the extra list generally are guaranteed a minimum number of hours of work or a minimum weekly salary, but frequently earn more than the guaranteed minimum.

The workweek for regular drivers usually consists of any 5 consecutive days, with Saturdays and Sundays being counted as regular workdays. Most transit companies run some buses in the evening and a few companies operate 24 hours a day. Therefore, some drivers have to work at night. Many have regular "straight" runs which are unbroken except for meal periods. Others may work the "swing" run, in which the operator drives for several hours, is off for several hours, and then drives again for several hours. If the total elapsed time between the beginning and end of a split shift exceeds a stated number of hours, the driver generally receives extra pay.

Nearly all local transit busdrivers are covered by labor-management contracts which provide for life and health insurance, and pension plans; the major pension plans are financed jointly by the workers and their employers, while many life and health insurance plans are paid for solely by the employer. Drivers also are given vacations with pay ranging from 1 to 5 weeks, depending on the length of service, and usually 6 or 7 or more paid holidays a year.

Although driving a bus is not physically exhausting, busdrivers are exposed to the nervous tension which arises from driving a large vehicle on heavily congested streets and dealing with many types of passengers. In addition to driving a bus, they must collect fares, answer questions, see that passengers are clear of the doors, and request riders to move to the rear.

Among the more favorable aspects of this job is steady year-round employment once a driver receives a regular assignment. Busdrivers are usually free of direct supervision—which many drivers also find desirable. Drivers take pride in being solely responsible for the safety of the passengers and bus and in acting as the bus company's representative to the general public.

Most busdrivers are members of the Amalgamated Association of Street, Electric Railway and Motor Coach Employes of America. Drivers in New York City and several other large cities belong to the Transport workers Union of America. The International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.) has also organized some local transit busdrivers.

Where To Go for More Information

For information on employment opportunities for a local busdriver, a young man should apply to the local transit company in his area or to the local office of the State employment service.

Taxi Drivers

(D.O.T. 7-36.040)

Nature of Work

In practically all communities, taxicabs are an essential part of the regular transportation system. Taxicab drivers, in addition to providing transportation, also perform other services. For example, they assist passengers in and out of the cab, handle their luggage, and may also pick up and deliver packages. In some communities, cabs are used for transporting crippled children to and from school. Cabdrivers occasionally provide sightseeing tours for out-of-town visitors.

Drivers get their "fares" or passengers in one or more ways. The majority of taxicab fleets are equipped with two-way radio systems over which requests for taxicabs are transmitted to the driver. These companies also have cab stands at which drivers may wait for phone calls from their central dispatching office which will direct them to pick up passengers. Many drivers wait in front of theaters, hotels, bus terminals, railroad stations, and other buildings which may have large numbers of prospective passengers. In small cities and in suburban areas, drivers may work from a central location, such as a terminal, to which they return after each trip. Passengers may also be picked up while the driver is returning to his stand or station. A good

Cabdriver picks up fare

driver keeps himself informed on what is happening in the city, where crowds will gather (for example, at theaters, and baseball and football games) and the times when the crowds will break.

Drivers are usually required to keep records, such as the date, time, and place passengers were picked up, and the destination, time of arrival, and amount of fare collected. If the cabdriver owns his own cab or if he rents a cab over an extended period of time, he may periodically clean the cab, as required by regulations in many municipalities. In large cab companies, this job is generally performed by cleaners employed by the company.

Where Employed

Approximately 150,000 taxi drivers were employed full time in 1962 in the taxicab industry, which is made up of both privately owned cabs and fleets of company-owned vehicles. In addition, perhaps as many were employed part time.

Although taxicab drivers are employed in every metropolitan area in the country, the greatest concentration of these workers is found in large cities. New York City, Washington, D.C., Chicago, Philadelphia, Boston, New Orleans, Detroit, St. Louis, and Baltimore lead in the employment of cabdrivers.

Training, Other Qualifications, and Advancement

To become a taxi driver in most large cities, it is necessary to have, in addition to a State-issued chauffeur's license, a special taxicab operator's license issued by the local police or safety department or Public Utilities Commission. Although licensing requirements vary considerably among cities, in general, applicants must be over 21, in good health, have a good driving record, and have no criminal record. A driver's record is checked for arrests, both locally and through the Federal Bureau of Investigation (FBI).

Most large communities require an applicant for a taxi driver's license to pass a written examination on taxicab and traffic regulations. The examination may include questions on street locations, insurance regulations, accident reports, lost articles, zoning or meter rules, and passenger pickup and deliveries. In some cities, the cab company will teach the driver-applicant taxicab regulations and the location of streets and important buildings. In other cities, the driver may prepare himself for the license examination. After the driver has passed the examination, he pays an annual license fee, generally ranging from 50 cents to $5.

Although formal education is seldom required, many companies prefer applicants for a taxi driving job to have at least an eighth-grade education. A neat, well-groomed appearance is desirable, as is the ability to deal tactfully and courteously with all types of people. Good foot, hand, and eye coordination are particularly desirable because taxi drivers must often operate their cabs in fast moving and heavy traffic.

Opportunities for advancement for taxi drivers are extremely limited, with promotion to the job of dispatcher often the only possible advancement. Some drivers, however, have become road supervisors, garage superintendents, or claims agents. Many drivers who work for companies try to purchase their own cabs so that they can become their own employers. In some large cities, however, the number of cabs is restricted by ordinance, which may limit the opportunity to own cabs in such areas.

Employment Outlook

There will be many opportunities for new workers to become taxi drivers during the remainder of the 1960's and in the longer run, primarily because of the high turnover rate in this occupation. However, the total number of full-time taxi drivers is not expected to change appreciably.

In the past, the employment of taxi drivers has been adversely affected by the increased use of privately owned automobiles, rented cars, and the continuing population shift to the suburbs. In more recent years, however, the level of employment appears to have stabilized. Increased population, higher consumer incomes, parking difficulties, and higher local transit bus and streetcar fares are some of the factors which may lead to a greater use of taxicabs and a slight increase in the employment of taxicab drivers.

The high turnover rate in this occupation results from the lack of assurance of a steady income, long hours, and the use of this job by some workers as stopgap employment when better jobs are not available. Transfers from this occupation are expected to be the major reason that employment opportunities will be available for many new workers who wish to enter this field of driving.

Earnings and Working Conditions

Comprehensive data on earnings of taxi drivers are not available. Most full-time drivers on the East Coast and in the Midwest averaged about $75 to $85 a week, according to fragmentary information from a small number of employers. In one major eastern city with a large number of taxicabs, a full-time taxi driver could expect to earn, with tips, about $100 a week for a 6-day week, in early 1963. Driver-owners earned about the same amount, after deduction of their overhead and driving costs. In many instances, a 5- or 6-day week is optional on the part of the driver.

Most taxi drivers employed by taxicab companies are paid a percentage—usually between 40 and 50 percent—of the total fare. Drivers also frequently receive tips, ranging from 10 to 20 percent of the fare. Some companies pay their drivers a salary and give them an additional commission based upon the amount of business the drivers do. A few companies guarantee their drivers minimum daily or weekly earnings. Many drivers rent their cabs from the company by the day for a set price. Any receipts above the cab rental and other operating expenses are retained by the drivers.

A large percentage of full-time taxi drivers work 9 or 10 hours a day for 6 days a week. They usually begin work between 6 a.m. and 8 a.m. Many drivers work nights, starting between 3 p.m. and 5 p.m. Some drivers work on Sundays and holidays.

Many college students have been able to work their way through school by driving cabs on a part-time basis and during summer and spring holidays. Some workers also become part-time drivers in order to supplement their regular income.

Driving a taxicab is not physically strenuous. Most drivers do not change tires or do other heavy repair work. Drivers are, however, subject to nervous tension from driving in heavy traffic in all kinds of weather, and dealing with all types of passengers.

Many drivers find the lack of direct supervision by an employer one of the more desirable aspects of their job. They may, however, be subject to municipal regulations which govern their personal appearance, the fares they charge, and their driving practices.

Although unionization in this occupation is not widespread in small cities, taxi drivers in many of the large cities belong to labor unions, particularly those drivers who work for the large taxicab companies. The main union in this field is the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.).

Taxi drivers usually put in long hours of work and do not receive overtime pay. Many of them do not receive fringe benefits, such as pensions and severance pay, that workers in many other occupations receive. When economic conditions decline, their earnings are generally reduced because of increased competition for less business.

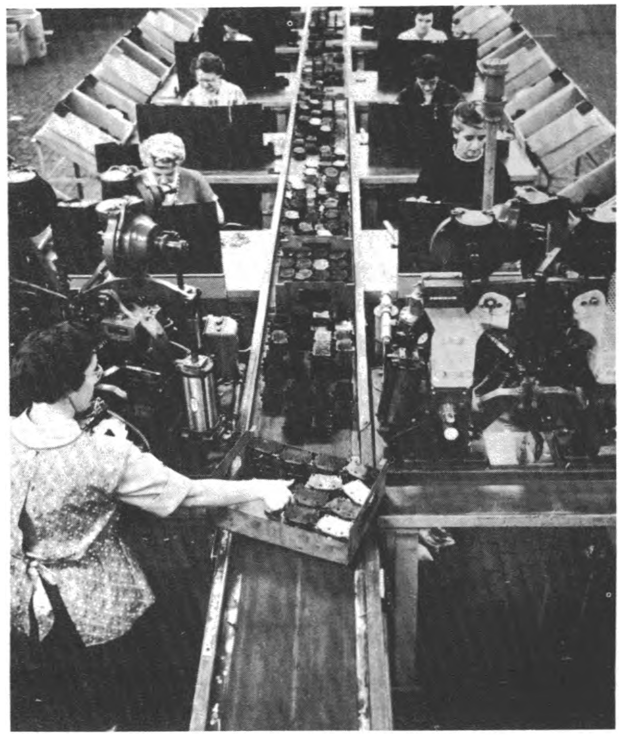
SOME FACTORY OCCUPATIONS NOT REQUIRING SPECIALIZED TRAINING

Assemblers

Nature of Work

Many of the products and parts made in factories must be assembled during various steps in the manufacturing process as well as in the final assembly of the product. For example, television sets, automobiles, and refrigerators are typical of the products which undergo many assembly operations. The workers who put together parts or finished products are known as assemblers.

Some assemblers, known as floor assemblers, put together large, heavy machinery or equipment on shop floors, often fastening parts with bolts, screws, or rivets. Others, known as bench assemblers, put together small parts to make subassemblies or small complete units, while working at a bench. Many assemblers work on products or parts which move automatically past their work stations on conveyors. These workers must do their assembly job within the time period it takes the part or product to pass their work station.



Women are often employed as bench assemblers

The job duties of assemblers depend upon the product being manufactured and the manufacturing process being used. In aircraft and missile production, these workers may assemble and install parts into subassemblies. In the automobile industry, one assembler may start nuts on bolts and the next worker on the assembly line tightens the nuts with power-driven tools. Assemblers in electronic plants may connect parts with electrical wire.

Semiskilled assemblers do relatively simple, repetitive operations under close supervision, often guided by simple instructions. In contrast, skilled assemblers work on the more complex parts of subassemblies with little or no supervision and are responsible for the final assembly of complex jobs. These skilled workers must know how to read blueprints and other engineering specifications and use a variety of tools and precision measuring instruments. In relatively new fields such as electronics, instrumentation, and missiles, subassembly work may require a high degree of skill.

The kinds of tools semiskilled assemblers use depend upon the job they are doing and the product on which they are working. Pliers, screwdrivers, soldering irons, power drills, and wrenches are among the common tools used by semiskilled assemblers.

Where Employed

Assemblers work in plants that mass-produce products such as automobiles, aircraft, television sets, cameras, refrigerators, watches, and electrical motors. In early 1963, approximately 600,000 semiskilled assemblers were employed in manufacturing plants, with the great majority in metalworking plants. The majority of semiskilled assemblers were employed in California, New York, Michigan, Illinois, Ohio, Indiana, and Pennsylvania.

More than 2 out of 5 semiskilled assemblers were women, who worked primarily as bench assemblers. More than 4 out of 10 women assemblers worked in the electrical machinery, equipment, and supply industry. Large numbers of women assemblers also were employed in other industries—fabricated metals; machinery, except electrical; transportation equipment; and instruments and related products.

Training, Other Qualifications, and Advancement

Inexperienced workers who are hired to do semiskilled assembly work are usually trained on the job in a few hours or days. The new worker may have his job duties explained to him by his supervisor and then be placed under the supervision of a more experienced employee. The trainee observes the experienced employee at work or directly assists him in his work. When the learner develops sufficient speed, he is placed "on his own" and is responsible for the work he produces.

Employers generally want applicants for semiskilled assembly jobs to be physically able, dependable, and to have some aptitude for mechanical work.

Some employers prefer persons with no previous experience in factory assembly work so that they can be more easily trained in the employers' assembly methods. High school graduates or workers who have taken vocational school courses, such as blueprint reading, are preferred by many employers. Employers frequently hire aplicants who do not have a high school diploma. Generally, for production-line assembly jobs, employers look for applicants who can do routine work at a steady and fast pace. For other types of assembly jobs, applicants may have to meet special requirements. For example, in plants producing electrical and electronic products, which may contain many different colored wires, applicants often are tested for color blindness.

Many women are employed in semiskilled bench assembly jobs because such work is relatively light and often requires the ability to work with small and delicate objects. This is particularly true in the electrical and electronic equipment industry. Male workers are usually employed as floor or line assemblers, where the work is physically hard. Final automobile assembly, for example, is generally done by men.

A relatively small number of workers who learn to perform a variety of assembly work and who have a knowledge of blueprint reading and shop mathematics are able to become skilled assemblers. A few workers also may become skilled inspectors or foremen.

Employment Outlook

The employment of semiskilled assemblers is expected to increase by several thousand annually during the remainder of the 1960's and in the longer run. Most job opportunities, however, will result from the need to replace large numbers of workers who retire, die, or transfer to other fields of work, and to replace women who leave their jobs to marry or raise a family. Deaths and retirements alone will account for about 20,000 openings each year.

Most of the industries that employ these workers, especially the electrical machinery industry, are expected to increase their employment during this period.

Not all assembly jobs are expected to increase at the same rate. Technological changes may slow the growth of some jobs. For example, the introduction of printed electrical circuits reduces the wiring work required in assembling radio and television sets, thus affecting the employment of assembly workers in plants producing these products. An increase in the use of automatic assembly processes also may decrease the employment of these workers.

Although the outlook for semiskilled assemblers in manufacturing industries is generally favorable, employment in metalworking manufacturing plants, which have many assemblers, is particularly sensitive to changes in business activities and national defense needs. Therefore, these workers are subject occasionally to layoffs.

Earnings and Working Conditions

Earnings of semiskilled assemblers in manufacturing industries vary widely, depending on their skill, the type of product assembled, and factors such as the size and location of the plant in which they are employed.

Assembly jobs are commonly classified as A, B, and C, to reflect the level of skill and responsibility involved. (For the purpose of this publication, class B and C assemblers are considered to be semiskilled workers.) In mid-1962, average straight-time hourly earnings of class B male assemblers in machinery (other than electrical) plants in 21 large cities and metropolitan areas ranged from $1.82 in Dallas to $2.88 in Pittsburgh; and earnings of class C male assemblers ranged from $1.38 in Dallas to $2.61 in Milwaukee. Hourly earnings of male assemblers varied considerably in the same city. In Dallas, for example, the straight-time hourly earnings of class B male assemblers ranged from $1.40 to $2.40; and, in Milwaukee, from under $2 to $4 and over. Earnings of class C female assemblers ranged from $1.32 in Dallas to $2.48 in Detroit.

The working conditions of semiskilled assemblers differ depending on the particular job performed. Assemblers of electronic equipment may put together small components at a bench in a room which is clean, well lighted, and free from dust. Floor assemblers of industrial machinery, on the other hand, may install and assemble heavy parts and are often exposed to contact with oil and grease. Assemblers on assembly lines may be under pressure to perform their assignments in the time the conveyor moves the parts or subassemblies past their work stations.

Many semiskilled assemblers in manufacturing industries are members of labor unions. These unions include the International Association of Machinists; the International Union of Electrical, Radio and Machine Workers; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; and the International Brotherhood of Electrical Workers. Most labor-management contracts in the manufacturing plants in which assemblers are employed provide for fringe benefits such as holiday and vacation pay, health insurance, life insurance, and retirement pensions.

Inspectors

Nature of Work

Almost everything manufactured must be carefully inspected during the manufacturing process. The millions of automobiles, sewing machines, television sets, production machinery, and other mass-produced items must be tested and inspected to make sure they operate properly. The workers who see that the size and quality of raw materials, parts, and assemblies, and the operation of the finished products, meet specifications are known as inspectors.

Semiskilled inspectors may look for scratches and other defects in products or parts. They often use simple gages to find out whether parts are made to specified sizes; they may also use measuring devices such as micrometers (a precision-measuring instrument) to check the accuracy of the parts. Semiskilled inspectors may be required to read simple work orders and do arithmetic involving decimals and fractions when reading measuring instruments. Some inspectors use handtools, such as screwdrivers or pliers, in their work.

The work done by inspectors varies by industry. For example, in radio and television manufacturing plants, many inspectors test tubes and circuits to see that they meet specifications. In the automobile industry, they examine raw materials and parts during the various stages of manufacturing.

Inspectors often keep records of the number of parts they have inspected, accepted, and rejected. When they find a large number of faulty pieces, they notify their supervisors so that corrections can be made on the production line. In some industries, inspectors may perform

Inspectors test electronic components

additional duties such as making minor repairs and adjustments, and grading products for quality.

The work done by semiskilled inspectors in factories is different from that performed by skilled inspectors. Semiskilled inspectors usually work under close supervision; skilled inspectors work under general supervision. In the metalworking industries, skilled inspectors are often required to read blueprints, interpret specifications, and use complex precision-measuring instruments.

Where Employed

In early 1963, about 500,000 semiskilled inspectors were employed in a wide variety of manufacturing plants. Most semiskilled inspectors were employed in plants that produce electrical motors, refrigerators, hoists, lathes, automobiles and parts, textiles, and clothing, while others were employed in plants that produce aircraft, missiles, rubber and plastic products, and in those that process food. More than half of the semiskilled inspectors were employed in Ohio, New York, Michigan, Illinois, Pennsylvania, California, and New Jersey.

Training, Other Qualifications, and Advancement

Semiskilled inspectors are generally trained on the job for a brief period—from a few hours or days to several months, depending upon the skill required.

Many employers prefer workers with no previous inspection experience. They look for applicants who are physically able, dependable, have good eyesight, and can follow instructions. Some employers prefer experienced production workers for inspection jobs. A few large companies give aptitude tests in selecting new employees for inspection work. For example, in the electronics industry, new workers may be given tests to determine their ability to work with numbers. Employers also look for employees who can do work requiring constant attention. Employers often hire applicants who do not have a high school diploma.

More than 2 out of 5 semiskilled inspectors are women. They are employed throughout the industries that manufacture metal products, but especially in the electrical machinery industry, where many jobs are not physically demanding. They generally work in plants that produce relatively small and light products and parts, such as electrical and electronic equipment. Women inspectors predominate in many food, textile, and apparel products industries.

Some semiskilled inspectors in the metal products industries who supplement their work experience with formal educational courses, such as blueprint reading, shop mathematics, and electrical theory, may advance to jobs as skilled inspectors. A few semiskilled inspectors, after acquiring sufficient experience and knowledge, may advance to foremen jobs.

Employment Outlook

The employment of semiskilled inspectors is expected to increase by several thousand annually during the remainder of the 1960's and in the longer run. In addition, a considerable number of job opportunities will result as workers retire, die, or transfer to other fields of work, and as women leave their jobs to marry or raise a family. Deaths and retirements alone will account for about 15,000 openings each year.

Most of the industries that employ these workers, especially the electrical machinery industry, are expected to increase their employment in the long run. The growing complexity of the products manufactured in our factories, and rising quality standards, should also result in a need for more inspectors. These favorable factors will be partially offset, however, by the increasing use of mechanized and automatic inspection equipment.

Earnings and Working Conditions

Inspectors' earnings vary considerably depending on their skill, the type of product inspected, the method of wage payment, and the size and location of the plant in which they are employed. Inspector jobs are commonly classified as A, B, and C, to reflect the level of skill and responsibility involved. (For the purpose of this publication, class B and C inspectors are considered to be semiskilled workers.) In mid-1962, average straight-time hourly earnings of class B male inspectors in machinery (other than electrical) plants in 19 large cities and metropolitan areas ranged from $2.05 in Dallas to $2.89 in Philadelphia; and earnings of class C male inspectors ranged from $1.72 in Dallas to $2.73 in Detroit. Even among machinery plants located in the same city, earnings of male inspectors of comparable skills differed. For example, among machinery plants in Dallas, straight-time hourly earnings of class B male inspectors ranged from $1.70 to $2.40; among machinery plants in Philadelphia, the range was from $2.10 to $3.40. Other studies indicate that average hourly earnings of inspectors (as a group) in the food processing, textile, and apparel industries were about equal to those of class C inspectors in metalworking industries.

The working conditions of inspectors vary considerably. For example, some may work in well-lighted, air-conditioned workplaces in an aircraft or missile plant; others may work on the production floor of a machinery or metal fabricating plant, often exposed to high temperatures, oil, grease, and noise.

Many inspectors employed in manufacturing industries are members of labor unions. The International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the International Association of Machanists; the International Union of Electrical, Radio and Machine Workers; and the International Brotherhood of Electrical Workers are among the larger unions to which these workers belong. Most of the labor-management contracts in manufacturing plants employing inspectors provide for fringe benefits such as paid holidays and vacations, health insurance, life insurance, and retirement pensions.

Power Truck Operators

Nature of Work

In the past, manual workers in factories usually did the hard physical labor of moving raw materials and products. Today, many heavy materials are moved, with little physical effort, by workers who operate various types of self-powered trucks, which can easily carry tons of material and lift it to heights of 18 or more feet.

A typical truck operated by these workers has a hydraulic or electric lifting mechanism with attachments such as forks to lift piles of cartons or other containers, and scoops to lift coal or other loose material. Some power trucks are equipped with tow bars used to pull small trailers.

Power truck operators start the truck, make it go forward or backward, stop the truck, and control the lifting mechanism and attachments by moving pedals and/or levers. Power truck operators may be required to keep records of material moved, do some manual loading and unloading of materials, and maintain their trucks in good working condition by cleaning, oiling, checking water in batteries, and making simple adjustments.

The driver must use care and skill in driving his truck. For example, in driving through aisles where material is stored or when loading or removing materials from stock, he must be able to judge distance so that no damage occurs. The operator also must know how much of a load

Forklift truck operator moves load

the truck can carry and the kinds of jobs it can do.

Where Employed

Semiskilled power truckers are employed in all types of manufacturing industries. Many of these workers are employed in metalworking plants that manufacture products such as automobiles and automobile parts, machinery, fabricated metal products, and iron and steel.

In addition to working in factories, large numbers of these workers are employed in warehouses, depots, dock terminals, mines, and other places where great quantities of materials must be moved. In 1961, between 5,000 and 6,000 forklift truck operators were employed by the Federal Government; most of them were employed by the Army, Navy, and Air Force. Large numbers of industrial power truck operators work in California, Michigan, New York, Ohio, Illinois, and Pennsylvania.

Training, Other Qualifications, and Advancement

Most workers can learn to operate a power truck in a few days. It takes several weeks, however, to learn the physical layout and operation of a plant or other establishment and the most efficient way of handling the materials to be moved.

Large companies generally require applicants for a power truck operator job to pass a physical examination. Many large employers also have formal training programs for new employees. In these training programs, the employee learns to operate the power truck, to do simple maintenance work, principles of loading and handling materials, plant layout and plant operation, and safe driving practices and rules.

There are some opportunities for advancement. A few operators may become materials movement foremen or supervisors.

Employment Outlook

The number of power truck operators in manufacturing industries is expected to increase in the remainder of the 1960's and in the longer run. Replacement needs resulting from retirements, deaths, and transfers to other jobs also will provide many job openings.

Most of the industries which employ large numbers of these workers are expected to have a long-range upward trend in employment. In addition, the greater use of power trucks in materials handling will increase the need for power truck operators. The favorable effects of these two factors on employment of power truck operators will be partially offset by the continued development and use of more efficient power trucks and other mechanized materials-handling equipment. For example, mechanized materials-handling equipment, such as continuous conveyor systems, moves materials in fixed paths at constant rates of speed, eliminating bottlenecks and allowing for accurate production control. This method of materials handling will result in less use of power trucks in some plants.

Earnings and Working Conditions

Power truck operators employed in manufacturing industries generally are paid an hourly rate. In 1962, the average straight-time hourly earnings of forklift power truck operators in manufacturing plants in 75 cities and areas ranged from $1.39 in Jackson, Miss., to $2.89 in Akron, Ohio.

Many power truck operators are subject to hazards—such as falling objects and collisions between vehicles. Safety instruction is therefore an important part of the job training in power trucking work.

The driver may operate his truck inside buildings, or outdoors where he is exposed to various weather conditions. Some operators may handle loose material that may be dirty or dusty.

Power truck operators have somewhat varied work in moving materials throughout a plant. Their work is likely to be less repetitive and routine than that of workers who do semiskilled machine operator work.

Many power truck operators are members of labor unions. Most labor-management contracts in manufacturing plants employing power truck operators provide for fringe benefits such as paid holidays and vacations, health insurance, life insurance, and retirement pensions.

Production Painters

Nature of Work

Almost every metal or wood product manufactured by American industry is given a coating of paint or other protective material. Although some of this paint is applied by automatic methods, much of the painting in mass-production industries is done by workers known as production painters. Most of these workers use spray guns to apply paint, lacquer, varnish, or other finishes to parts or finished manufactured products. Some production painters use brushes to apply paint. The work done by production painters in factories is different from that performed by skilled painters who are employed in construction and maintenance work. (See index for page number references to Painters.)

Painters who operate spray guns pour mixed paints into a spray gun container which is attached to an air-compressor unit. They adjust the nozzle of the spray gun and the air-compressor so that the paint will be applied uniformly. The objects being sprayed may be stationary or attached to a moving conveyor. When working on objects requiring more than one color, production painters may apply masking tape to prevent overlapping of colors.

Although the duties of most production painters are quite simple and repetitive, the jobs of some may be rather varied. These production painters may make decisions involving the application of finishes, thinning of paint, and the adjustment of paint spray equipment. Production painters also may clean the surface to be painted before painting. For some assignments, which require production painters to mix paints and figure the size of the area to be painted, they use simple arithmetic involving decimals and fractions. Production painters may replace nozzles and clean guns and other paint equipment when necessary. Some production painters may operate specialized spray guns such as those operated at high temperatures and used to spray powdered plastics. In addition to spray tanks and spray guns, production painters use tools such as mixing paddles, pliers, rules, and liquid mixing devices.

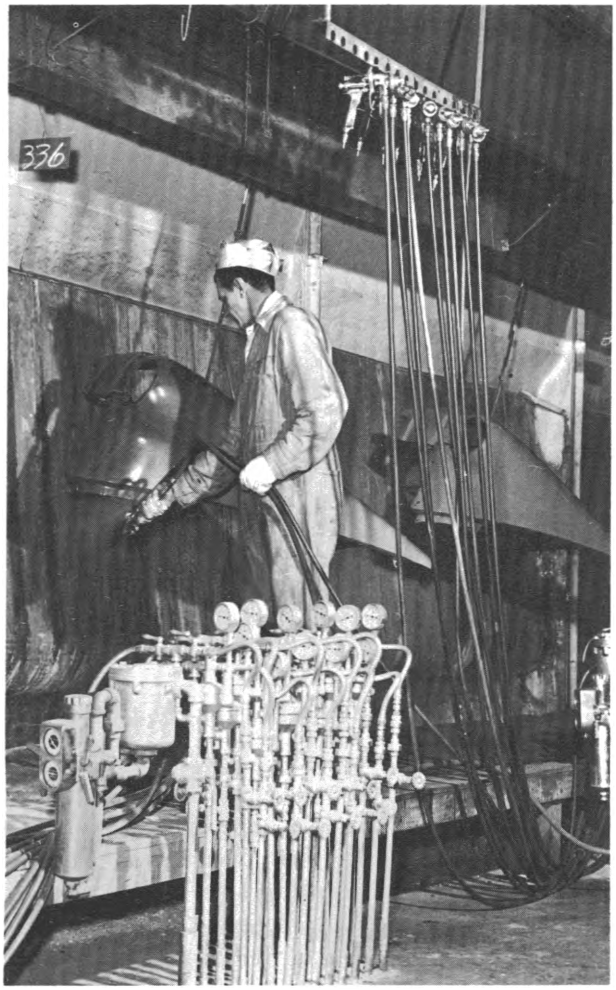
Where Employed

About 110,000 production painters were employed in manufacturing industries in early 1963; about 85 percent of these were in industries making durable items such as automobiles, refrigerators, furniture, electrical measuring meters, and transformers. More than half of all production painters were employed in New York, Michigan, Ohio, Illinois, California, Pennsylvania, North Carolina, and New Jersey. Approximately 15 percent of them were women.

Training, Other Qualifications, and Advancement

Most production painters learn their jobs through on-the-job training. The length of training may vary from 2 weeks to several months.

The new worker may have his job duties explained to him by his supervisor and then be placed under the supervision of an experienced



Production painter sprays automobile body part attached to moving conveyor

employee. The trainee may observe the experienced employee at work or assist him in his work.

Persons going into this work should be in good health, be able to stand for long periods of time, have a steady hand, and have good eyesight so that they can distinguish between colors and see whether the paint is applied evenly.

There are some opportunities for advancement in this field of work. A small number of workers have become skilled inspectors or foremen.

Employment Outlook

Several thousand job opportunities for new production painters are expected during the rest of the 1960's and in the longer run. Many job openings will arise from the need to replace workers who retire, die, or transfer to other lines of work. Deaths and retirements alone will result in almost 2,000 openings each year.

Many industries which employ production painters are expected to increase their employment. Employment of production painters, however, will not increase as rapidly as total employment in these industries because of the increasing development and use of mechanized and automatic painting equipment.

Earnings and Working Conditions

Production painters generally are paid on an hourly basis. According to a 1962 wage survey of the nonupholstered wood household furniture industry, male production painters had average straight-time hourly earnings of $1.70. An examination of selected 1962 labor-management contracts in the metalworking industries indicates that these workers earned from about $2.20 to $2.70 an hour.

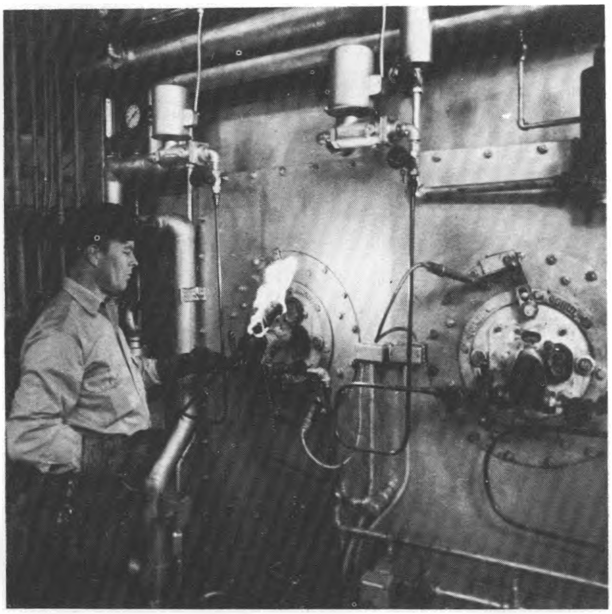
Production painters are exposed to fumes from paint and paint-mixing ingredients. Some painters wear protective goggles and masks which cover the nose and mouth. When working on large objects, they may work in awkward and cramped positions.

Many production painters are members of unions. Among the labor organizations to which they belong are the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the United Furniture Workers of America; and the United Steelworkers of America. Many labor-management contracts in the plants in which these workers are employed provide for fringe benefits such as holiday and vacation pay, health insurance, life insurance, and retirement pensions.

Stationary Firemen (Boiler)

Nature of Work

Stationary firemen employed in manufacturing plants are semiskilled workers who operate and maintain steam boilers used to power industrial machinery, and to heat factories. Their duties and responsibilities vary. Some experienced sta-



Stationary fireman lights a boiler

tionary firemen may be responsible for inspecting boiler equipment, for lighting boilers, and building up steam pressure. On the other hand, the responsibilities of some stationary firemen may be limited to keeping equipment in good working order by cleaning, oiling, and greasing moving machinery parts.

In most plants, stationary firemen operate mechanical devices which control the flow of air, gas, oil, or powdered coal into the firebox in order to keep proper steam pressures in the boilers. Duties of these workers may include reading meters and other instruments to make sure that the boilers are operating efficiently and in accordance with safety regulations.

Fully qualified stationary firemen should be able to detect malfunctions without relying entirely on safety devices. In some plants, stationary firemen may be expected to know how to make minor repairs. Stationary firemen are often supervised by stationary engineers. (The stationary engineer is a skilled worker who is responsible for the operation and maintenance of a variety of equipment, including boilers, diesel and steam engines, and refrigeration and air-conditioning equipment. See index for page number reference to Stationary Engineers.)

Where Employed

About 50,000 stationary firemen were employed in a wide variety of manufacturing industries in early 1963. Generally, these workers are employed in industries which are large users of power generating equipment. Leading industries in the employment of stationary firemen are lumber, food, iron and steel, paper, chemicals, and transportation equipment. The lumber and paper industries, together, employed about 11,000 stationary firemen.

Because stationary firemen work in so many different industries, they are employed in all parts of the country. Although some are employed in small towns and even rural areas, most work in the more heavily populated areas where large manufacturing plants are located. The States of Ohio, New York, Pennsylvania, Illinois, Michigan, New Jersey, and California account for about 45 percent of the total number of firemen.

Training, Other Qualifications, and Advancement

Some large cities, and a few States, require stationary firemen to be licensed. Applicants can obtain the knowledge and experience to pass the license examination by first working as a helper in a boilerroom, or working as a stationary fireman under a conditional license.

License requirements differ from city to city and from State to State. However, the applicant usually must prove that he meets the experience requirements for the license and pass an examination testing his knowledge of the job. For specific information on State and local licensing requirements, consult your State or local licensing authorities.

There are two types of stationary firemen licenses—for low and high pressure boilers. Low pressure firemen operate low pressure boilers generally used for heating. High pressure firemen operate the more powerful high pressure boilers and auxiliary boiler equipment used to power machinery and equipment in addition to heating buildings. Both high and low pressure operators, however, may operate equipment of any pressure class, provided a stationary engineer is on duty.

Stationary firemen should understand the operation of machinery and must have normal vision and good hearing. (Because of the mechanization of equipment, physical strength is no longer a major requirement for this type of work.)

Stationary firemen may advance to jobs as stationary engineers. To become stationary engineers, firemen sometimes supplement their on-the-job training by taking courses in subjects such as practical chemistry; elementary physics; blueprint reading; applied electricity; and theory of refrigeration, air conditioning, ventilation, and heating. Stationary firemen may also advance to jobs as maintenance mechanics.

Employment Outlook

Employment of stationary firemen in manufacturing industries is expected to continue to decline during the remainder of the 1960's and in the longer run. Some opportunities for new workers, however, will result each year from the need to replace workers who transfer to other fields of work or who retire or die.

An increase in the use of stationary boilers and auxiliary equipment is expected during the next 10 to 15 years. However, use of automatic, more powerful, and more centralized equipment, and better use of manpower are expected to result in a decline in the number of stationary firemen. In large plants where turbines and engines are housed under a separate roof and where there is a need for constant surveillance of boilers, firemen will continue to be needed.

Earnings and Working Conditions

Among the factors affecting the earnings of stationary firemen are the type of equipment which these workers operate and the industry in which they are employed. In 1962, the average straight-time hourly earnings of stationary firemen in manufacturing plants in 64 cities and areas ranged from $1.33 in Raleigh, N.C., to $3.11 in Detroit, Mich., Los Angeles and Long Beach, Calif.

Although many boilerrooms where stationary firemen work are clean and well lighted, these conditions do not always exist. Most stationary firemen, even under the most favorable conditions, are at times exposed to noise, high temperatures, dirt, dust, contact with oil and grease, odors, and fumes from oil, gas, coal, or smoke. In repair or maintenance work, these workers may have to crawl inside a boiler and work in a crouching or kneeling position.

Stationary firemen are subject to burns and falls, and injury from moving machinery. Boilers and auxiliary equipment that are not operated correctly, or are defective, may be dangerous to these workers and to other persons in the work vicinity. However, modern equipment and safety procedures have reduced accidents considerably in recent years.

Many stationary firemen are employed in plants that have labor-management contracts, most of which provide benefits that may include paid holidays and vacations, hospitalization, medical and surgical insurance, sickness and accident insurance, and retirement pensions. Among the unions to which these workers belong are the International Brotherhood of Firemen and Oilers and the International Union of Operating Engineers.

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OTHER TRADES AND MANUAL OCCUPATIONS

Blacksmiths

(D.O.T. 4-86.010 and .210)

Nature of Work

Blacksmiths make and repair many different kinds of metal articles and parts, such as tools, machine frames, automobile parts, and other industrial and agricultural equipment. They also sharpen hand and machine tools, such as chisels, drills, and picks. They do their work by shaping and sometimes joining together glowing hot metal which has been heated in a special type of furnace called a forge. In performing the shaping and joining processes, the latter known as forge welding, blacksmiths hammer heated metal on an anvil. They use handtools, such as hand hammers, tongs, and chisels, and may also use welding equipment, grinders, presses, and power hammers.

After a metal article or part has been formed, the blacksmith may heat-treat it to harden and temper it properly. He hardens the metal by heating it to a high temperature and then letting it quickly cool in an oil or water bath. To temper the metal (that is, make it tougher and less brittle), he also heats it, but to a lower temperature than is needed for hardening, keeps the metal at this lower temperature for a specified time, and then lets it cool gradually in the air.

Where Employed

About two-thirds of the approximately 21,000 blacksmiths employed in the United States in early 1963 were industrial blacksmiths. They were employed in a variety of industries, mostly for maintenance and repair work. Nearly half of industrial blacksmiths worked in manufacturing industries, especially in the basic iron and steel industry and in the manufacture of machinery, transportation equipment, and fabricated metal products. Nearly one-fourth of industrial blacksmiths worked in mining industries, chiefly in the extraction of crude petroleum and natural gas. (Where oil wells are being drilled, for example, blacksmiths sharpen and temper drill bits, repair tools, and assist drillers in the operation and maintenance of drilling equipment.) The railroads and the construction industry also employed relatively large numbers of industrial blacksmiths.

The remaining one-third of the estimated 21,000 blacksmiths worked in small shops where they repaired tools and other equipment, and performed such services as welding and tool sharpening. Some blacksmiths in small establishments specialized in the shoeing of horses. More than four-fifths of the blacksmiths in small repair shops were self-employed.

Job duties of blacksmiths are similar to those of many forge shop workers, who operate heavy machinery to shape and form articles from heated metal. (A detailed discussion of jobs and job opportunities in forge shops is provided in the section on Forge Shop Occupations which appears elsewhere in this *Handbook.* See index for page numbers.)

Blacksmiths work in all parts of the country, in small rural communities as well as in large industrial centers. In 1960, only 6 States had more than 1,000 blacksmiths each—Texas, California, Pennsylvania, Illinois, Ohio, and New York.

Training and Other Qualifications

Most workers enter the occupation by getting jobs as helpers in blacksmith shops, where they gradually learn the trade. Others enter through formal apprenticeship training programs, which generally last 3 or 4 years and customarily provide training in blueprint reading, the use of tools and equipment, heat-treatment of metal, and forging methods, including forge welding. Most apprentices are found in large industrial firms rather than in small repair shops. Vocational school or high school courses in metalworking, blueprint reading, and mathematics will be helpful to young persons interested in becoming blacksmiths.

A blacksmith must have considerable strength and stamina to pound metal into shape and to handle heavy parts for an entire working day. He must also have a precise touch when shaping metal parts, even though he uses heavy tools and equipment.

Employment Outlook

A small number of openings are expected for new workers in the blacksmith trade during the 1960's and in the longer run, to replace workers who shift to other occupations or who retire or die. Many blacksmiths are older men; nearly 1,000 blacksmiths will leave the occupation each year, it is estimated, because of retirement or death.

The total number of blacksmiths in the country is not expected to increase during the next 10 to 15 years, and may even decline. The rate of decline, however, should be much less rapid than it has been during the past 10 or 20 years. The employment of blacksmiths has already fallen sharply because of declining activity in the railroad and coal mining industries, because many tasks performed by blacksmiths have been transferred to other workers such as welders and forge shop craftsmen, and because large forge shops have been producing many small metal articles formerly made by blacksmiths—horseshoes, for example. In addition, the use of parts which are cheaper to replace than to repair has made unnecessary some repair work once done by blacksmiths. The skills of all-round blacksmiths, however, will continue to be needed in the maintenance departments of large industrial employers and in many small metalworking and repair shops throughout the country.

Earnings and Working Conditions

Earnings of skilled blacksmiths vary according to the industry, the kind of shop, and the part of the country in which they work. In the petroleum industry in 1961, experienced blacksmiths were receiving \$3.13 to \$3.38 an hour while trainees were receiving \$2.78 to \$3.12 an hour. In the same year, blacksmiths employed by one major steel company were receiving \$2.92 to \$3.19 an hour; blacksmiths employed in the shipbuilding industry were paid \$2.80 to \$3.27 an hour on the West Coast, \$2.67 to \$3.07 an hour on the East Coast, and \$2.30 to \$3.08 an hour on the Gulf Coast. In railroad shops, straight-time hourly earnings for blacksmiths averaged \$2.65 in 1961.

Blacksmith shops, especially the larger ones, are hot and noisy because of the furnaces and hammers, although in recent years heat and noise have been decreased by the introduction of large ventilating fans and the lessening of machine vibration. Blacksmiths are subject to a number of job hazards, such as burns from forges and heated metals and injuries from large pieces of metal which may drop while being handled. Increased use of safety devices, such as goggles, metal-tip shoes, and leather aprons, have helped to decrease the number of injuries.

Many blacksmiths belong to unions. One important union in the trade is the International Brotherhood of Boilermakers, Iron Shipbuilders, Blacksmiths, Forgers and Helpers. Other unions which represent blacksmiths include the United Steelworkers of America and the International Union of Journeymen Horseshoers. Major union-employer agreements covering blacksmiths provide health insurance, paid vacations, and pension plans.

Where To Go for More Information

International Brotherhood of Boilermakers, Iron Shipbuilders, Blacksmiths, Forgers and Helpers, 8th at State Ave., Kansas City, Kans., 66101.

Boilermaking Occupations

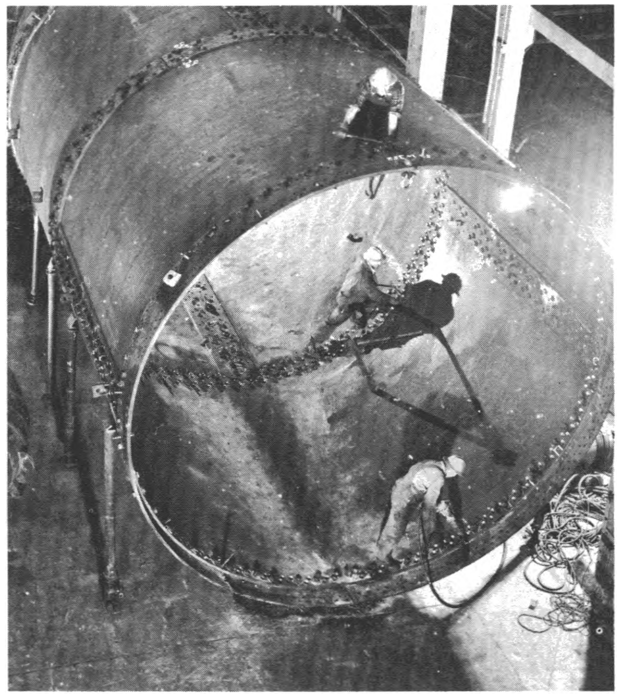
Nature of Work

Boilermakers, layout men, and fitup men are skilled workers who specialize in the repair, fabricating, and assembling of boilers, tanks, vats, and similar vessels made of metal plate. These boilers and other vessels are widely used throughout industry to hold liquids and gases under pressure. Boilermakers are primarily engaged in repairing and erecting boilers and vessels, while layout men and fitup men usually are employed in manufacturing new boilers and heavy tanks. The repair work performed by boilermakers requires these workers to have all-round skills; fitup men and layout men have more specialized duties.

Boilermakers (D.O.T. 4–83.100). These craftsmen assemble and erect prefabricated parts and fittings at construction sites where the boilers or other pressure vessels are to be used. After installation is completed, they make all necessary tests to check for defects. Boilermakers also do repair work in the field. After first determining the cause of trouble, they may then dismantle the boilers or other units and make repairs, such as patching weak spots with metal stock, replacing defective sections with new parts, or strengthening joints. Installation and repair work performed by boilermakers must often meet standards set by State and local laws covering boilers and other pressure vessels.

Boilermakers use a variety of tools and equipment in assembly and repair work. They cut and shape plate to size with power shears, power rolls, power presses, or oxyacetylene torches. They use welding or riveting equipment. When assembling and erecting steel plate units at a field construction site, they may use all types of rigging equipment including hoists, jacks, and rollers.

Layout Men (D.O.T. 4–83.200). Metals used in the manufacture of boilers, tanks, vats, and other pressure vessels are initially prepared for fabricating operations by layout men. These workers mark on metal plates and tubes all curves, lines, points, and dimensions which serve as directions



Boilermakers assemble units made of heavy steel plate

to other workers for cutting or shaping the parts required for the pressure vessel being fabricated. They lay out parts to scale as outlined on blueprints, sketches, or patterns. Layout men use compasses, dividers, scales, surface gages, hammers, and scribers in their work.

Fitup Men (D.O.T. 4–83.300). Before the various parts of boilers, tanks, vats, and other pressure vessels are finally assembled, fitup men assemble and temporarily fit them together in the shop. They bolt or tack-weld parts together and correct irregularities in parts so that they fit together neatly and securely. Fitup men also assemble and fit together nozzles, pipes, fittings, and other parts.

Fitup men read and interpret blueprints and drawings used in the manufacturing process, in order to check parts for accuracy and fit according to specifications. They use handtools such as hammers, sledges, wrenches, and punches, and equipment such as welding machines, portable drills, and grinding tools.

Where Employed

About 25,000 boilermakers, layout men, and fitup men were employed in the United States in early 1963. Boilermakers, who are engaged mainly in repair and installation work, are employed chiefly in the maintenance and repair departments of firms in industries such as iron and steel manufacturing, petroleum refining, railroad transportation, and electric and gas utilities. Large numbers also work in Federal Government installations, principally in Navy shipyards and Federal power plants. Several thousand are employed in the construction industry, mainly to assemble and erect boilers and other pressure vessels. Some work in repair shops. Layout men and fitup men are employed mainly in establishments which fabricate fire-tube and water-tube boilers, heating boilers, heat exchangers, heavy tanks, and similar boiler-type items.

Boilermakers are employed in every State because of the widespread need of their skills in repair and installation work. Large numbers are located in the Middle Atlantic and East North Central regions, where the metalworking industries are concentrated. Most layout men and fitup men work in these two industrial regions also. Pennsylvania, California, Texas, Illinois, Ohio, New York, and New Jersey are among the leading States in numbers of boilermaking craftsmen.

Training and Other Qualifications

Many men have become boilermakers by working as helpers for several years, but most training authorities agree that a 4-year apprenticeship is the best way to learn this trade. In the apprenticeship program, the apprentice works under the close supervision of a journeyman who instructs him in the skills of the craft. The apprentice learns how to use the tools and machines of the trade. Apprenticeship programs usually provide for about 8,000 hours of relatively continuous employment and training, supplemented by about 600 hours of related technical instruction. Some of the related technical subjects studied by apprentice boilermakers are blueprint reading, shop mathematics, welding techniques, and shop metallurgical science covering stress and strain of metals.

Many layout men and fitup men acquire their skills on the job. They are usually hired as helpers and learn the trade by working with experienced workers. It generally takes at least 2 years to qualify as an experienced layout or fitup man in a fabricating shop where boilers and other pressure vessels are produced on a mass-production basis. In shops where products are custom made, layout and fitup jobs are generally filled by men who have first qualified as skilled boilermakers.

Prior training in mathematics, blueprint reading, and shopwork will be helpful to young men interested in becoming boilermakers, layout men, or fitup men. Mechanical aptitude and manual dexterity are important qualifications, as are also good physical health and the ability to do heavy work.

Employment Outlook

During the remainder of the 1960's and in the longer run, replacement needs will be the main source of opportunities for new workers to enter the boilermaking trades. Retirements and deaths are expected to result in several hundred job openings annually during the next 10 to 15 years, and additional openings may be created by the transfer of experienced workers in these occupations to other fields of work.

A small increase in the total number of boilermakers, layout men, and fitup men may also be expected during the next 10 to 15 years. The demand for boiler products is expected to grow because of the anticipated expansion of facilities in electric and gas utilities, chemical plants, steel plants, petroleum refineries, the construction industry, and other major industries. The number of boilermaking craftsmen fell during the 1950's chiefly because of a sharp decline in the number employed by the railroads, but future expansion in other industries is expected to more than offset any further drop in railroad employment.

Earnings and Working Conditions

Wage rates of skilled boilermaking workers compare favorably with those of other craftsmen. Boilermakers generally are paid more than layout men or fitup men, although wages vary widely in each occupation because of differences in such factors as the experience and skill of the worker, the kind of industry in which he is employed, and the region of the country in which he works.

Boilermakers in field assembly and installation work generally receive higher hourly wages than those in maintenance and repair departments of industrial firms, although they may not be so steadily employed throughout the year. A review of representative labor-management agreements indicated that, in 1962, boilermakers in field construction work were receiving $3.95 to $5.50 an hour while those in other industries were receiving $2.63 to $4.10 an hour. Layout men were paid $2.57 to $3.69 an hour, and fitup men $2.50 to $3.20 an hour.

Many boilermakers, layout men, and fitup men are employed in plants which have labor-management contracts. Most of these agreements have provisions for fringe benefits such as hospitalization, medical and surgical insurance, life insurance, sickness and accident insurance, and retirement pensions.

When engaged in boiler repair and assembly work, boilermakers are often required to work in cramped quarters or at great heights. Some work must also be done under conditions of dampness, heat, and poor ventilation.

Boilermaking tends to be more hazardous than many other metalworking occupations. Although the injury-frequency rate in boilershops is higher than the average for manufacturing industries as a whole, it has been declining in recent years because of the safety programs of employers and unions.

Most boilermakers, layout men, and fitup men belong to labor unions. The principal union in these trades is the International Brotherhood of Boilermakers, Iron Shipbuilders, Blacksmiths, Forgers and Helpers. Some boilermaking craftsmen also are members of industrial unions, such as the Industrial Union of Marine and Shipbuilding Workers of America; the Oil, Chemical and Atomic Workers International Union; and the United Steelworkers of America.

Where To Go for More Information

International Brotherhood of Boilermakers, Iron Shipbuilders, Blacksmiths, Forgers and Helpers, 8th at State Ave., Kansas City, Kans., 66101.

Dispensing Opticians and Optical Laboratory Mechanics

Nature of Work

Dispensing opticians and optical laboratory (shop) mechanics make and fit eyeglasses prescribed by an eye physician (oculist or ophthalmologist) or optometrist to correct a patient's visual defect. The shop mechanic grinds and polishes the lenses to meet the specifications of the prescription and the dispensing optician, and assembles the lenses in a frame. Then the dispensing optician fits and adjusts the glasses to the customer's requirements. Fabricating and fitting the glasses usually involve two separate functions. The dispensing optician serves the customer directly, and the optical mechanic works in the shop. Occasionally, both functions are performed by the same person.

Dispensing opticians may also fit contact lenses which are worn in contact with the eyes and used as a substitute for, or in addition to, conventional eyeglasses. The most recently developed and currently the most popular type of contact lens is the corneal lens, a tissue-thin plastic disc, about a third of an inch in diameter.

The *dispensing optician* (D.O.T. 5–08.010) works in a retail optical establishment. He makes certain that the glasses follow the prescription and fit the customer properly. The optician determines exactly where the lenses should be placed in relation to the pupils of the eyes by measuring the distance between the centers of the pupils. He also assists the customer in selecting the proper eyeglass frame by measuring the customer's facial features and giving consideration to the various styles and colors of the eyeglass frames.

Before prescription eyeglasses are fitted, the dispensing optician prepares a work order which gives the optical laboratory mechanic the information he needs to interpret the prescription properly, grind the lenses, and insert them in a frame. The work order consists of the lens prescription; information on the size, tint (where appropriate), optical centering of the lens, and other optical requirements; and the size, color, style, and shape of the frame. After the eyeglasses are made, the optician adjusts the frame to the contours of the customer's face and head to make sure they fit properly and comfortably. He uses small handtools, such as optical pliers, files, and screwdrivers, and also uses a precision instrument to check the power and surface quality of the lenses. In small shops, especially, he may do some lens grinding and finishing, and sell other optical goods such as binoculars, magnifying glasses, and nonprescription sunglasses.

In fitting contact lenses, the dispensing optician, following the physician's or optometrist's prescriptions, takes certain measures of the cornea of the customer's eye and then prepares specifications to be followed by a firm specializing in finishing such lenses. The dispenser uses precision instruments to measure the power and curvature of the lenses and the curvature of the cornea of the eye. Contact lens fitting requires considerably more skill, care, and patience than conventional eyeglass fitting. The dispensing optician instructs the customer in the insertion, removal, and care of the contact lenses during the initial period of adjustment, which may last several weeks. The physician or optometrist rechecks their fit, as needed. If minor adjustments are necessary, the dispensing optician makes them; if major changes are needed, he returns the lenses to the contact lens manufacturer.

The *optical mechanic* (D.O.T. 5–08.010) performs the shop or laboratory work required to make prescription eyeglasses; but he does not make contact lenses, which involve somewhat different operations. The two principal types of optical mechanics are the *surfacer* (D.O.T. 5–08.077) and the *benchman* (or finisher) (D.O.T. 5–08.033). The surfacer, starting with standard or stock size lens blanks, lays out the work, grinds and polishes the surfaces of the lenses, and makes sure that the ground lenses conform to the prescription requirements. In small laboratories, one man may perform all these operations, and benchwork also. In large laboratories, the work is divided into separate operations which are performed by semiskilled

Benchman checks lens to insure proper fit into eyeglass frame

workers who operate power grinding and polishing machines. The surfacer uses precision instruments to measure the power of curvature of lenses.

The benchman marks and cuts the ground and polished lenses to fit the frame, bevels or smooths the edges of the lenses, and assembles the lenses and frame parts into the finished eyeglasses. In large laboratories, these duties are divided into several operations which are performed by semiskilled workers. The benchman uses small handtools, such as lens cutters, chippers, pliers, files, protractors, and diamond point glass drills, and also uses precision instruments to determine, for example, if there are any imperfections in the lenses.

Both the surfacer and the benchman do repair work; they may also duplicate broken eyeglass lenses and replace damaged parts of frames.

Where Employed

About 21,000 dispensing opticians and optical laboratory mechanics were employed throughout the country in early 1963. Of these, about 8,000 (4,000 opticians and 4,000 mechanics) were employed in the Nation's estimated 3,100 retail optical shops. About 10,000 were employed in the prescription departments of the approximately 1,400 wholesale optical laboratories which did work for retail optical firms. About 300 optical mechanics were employed in special prescription shops in the large ophthalmic goods factories to handle especially difficult jobs. In addition, about 1,600 mechanics and dispensers were employed by eye physicians or optometrists who sell eyeglasses directly to their patients. Some also work for hospitals, government agencies, construction firms, and mining companies. A few thousand women are employed in these trades. Many work as dispensers in retail optical outlets.

In addition to the 21,000 dispensing opticians and optical mechanics mentioned above, many of the approximately 2,500 proprietors of retail optical establishments were optical mechanics or dispensing opticians. Opticians and mechanics are mainly employed in cities and industrial areas. New York, Massachusetts, Pennsylvania, Texas, California, and Illinois are the leading States in the employment of these workers.

Training, Other Qualifications, and Advancement

Most dispensing opticians and optical mechanics learn their skills through informal, on-the-job training. Mechanics start in jobs requiring simple skill and dexterity and gradually work into the more difficult jobs. Some then move into dispensing offices and, with additional training, become dispensing opticians. A small number of opticians start immediately in dispensing work and learn their jobs under the guidance of trained opticians.

High school graduates can prepare for these occupations through formal apprenticeship programs. Most training authorities agree that workers who learn as apprentices have more job opportunities, improved job security, and greater advancement. A number of optical firms have 4- and 5-year apprenticeship programs. Apprentices with exceptional ability may complete their training in a shorter period.

The typical program for an optical mechanic apprentice in eyeglass lens production includes on-the-job training and related instruction in ophthalmic optics (vision improvement). It also includes instruction in subjects such as types and measurement of lenses, the measurement and curvature of lens surfaces, and the effect of glass surfaces on light rays. This training qualifies a person for both surfacing and finishing work. However, apprentices may specialize in one phase of this work in the larger laboratories. The apprenticeship program for the surfacer emphasizes training in grinding operations, polishing, blocking, inspection, and layout. The benchman apprenticeship program concentrates on lens edging, layout for cutting, lens cutting and drilling, rimless spectacle assembly, inserting lenses into frames, and inspection of eyeglasses.

The dispensing optician apprentice is given training similar to that of the benchman apprentice. He receives additional instruction in optical mathematics, optical physics, physiology of the eye, use of precision measuring instruments, interpretation of prescriptions, the mechanics of dispensing, and the inspection of eyeglasses.

Formal school training plays a relatively small part in preparing for these occupations. However, academic training for the dispensing optician is becoming increasingly necessary. In 1962, three schools offered 2-year full-time courses at the college level in optical fabricating and dispensing work. In addition, one college offered a 2-year evening course. Another college offered a 2-year home study course in optics and optical dispensing to supplement the training of apprentices in retail optical dispensing shops. A few vocational schools have courses for optical mechanics. The larger manufacturers of contact lenses offer dispensers courses of instruction in contact lens fitting, usually lasting a few weeks.

Employers prefer applicants for entry jobs as dispensing opticians and optical mechanics to be high school graduates who have had courses in the basic sciences. A knowledge of physics, algebra, geometry, and mechanical drawing is particularly valuable. Interest in, and ability to do, precision work are essential. Because dispensing opticians deal directly with the public they must be tactful and have a pleasing personality.

In early 1963, 17 States had licensing requirements governing dispensing opticians: Arizona, California, Connecticut, Florida, Georgia, Hawaii, Kentucky, Massachusetts, Nevada, New Jersey, New York, North Carolina, Rhode Island, South Carolina, Tennessee, Virginia, and Washington. Some of these States also require licenses for optical laboratory mechanics in retail optical shops or for the retail optical shop itself. Some

States permit dispensing opticians to fit contact lenses, while other prohibit them from doing so. To obtain a license, the applicant generally must meet certain minimum standards of education and training and also pass a written or practical examination, or both. For specific requirements, the licensing boards of individual States should be consulted.

Advancement opportunities are available to both optical mechanics and dispensing opticians. Optical laboratory mechanics can become supervisors, foremen, and managers. Many optical mechanics have become dispensing opticians, although there is a trend to train especially for this job. There are opportunities for mechanics and dispensing opticians to go into business for themselves. In the past decade or so, the number of proprietors of retail optical establishments has increased substantially, reaching a total of about 2,500 in 1962. Most of these owners had been optical mechanics or dispensing opticians. A few opticians may be employed as salesmen for wholesale optical goods companies or for manufacturers of conventional eyeglasses or contact lenses. With additional college training, an optician may become an optometrist. The amount of college work depends on his formal educational background.

Employment Outlook

Employment of optical mechanics and dispensing opticians is expected to continue to increase in the 1960's and early 1970's. New jobs in these relatively small occupations will provide employment opportunities for a few thousand workers. In addition, replacement needs will create several hundred job openings each year.

More optical mechanics and dispensing opticians will be needed to perform the growing amount of prescription lens fabrication and dispensing work. Because of the increasing size, literacy, and educational level of the population, and the large increase in the number of older persons (who are most likely to need eyeglasses), the production of prescription lenses should grow considerably. The market will expand also because of the increased emphasis on good vision. Half of the population over 6 years of age (about 83 million persons) now uses eyeglasses, and it is estimated that one-third of the remainder should do so. (A widespread national promotion program which seeks to educate the public about the need for professional eye care is being sponsored by the optical industry.) The more attractive design of eyeglass frames, in many different styles and colors, has increased the numbers of pairs of eyeglasses purchased by individuals and has lessened the opposition to wearing eyeglasses. Contact lenses are now used by several million people and their use is expected to continue, providing more dispensing work for opticians. The population shift to the suburbs will also offer more opportunities for dispensing opticians (especially those with all-round training in both shop and dispensing work) to work in, manage, or establish optical stores.

As in the past, many technological developments affecting employment needs will continue to be made in the manufacture of eyeglasses and in the equipment used by optical laboratories to fabricate lenses to prescription specifications. Nevertheless, the expanding market for eyeglasses should result in a continued growth in the number of optical mechanics and dispensing opticians. Optical mechanics will have more opportunities for employment in benchwork or finishing operations than in surfacing operations because of the greatly increased output of newly developed surfacing machines.

Earnings and Working Conditions

Weekly earnings for qualified optical laboratory mechanics generally ranged from about $90 to $150 a week in late 1962. Dispensing opticians usually earn about 10 to 20 percent more than optical mechanics. Opticians who have their own business may earn much more. Foremen earn up to 20 percent more than skilled workers depending on their experience, skill, and responsibilities. Apprentices start at about 60 percent of the skilled worker's rate and their wages are increased periodically, so that after they complete the apprenticeship program they receive the pay of skilled workers. Graduates of technical training institutes start at $80 to $90 a week, and reach $150 to $160 after 5 to 8 years' experience. Wholesale establishments usually have a 5-day, 40-hour workweek. Retail shop employees gener-

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ally work a 5½- or 6-day week. Workers in these occupations usually have year-round employment.

The work of the dispensing optician requires little exertion and is generally performed in pleasant, well-lighted, and well-ventilated surroundings. Optical mechanics may work under fairly noisy conditions, because power grinding and polishing machines are used. New machines are much quieter, however.

Physically handicapped persons who have full use of their eyes and hands and can do sedentary work can perform some of the more specialized jobs in the larger laboratories.

Some optical mechanics and dispensing opticians are members of unions. One of the unions organizing these workers is the International Union of Electrical, Radio and Machine Workers.

Where To Go for More Information

American Optical Co.,
Box 1, Southbridge, Mass., 01551.

Bausch and Lomb, Inc.,
635 St. Paul St., Rochester, N.Y., 14602.

Optical Wholesalers Association,
222 West Adams St., Chicago, Ill., 60606.

International Union of Electrical,
Radio and Machine Workers,
1126 16th St. NW., Washington, D.C., 20036.

The following organizations can provide general information, the names of vocational schools, and other materials on training requirements:

Guild of Prescription Opticians of America,
494 Broad St., Newark, N.J., 07102.

American Board of Opticianry,
Frank X. Brandstetter, Secretary,
821 Eggert Rd., Buffalo, N.Y., 14226.

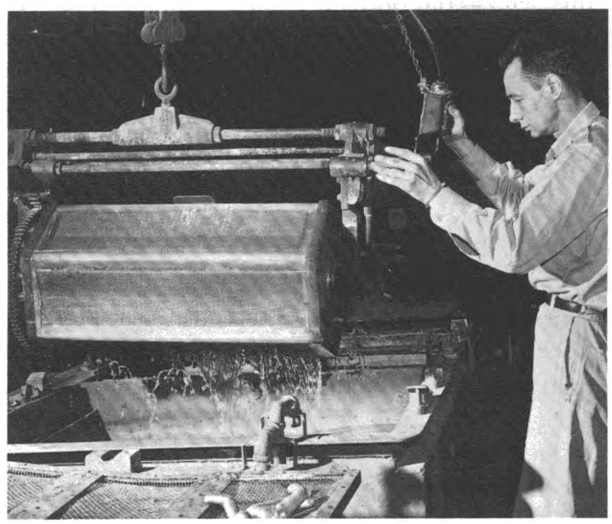
Electroplaters

(D.O.T. 4–74.010)

Nature of Work

Electroplaters (platers) are skilled workers who use plating solutions and electric current to coat metal articles with a layer of chromium, nickel, silver, gold, or other metal. The electroplating process gives the metals a protective surface or a more attractive appearance. Metal products that are often electroplated include such widely different items as automobile bumpers, cigarette lighters, silverware, costume jewelry, plumbing fixtures, electrical appliances, bearings, component parts of electronic equipment, jet engine parts, and ammunition.

The skilled plater first studies specifications that indicate the parts of the objects to be plated, the type of plating metal to be applied, and the desired thickness of the plating. He prepares the plating solution by mixing a compound of the plating metal with other chemicals. The plater also calculates the amount of electric current required to carry the metal particles through the plating solution and the length of time the objects must remain in the solution so that the plating metal will be of the specified thickness. A plater must often use originality in designing special racks for holding the objects while they are in the plating tank.



Electroplater removes tumbler barrel of small parts from electroplating bath

In preparing an article for electroplating, the plater cleans it by dipping it in cleansing solutions, or by scouring it. He covers with lacquer, or with rubber or plastic tape, any part of the article which is not to be plated. He then places the article in the plating tank, where an electric current carries metal in the solution to the surface being plated. When the desired thickness of metal plate has been obtained, he removes, rinses, and dries the article.

The plater must analyze the plating solution periodically and sometimes add chemicals to keep the solution constant. It is also necessary for him to control the temperature of the solution. He examines finished articles for defective plating and may use micrometers, calipers, and electronic devices to check the thickness of the plating. In addition to plating, platers in some shops may do other kinds of finishing, such as spray painting, dipping, and flow painting.

Electroplaters employed in job shops, which do small lot plating of great variety, are often required to use considerable ingenuity in their work. Platers working in production shops, where large lots of metal parts of the same type are electroplated, usually carry out less difficult assignments. In some of the larger shops, chemists and chemical engineers often make the technical plating decisions while platers act as foremen and do some of the routine plating work.

Electroplaters often supervise the work of helpers, who place objects on racks before plating and remove them afterwards, and clean tanks and racks. In some shops, a plater is expected to order chemicals and other supplies for his work.

Where Employed

Several thousand skilled electroplaters were employed in early 1963. About 2 out of every 3 worked in independent job shops specializing in metal plating and polishing for other manufacturing firms and for individuals. The remaining platers were employed in the plating departments of plants primarily engaged in the manufacture of plumbing fixtures, heating and cooking utensils, lighting fixtures, wire products, electric control apparatus, electric appliances, radio and television products, motor vehicles and parts, mechanical measuring instruments, miscellaneous hardware items, and other metal products.

Electroplaters are employed in almost every part of the country, although most work in the Northeast and Midwest, near the centers of the metalworking industry. Large numbers of electroplaters work in Chicago, Detroit, New York, Cleveland, Newark, Jersey City, Providence, and Los Angeles.

Training, Other Qualifications, and Advancement

Most electroplaters are hired as helpers and learn the trade by working with skilled platers. It usually takes 4 years or longer to become a skilled worker in this way. Since less time is required to learn to work with only one or two metals, many employers tend to develop specialized platers rather than those who can work with all kinds of metals. This often makes it difficult for a plater to transfer to shops doing other kinds of electroplating.

Another way to enter the electroplating trade is through an apprenticeship program. Although apprentice training provides better all-round preparation, only a small percentage of electroplaters have been trained this way.

The planned program for apprentices includes a combination of on-the-job training and related classroom instruction in the properties of metals, chemistry, and electricity as applied to plating. The apprentice does progressively more difficult work as his skill and knowledge increase. By the third or fourth year, he determines cleaning methods, does plating without supervision, makes solutions, examines plating results, and supervises helpers. After 3 or 4 years of an apprenticeship program or general work experience, the worker usually becomes a fully qualified plater. From this position, he may qualify as a foreman.

High school and vocational school courses in chemistry, electricity, physics, mathematics, and blueprint reading will prove helpful to young persons interested in becoming master electroplaters. Some colleges, technical institutes, and vocational high schools offer 1- to 2-year courses in the principles and practices of electroplating. In addition to the training offered by these schools, many branches of the American Electroplaters Society conduct basic courses in the fundamentals of electroplating. The increasing complexity of the plating process and the greater use of precision plating will require platers with a higher degree of technical training in the future.

Employment Outlook

The number of electroplaters is expected to increase slightly during the 1960's and in the longer run. In addition to new job openings resulting from the growth of the occupation, a small number of vacancies will result from the need to replace experienced electroplaters who retire, die, or transfer to other lines of work.

Continuing mechanization of the electroplating process will tend to limit employment growth in this occupation. However, it is expected that this trend will be more than offset by the longrun expansion in the machinery and metalworking industries, and the broader application of the electroplating process brought about by recent developments in the use of aluminum, other metals, and metal alloys.

Earnings and Working Conditions

Wage rates of skilled electroplaters ranged from about $1.60 to $3 an hour in late 1962, as indicated by examination of a number of union contracts and information from a limited number of employers. During a worker's period of apprenticeship or on-the-job training, his wage rate usually starts at 60 to 70 percent of a skilled worker's rate and progresses to the full rate by the end of his training period. In almost all plants, workers are paid shift premiums for working at night.

Plating work involves some hazards because acid, alkaline, or poisonous solutions are used. Humidity and odor are also problems in electroplating plants. However, most plants have installed systems of ventilation and other safety devices which have considerably reduced the occupational hazards. Protective clothing and boots provide additional protection. Mechanical devices are generally used to handle most of the lifting required, but at times the worker must lift and carry objects weighing up to 100 pounds.

Some platers are members of the Metal Polishers, Buffers, Platers and Helpers International Union. Other platers have been organized by the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America, and the International Association of Machinists. Some of the labor-management contracts covering electroplaters provide health insurance and other benefits.

Where To Go for More Information

For educational information concerning electroplating and other metal finishing methods, write to:

American Electroplaters Society, Inc.,
445 Broad St., Newark, N.J., 07102.

For information on job opportunities, training, and other questions, write to:

National Association of Metal Finishers,
11 Park St., Montclair, N.J., 07042.

Gasoline Service Station Attendants

(D.O.T. 7-60.500)

Nature of Work

Each of the 73 million motor vehicles in the United States, at one time or another, is serviced in a gasoline service station. When a car or truck is driven into the station, the service station attendant is usually the one who greets the customer and inquires about his needs. The attendant may perform a variety of services for the customer or his vehicle, ranging from merely directing the customer to a street address to making a minor repair on the vehicle. A few attendants, called mechanic-attendants, make more difficult automobile repairs.

When servicing a car, the attendant pumps gasoline, cleans the windshield, checks the water level in the car's radiator and battery, and the oil level in the car's engine, and in the automatic transmission if it has one. He performs preventive maintenance by examining parts of the car for excessive wear. In addition, if the customer requests, the attendant checks tires for correct air pressure. Also, the service station attendant sells automobile tires, batteries, light bulbs, and accessories such as seat covers, windshield wiper blades, and mirrors. When a customer pays his bill, the attendant makes change, or prepares a charge slip if the customer uses a credit card. In small stations particularly, he may install accessories as well as perform minor maintenance and repair work, such as lubrication, rotating tires, repairing tires, or replacing a muffler. Before and after doing this work, the attendant

Service station attendant checks oil level

may drive the customer's car between a convenient parking place and the service area. He may also keep the service areas, building, and restrooms clean and neat. In some stations the attendant helps the station manager take inventory, set up displays, and perform other duties associated with the running of a small business.

If a gasoline station provides emergency road service, the attendant may drive a tow truck to a stalled car and change a flat tire or make other minor repairs needed to get the customer on his way again. If more extensive repairs are needed, he tows the vehicle back to the service station.

In doing maintenance and repair work, gasoline service station attendants use different kinds of tools and equipment. These are usually simple handtools, such as screwdrivers, pliers, and wrenches. However, power tools and more complex equipment, such as motor analyzers and wheel alinement machines, are frequently used.

Where Employed

An estimated 320,000 full-time service station attendants were employed in gasoline service stations in early 1963. More than half were employed in stations that had one to five workers. Several thousand additional people worked part time as service station attendants. In addition to attendants, there were about 200,000 gasoline service station managers and owners who may do work similar to that done by attendants. A few thousand additional attendants were employed in garages, parking lots, motels, and other places where gasoline, oil, and motor vehicle accessories were sold.

Because motor vehicles are used throughout the Nation, gasoline service station attendants are employed in every section of the country, in the largest cities and the smallest towns. About 40 percent of gasoline service station attendants are employed in the seven States which have the largest numbers of motor vehicles: California, New York, Texas, Pennsylvania, Ohio, Illinois, and Michigan.

Training, Other Qualifications, and Advancement

Employers prefer high school graduates for jobs as gasoline service station attendant, although men with less education are hired. A high school education is generally required, however, in order to qualify for service station attendant training programs conducted by oil companies, or to advance to positions such as automobile mechanic or gasoline service station manager.

An applicant for a job as a gasoline service station attendant must have some sales ability, a driver's license, and an understanding of how an automobile works. He should be friendly and able to speak well, present a generally neat appearance, and have self-confidence. He should know simple arithmetic so that he can make change quickly and accurately and help keep business records. An applicant should be acquainted with local roads, highways, and points of interest in order to be able to direct strangers.

Gasoline service station attendants usually are trained on the job, although there are some formal training programs. Attendants who are trained on the job are first given relatively simple work assignments. They may be required to keep the station clean; do simple automobile maintenance such as washing cars, rotating or repairing tires, and pumping gasoline; and make themselves otherwise generally useful. Gradually, the attendant progresses to the more advanced work such as helping to keep station records, making sales, writing credit tickets, and installing accessories on cars. It usually takes several months for a gasoline service station attendant to become fully qualified.

Formal training programs for young people who want to do gasoline service station work are offered in many high schools around the country. In this curriculum, known as distributive education, students spend their last 2 years taking business education courses (such as merchandising and commercial law and other high school courses) as well as working part time in a gasoline service station where they receive instruction and supervision in all phases of service station work.

Vocational education agencies, in cooperation with local offices of the U.S. Employment Service, conduct training programs in many parts of the country for young men who want to become gasoline service station mechanic-attendants. These particular programs, which last up to a year, emphasize the maintenance and repair duties of the occupation so that an attendant will be able to make more difficult automobile repairs, as well as sell gasoline, oil, and automobile accessories.

Most major oil companies conduct formal training programs for service station managers. However, a few attendants are also enrolled in these programs. The programs usually last from 2 to 8 weeks and emphasize subjects such as simple automobile repairs, salesmanship, and business management.

A gasoline service station attendant with business management capabilities may advance to station manager. Other attendants may obtain additional training and become automobile mechanics. With experience, many station managers and automobile mechanics go into business for themselves by leasing a station from an oil company, as is most common, or buying their own service station. Some service station attendants and managers advance to positions such as salesman or district manager with oil companies.

Employment Outlook

Employment of gasoline service station attendants is likely to increase rapidly throughout the remainder of the 1960's and in the longer run, with several thousand job opportunities occurring each year. In addition, many thousands of job openings in this large occupation will result from the need to replace attendants who transfer to other fields of work, are promoted, retire, or die. Deaths and retirements alone may account for 5,000 to 6,000 job opportunities each year for new workers.

Employment of service station attendants is expected to increase for several reasons. The number of motor vehicles, which increased by about 50 percent between 1952 and 1962, is expected to rise by about a third in the next 10 years, because of growing population, income, and multiple car ownership, and the continuing movement to the suburbs. Also, greater use is expected to be made of cars as families have more leisure time to visit national parks and other points of interest, and as roads continue to improve. These factors are expected to result in increased use of gasoline and other service station products and, consequently, in the employment of a larger number of gasoline service station attendants.

More attendants may also be needed to perform additional maintenance on newer, more complex cars. For example, cars equipped with devices that reduce exhaust fumes must be serviced periodically. On the other hand, the increased number of cars which require oil changes and lubrication less frequently will partially offset the servicing requirements of additional, more complex vehicles.

Earnings and Working Conditions

Hourly earnings of gasoline service station attendants vary considerably in different parts of the country and in different size service stations. Hourly earnings are generally higher in large gasoline stations located in metropolitan areas in the West than in stations elsewhere. About half of all gasoline service station attendants had straight-time average hourly earnings between $1 and $1.60 in mid-1961. However, attendants employed in a few large cities earned over $2 an hour.

In addition to their hourly rates, many service station attendants are paid commissions based on the value of products and services they sell. Most attendants work more than 40 hours per week, with many working more than 49 hours. They frequently work nights, weekends, and holidays. Average weekly earning for full-time attendants was about $70 in mid-1961.

In many stations, employers provide attendants with fringe benefits such as accident and health insurance and paid vacations.

Some high school and college students have been able to work their way through school by working as gasoline service station attendants after school, and on vacations and holidays. Some workers also supplement their income from regular jobs by working part time as attendants.

Attendants in many gasoline service stations are required to wear uniforms. Some employers furnish the uniforms and pay the cost of their cleaning; others require the attendant to meet these expenses.

A gasoline service station attendant works out of doors in all kinds of weather. He must be in good physical condition because he does considerable lifting and stooping and spends much time on his feet. Possible injuries include cuts from sharp tools and burns from hot engines. The attendant frequently gets dirty because he handles oil and grease and works with greasy tools and around dirty cars. For many attendants, however, the opportunity to meet new people and the possibility of someday managing his own service station more than offset these disadvantages.

Where To Go for More Information

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

Jewelers and Jewelry Repairmen

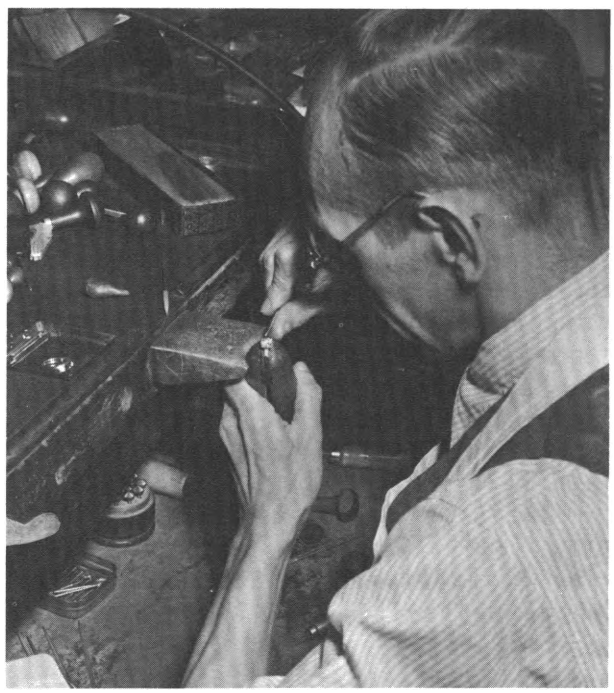
(D.O.T. 4–71.010, .020, and .025)

Nature of Work

Jewelers make rings, pins, necklaces, bracelets, and other precious jewelry by hand. They frequently use precious or semiprecious jewels or synthetic stones and set them in gold, silver, or platinum; they also create fine pieces of jewelry, using only these metals. Jewelers also repair jewelry, make rings larger or smaller, reset stones, and refashion old jewelry.

In making jewelry, they may follow their own design or one by a specialist in design work. The metal is formed to follow the design either by melting and casting it or by using small hand and machine tools such as drills, files, saws, soldering irons, jewelers' lathes, and flexible shaft machines. Jewelers' work is often very delicate and must be done with care and precision, as the materials used are extremely expensive. An eye loupe, or magnifying glass held over the eye, is often necessary.

As a rule, jewelers specialize in making a particular kind of jewelry, or in a particular operation such as making models and tools for jewelry, or polishing or setting diamonds and other stones. A few, after years of experience, become all-round jewelers, capable of making and repairing any kind of jewelry. Costume jewelry and some kinds of precious jewelry are mass produced by factory workers using assembly-line methods. However, highly skilled jewelers are needed to make the models and tools for this large-scale production.



Skilled jewelry worker sets a diamond

Many jewelers make and repair jewelry and also have stores where they sell jewelry, watches, and, often, other merchandise such as silverware, china, and glassware. They may also do some minor watch repairing. However, an increasing number of the newer retail jewelry stores are owned or operated by merchants who are not jewelry craftsmen. When repair work is brought to these merchants, the articles are sent to a "trade shop" specializing in this work.

Where Employed

Employment of jewelers and jewelry repairmen was estimated at more than 25,000 in early 1963. About half of these were salaried employees in manufacturing establishments, retail stores, trade shops, and wholesale establishments; the remainder were the proprietors of such establishments. Of the salaried workers, less than half were employed in shops manufacturing precious jewelry, a few thousand worked in trade shops or wholesale establishments, and the remainder worked in retail stores, especially the larger jewelry stores with a great volume of business in precious jewelry and diamonds. Nearly half of the proprietors were self-employed operators of trade shops, more than a thousand were operating precious jewelry manufacturing plants, and the remainder owned retail jewelry stores.

Although most small towns have at least one store that sells and repairs jewelry, most of the Nation's 24,000 retail jewelry stores, as well as the thousands of small trade shops that service these stores, are in and near large cities. The chief centers of precious jewelry manufacturing are the New York City metropolitan area, followed by the Providence, R.I., area. More than three-fourths of all precious jewelry manufacturing plants and employment in the country are in New York, Rhode Island, New Jersey, Massachusetts, and Pennsylvania.

Training, Other Qualifications, and Advancement

Young persons generally learn the jewelry trade either by serving a formal apprenticeship or through informal on-the-job training while working for an experienced jeweler. Jewelry repair, which is usually less complicated than jewelry making, can be learned in a short time by individuals already trained in filing, sawing, drilling, and other basic mechanical skills. Courses in jewelry repair are sometimes given in trade schools which teach watchmaking and watch repairing.

Formal apprenticeship in this trade takes from 3 to 4 years, depending on the type of training. For example, 3 years are required to become a colored-stone setter and 4 years to qualify as a diamond setter. Throughout the apprenticeship, training on the job is supplemented by trade school instruction in design, quality of precious stones, the chemistry of metals, and other related subjects. First work assignments may be to set up work for soldering or to do simple soldering or rough polishing. As apprentices gain experience, they advance to more difficult work. On completion of the apprenticeship, they become journeymen jewelers.

High school education is desirable for young people seeking to enter the trade. Courses in chemistry, physics, mechanical drawing, and art are particularly useful. Personal qualifications important for success in this field are mechanical aptitude, finger and hand dexterity, and good eyesight. Artistic ability is necessary for work in jewelry design. For those planning to become retail jewelers or open a trade shop or manufacturing establishment, the ability to deal with people and manage a business is also important. Because people in this trade work with precious stones and metals, they must be bonded. Bonding requires an investigation of one's personal background for such traits as honesty, trustworthiness, and respect for the law.

Jewelry manufacturing establishments in the major production centers offer the best opportunities for a young person to acquire all-round skills, even though the number of trainees accepted is small. Trade shops also offer some training opportunities, but their small size—many are one- or two-man shops—restricts the number of trainees.

Young jewelers interested in going into business for themselves will find it advantageous to first work in an established retail jewelry store, trade shop, or manufacturing plant. Persons planning to open their own jewelry stores should expect considerable competition in most parts of the country and should be prepared to make a substantial financial investment. Retail jewelers who can also repair watches will have an advantage over those who can work on jewelry only, since watch repair work is a substantial part of the business of small jewelry stores, particularly in the smaller towns. Talented and experienced jewelers of recognized integrity can establish their own trade shop or small manufacturing shop with a more moderate financial investment. The location of such shops would be limited to areas with a large volume of jewelry business. For manufacturing, this means the major production centers. Trade shops have best chances for success in the moderate size or larger cities where there are many retail jewelry stores.

Employment Outlook

Relatively few job openings for skilled jewelers and repairmen are expected to occur during the remainder of the 1960's and in the longer run. The number of these skilled workers will show little change from current levels. Demand for precious jewelry will increase as incomes rise and population expands. Sales of engagement and wedding rings are expected to increase as the large number of children born immediately after World War II grow up and marry. Also, so-called fashion (better grade costume) jewelry, produced by mass-production methods and requiring relatively few skilled jewelers, is becoming increasingly popular. Moreover, the smaller jewelry stores seldom have enough jewelry repair business to keep a jeweler fully employed. Hence, more retail jewelry stores are contracting out their jewelry repairs to trade shops in which a few skilled jewelers, by working full time and with more complete equipment, can service many retail stores.

Several hundred job opportunities will occur each year because of the need to replace craftsmen who die, retire, or transfer to other fields of work. Openings that result from replacements will be limited because the occupation is small and jewelers traditionally work well beyond the normal retirement age, for as long as they retain good eyesight and steady hands. Moreover, people who are not trained in this craft are replacing many of the retail jewelry store owners and workers who die or retire.

Nevertheless, skilled all-round jewelers, especially those with artistic talent and mechanical ability, will readily find employment. Specialized craftsmen, such as stone setters or model makers, will also have favorable employment prospects, particularly in manufacturing shops. In the retail jewelry field, most job opportunities will be available in the very large retail jewelry stores which have enough business to justify keeping a staff of trained jewelers and jewelry repairmen.

Earnings and Working Conditions

Jewelry repairmen employed in retail stores started at about $80 a week in early 1963, while experienced workers earned up to $200 weekly. Self-employed jewelers in retail stores or trade shops generally earn more, although there is much geographic variation.

About half of the skilled jewelry workers employed by precious jewelry manufacturers in the New York City area are covered by union management contracts between their employers and the International Jewelry Workers' Union. One agreement covering about 1,600 jewelry workers in manufacturing plants in New York City provides the minimum hourly rates shown in the following tabulation for inexperienced workers (including apprentices) and for journeymen in selected crafts, as of February 1, 1963, 1964, and 1965. Average hourly earnings for journeymen, in February 1963, are also shown in the tabulation.

Occupation	*Average hourly earnings February 1963*	*Minimum hourly job rates*		
		February 1963	*February 1964*	*February 1965*
Starting rate—all inexperienced workers	--------	$1.30	$1.35	$1.40
Journeyman's rate:				
Production jewelers	$3.04	2.40	2.45	2.50
Jewelers—handmade work	3.87	2.70	2.85	3.00
Model makers	4.13	2.90	3.00	3.05
Stone setting	3.59	--------	--------	--------
Diamond—production	--------	2.90	2.95	3.00
Other stones—production	--------	2.45	2.50	2.55
Handmade work	--------	3.05	3.15	3.25

Under this agreement, all inexperienced workers, including apprentices, receive increases of 10 cents an hour every 3 months until they reach the minimum journeyman's rate for their particular job, which is considerably lower than average hourly earnings in the trades. The very skilled and competent workers earned far more than these averages.

Skilled workers in the precious jewelry manufacturing union shops in the New York City area have a 35-hour workweek and are paid time and one-half for all work done before or after the regular workday. Some workers may be subject to unemployment during the post-Christmas and post-Easter seasons when sales decline. On the other hand, retail jewelers and jewelry repairmen often work more than 35 hours, especially during the Christmas season and other peak periods.

Where To Go for More Information

Information on employment opportunities for jewelers and jewelry repairmen in retail stores and trade shops may be obtained from:

Retail Jewelers of America, Inc.,
711 14th St. NW., Washington, D.C., 20005.

Stationary Engineers

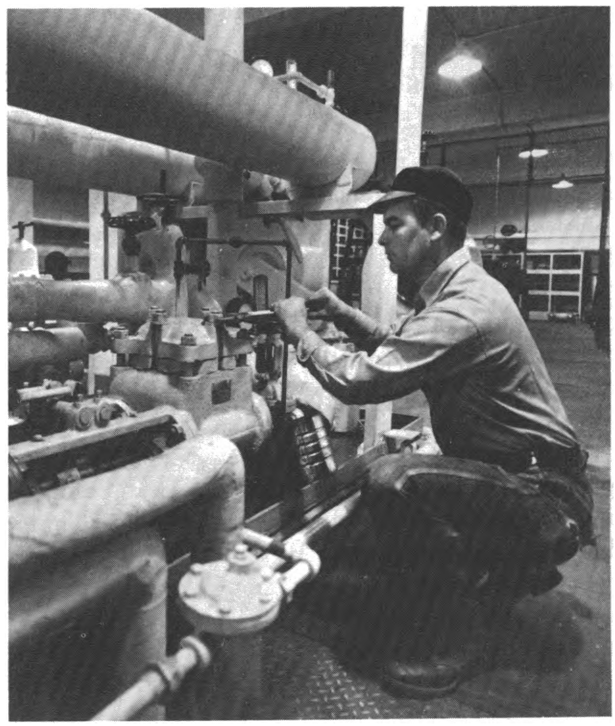
(D.O.T. 5-72.010)

Nature of Work

Stationary engineers operate and maintain equipment that is essential to generate power and to heat, ventilate, humidify, dehumidify, and air-condition industrial plants and other buildings. These workers are needed wherever large boilers, diesel and steam engines, refrigeration and air-conditioning machines, generators, motors, turbines, pumps, compressors, and similar equipment are used. They must operate and maintain the equipment in accordance with State and local laws since the safety of many people depend upon its proper functioning.

The most important duty of the stationary engineer is to constantly observe meters, gages, and other instruments to determine the operating condition of the equipment. He also records information such as the amount of fuel used, temperature and pressure of boilers, number of pieces of equipment in use, hours of operation, and repairs made. He must detect and identify any trouble that develops, by analyzing the various instrument readings and watching and listening to the machinery. He operates levers, throttles, switches, valves, and other devices to regulate and control the machinery so that it works efficiently. He must also regularly inspect the equipment to make sure it is working properly.

Stationary engineers usually repair the equipment they operate, using handtools of all kinds, including precision tools. Common repairs performed by these workers are resealing valves, replacing gaskets, bearings, and belting, and adjusting piston clearance. Occasionally, stationary engineers make mechanical changes so that



Stationary engineer adjusts pump

the equipment will operate more efficiently or conform to the requirements of a different process.

The duties of stationary engineers depend on the size of the establishment in which they work and the type and capacity of the machinery for which they are responsible, but the primary responsibilities are very much the same for all kinds of plants—safe and economical operation. In a large plant, the chief stationary engineer may have charge of the entire operation of the boilerroom and direct the work of assistant stationary engineers and other employees including turbine operators, boiler operators, and air-conditioning mechanics. Assistant stationary engineers may be responsible for the operation of all the equipment during a shift, or in charge of a specific type of machinery such as refrigeration equipment. In relatively small plants, only an engineer and a helper may be needed, and the engineer, himself, may oil and clean the equipment, grease moving parts, and clean boiler tubes and walls.

Where Employed

In early 1963, more than 250,000 stationary engineers were employed in a wide variety of establishments, such as power stations, factories, breweries, sewage and water-treatment plants, office and apartment buildings, hotels, hospitals, and schools. More than 35,000 of these workers were employed by Federal, State, and local governments. The size of establishments in which the engineers worked ranged from giant hydroelectric plants and large public buildings to small industrial plants. Most plants which operate on three shifts employ from 4 to 8 stationary engineers, but some have as many as 60. In many establishments, only one engineer works on each shift.

Because stationary engineers work in so many different kinds of establishments and industries, they are employed in all parts of the country. Although some are employed in small towns and in rural areas, most work in the more heavily populated areas where large industrial and commercial establishments are located. New York, Texas, California, Illinois, Pennsylvania, Ohio, New Jersey, and Michigan employ well over half of these workers.

Training, Other Qualifications, and Advancement

Many of the stationary engineers started as helpers or craftsmen in other trades and acquired their skills largely through informal on-the-job experience. However, most training authorities recommend formal apprenticeship as the most desirable method for learning this occupation, because of the increasing complexity of the machinery.

In selecting apprentices, most joint labor-management apprenticeship committees prefer young men between 18 and 25 years of age with high school or trade school education, who have received instruction in such subjects as algebra, geometry, trigonometry, shop mathematics, mechanical drawing, machine-shop practice, physics, and chemistry. They also look for young men with mechanical aptitude and manual dexterity.

A stationary engineer apprenticeship customarily lasts 4 years. Through on-the-job training, the apprentice learns to operate, maintain, and repair stationary equipment, such as blowers, generators, compressors, boilers, motors, and air-conditioning and refrigeration machinery. He is taught how to use a variety of hand and machine tools, such as chisels, hammers, electric grinders, lathes, and drill presses. He may also learn to use precision-measuring instruments, such as calipers and micrometers. In addition, he may be taught how to move machinery by the use of blocks, chain hoists, or other equipment. This on-the-job training is supplemented by classroom instruction and home study in such related technical subjects as practical chemistry, elementary physics, blueprint reading, applied electricity, and theory of refrigeration, air conditioning, ventilation, and heating.

Persons who become stationary engineers without going through a formal apprenticeship program usually do so only after many years of experience as assistants to licensed stationary engineers in such occupations as boiler, refrigeration, or turbine operator. This practical experience usually is supplemented by technical or other school training or home study.

Eight States and more than 50 large and medium-size cities require stationary engineers to be licensed. About half of all stationary engineers work in areas requiring at least one engineer to be licensed in each establishment. Although requirements for obtaining a license differ from place to place, the following are usual: (1) The applicant must be over 21 years of age; (2) he must have resided in the State or locality in which the examination is given for a specified period of time; and (3) he must demonstrate that he meets the experience requirements for the class of license requested. A license is issued to applicants who meet these requirements and pass an examination which may be written, oral, or a combination of both types.

There are generally several classes of stationary engineer licenses; these specify the steam pressure or horsepower of the equipment the engineer may operate. The first-class license permits the stationary engineer to operate equipment of all types and capacities without restriction. The lower class licenses limit the capacity of the equipment the engineer may operate. However, engineers with lower class licenses may operate equipment restricted by their license class, provided they are under the supervision of a higher rated engineer —usually one with a first-class license.

Stationary engineers advance to more responsible jobs by being placed in charge of larger, more powerful, or more varied equipment. Generally, the engineer advances to such jobs as he obtains higher grade licenses. Advancement, however, is not automatic. For example, an engineer with a first-class license may work for some time as an assistant to another first-class engineer before a vacancy requiring a first-class licensed engineer occurs. In general, the broader the knowledge he has about the operation, maintenance, and repair of various types of equipment, the better are his chances for advancement. Stationary engineers may also advance to jobs as plant engineers and as building and plant superintendents.

Employment Outlook

Employment of stationary engineers is expected to increase by a few thousand each year during the remainder of the 1960's and early 1970's. In addition, it is estimated that about 7,000 new workers will enter this large field each year during the next 10 years, because of the need to replace workers who retire or die. Transfers to other fields of work also will create job openings for new workers.

Employment in this occupation is expected to rise mainly because of the continuing increase in the use of large stationary boilers and refrigeration and air-conditioning equipment in factories, powerplants, and others buildings. Other job opportunities for these engineers may arise because of the continued growth of pipeline transportation and saline water conversion. However, improved efficiency from more powerful, automatic, and more centralized equipment and better utilization of workers may limit the growth in the employment of stationary engineers.

The increasing use of atomic energy to generate power should not affect significantly the employment of stationary engineers. It is likely that both the number and skill requirements of operating jobs (i.e., stationary engineer, boiler operator, turbine operator, etc.) in a nuclear plant will be about the same as those in a new conventional powerplant.

Earnings and Working Conditions

Average hourly earnings of all classes of stationary engineers in 1962 ranged from $2 in Greenville, S.C., to $3.32 in the Newark and Jersey City, N.J., area, according to wage surveys by the U.S. Department of Labor's Bureau of Labor Statistics. Stationary engineers who are in charge of a large boilerroom operation may earn considerably more than the average; some of these workers earn more than $180 a week.

Stationary engineers generally have steady year-round employment. They usually work a straight 8-hour day and 40 to 48 hours a week. In plants or institutions that operate around the clock, they may be assigned to any one of three shifts—often on a rotating basis—and to Sunday and holiday work.

Many stationary engineers are employed in plants which have union-employer contracts. Most of these contracts provide benefits which may include hospitalization, medical and surgical insurance, life insurance, sickness and accident insurance, and retirement pensions. Similar benefits may also be provided in plants which do not have union-employer contracts. Among the unions to which these workers belong are the International Union of Operating Engineers and the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America.

Most engine rooms, powerplants, or boiler rooms where stationary engineers work are clean and well-lighted. However, even under the most favorable conditions, some stationary engineers are exposed to high temperatures, dust, dirt, contact with oil and grease, and odors from oil, gas, coal, or smoke. In repair or maintenance work, they may have to crawl inside a boiler and work in a crouching or kneeling position to clean or repair the interior.

Because stationary engineers often work around boilers and electrical and mechanical equipment, they must be alert to avoid burns, electric shock, and injury from moving machinery. If the equipment is defective or is not operated correctly, it may be dangerous to them and to other persons in the vicinity. However, in recent years, modern equipment and safety procedures have reduced accidents greatly.

Where To Go for More Information

Further information on this occupation may be secured from State or local licensing agencies. Locals of the International Union of Operating Engineers also may be an important source of information. Additional information may be obtained from:

International Union of Operating Engineers,
1125 17th St. NW., Washington, D.C., 20036.

Welders and Oxygen and Arc Cutters

Nature of Work

Welders join (weld) metals by applying intense heat and, sometimes, pressure to the edges of the metals in order to melt the edges and thus form a permanent bond, with or without the use of filler metal. Many of the parts used in automobiles, airplanes, refrigerators, and thousands of other products are joined in this way. Welding is also widely used to repair broken metal parts.

There are more than 40 different welding processes, most of which fall under 3 basic categories: arc, gas, and resistance welding. *Arc welders* (D.O.T. 4–85.020) perform their work either by hand or machine methods. *Gas welders* (D.O.T. 4–85.030) usually join metals by hand operations, although they also may use automatic and semiautomatic gas-welding equipment. Resistance welding is mainly a machine process performed by semiskilled *resistance-welding operators* (D.O.T. 6–85.010, .020, .030, 060, .100).

The principal duty of the welder using the manual technique is to control the melting of the metal edges by directing heat, either from an electric arc or from a gas-welding torch, and to add filler metal where necessary to complete the joint. In one of the most commonly used of the manual arc welding processes, the welder obtains a suitable electrode and adjusts the electric current. The welder first "strikes" an arc (creates an electric circuit) by touching the metal with the electrode. After the arc is made, the welder guides the electrode at a suitable distance from the joint seams to be welded. The intense heat caused by the arc melts the metal seams and the electrode tip. The molten metal from the electrode is deposited in the joint and together with the molten metal edges solidifies to form a solid connection. During the past decade or so, there has been a considerable increase in the use of arc welding processes employing inert gas for shielding the weld area. This type of welding was developed for joining hard-to-weld metals such as aluminum, magnesium, stainless steel, and titanium. Many welders are now specializing in this process.

In gas welding, the welder applies an intensely hot flame (obtained from the combustion of a mixture of fuel gas—most commonly acetylene and oxygen) from a gas welding torch to the metal edges. After the welder obtains the proper types of welding rods and welding torch tips and adjusts the regulators on the oxygen and acetylene cylinders, he lights his welding torch. He then adjusts the oxygen and acetylene valves on the torch to obtain the proper size and quality of flame. The kind of flame selected depends on the type of metal to be joined and the type of joint to be made. The welder heats the metal parts to be welded by directing the flame against the metal until it begins to melt. He then applies the welding rod to the molten metal to supply additional metal for the weld.

Resistance-welding operators, unlike arc and gas welders who use manual as well as machine methods, operate machines that weld metal parts by bringing them together under heat and

Arc welder joins flange to pipe

pressure. The operator adjusts the controls of the machine for the desired electric current and pressure, feeds and alines the work, and removes it after the welding operation is completed.

Semiskilled *oxygen cutters* (D.O.T. 6-85.215, .240) and *arc cutters* (D.O.T. 6-85.280), sometimes called flame or thermal cutters, commonly use hand-guided torches to cut or trim metals. In the oxygen-cutting process, for example, the oxygen cutter directs a flame of oxygen and fuel gas on the area to be cut until the metal begins to melt. He then releases an additional stream of oxygen which cuts the metal. The oxygen cutter prepares for the cutting job by attaching the proper torch tip for the particular job, connecting the torch to the gas and oxygen hoses, and regulating the flow of gases into the torch for the desired cutting flame. He then cuts through the metal, manually guiding the torch along previously marked lines or following a pattern. He may mark guidelines on the metal by following blueprints or other instructions. Arc cutting differs from oxygen cutting because an electric arc is used as the original source of heat. However, as in oxygen cutting, an additional stream of gas may be released in cutting the metal.

Oxygen and arc cutters may also operate a torch or torches mounted on a machine. These electrically or mechanically controlled machines automatically follow the proper guideline.

Workers other than welders frequently use welding in maintenance and repair work. For example, the boilermaker, the structural-steel worker, the machinist, and the plumber may at times be required to weld.

Where Employed

In early 1963, an estimated 370,000 welders and oxygen and arc cutters were employed throughout the country. About three-fourths of these workers were employed in manufacturing industries. Of these, about 70,000 worked in the automobile, shipbuilding, and aircraft industries. Other manufacturing industries with large numbers of welders and oxygen and arc cutters were fabricated metal products (55,000); primary metals (28,000); and electrical machinery (24,000). The remainder were widely distributed among other manufacturing industries.

Of the approximately 100,000 welders and oxygen and arc cutters employed in nonmanufacturing industries, over 30,000 were employed by construction firms; about 25,000 by establishments performing miscellaneous repair services; and the remainder were widely distributed among other nonmanufacturing establishments.

The widespread use of the welding and cutting processes in American industry enables welders and cutters to find jobs in every State. Most of these jobs, however, are in the major metalworking areas, with more than 40 percent of them concentrated in Pennsylvania, California, Ohio, Michigan, and Illinois. Large numbers of welders and cutters are employed in Detroit, Chicago, Philadelphia, Los Angeles, and other important metalworking centers.

Training, Other Qualifications, and Advancement

Skills of manual arc and gas welders, machine resistance-welding operators, and oxygen and arc cutters vary widely. Generally it takes several years of training to become a skilled manual arc or gas welder. Some skilled jobs may require a knowledge of blueprint reading, welding symbols, properties of metals, and electricity. Some of the less skilled manual jobs can be learned after a few months of on-the-job training.

Training requirements for the resistance-welding operator's job depend upon the particular type of equipment used; most of these operators learn their work in a few weeks. Little skill is required for most oxygen- and arc-cutting jobs and, generally, they can be learned in a few weeks of on-the-job training. However, the cutting of some of the newer alloys requires a knowledge of the properties of metals as well as greater skill in cutting.

Welding and oxygen- and arc-cutting work require manual dexterity, a steady hand, good eye-hand coordination, and good eyesight.

Manual welders often learn their trade through study of welding methods in public or private vocational schools, followed by several years of job experience. A formal apprenticeship generally is not required for this occupation. However, a few large companies offer apprenticeship programs for welders. Also the U.S. Department of the Navy, at several of its installations, conducts 4-year welding apprenticeship programs for its civilian employees.

Young persons entering the welding trade often start with simple manual welding production jobs where the type and thickness of metal, as well as the position of the welding operation, rarely change. Occasionally, they are first given jobs as oxygen or arc cutters and later move into manual welding jobs. Some large companies employ general helpers in maintenance jobs who, if they show promise, may be given opportunities to become welders. After serving as a helper to an experienced welder, a young man may be promoted to a semiskilled welding job where he will usually perform repetitive work or work which does not involve critical safety and strength requirements. The work duties of the semiskilled welder are primarily performed in only one position (flat, vertical, horizontal, or overhead).

The class A or skilled, all-round welder should be able to plan and lay out work from drawings, blueprints, or other written specifications. He should have a knowledge of the welding properties of steel, stainless steel, cast iron, bronze, aluminum, nickel, and other metals and alloys. He should be able also to determine the proper sequence of work operations for each job and be able to weld all types of joints, in flat, vertical, horizontal, and overhead positions. Some skilled manual welders are required to know both arc and gas welding. These craftsmen are usually called "combination welders." The skilled manual arc welder may specialize in one of the many types of arc welding.

Before being assigned to work where the strength of the weld is a highly critical factor, welders may be required to pass a qualifying examination. The test may be given by an employer, a municipal agency, a private agency designated by local government inspection authorities, or a naval facility. Certification tests are also given to welders on some construction jobs or to those who may be engaged in the fabrication or repair of steam or other pressure vessels where critical safety factors are involved. In addition to certification, some localities require welders to obtain a license before they can do certain types of outside construction work. New developments in some manufacturing industries are increasing the skill requirements of welders. This is particularly true in fields such as atomic energy or missile manufacture, which have high standards for the reliability of welds and require more precise work.

With 2 years' training at a vocational school or technical institute, the skilled welder may qualify as a welding technician. Generally, workers in this small but growing occupation interpret the engineers' plans and instructions. Occasionally, welders may be promoted to jobs as inspectors where they check welds for general conformance with specifications and for quality of workmanship. Welders also may become foremen who supervise the work of other welders. A small number of experienced, all-round welders establish their own welding and repair shops.

Employment Outlook

The number of welding jobs is expected to increase moderately in the remainder of the 1960's and early 1970's as a result of the generally favorable longrun outlook for metalworking industries and the wider use of the welding process. In addition, about 6,000 openings will occur each year because of vacancies resulting from retirements and deaths. Opportunites will also result as some welders transfer to other lines of work.

Employment prospects for resistance welders, who make up the largest single group of welders, are expected to continue to be favorable because of the increased use of the machine resistance-welding process in activities such as the manufacture of motor vehicles, aircraft and missiles, and the production of light, streamlined railroad cars. The use of faster and more highly automatic welding machines, however, will slow down the growth in the number of these welders.

Many more manual welders will be needed for maintenance and repair work in the growing metalworking industries. The number of manual welders engaged in production work is expected to increase in plants manufacturing structural-metal products, such as metal doors, boilers, and sheet-metal products. The construction industry will need an increasing number of welders as the use of welded steel structures expands.

The number of jobs for oxygen and arc cutters is expected to rise somewhat during the years ahead as the result of the general expansion of metalworking activity. The increased use of oxygen- and arc-cutting machines, however, will tend to restrict the growth of this occupation.

Earnings and Working Conditions

The earnings a welder can expect depends to a great extent on the skill requirements of his job and on the industry or activity in which he is employed. Earnings of highly skilled manual welders generally compare favorably with those of other skilled metalworking occupations. Machine welders, such as resistance welders, who require little training, generally earn somewhat less than skilled manual welders.

Average straight-time hourly earnings for skilled (class A) manual welders in machinery manufacturing industries in 21 cities and metropolitan areas in mid-1963 ranged from $2.27 to $3.15, with the highest rates in San Francisco–Oakland and New York City ($3.15). Semiskilled (class B) manual welders' average hourly earnings ranged from $1.84 to $2.74. Welders who are covered by union contracts may earn considerably more than these average earnings.

Many welders and cutters are union members. Among the labor organizations which include welders and cutters in their membership are the International Association of Machinists; the International Brotherhood of Boilermakers, Iron Shipbuilders, Blacksmiths, Forgers and Helpers; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the United States and Canada; and the United Electrical, Radio and Machine Workers of America (Ind.). Labor-management contracts which cover welders and oxygen and arc cutters provide employees with major benefit programs which may include paid holidays and vacations, hospitalization, medical and surgical insurance, life insurance, sickness and accident insurance, and retirement pensions.

Welders and cutters are exposed to some hazards in their work, but safety programs have kept the injury rate relatively low. For example, protective clothing, goggles, helmets with protective lenses, and other devices are provided for the safety and protection of the welder. Although lighting and ventilation are usually adequate, welders occasionally work in the presence of toxic gases and fumes generated by the melting of some metals. Welders are often in contact with rust, grease, paint, and other elements found on the surface of the metal parts to be welded. Operators of resistance-welding machines are largely free from the hazards associated with hand welding. A clear eye shield or clear goggles generally offer adequate protection to these operators.

Where To Go for More Information

The American Welding Society,
345 East 47th St., New York, N.Y., 10017.

International Association of Machinists,
1300 Connecticut Ave. NW., Washington, D.C., 20036.

International Brotherhood of Boilermakers, Iron Shipbuilders, Blacksmiths, Forgers and Helpers,
8th at State Ave., Kansas City, Kans., 66101.

International Union, United Automobile, Aerospace and Agricultural Implement Workers of America,
8000 East Jefferson Ave., Detroit, Mich., 48214.

United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the United States and Canada,
901 Massachusetts Ave. NW., Washington, D.C., 20001.

State Supervisor of Trade and Industrial Education or the local Director of Vocational Education in the State and/or city in which a person wishes to receive training.

Some Major Industries and Their Occupations

OCCUPATIONS IN AIRCRAFT, MISSILE, AND SPACECRAFT MANUFACTURING

America's entry into the space age has caused rapid growth in the aircraft, missile, and spacecraft field. By early 1963, about 1.4 million persons were employed in private industry and Federal agencies in the manufacture of aircraft, missiles, and spacecraft. Many thousands of new and interesting jobs have come into being, and many more will be created during the remainder of the 1960's and in the longer run.

Generally known as the "aerospace" industry, this field is one of the most rapidly changing in the country today, with a future full of exciting prospects and stimulating job opportunities. Because its products are complex and changing, the majority of its job openings are for workers with a college education or a specialized skill. Engineers, scientists, and technicians represent a much larger percent of total employment than in most other manufacturing industries, and probably will account for an even higher percent during the years ahead. Increases are also expected in the number of skilled workers employed, such as tool and die makers, skilled assemblers and inspectors, welders, and various types of mechanics. Employment opportunities for semiskilled and unskilled workers, on the other hand, are not expected to grow during the next 10 to 15 years and may even decrease.

Nature and Location of the Industry

Aircraft, missiles, and spacecraft have the same main components: A frame to hold and support the rest of the vehicle, an engine to propel the vehicle, and a guidance and control system. A major difference is that missiles and spacecraft can reach into space and attain speeds many times the speed of sound, whereas aircraft fly in the earth's atmosphere and at slower speeds. Another difference is that aircraft are manned whereas missiles and most spacecraft are not, although spacecraft for manned flights by astronauts are also built.

Types of aircraft vary from small personal planes, costing not much more than an automobile, to multimillion-dollar giant bombers and supersonic fighters. Aircraft plants also produce transport planes, helicopters, dirigibles, balloons, and gliders. About three-fourths of aircraft production in dollar value is manufactured for military use; the rest is for commercial passenger and freight traffic, private business and pleasure use, and civilian instructional flying.

Missiles and spacecraft also vary greatly in the purposes for which they are made, and in their size and capabilities. Missiles are produced chiefly for military use and generally carry destructive warheads. Some can travel only a few miles and are intended for such purposes as the support of ground troops and defense against low flying aircraft. Others, such as the Atlas, Titan, and Minuteman, have intercontinental ranges of 5,000 miles or more. Some missiles are designed for launching from land or underground sites, others for firing from aircraft, submarines, or ships.

Spacecraft are sent aloft with a payload (useful cargo) of instruments which can measure and record conditions in space and transmit the data to receiving stations on earth. Payloads in manned spacecraft also include a cabin capsule for astronauts. The first American space vehicles had payloads weighing only 20–30 pounds or less; currently being developed is the Saturn launch vehicle which will be able to launch 120-ton payloads. Some space vehicles probe the space environment and then fall back to earth. Others are

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put into orbit and become artificial satellites around the earth, sun, or other celestial body. Nearly all this country's missiles and spacecraft are built for the Air Force, Navy, Army, or the National Aeronautics and Space Administration (NASA).

Because the aerospace industry makes many kinds of finished products, it uses many kinds of engines, electronic systems, and other components. Aircraft engines may be reciprocating (piston), jet, or rocket. Missile engines may be jet or rocket. Spacecraft are always rocket powered, because rockets are the most powerful type of engine and can operate in airless space whereas other engine types need oxygen from the air for combustion. Today's rocket engines are powered by chemical propellants, which may be either liquid or solid. New sources of rocket propulsion such as nuclear or electric energy may be available in the future. Guidance, control, and instrument-payload systems are largely electronic. Because missiles and most spacecraft are unmanned, they generally have more complex guidance and control systems than aircraft.

An aircraft, missile, or spacecraft is manufactured usually under the technical direction of a prime contractor. He manages and coordinates the entire project, subject to periodic inspections by the Federal agency or the airline which ordered the vehicle. His engineering department prepares design drawings, blueprints, and other specifications. These go to the production department, where planners work on the many details regarding machines, materials, and operations needed to manufacture the vehicle in the quantity required. Decisions must be made as to what part of the production work the prime contractor will do and what part will be contracted to outside firms.

Special tools, dies, jigs, and fixtures must be made to manufacture the vehicle. Many sheet-metal workers, machinists, machine tool operators, and other metal processors produce the thousands of parts and components which go into the craft. All parts and equipment must be inspected and tested many times, both before and after they are assembled, and all assembly work must also be thoroughly inspected and checked. Assemblers and installers are needed in every stage of the production process to fit together, hook up, and install systems and components. After its final assembly, the vehicle is checked out by a team of mechanics, flight tested if an aircraft, and then prepared for delivery.

Electrical assembler installs wiring in jet fighter aircraft

Many subcontracts are awarded for the parts and assembly work that go into the aircraft, missile, or spacecraft. It is estimated, for example, that about 50,000 subcontractors produce components and other equipment for missiles and that the average missile contains approximately 300,000 parts. The prime contractor may manufacture components of the craft and also do the final assembly.

Aerospace plants range in size from the large factories of major manufacturers, each with thousands of employees, to the shops of small subcontractors and suppliers with only a few workers each. Jobs in aerospace work may be found in practically every State, although roughly one-third are concentrated in California. Other States with large numbers of aerospace jobs include, east of the Mississippi River, New York, New Jersey, Pennsylvania, Connecticut, Massachusetts, Ohio, Florida, and Maryland; and, west of the Mississippi River, Washington, Texas, Missouri, and Kansas.

An estimated 1.4 million people—about one-fifth of them women—were working on aerospace products in early 1963. About 500,000 of these were producing missiles and spacecraft; nearly 500,000 were making aircraft, aircraft engines, and propellers; and more than 200,000 worked in the electronics field producing equipment for aircraft, missiles, and spacecraft. The rest of the 1.4 million were civilian employees of the Federal Government working in the aerospace field—approximately 150,000 in the Department of Defense, 27,000 in the National Aeronautics and Space Administration, and a small number in a few other agencies.

Occupations in Aircraft, Missile, and Spacecraft Manufacturing

Workers with many different kinds of educational backgrounds and job skills are needed to design and manufacture aircraft, missiles, and spacecraft. Engineers and scientists with advanced university degrees, as well as plant workers who can learn their jobs after a few days or weeks of training, are employed.

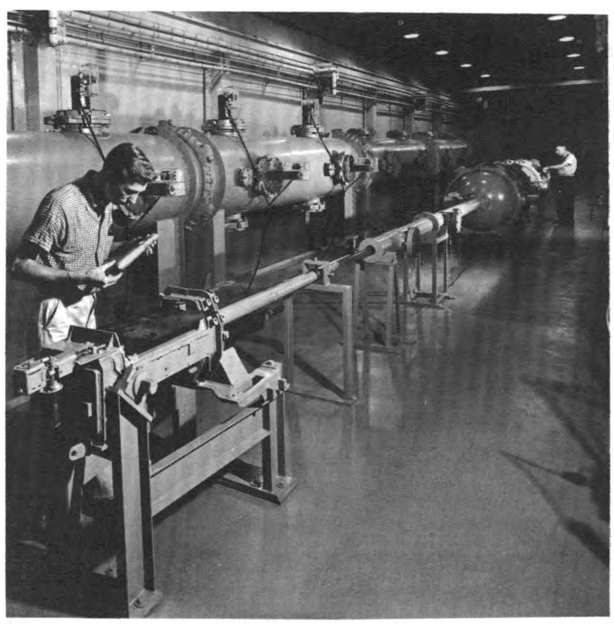
Occupational needs vary among establishments in the industry, depending on the work being done. Research and development laboratories employ mainly engineers, scientists, and supporting technicians and craftsmen. These laboratories are run by manufacturers, universities, independent research organizations, and Government agencies such as the Air Force, Navy, Army, and the National Aeronautics and Space Administration. Factories engaged in production, on the other hand, employ mostly plant workers such as assemblers, inspectors, tool and die makers, sheet-metal workers, machinists, and machine tool operators.

Some of the more important jobs found in aerospace-products manufacturing are described below, under three major categories: professional and technical occupations; administrative, clerical, and related occupations; and plant occupations. (Many of the jobs in this industry are found in other industries as well and are discussed in greater detail elsewhere in this *Handbook*, in the sections covering individual occupations. See index for page numbers.)

Professional and Technical Occupations. Before production of an aircraft, missile, or spacecraft can begin, a design must be approved. This requires many experiments and "feasibility" studies, to determine how well various design possibilities meet the conditions under which the vehicle will be operated. A scale model is made from the approved design. It is tested in wind, temperature, and shock tunnels, on ballistic ranges, and in centrifuges where actual flight conditions are simulated. The next stop is to develop a full-size experimental model or prototype, which is thoroughly tested in the air and on the ground. If test results are satisfactory, production may begin. Many modifications in the craft are normally made during the course of design and development, and often even after production has started.

The pace of discovery and change is so rapid that much equipment becomes obsolete while still in the experimental stage or soon after being put into operation. Research and development are vital in the industry, particularly in the missile and spacecraft field. An intensive effort is being made to develop aerospace vehicles with greater speeds, ranges, and reliability; engines with more power; and metals and plastics with wider capabilities.

Increasing emphasis on research and development makes the aerospace industry an important and growing source of jobs for engineers, scientists, and technicians. It is estimated that in early 1963 nearly one-fourth of all employees in plants



Courtesy of National Aeronautics and Space Administration

Scientists conduct high velocity impact test to determine potential meteorite damage to space vehicles

making aerospace products were engineers, scientists, and technicians; this is considerably more than the percent of such personnel in most other manufacturing industries.

Many kinds of engineers and scientists are employed in aerospace work. For example, over 30 different college degree fields are represented among the engineers and scientists employed by the National Aeronautics and Space Administration. Among the more important types of engineers working in the industry are electronics, electrical, aeronautical, chemical, nuclear, mechanical, and industrial engineer. Some of the types of scientists employed in the industry include physicist, mathematician, chemist, metallurgist, psychologist, physiologist, and astronomer. Aerospace engineers and scientists work in a wide and varied range of applied fields, such as materials and structures, energy and power systems, fluid and flight mechanics, measurement and control systems, communications and data systems, life sciences and systems, and space sciences.

Engineers and scientists are assisted by many types of workers, such as draftsmen, mathematics aids, laboratory technicians, electronics technicians, tool designers, research mechanics, and research electricians. They also work with *production planners* (D.O.T. 0–68.50), who plan the layout of machinery, movement of materials, and sequence of operations so that manufacturing processes will flow efficiently from one step to the next; and *technical writers* (D.O.T. 0–06.90) and *technical illustrators* (D.O.T. 0–48.32), who produce technical manuals and other literature used to describe the operation and maintenance of air and space craft and their many parts.

Administrative, Clerical, and Related Occupations. Managerial and administrative jobs are generally comparable with similar jobs elsewhere in the economy, except that they are more closely related to engineering than in many other industries, because of the importance of research and development in the aerospace field. Personnel in these jobs include executives, responsible for the direction and supervision of research and production, and officials in departments such as sales, purchasing, accounting, public relations, advertising, and industrial relations. Many thousands of clerks, secretaries, stenographers, typists, tabulating machine operators, and other office personnel are also employed.

Plant Occupations. About 55 percent of all workers in the aircraft, missile, and spacecraft field were employed in plant jobs in early 1963. Plant jobs can be classified into the following groups: Sheet-metal work; machining and tool fabrication; other metal processing; assembly and installation; inspecting and testing; flight checkout; and materials handling, maintenance, and custodial.

Sheet-metal occupations. Sheet-metal workers shape parts from sheet metal by hand or machine methods. When hand methods are used, the worker shapes the part by pounding it with a mallet and by bending, cutting, and punching it with handtools. Machine methods involve the use of power hammers and presses, saws, tube benders, and drill presses. The all-round *sheet-metal worker* (D.O.T. 4–80.050 and .060) lays out the sequence of operations on the basis of blueprints and other engineering information. He then fabricates complicated metal shapes, using handtools or machines. Less complex parts, as well as those produced in large numbers, are fabricated by less skilled sheet-metal workers or workers who specialize in operating a single machine. They have such titles as *stretch press operator* (D.O.T. 6–88.627), *power brake operator* (D.O.T. 6–94.207), *power hammer operator* (D.O.T. 6–94.221), *power shear operator* (D.O.T. 6–88.664), *punch press operator* (D.O.T. 6–88.622), *profile cutting torch operator* (D.O.T. 6–85.240).

Machining and tool fabrication occupations. Another important group of workers engaged in shaping and finishing metal parts with machine tools are *machinists* (D.O.T. 4–75.010 and .120) and *machine tool operators.* The most skilled of these are the all-round or general machinists who can lay out the work and set up and operate several types of machine tools. They perform machining operations of a highly varied and nonrepetitive nature. They are most frequently employed in departments engaged in experimental and prototype production.

Machine tool operators are employed in the large-volume production of metal parts. They generally specialize in the operation of a single type of machine tool, such as a lathe, drill press, or milling machine. The more skilled machine tool operators are able to set up the work on a machine and handle difficult and varied jobs. The less skilled operators usually do more repetitive work.

Machinists and machine tool operators represent a higher proportion of the work force in engine and propeller plants, which are basically metalworking establishments, than in plants performing the final assembly of air and space vehicles. Among engine plants, those manufacturing reciprocating engines do relatively more machining and less sheet-metal work than those producing jet or rocket engines.

Many of the plants in the aerospace industry make a large proportion of the jigs, fixtures, tools, and dies they use. Fabrication of these items requires skilled metal-processing workers, chiefly *jig and fixture builders* (D.O.T. 5–17.060) and *tool and die makers* (D.O.T. 4–76.010, .040, and .210). Jig and fixture builders make the work-holding and tool-guiding devices used in production and assembly operations. On the basis of information received from the engineering department, they plan the sequence of metal machining operations involved in making a jig and carry the job through to completion. Tool and die makers make the cutting tools and fixtures used in machine tool operations and the dies used in forging and punch press work. They must be experts in the use of machine tools.

Other metal-processing occupations. Other metalworkers, such as tube benders, riveters, and welders are also employed. *Tube benders* (D.O.T. 6–95.060) form tubings used for oil, fuel, hydraulic, and electrical conduit lines. *Riveters* (D.O.T. 6–95.080 and .081) and *welders* (D.O.T. 4–85.020, .030, .040, and .063) join fabricated parts by hand or machine riveting and by electric arc, gas, or electric resistance welding.

Additional metal fabricating is performed by skilled foundry workers such as patternmakers, molders, and coremakers. Drop hammer operators and other forge shop workers are employed in the forging departments.

Many aircraft, missile, and spacecraft parts are chemically and heat treated during several stages of their manufacture in order to clean, change, or protect their surface or structural condition. Sheet-metal parts are heat treated to keep the metal soft and malleable while it is being worked into the required shape. Many processes, such as painting and plating, are used on the surfaces of parts. Workers in these metal-processing jobs have such titles as *heat treater* (D.O.T. 4–87.020), *painter* (D.O.T. 5–16.940), and *plater* (D.O.T. 4–74.010).

Assembly and installation occupations. Assembly and installation workers are a major occupational group, employed in practically all plants in the industry. Many work in factories producing engines, electronic equipment, and auxiliary components, but the majority are found in plants which assemble air or space craft into completed form. They perform such final assembly work as the fitting together of major subassemblies and the installing of major components. In the case of aircraft, for example, this work involves joining wings and tail to the fuselage and installing the engine and auxiliary equipment such as the fuel system and flight controls. In the course of their duties, assemblers perform such operations as riveting, drilling, filing, bolting, soldering, cementing, and gluing.

A large proportion of assemblers are semiskilled workers doing repetitive work, but some are skilled mechanics and installers. Many of the latter perform diversified assembly or installation operations, and often work on experimental, prototype, or special craft. They assemble, take apart, inspect, and install complex mechanical and electronic assemblies. They read blueprints and interpret other engineering specifications. They may be called *final assemblers* of complete aircraft (D.O.T. 5–03.572), *missile assembly mechanics* (temporary D.O.T. 5–03.599), or *rocket assembly mechanics* (temporary D.O.T. 5–03.699).

Some skilled assemblers are employed in plants which produce relatively large numbers of aircraft and missiles rather than a few experimental types. These assemblers usually specialize in one or more fields of work. They are often assisted by less skilled assemblers who do the more routine work. For example, a *class A armament assembler* (D.O.T. 5–83.543) typically does such work as assembling, installing, and alining power turrets, weapons, gun cameras, and related accessories. Lower rated armament assemblers typically do such work as uncrating and cleaning weapons, loading ammunition, installing armor plate, and placing parts in jigs. *Power plant installers* (D.O.T. 5-03.572), sometimes known as engine mechanics, install, aline, and check the various types of engines and accessories. Skilled *electrical assemblers* (D.O.T. 4-97.910), sometimes called electricians, install, hook up, and check major units in electrical or radio systems. They are assisted by less skilled assemblers, who do the more routine installations and wire routings by following standard wiring diagrams and charts. Assemblers also specialize in other systems, such as plumbing, hydraulic, heating and ventilating, and rigging and controls.

Inspecting and testing occupations. Because aircraft, missiles, and spacecraft are extremely complex, thousands of painstaking inspections and tests must be made as each component and part moves toward final assembly of the whole system. Inspections are made not only by employees of the manufacturers but also by civilian employees of Federal agencies which have contracted for the equipment.

Some inspectors specialize in examining materials and equipment purchased from the outside, others inspect components during fabrication and subassembly within their own plants, while still others inspect completed craft after their final assembly. Many inspection jobs require highly skilled workers. On the other hand, some tests are made by automatic equipment which can be run by relatively unskilled persons. Such equipment not only checks the component or assembly under test but may also run simultaneous checks on itself.

Some of the most skilled inspectors, especially in final assembly plants, are *outside production inspectors* (D.O.T. 4-76.220). They examine machined parts, subassemblies, and tools and dies which have been ordered from other firms. They also serve as liaison men between their own engineering departments and supplying companies. Other inspectors, frequently known as *receiving inspectors* (D.O.T. 7-03.810), with less responsibility than outside production inspectors, check purchased materials and parts for conformity

Assembly mechanics install equipment in cabin capsules for manned space exploration

with blueprints, armed services requirements, and other established standards. They operate testing equipment and must be familiar with specifications of the parts and materials purchased from different sellers.

In the production department, *machined parts inspectors* (D.O.T. 4-78.671) determine, by the use of precision testing instruments, whether or not a part has been properly machined to conform to blueprint specifications. They may also test for hardness and porosity and determine the "machineability" of castings and forgings. *Fabrication inspectors* (D.O.T. 5-03.812) are generally skilled sheet-metal workers. They inspect fabricated sheet-metal work and complex parts which have required numerous fabricating operations.

As the parts are fitted together, they undergo numerous inspections by *assembly inspectors* (D.O.T. 5-03.814). These inspectors are employed, for the most part, in the later stages of the assembly process. They usually inspect complete major assemblies and installations, such as fuselage, wing, and nose sections, to insure their proper final fitting. They also check the functioning of such systems as hydraulics, plumbing, and controls. Subassemblies are usually inspected by less skilled assembly inspectors. Final testing must be especially rigorous with missiles and most spacecraft since, unlike aircraft, they have no human guidance aboard to correct for improper working of components which may cause a target miss or other failure of the mission.

Flight checkout occupations. The job of checking out an air or space craft before its first flight requires a team of mechanics with different levels and types of skills. Sometimes the checking-out process involves making repairs or returning the craft to the plant for repairs. The *chief mechanic* or *crew chief*, who is the most skilled worker of the team, is responsible for the entire checking-out operation including repair work. He usually directs the work of a crew of mechanics, each of whom specializes in one or more fields. For example, *engine mechanics* specialize in checking out the power plant, including the engine, propellers, and oil and fuel systems. Engine mechanics use handtools, testing equipment, and precision measuring instruments. The *electronics checkout men* perform or supervise the final operational checkout of such systems as radio, radar, automatic pilot, fire control, and complete electronic guidance systems. Other skilled workers may specialize in checking out and repairing armament, instruments, rigging and controls, plumbing, and hydraulic systems. In some cases, less skilled mechanics help conduct tests and make repairs.

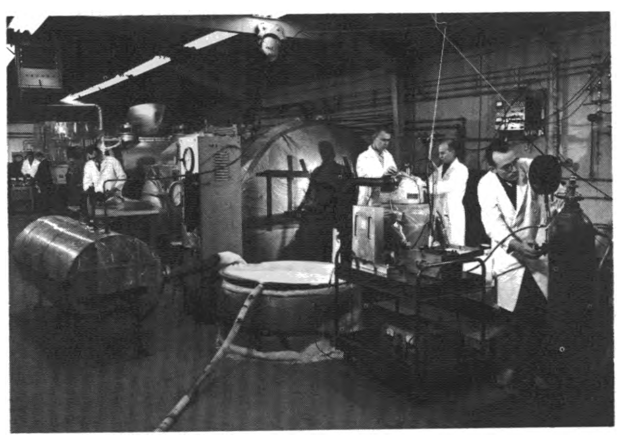
Materials handling, maintenance, and custodial occupations. Aerospace plants employ large numbers of material handlers, such as truckdrivers, crane operators, shipping clerks, stock clerks, and tool crib attendants. Maintenance workers, who keep equipment and buildings in good operating condition and make changes in the layout of the plant, include maintenance mechanics, millwrights, electricians, carpenters, plumbers, painters, and welders. Guards, firemen, and janitors make up a major portion of the plant's protective and custodial employees.

Training, Other Qualifications, and Advancement

A college degree in engineering or in one of the sciences is usually the minimum requirement for engineering and scientific jobs in the aerospace industry. A few workers may get jobs as professional engineers without a college degree, but only after years of semiprofessional work experience and some college-level training. Since many kinds of engineers and scientists are employed in aerospace work, college graduates in many different degree fields may qualify for professional jobs in the industry. Regardless of his degree field, the undergraduate student preparing for professional aerospace work is well advised to get as solid a grounding as possible in fundamental concepts and basic general areas of engineering and science. Mathematics and physics courses are especially important, since these sciences provide the necessary language understood by the variety of engineers and scientists working on any given project. Training in the more concentrated fields of specialization which exist in aerospace work is generally received in graduate school or on the job.

An increasing number of semiprofessional workers, such as electronics technicians, engineering aids, draftsmen, production planners, and tool designers receive training for their jobs through 2 years of formal education in a technical institute or junior college. Others qualify through several years of diversified shop experience.

Training requirements for plant jobs vary from a few days of on-the-job instruction to several years of formal apprenticeship. Apprenticeship programs develop craftsmen, such as machinists, tool and die makers, sheet-metal workers, patternmakers, aircraft mechanics, and electricians. These programs vary in length from 3 to 5 years depending on the trade; during this time, the apprentice handles work of progressively increasing difficulty. Besides on-the-job experience, he receives classroom instruction in subjects related to his craft. Such instruction



Laboratory technicians record temperature, pressure, and other conditions of simulated space flight for a machinist apprentice, for example, would include courses in blueprint reading, mechanical drawing, shop mathematics, trade theory, physics, safe working practices, and other subjects.

Many levels of skill are required for other factory jobs. Workers with little or no previous training or experience are hired for the less skilled assembly jobs. On the other hand, skilled assemblers may need 2 to 4 years of plant experience in addition to a high school or vocational school education or its equivalent. Skilled assemblers must be able to read and interpret engineering blueprints, schematic diagrams, and production illustrations.

Skilled inspectors must have at least several years of machine shop experience. They must be able to install and use various kinds of testing equipment and instruments, read blueprints and other engineering specifications, and use shop mathematics. New workers with little or no experience in shop trades may also be hired and trained for jobs requiring less skilled inspectors.

Mechanics who perform the final checkout of air and space craft qualify for their jobs in several ways. Many gain experience as mechanics by working in earlier stages of the plant's production line, before final checkout of the craft. Others receive all their training in checkout work, or come from "line maintenance" jobs with commercial airlines.

Chief mechanics usually need 3 to 5 years of experience in the manufacture of aircraft, missiles, and spacecraft, including at least 1 year as a checkout mechanic. Specialized mechanics, working under the supervision of the chief mechanic, are usually required to have at least 2 years' experience. Workers with less experience serve as helpers or assistants and pick up the mechanic's skills on the job and through plant training courses.

Because the manufacture of their complex and rapidly changing products requires workers who are highly trained and aware of new developments, the majority of aerospace plants support some kind of formal worker training. Instructions of this type supplements day-to-day job experience and helps workers advance more rapidly to higher skills and better paid work. A survey of some of the industry's major producers showed that many conduct educational and training classes themselves, others pay tuition and related costs for outside courses taken by their employees, and some do both. Some classes are held during working hours, in which case trainees are paid for class time, and other classes are after working hours. Courses are available for practically every occupational group, and cover many skills and areas of knowledge. Examples of subjects typically offered include blueprint reading, drafting, welding, aircraft maintenance and repair, electronic data processing, shop mathematics, supervisory practices, and safe working practices. Most trainees take short-term courses designed to meet immediate skill needs. Only a relatively few employees are enrolled in long-term programs scheduled to run for several years, such as apprenticeship.

Employment Outlook

Thousands of employment opportunities are expected to develop in the aerospace field during the remainder of the 1960's and in the longer run. Many new jobs will be created by expanding activity in the industry, and many others will result from the need to replace workers who transfer to other industries, retire, or die. Retirements and deaths alone will probably result in approximately 20,000 to 25,000 openings each year during the next 10 to 15 years.

The industry's future depends largely on Government spending. Unless the international situation changes significantly from that prevailing in early 1963, Government expenditures for aerospace products are expected to rise during the years ahead.

The overall picture for aerospace activity during the next 10 to 15 years is one of growth, but this is not true for every segment of the industry. Jobs in the spacecraft field will probably continue to increase rapidly, because of factors such as expected growth in the military space program and the national effort to complete a manned expedition to the moon by 1970. Employment in the production of missiles rose sharply during the last few years of the 1950's, but has since leveled off and is expected to remain fairly stable. Employment in aircraft manufacture will probably fall somewhat. Many new jobs will be created to produce electronic units for the industry. Electronic systems and components are major items of aerospace craft and their importance in the industry is growing.

Expenditures for research and development should continue to rise rapidly. Employment opportunities will, therefore, be particularly favorable for workers such as engineers, scientists, draftsmen, electronics technicians, mathematics aids, and research craftsmen. Many job openings in these occupations will become available not only in manufacturing concerns but also in university laboratories, independent research organizations, and Federal agencies such as the Air Force, Navy, Army, and the National Aeronautics and Space Administration.

Many job openings will become available also for skilled plant personnel, such as tool and die makers, skilled assemblers and inspectors, and maintenance craftsmen. Because of expected continuance of the shift from volume production of conventional items, chiefly aircraft, to custom production of relatively small numbers of many diversified products, employment of semiskilled and unskilled plant workers is not expected to increase and may even decrease. Semiskilled and unskilled workers are also more likely to be laid off during production cutbacks than are skilled workers and office personnel. Aerospace employment has fluctuated sharply in the past, owing mainly to changes in the needs of the industry's major customer—the Federal Government.

Earnings and Working Conditions

Plant workers' earnings in the aerospace industry are higher than those in most other manufacturing industries. In 1962, for example, production workers in plants making aircraft and parts earned an average of $120.25 a week or $2.87 an hour, while production workers in all manufacturing industries as a whole averaged $96.56 a week or $2.39 an hour. Production workers in the Department of Defense and other Federal agencies receive wages equal to prevailing rates paid for comparable jobs by local private employers.

Information on earnings for professional and technical workers in the aerospace field indicate that they are higher than earnings for similar work in most other industries. The relatively favorable position of these workers is due mainly to the recent rapid growth of research and development activity on missiles and spacecraft, which has created an urgent need for well-qualified engineers, scientists, and technicians. (General information on earnings of professional and technical personnel may be found in the sections on individual occupations in this *Handbook*. See index for page numbers.)

The following tabulation was developed from examination of collective bargaining agreements of a number of representative aerospace manufacturers. It indicates the approximate range of hourly wage rates for selected occupations in mid-1962. The ranges in the various jobs are rather wide, partly because wages within an occupation vary according to the worker's skill and experience and partly because wages differ from plant to plant depending upon type of plant, locality, and other factors.

Aircraft mechanics	$2. 00–$3. 34
Assemblers	1. 84– 3. 23
Electronics technicians	2. 35– 3. 33
Heat treaters	2. 00– 3. 21
Inspectors and testers	1. 94– 3. 50
Jig and fixture builders	2. 00– 3. 50
Laboratory technicians	2. 61– 3. 33
Machine tool operators	1. 94– 3. 50
Machinists	2. 00– 3. 40
Maintenance craftsmen	1. 84– 3. 26
Riveters	2. 07– 2. 76
Tool and die makers	2. 00– 3. 40
Welders	1. 84– 3. 27

Fringe benefits are common in the industry. Workers usually get 2 weeks of paid vacation after 1 or 2 years of service, and 3 weeks after 10 or 12 years. They generally get 6 to 8 paid holidays a year and 1 week of paid sick leave. Other major benefits include life insurance; medical, surgical, and hospital insurance; payments in case of accident and sickness; and retirement pensions. Fringe benefits in Federal aerospace employment are comparable with those in the rest of the industry.

Most employees work in modern factory buildings which are clean, light, and airy. Some work is done outdoors. Operations such as sheet-metal processing, riveting, and welding may be relatively noisy, and some assemblers may work in cramped quarters. Aerospace plants are comparatively safe working places, with an injury-frequency rate which in 1962 averaged only about one-third that for manufacturing as a whole.

Most plant workers in the aerospace field are union members. They are represented by several unions, among them the International Association of Machinists; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; and the International Union of Electrical, Radio and Machine Workers. Some craftsmen, guards, and truck-drivers belong to unions which represent their specific occupational groups.

Where To Go for More Information

National Aeronautics and Space Administration, Washington, D.C., 20546.

Aerospace Industries Association of America, Inc.,
1725 DeSales St. NW., Washington, D.C., 20036.

International Association of Machinists,
1300 Connecticut Ave. NW., Washington, D.C., 20036.

International Union, United Automobile, Aerospace and Agricultural Implement Workers of America,
8000 East Jefferson Ave., Detroit, Mich., 48214.

International Union of Electrical, Radio and Machine Workers,
1126 16th St. NW., Washington, D.C., 20036.

OCCUPATIONS IN THE APPAREL INDUSTRY

Well over a million workers are employed in the factories that make clothing for the Nation's population. The apparel industry produces about $70 worth of clothing annually for every man, woman, and child.

The industry is an important source of jobs for workers with widely different skills and interests. Some of the jobs in this industry can be learned in a few weeks; others can be filled only by persons who have had several years of experience or training.

Four out of five garment workers are women, making this industry the Nation's largest employer of women in manufacturing. Women work mainly as sewing machine operators. Many others work in jobs such as hand sewer, bookkeeper, and designer. Men usually predominate in jobs such as cutter and marker.

Nature and Location of the Industry

More than 1.2 million men and women were employed in the apparel industry in early 1963. About 350,000 made women's garments, such as dresses, skirts, blouses, suits, and coats. Approximately 80,000 made clothing for girls and children. About 120,000 produced tailored clothing (suits and coats) for men and boys. More than 325,000 made men's and boys' shirts, slacks, work clothes, separate trousers, nightwear, and other furnishings. More than 35,000 produced hats, caps, and millinery. About 120,000 produced undergarments for women and children. Another 70,000 made fur goods and miscellaneous apparel such as raincoats, gloves, and dressing gowns. About 140,000 workers classified in the apparel industry produced curtains and draperies.

Apparel factories usually are small; only a handful employ more than a thousand people each. The great majority of the tens of thousands of apparel establishments in the United States employ fewer than 100 workers each. Plants that manufacture garments subject to rapid style changes tend to be smaller than plants that make standardized garments having little or no style change.

The New York metropolitan area is the center of the Nation's apparel industry. It is the Nation's women's apparel fashion center where store buyers flock to its many showrooms and where new styles are created by several thousand designers. About 40 percent of all garment plants and about 25 percent of the industry's workers are located in this area. The rest of the workers are employed in many cities throughout the United States; none of these other cities, however, has more than 6 percent of the workers.

The major centers of the men's tailored clothing industry are New York City, Philadelphia, Chicago, Rochester, Baltimore, Boston, Cincinnati, Los Angeles–Long Beach, and St. Louis. Jobs for workers who manufacture women's dresses, coats, and suits are concentrated in New York City, Wilkes-Barre–Hazelton, Los Angeles–Long Beach, Fall River, New Bedford, Newark, Jersey City, Chicago, Philadelphia, St. Louis, Dallas, and Boston. Large numbers of workers are employed in plants located throughout the South and Southwest, many of them in small communities. These plants generally manufacture inexpensive items such as separate trousers, work clothing, skirts, pajamas, and children's clothing.

Occupations in the Industry

The major operations in making apparel are: Designing the garment, cutting the cloth, sewing the pieces together, and pressing the assembled garment. Generally, high-grade clothing and style-oriented garments involve more handwork and fewer machine operations than cheaper and more standardized garments. For example, making men's high-quality suits requires a great amount of hand tailoring and pressing. Similarly, much hand detailing goes into a high-priced woman's fashionable cocktail dress. In contrast, standardized garments such as men's undershirts, overalls, and work shirts are usually sewn entirely by machine. To make the many different types, styles, and grades of garments, workers with various skills and educational backgrounds are employed in the apparel industry.

Most apparel jobs are semiskilled and are largely concentrated in sewing room occupations. Skilled apparel jobs are concentrated in establishments making men's and boys' suits and coats, and women's dresses, suits, and coats, although skilled jobs are found throughout the apparel industry.

Designing Room Occupations. Typically, the manufacturing process begins with the *designer* (D.O.T. 0-46.01) who creates original designs for new types and styles of apparel. He may get ideas for designs by visiting museums, libraries, and major fashion centers in both the United States and Europe. He makes sketches of his designs and presents them to the management and sales staff of his company for approval. The sketches include information about the type of fabric, trim, and color. The designer makes an experimental garment in muslin from approved sketches. He cuts, pins, sews, and adjusts the muslin on a dress form or on a live model until the garment matches his sketch. In large manufacturing plants, a *sample stitcher* (D.O.T. 4-26.202) or skilled all-round *tailor* (D.O.T. 4-26.201) prepares these sample garments by following the designer's sketch.

Since designing is a creative job, designers usually work without close supervision, but they must produce a satisfactory number of successful styles during a season. A large garment manufacturer generally has one designer and several assistants who often have specialized designing responsibilities of their own. Most small plants and plants making standardized garments do not employ designers, but purchase readymade designs or patterns.

When the sample garment has been approved, it is sent to a *patternmaker* (D.O.T. 4-27.432) who constructs a full-size master pattern. Working closely with the designer, the patternmaker translates the sketch or sample garment into paper or fiberboard pattern pieces to be used as guides for cutting fabric. In drawing and cutting pattern pieces, the patternmaker must make allowances for pleats, tucks, yokes, seams, and shrinkage. In some shops, designers or all-round tailors make patterns, whereas in other shops the assistant designer performs the patternmaking tasks.

The master pattern serves as a guide for the *pattern grader* (D.O.T. 4-27.431) who makes a wide range of sizes in each garment style. In a sense, the pattern grader is a specialized draftsman. He measures the pieces that make up the master pattern and modifies them to fit all sizes. The pattern grader then draws an outline of each revised pattern piece on fiberboard and cuts out the pieces by following the outlines. After he completes a set of pattern pieces for each garment size, he attaches a label to identify the part and size of the garment.

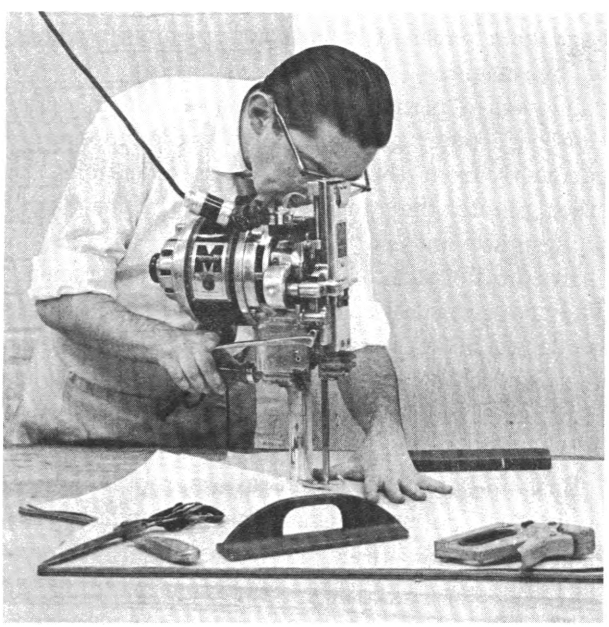
Cutting Room Occupations. Workers in the cutting room prepare cloth for sewing into articles of wearing apparel. There are five basic operations in the cutting department: marking, spreading, cutting, assembling, and ticketing. In small shops, two or more of these operations may be combined into a single job. Most jobs in the cutting room are held by men.

In most plants, *markers* (D.O.T. 6-27.011) trace the fiberboard pattern pieces on large sheets of paper, making several carbon copies

Marker arranges pattern pieces on cloth to guide cutter of these tracings. In plants that make men's and boys' suits and coats, the pattern pieces are traced with chalk directly on the cloth itself, rather than on paper. In order to get the greatest number of cuttings from a given quantity of cloth, markers arrange pattern pieces so that there is just enough distance between them for the cutter to work. Figured materials must be marked in such a way that adjoining garment parts will match when the garment is assembled.

The fabric that has been selected by the designer to use with a particular garment style is laid out on long tables by spreaders. *Hand spreaders* (D.O.T. 6–27.016) lay out bolts of cloth by hand, neatly piling the layers into exact lengths on the cutting table. In large plants, *machine spreaders* (D.O.T. 6–27.015) do this work, using a machine which lays the cloth by traveling back and forth over the table.

The job of a *cutter* (D.O.T. 6–27.054) is to cut out the various garment pieces from the layers of cloth which are spread on the cutting table. He follows the outline of the pattern on the cloth with an electrically powered cutting knife which cuts through all the layers at once. Sometimes layers of cloth are as high as 9 inches. The work of a cutter and a marker is frequently combined into the single job of cutter-marker.



Cutter uses machine to cut garment parts

Other types of cutters are employed in shops making high-quality garments. *Hand cutters* or *shapers* (D.O.T. 4–27.043) trim and cut the pieces for these garments to make them conform exactly to the original pattern. Sometimes cutters sit in sewing rooms so that they can trim and shape garments as they advance through sewing operations.

The pieces of cloth that have been cut out are prepared for the sewing room by another group of specialized workers. *Assemblers*, sometimes called *bundlers*, (D.O.T. 6–27.137) bring together and bundle garment pieces and accessories (linings, tapes, and trimmings) needed to make a complete garment. They sort the pieces by matching color, size, and fabric design. In addition, assemblers may mark locations for pockets, buttonholes, buttons, and other trimmings with chalk or thread. They identify each bundle with a ticket. The ticket is also used to figure the earnings of workers who are paid on the basis of the number of pieces they produce. The bundles are then routed to the various sections of the sewing room.

Sewing Room Occupations. Almost half of all clothing workers are sewers and stitchers. Most of the employees in these jobs are women. Sewers stitch garment cuttings together either by machine or by hand. The quality and style of the finished garment usually determine how much handwork is involved. Generally, higher priced clothing, such as suits and coats, require more handwork than do standardized garments. In the average plant, however, the work is broken down into a large number of machine operations, with some handwork when the garment nears completion.

Sewing machine operators (D.O.T. 6–27.530 through .589) use power-driven sewing machines which are generally used to stitch material together. These machines are usually heavier and capable of faster speeds than the sewing machines found in the home. Special devices or attachments that hold buttons, guide stitches, or fold seams are often used. Some sewing machine operators specialize in a single operation such as sewing shoulder seams, attaching cuffs to sleeves, or hemming blouses. Others make garment sections such as pockets, collars, or sleeves.

Still others assemble these completed sections and join them to the main parts of the garment. Some sewing machine operators are classified according to the type of machine they use, such as single-needle sewing machine operator or blind-stitch machine operator. Others are known by the type of work performed, such as collar stitcher, sleeve finisher, or cuff tacker. (Further discussion of Sewing Machine Operators is included elsewhere in this *Handbook*. See index for page numbers.)

Hand sewing is done on better quality or highly styled dresses, suits, or coats to produce garments which are superior in fit and drape. *Hand sewers* (D.O.T. 4–27.070 through .119, 6–27.071, .074, .075, .082, and .098) use needle and thread to perform various operations ranging from simple sewing to complex stitching. Many hand sewers specialize in a single operation such as buttonhole making, lapel basting, or lining stitching.

In a typical garment factory, bundles of cut garment pieces move through the sewing department where the garments take form as they pass through a series of sewing operations. Each

Sewing machine operators are the largest group of apparel workers

operator performs one or two assigned tasks on each piece in the bundle and then passes the bundle to the next operator. Some plants employ *work distributors* (D.O.T. 9–88.40), often called floor boys or floor girls, who move garment pieces from one sewing operation to another.

At various stages of the sewing operations, *inspectors* (D.O.T. 4–27,121) and *checkers* (D.O.T. 6–27.120, .121, .125, and .126) examine garments for proper workmanship. They mark such defects as skipped stitches or bad seams, which are repaired before passing the garments on to the next sewing operation. Inspectors sometimes make minor repairs. *Thread trimmers* and *cleaners* (D.O.T. 6–27.122) remove loose threads, basting stitches, and lint from garments.

Tailoring Occupations. Tailors (D.O.T. 4–26.101 and .201) and *dressmakers* (D.O.T. 4–25.025 and .030) are skilled hand and machine sewers who are able to perform all or most of the sewing operations needed to make a garment. These skilled workers are usually employed in shops which specialize in making better quality or styled dresses, suits, and coats. Because their duties vary widely from shop to shop and from one type of garment to another, some tailors and dressmakers are more highly skilled than others.

All-round tailors and dressmakers are able to make a garment from start to finish by hand or by machine. Some skilled tailors who are employed in plants making men's, women's, and children's outer garments may make up sample garments from the designer's specifications. In other plants, they may also perform the duties of designer and patternmaker.

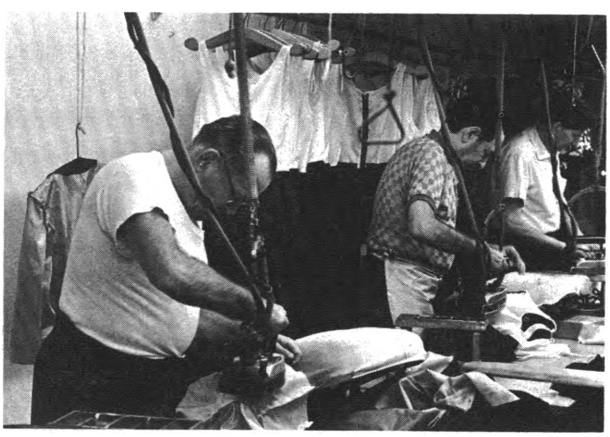
Head tailors are often known as "quality men." They supervise all-round tailors and the machine sewers to make certain that standards of workmanship set by the shop are met and that garment parts which have imperfections are returned to the operator for correction.

Bushelmen, or alteration tailors, repair defects in finished garments that were rejected by the inspector. They alter garment parts that have not been sewn correctly, rearrange padding in coats and suits, and do other sewing necessary to correct defects.

Shop tailors perform specialized hand or machine sewing tasks required for making many types of high quality garments. They may set in sleeves by machine, hand-sew canvas linings in suits and coats, stitch shoulder padding, or baste collars to coat bodies. Shop tailors are usually known by the type of work they do; for example, there are coat basters, or sleeve tailors. Although the work of shop tailors is generally limited to one or two operations, some shop tailors can do all-round tailoring because of their training and experience. In some plants, a skilled tailor may be responsible also for a thorough final inspection of garments.

Pressing Occupations. The shape and appearance of the finished garment depend to a large extent on the amount of pressing that is done during and after sewing operations. Pressing is particularly important in making high-quality garments. For example, from time to time during the sewing of suits, coats, and better quality dresses, seams are pressed open in order to produce a better fitting and neater garment and to make it easier to assemble the garment. In the manufacture of lighter weight garments, on the other hand, pressing is done only after completion of all the sewing operations.

Pressers (D.O.T. 7–57.501, .510, and .511) use various types of steam pressing machines or hand irons to flatten seams and to shape garments parts and finished garments. Pressers may specialize in one type of pressing or ironing. For example, in a shirt factory, a *collar pointer* (D.O.T. 6–27.211) operates a pressing machine that shapes and presses points of shirt collars; in a necktie plant, a *roller presser* (D.O.T. 6–27.218) feeds neckties between heated rollers of a roller press.



Pressers use hand irons to press seams and hems in dresses

There are two basic types of pressers—underpressers and finish pressers. Underpressers specialize on particular garment parts, such as collars, shoulders, seams, or pockets. Their duties vary from simple smoothing of cloth and flattening of seams to skillful shaping of garment parts. Finish pressers generally do final pressing and ironing at the end of the sewing operations. Their duties vary from operating a machine which presses a dozen folded shirts at a time to hand pressing delicate ruffles on an evening gown.

Fur Shop Occupations. The apparel industry includes plants that manufacture garments made of fur. Because furs are expensive materials and difficult to work with, each operation in making a fur garment requires skilled handwork by an experienced craftsman. Although fur shops employ only about 10,000 workers altogether, a large proportion of these workers have special skills not found in plants that make other types of apparel.

The most skilled job in a fur garment manufacturing plant is that of a cutter who sometimes is also the foreman in the shop. A *fur cutter* (D.O.T. 4–21.210) selects and matches enough fur skins to make a single garment such as a fur coat or jacket. He arranges and cuts the skins on pattern pieces so that the choice sections of fur are placed where they will show. Following the sewing instruction given by the cutter, *fur machine operators* (D.O.T. 6–21.110) stitch these pelts together to form the major garment sections. A *fur nailer* (D.O.T. 6–21.210) wets the sewn garments sections, stretches them by hand, and nails them on a board so that they will cover the pattern. When the sections are dry, the nailer removes the nails and trims the fur exactly along the outline of the pattern. The fur machine operator then finishes sewing the various sections together to make the complete garment. *Fur finishers* (D.O.T. 4–21.110) sew in the lining, tape edges, make pockets, and sew on buttons and loops.

Office, Sales, and Related Occupations. The majority of the administrative positions in an apparel plant are in the production department. The production manager and his assistants plan the flow of work, make up the work specifications, and supervise all the operations used to make a finished garment.

Clerks, bookkeepers, stenographers, and other office workers make up payrolls, prepare invoices, keep records, and attend to other paperwork required in this industry. Salesmen, purchasing agents, models, credit managers, and accountants are among other types of workers in the apparel industry. (Discussions of many of these jobs can be found elsewhere in this *Handbook*. See index for page numbers.)

Training, Other Qualifications, and Advancement

Training requirements for production (plant) jobs in the apparel industry range from a few days of on-the-job training to several years of training and experience. The difference in training time needed before an employee can reach his maximum speed and efficiency depends on the type of job and the worker's aptitude. Most plant workers pick up their skills while working as helpers or assistants to experienced workers. Apprenticeship is infrequent and is limited mainly to designing, cutting, or tailoring jobs. Some private and public schools in garment manufacturing centers offer instruction in occupations such as designing, patternmaking, and cutting as well as machine and hand sewing.

Physical requirements for most production jobs in the apparel industry are not high, but good eyesight and manual dexterity are essential. Many occupations are well suited for handicapped workers since the majority of the jobs are performed while seated and require little physical exertion. Older workers and women workers also perform well in a variety of jobs. Many workers in their fifties and sixties are among the industry's most skilled and productive. Women are employed in most of the occupations in this industry, although men hold most of the cutting, tailoring, and pressing jobs.

Designers enter the industry in various ways. Many receive their training by working on the job with experienced designers, by advancing from cutting or patternmaking jobs, or through apprenticeship. Some designers have worked in related fields such as designing textiles; others have attended schools or colleges which offer specialized training in design. There is an increasing tendency for apparel firms to recruit designers from colleges that offer specialized training in design. Some young people with a background in designing may take jobs as designers with small firms and once their reputations have been established, transfer to jobs in larger, better paying firms. In large firms, young people may start as assistant designers.

A designer should have artistic ability, including a talent for sketching, a thorough knowledge of fabrics, a keen sense of color, and the ability to translate design ideas into a finished garment. He should also be acquainted with garmentmaking techniques so that he can make, or supervise others in the making of, sample garments.

Most patternmakers pick up the skills of the trade by working for several years as helpers to experienced patternmakers. Pattern graders and cutters are occasionally promoted to patternmaking jobs. Patternmakers must have the ability to visualize from a sketch or model furnished by the designer the size, shape, and number of pattern pieces required. Patternmakers must also have a detailed understanding of how garments are made as well as a knowledge of body proportions. Like the designer, they must also have a thorough knowledge of fabrics.

Pattern graders are usually selected from employees working in the cutting room or in other plant jobs. Training in drafting is helpful since much of the work requires the use of drafting tools and techniques.

Most workers enter the cutting room by taking jobs as assemblers, or bundlers. Patience and the ability to match colors and patterns are necessary qualifications for these jobs. Assemblers, or bundlers, may sometimes be promoted to jobs such as spreader. Several years of experience in the cutting room are required before an employee can become a skilled marker or cutter. A small number of the larger plants have apprenticeship programs which usually last 4 years and include training in spreading, cutting, marking, and patternmaking.

Entry into beginning hand- or machine-sewing jobs is relatively easy since there are few restrictions regarding education, physical condition, age, or sex, though women hold most sewing room jobs. Some previous training in sewing operations is preferred, but many apparel plants hire workers who have had no experience in sewing. Training is generally informal and received on the job. New workers usually start by sewing straight seams, under the supervision of a section foreman or experienced worker.

Most sewing jobs require the ability to do routine work rapidly. The same sewing operation is repeated on each identical garment piece. Since almost all these workers are paid on the basis of the number of pieces produced, any clumsiness of hand may reduce the worker's earnings. Good eyesight and ability to work at a steady and fast pace are essential for both hand- and machine-sewing jobs.

The average sewer has little opportunity for promotion beyond section forelady, although some sewers have worked their way up to the job of production manager. Most sewers stay on the same general type of operation throughout most of their working lives. Promotion is largely from beginning sewing jobs to more skilled and better paid sewing jobs in the same field.

Some tailors and dressmakers learn the trade through apprenticeship and vocational training in day or evening schools. Graduates from vocational schools frequently are hired and given additional training on the job. Training time varies from the few months required to become a shop tailor to the many years of experience necessary to become an all-round tailor or dressmaker. Generally, men are employed in tailoring jobs and women in dressmaking jobs, but more and more women are entering tailoring.

In establishments that make men's and boys' suits and coats, hand tailors and all-round tailors must be able to do all the operations involved in making a garment and also be familiar with the firm's quality standards. Much more training is needed by these tailors than by the bushelmen, whose work is restricted to the correction of defects, or by the shop tailors, who are limited to one or two sewing operations.

Fully qualified dressmakers in establishments making women's dresses, coats, or suits must be able to do all the operations involved in making a woman's garment. Dressmakers working in establishments that custom-make women's apparel must be more skilled than those working in shops that manufacture ready-to-wear apparel. The most highly skilled dressmakers can produce a garment from a designer's specifications, and in custom shops are responsible for its fit on a customer.

In establishments manufacturing men's and boys' suits and coats, a possible path of promotion is from bushelman to all-round tailor to head tailor. In some cases, all-round tailors with artistic ability may advance to assistant designer or designer. Supervisory jobs are often filled by workers who were once all-round tailors. Promotion for shop tailors is limited because of the specialized nature of their job, although some may have an opportunity to become section foremen or bushelmen. In women's apparel, a possible path of promotion for a small number of workers is from machine sewing to making simple dress samples, to draping or fitting. Highly skilled tailors and dressmakers may qualify for jobs as fitter or alteration tailor in department stores, clothing stores, and cleaning and dyeing shops. Some tailors open their own tailoring shops since the amount of capital needed for such a business is low.

Pressers usually begin as underpressers working on simple seams and garment parts. This job can be learned in a very short time. After the pressers gain experience, they work on more difficult operations and eventually may be promoted to the job of finish presser. Pressing, like tailoring, is one of the few needle trades in which workers can find similar employment in stores and in cleaning and dyeing shops. There is some transferring back and forth between pressing jobs inside and outside the apparel industry.

Employment Outlook

The apparel industry will offer many thousands of job opportunities for new workers annually during the next 10 to 15 years. Although total employment in the industry is expected to increase only moderately above the more than 1.2 million employed in early 1963, a considerable number of opportunities for young people to enter the apparel industry will occur because of the large

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numbers of experienced workers who will leave. About 80 percent of needle trades' workers are women, and a large number of women leave the industry each year to marry or to raise families. Also, because there are more older workers in this industry than in many other industries, opportunities will arise for young people to replace workers who retire or die.

Demand for apparel in the years ahead will grow substantially and will be the major reason for the rise in employment. The increased need for apparel will be due mainly to rapidly growing population, but other factors will also be important. For example, the number of people in their teens and early twenties will rise greatly in the next decade, and these are the age groups in which spending for apparel is greatest. The trend toward more workers in clerical, sales, professional, and other white-collar occupations will increase the demand for apparel since these workers spend more for apparel than other workers. Increasing numbers of working women, particularly those in secretarial and other office jobs that require "dressing up," will stimulate apparel purchases. Men, also, are buying more clothing that is highly styled because they are becoming more fashion-conscious.

Most of the opportunities for employment will be in sewing machine operator jobs because this is the largest occupational group and because this group is made up mostly of women. Some job openings will also occur in tailoring occupations in which a large proportion of the employees are older workers.

Opportunities for jobs as tailors, dressmakers, fitters, and other skilled occupations in the apparel industry will continue to be mainly in the metropolitan centers where plants manufacturing dresses, women's suits and coats, or men's and boys' suits and coats are located. There will be a small number of new employment opportunities in men's clothing designing, patternmaking, and cutting room jobs. Job opportunities for women designers will continue to be good. Most opportunites in this occupation will arise from the need to replace women who leave to marry or raise families.

The nature of the jobs in this industry will remain about the same since it is much less mechanized than most manufacturing industries. However, some new and improved equipment that is being introduced speeds production and reduces the physical and skill requirements of certain jobs. For example, new compressed-air pressing machines which require less physical effort than the older pressing machines make it possible to employ more women in these jobs.

Earnings and Working Conditions

In 1962, average earnings of production workers in the apparel industry were $60.62 a week or $1.67 an hour, compared with $96.56 a week or $2.39 an hour for those in all manufacturing industries. Production workers in this industry generally worked fewer hours per week than those in manufacturing as a whole. Production workers have much higher earnings in some kinds of garment factories than in others. For example, those making women's suits, coats, and skirts averaged $78.31 a week in 1962 whereas those producing men's work clothing averaged $51.20 a week. There is also a wide variation in earnings among the different occupations in the apparel industry, and the States in which garment factories are located. The following tabulation gives estimated average hourly earnings for selected jobs and geographical areas in three segments of the apparel industry in 1962:

	Estimated average hourly earnings	
	August 1962	
Women's and misses' coats and suits	*Baltimore*	*New York City*
All production workers	$1.88	$2.81
Cutters and markers (men and women)	2.53	3.68
Pressers, hand (men)	2.58	3.92
Pressers, hand (women)	2.13	2.28
Pressers, machine (men and women)	2.53	4.38
Sewers, hand (finishers) (men and women)	1.76	2.62
Sewing machine operators, single hand (tailor) system (men and women)	2.72	3.45
Sewing machine operators, section system (almost all women)	1.70	2.49
	May–June 1962	
Work clothing	*Virginia*	*California*
All production workers	$1.24	$1.59
Cutters, machine (men)	1.69	2.51
Pressers, finish, machine (women)	1.23	1.56
Sewing machine operators (women)	1.22	1.52
Men's and boys' shirts (except workshirts) and nightwear	*Tennessee*	*New York*
All production workers	$1.17	$1.65
Cutters, hand (men)	----	3.03
Cutters, machine (men)	1.17	2.86
Pressers, finish, hand (women)	1.17	1.83
Sewing machine operators (women)	1.17	1.59

Because most production workers in this industry are paid on the basis of the number of pieces they produce, their total earnings depend mainly upon speed as well as skill. Sewing machine operators, hand sewers, and pressers are generally 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 metropolitan areas, almost all apparel employees work in shops that have labor-management 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 offer training courses for sewing machine operators. Others give tests to determine hand-eye coordination.

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.

Clothing Manufacturers Association of U.S.A.,
220 Fifth Ave., New York, N.Y., 10001.

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

Continued growth in existing uses of atomic energy and the development of new applications will provide many thousands of job openings for young people in the atomic energy field during the remainder of the 1960's and in the longer run. Opportunities will be especially good for professional and technical personnel and for highly skilled craftsmen. In 1962, approximately 200,000 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. Scientists, engineers, technicians, and craftsmen account for a large proportion of atomic energy workers.

Applications of Atomic Energy

Atomic energy is an enormous source of heat and radiation which can be used in many important ways for both peaceful and military purposes. One use of this energy of great potential significance is the production of commercial electricity using nuclear reactors as the heat source. A nuclear reactor (chart 31) can be thought of as an atomic furnace, although there is no fire or combustion in the usual sense. Reactors are already producing energy to generate electricity which is fed into electric utility lines for public consumption, and others are being built. Progress is being made in the development of portable nuclear power plants to provide electricity and heat for buildings at remote installations. Reactors are used to power submarines and surface ships. Intensive research is in progress toward developing nuclear propulsion systems and auxiliary nuclear-electronic power devices for space vehicles and missiles. Reactors built primarily as radiation rather than heat sources are used for many kinds of research and may be used, for example, to initiate chemical reactions and to produce radioisotopes.

Radioisotopes, once considered only byproducts of nuclear reactors, have become immensely valuable as research tools in agriculture, medicine, and industry and for use in industrial inspection and control devices. Their value lies in their unique property of emitting radiation which can alter materials and be detected even in minute quantities by sensitive instruments.

One important use of radioisotopes is as tracers. Radioisotopes can be placed in the blood stream of men and animals, for example, and their movements traced by instruments. In medicine, this aids the physician in diagnosing a patient's illness. Tracers may also be used to study such diverse processes as the assimilation of fertilizer by plants and the wear on automobile engine parts.

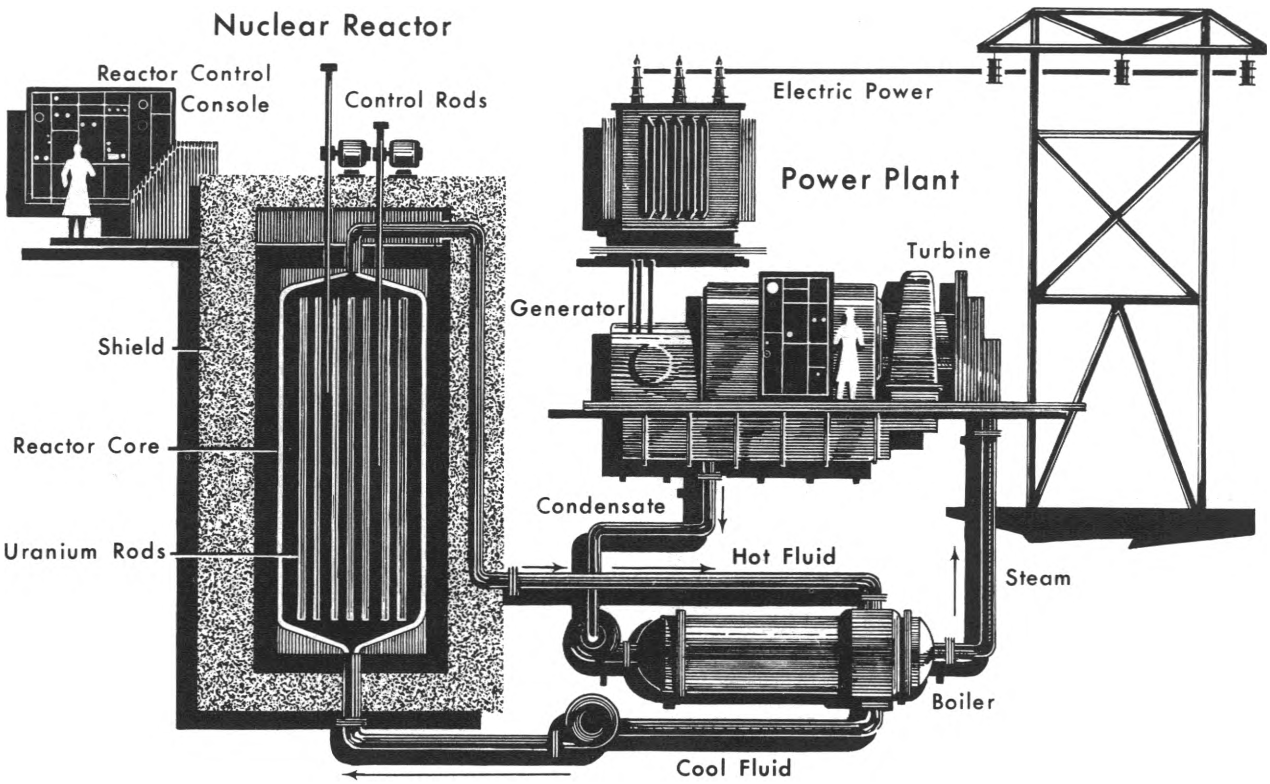
Radioisotopes are also used as high intensity radiation sources to kill bacteria, to destroy cancerous tissue, to sterilize insect pests, and to develop better strains of plants. They are used in radiography units (similar to X-ray machines) to detect flaws in metal castings and welds. Radioisotope gages are used to measure and control, automatically, the thickness of products manufactured in sheet form and the level of liquids in closed containers.

How Atomic Energy Is Produced

Atomic energy, or more accurately nuclear energy, may be produced through two processes, called fission and fusion. In fission, the nucleus of an atom is split, thereby releasing energy in the form of heat and radiation. In fusion, energy is produced by combining the nuclei of two atoms. The detonation of nuclear bombs is an application of the explosive release of the enormous energy created through the fission and fusion processes. Nonweapon applications require that release of this energy be carefully controlled

CHART 31

NUCLEAR REACTOR GENERATING ELECTRICITY .....



and regulated so that it proceeds at a manageable rate. Scientists have developed practical methods of controlling the fission reaction, but have not yet mastered control of the fusion (or thermonuclear) reaction.

Controlled fission is produced in a nuclear reactor. The reactor, being a kind of furnace, needs fuel to operate. The principal source material for reactor fuel is natural uranium, which contains a small percent of the readily fissionable material, uranium U–235. Although natural uranium may be used as reactor fuel, a more concentrated fuel, called "enriched uranium," can be made by separating the U–235 atoms from the remaining atoms which are difficult to fission. U–235 is the only naturally occurring material that undergoes fission readily, but two manmade fissionable materials (plutonium and uranium U–233) can also be used as reactor fuel.

Fissionable fuel is placed in the nuclear reactor in a particular arrangement with certain other elements. 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 can be made to split other fissionable atoms. These, in turn, release additional neutrons which can similarly split more atoms. This is how the fission process is maintained. 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 electric power stations is that the energy 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, neutrons and other forms of nuclear radiation are released. Nuclear radiation, identifiable only by sensitive instruments, can be ruinous to equipment and highly dangerous to personnel. Therefore, special metals, resistant to damage by radiation, are used in reactors and great care is taken to protect personnel. For example, the nuclear reactor is housed in a special container and surrounded by shielding materials, such as concrete, water, and lead.

A valuable byproduct of reactor operation is the production of radioisotopes. The major method of producing radioisotopes is to expose stable atoms of various elements to the neutrons emitted from the reactor core. Radioisotopes can also be produced by bombarding materials placed in a particle accelerator (also known as an "atom smasher"), a machine which accelerates electrically charged particles to speeds of thousands of miles per second.

Nature of the Atomic Energy Field

Many different kinds of research and industrial activities are required for the production and application of nuclear energy. These include the mining, milling, and refining of uranium-bearing ores; the production of nuclear fuels; the manufacture of nuclear reactors, reactor components, and nuclear instruments; the production of special materials for use in reactors; the designing, 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 many 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. Most of the AEC's work program, including the operation of Commission-owned facilities, is contracted out to private organizations. The AEC-owned facilities include laboratories, uranium processing plants, nuclear reactors, and weapon manufacturing plants. More than half of all workers in the atomic energy field are employed in these facilities. Private firms in their own installations are engaged in every type of atomic energy activity except development and production of military weapons and certain nuclear fuel processing operations.

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 research centers and by university and college laboratories, other nonprofit institutions, and industrial organizations under Commission contracts. Some research in atomic energy is carried on without financial assistance from the AEC.

Jobs in the atomic energy field are found in every State, although employment is most heavily concentrated in New Mexico, California, Tennessee, Missouri, and Washington.

Occupations in the Atomic Energy Field

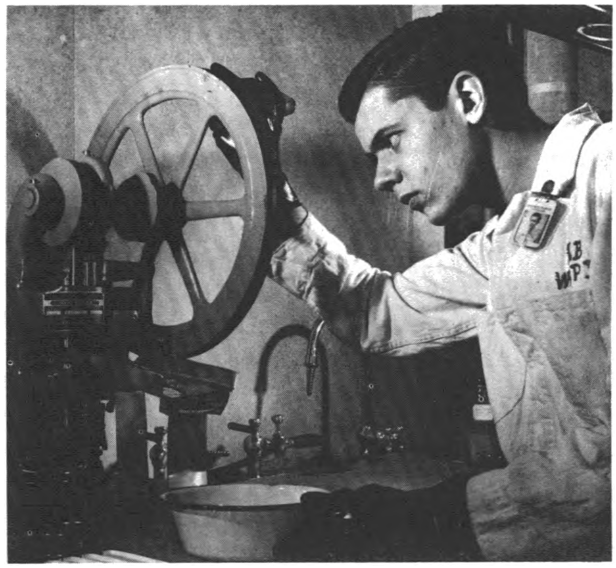
Engineers, scientists, technicians, and craftsmen accounted for a large proportion of the approximately 200,000 workers in the atomic energy field in 1962. A higher proportion of professional and technical workers are in this field than in most other fields of work, largely because of the concentration on 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. The following tabulation shows the distribution of employment among major occupational groups as reported in a 1962 Bureau of Labor Statistics survey covering about two-thirds of the estimated employment in the atomic energy field. (These percents would not necessarily apply to atomic energy employment not covered by the survey.)

	Percent
Total employment	100
Engineers	13
Scientists	8
Administrative and other professional workers	9
Clerical and other office workers	15
Technicians	14
Skilled workers	19
All others	22

Although some engineers in the atomic energy field are highly trained in nuclear technology, engineers in all major engineering fields are employed. Mechanical engineer is probably the largest single engineering occupation, but large numbers of electrical and electronics, chemical, reactor, civil, and metallurgical engineers are also 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 supervision of construction activities or the operation of production plants.

Mainly because of the emphasis given to basic and applied nuclear research, a large number of scientists are employed by research laboratories and other organizations engaged in atomic energy work. 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 include draftsmen; electronics, instrument, chemical, and other engineering and physical science technicians; and radiation monitors.



Chemical process operator prepares nuclear fuel elements for testing

The atomic energy field employs many highly skilled workers because of the need to fabricate special parts and equipment for use in experimental and pilot work and the need for large maintenance forces to care for the considerable amount of complex equipment and machinery. Machinery repairmen, millwrights, and all-round machinists are employed extensively in most atomic energy activities, as are electricians, carpenters, plumbers, pipefitters, sheet-metal workers, and instrument repairmen. A large number of chemical process operators work in the production of defense materials and reactor fuel materials. The following tabulation shows the occupational distribution of skilled workers in the atomic energy field in 1961, the latest year for which such information is available.

	Percent
Total skilled workers	100
Chemical process operators	15
All-round machinists	15
Machinery repairmen and millwrights	14
Electricians	8
Plumbers and pipefitters	6
Welders	5
Instrument repairmen	5
Carpenters	4
Tool and die makers	3
Sheet-metal workers	3
Instrument makers	2
Other skilled workers	20

Activities in the Atomic Energy Field

A brief description of some important atomic energy activities and the types of workers employed in them follows. In several of these activities, such as uranium mining, the percent distribution of employment by occupation is similar to that in comparable nonatomic work.

Uranium Mining. The 4,300 workers employed in over 1,000 uranium mines in 1962 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 miners and drillers in underground mines, and truckdrivers, bulldozer operators, and machine loaders 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. The basic steps included are ore preparation (primarily crushing and grinding), leaching to extract uranium, and product recovery—operations similar to those used in the milling of other metallic ores. The 24 uranium mills in operation in 1962, most of them located in the Colorado Plateau, employed more than 3,400 workers. These workers were distributed among major occupational groups in the following proportions:

	Percent
Total employment	100
Engineers and scientists	7
Administrative and other professional workers	9
Clerical and other office workers	7
Technicians	5
Skilled workers	24
Other workers	48

More than a third of the skilled workers were chemical process operators, and many skilled machinery repairmen, millwrights, pipefitters, carpenters, and electricians were also employed. Chemists, chemical engineers, metallurgists, and metallurgical engineers accounted for about three-fifths of the engineers and scientists employed in these mills.

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, Missouri, and Illinois. In 1962, a dozen plants were engaged in refining and enriching uranium. About 10,000 workers were employed, distributed among major occupational groups in the following proportions:

	Percent
Total employment	100
Engineers and scientists	13
Administrative and other professional workers	11
Clerical and other office workers	14
Technicians	7
Skilled workers	36
Other workers	19

Among skilled workers, the largest single occupation was chemical operator in processing operations. Maintenance craftsmen, particularly in the highly automatic uranium enriching plants, accounted for a large proportion of skilled workers. Chemical engineers and chemists accounted for about half of the engineers and scientists employed in refining and enriching operations. Many of the technicians worked in chemical analytical laboratories associated with production processes.

Reactor Manufacturing. Nearly 20,000 workers are estimated to have been employed in 1962 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. Many reactor components are similar to standard power equipment and are purchased from plants manufacturing such products.

About two-fifths of the employees in firms that design and manufacture reactors are professional and administrative workers. Engineers alone represent about one-fourth of the employment, with mechanical engineers and reactor engineers, who are specialists in reactor technology, predominating. Among scientists, the largest group are physicists, but many chemists, mathematicians, and metallurgists are also 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 and sheet-metal workers account for a large proportion of these craftsmen. Other craftsmen, such as instrument makers, machinery repairmen, instrument repairmen, and electricians, are also employed. Reactor manufacturers employ nuclear reactor operators to operate experimental and test reactors.

Fuel elements and other unique components are fabricated not only by reactor manufacturers but in specialized plants as well. Many mechanical and metallurgical engineers, technicians, and chemical process operators are employed in these plants.

Reactor Operation and Maintenance. More than 600 workers were engaged in the operation and maintenance of nuclear reactors producing commercial electricity in 1962. Principal types of occupations found in the operation of a nuclear power station are mechanical engineer, electrical and electronics engineer, chemist, 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. Twenty research and development laboratories and other research facilities are owned by the Atomic Energy Commission and are operated for the AEC by colleges and 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 1962, they employed nearly 43,000 workers, distributed among major occupational groups in the following proportions:

	Percent
Total employment	100
Engineers	16
Scientists	14
Administrative and other professional workers	8
Clerical and other office workers	16
Technicians	23
Skilled workers	12
Other workers	11

This occupational distribution indicates that 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 another 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 die makers, 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.

In addition to the research performed by the AEC research and development facilities, additional atomic energy research is performed in the privately owned research laboratories of educational institutions and other nonprofit institutions, and of industrial concerns. Like the AEC facilities, these laboratories employ a high proportion of workers in scientific, engineering, and other technical jobs.

Production of Nuclear Weapons and Other Defense Materials. Nearly 41,000 workers were employed in 1962 in establishments producing nuclear weapons and weapon components, plutonium, and other defense materials. These workers were distributed among major occupational groups in the following proportions:

	Percent
Total employment	100
Engineers and scientists	12
Administrative and other professional workers	12
Clerical and other office workers	12
Technicians	9
Skilled workers	26
Other workers	29

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 die makers, 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. Large numbers of chemical process operators, nuclear reactor operators, and skilled craftsmen are also employed.

Other Atomic Energy Activities. About 2,500 workers were employed in 1962 to produce special materials such as beryllium, zirconium, and hafnium for use in reactors. Nearly three-fifths of these workers are in production, maintenance, and service jobs. Chemical process operators, all-round machinists, and machinery repairmen are numerically important groups of skilled workers. Among scientists and engineers, principal occupations include metallurgist, metallurgical engineer, chemist, and chemical engineer.

Many thousands of workers are engaged in designing and constructing nuclear reactor housing, atomic energy laboratories, and reactor fuel processing plants. Civil and mechanical engineers and draftsmen are among those employed in the design of these facilities. Pipefitters, electricians, carpenters, boilermakers, operating engineers, and other building trades craftsmen are employed in the construction of these facilities.

About 2,500 workers were employed in 1962 by companies that manufacture reactor control instrumentation, 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. Among engineers and technicians, who represent a substantial proportion of employment in such companies, numerically important occupations include electrical and electronics engineer, mechanical engineer, electronics technician, instrument technician, and draftsman.

A few companies, which employed approximately 1,000 workers in 1962, specialize in the manufacture of particle accelerators—machines which enable scientists to study the structure and properties of the elementary particles that make up the nucleus of an atom. Workers typically 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 in 1962 were engaged in such activities as processing and packaging radioisotopes, manufacturing radiography units and radiation gages, packaging and disposing of radioactive wastes, and industrial radiography. Among the workers in these activities are engineers, chemists, biological technicians, radiographic equipment operators (radiographers) remote handlers and packagers of radioisotopes, and mechanics and other workers who repair equipment containing radioisotopes.

Government Employment. The Atomic Energy Commission, which directs the Federal Government's atomic energy program, employed nearly 6,900 workers in its national and field offices in 1962. About 1,200 engineers and scientists were employed by the Commission, including personnel in nearly every major engineering and scientific occupation, such as reactor, civil, and electrical and electronics engineers, chemists, health physicists, and physicists. Since the AEC is primarily an administrative and regulatory agency, approximately two-thirds of Commission employees were in administrative and other professional positions and in clerical and other office jobs. This proportion of administrative and clerical personnel is much larger than in most other activities in the atomic energy field. Another large group of AEC employees were engaged in protective and security activities.

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 health and labor departments of State and local governments. Their duties involve atomic energy research and application, and preparing and carrying out radiation health and safety measures. Outside the AEC, most of the scientists, engineers, and other professional and supporting workers in atomic energy work in Federal Government agencies are employed by the Departments of Defense, the Interior (Geological Survey), Agriculture, and Health, Education, and Welfare, and by the National Aeronautics and Space Administration. The Department of Health, Education, and Welfare, in cooperation with the AEC, aids States in establishing measures to meet radiation health hazard problems.

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 may 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 this *Handbook.* (See index for page numbers.)

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 have the very responsible job of protecting individuals and property from the hazards of radiation by detecting radiation and controlling exposures to it. These professional workers usually are assisted by radiation monitors. In 1962, about 700 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. For example, they set up standards of inspection and establish 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 inspect shipments of equipment and materials and radioactive waste disposal activities, to insure compliance with Government standards and regulations. Another duty involves the preparation of reports on radioactive contamination, radiation levels, and radiation exposure.

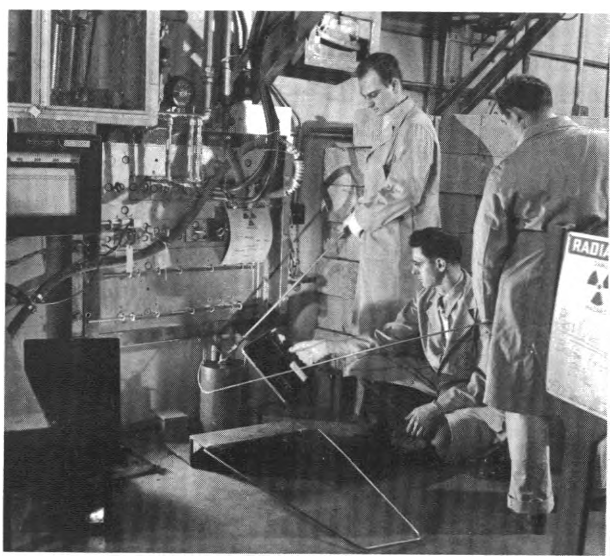
Health physicists may also plan and supervise training programs dealing with radiation hazards and may advise public authorities on methods of dealing with such hazards. In some cases, they are employed on research projects dealing with the effects of human exposure to radiation and may develop procedures to be followed in using radioactive materials. Finally, they assist in the development of better methods and equipment for the detection and control of radiation hazards.

Radiation monitors (also called health-physics technicians) generally work under the supervision of health physicists. An estimated 1,500 radiation monitors were employed in the atomic energy field in 1962. They use special instruments to monitor (check) work areas, tools, and equipment to detect radioactive contamination. They monitor incoming and outgoing shipments of equipment and materials for radiation levels and contamination. Soil, water, and air samples are taken to determine radiation levels. Monitors may also collect and analyze radiation monitoring equipment worn by workers, such as film badges and pocket detection chambers, to measure each worker's exposure to 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 for workers and the radiation level in the area. Monitors may also determine clothing requirements and other safety precautions to be followed by workers entering radiation zones.

Other duties may include instructing workers in radiation safety procedures, checking and servicing radiation detection instruments, and maintaining records on individual radiation exposures and the location and intensity of radioactivity in contaminated areas.

In addition to health physicists and radiation monitors, other occupations require training which is unique to the atomic energy field. For example, although a *nuclear reactor operator's* job in a nuclear power station is similar to a boiler operator's job in a conventional power station, he must learn to operate the controls of a nuclear reactor rather than the controls of a conventional steam-generating boiler. He may also control the operation of other equipment such as turbines and generators. In addition, reactor operators may perform work in connection with reactor fuel handling operations, such as the loading and unloading of nuclear fuel.



Radiation monitor flanked by nuclear reactor operators checks radioactive material

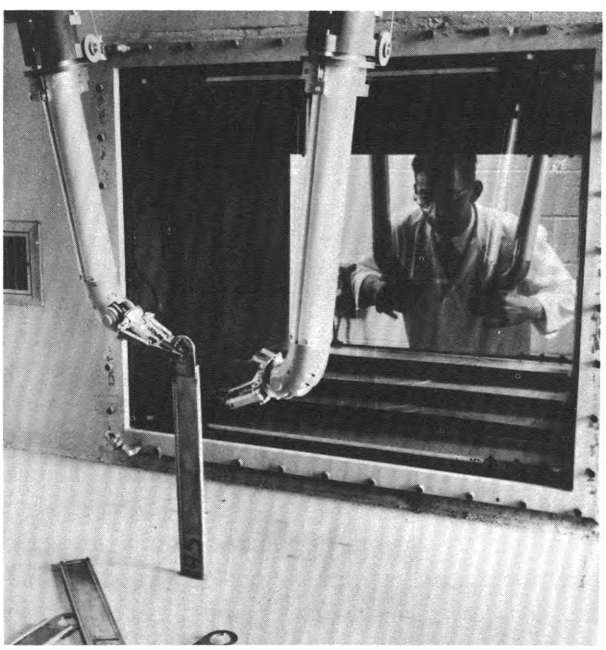
Nuclear reactor operators who work with research and test reactors check reactor control panels and adjust controls to maintain specified operating conditions within the reactor, such as power and radiation levels. They also assist in setting up and conducting tests and experiments; for example, they may insert objects into the reactor core for exposure to radiation. They work under the direction of scientists and engineers in charge of the tests and experiments.

An estimated 1,200 nuclear reactor operators were employed in atomic energy activities in 1962. More than half were engaged in the production of plutonium and other special defense materials, and most of the remainder worked in research and development laboratories.

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 may also assist in the maintenance of equipment.

An estimated 400 *radiographers* were employed in atomic energy work in 1962. 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 also remove and develop the film or plate and may assist in its analysis.

Many other specialized workers are employed in the atomic energy field. *Hot-cell technicians* operate remote-controlled equipment to test radioactive materials which are placed in hot cells—rooms which are enclosed with radiation shielding materials, such as lead and concrete. By controlling "slave manipulators" (mechanical devices which 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 tests involving radioactive materials. Hot-cell technicians may also enter the cell wearing protective clothing (after clearance by a radiation monitor) 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 slave manipulators and other equipment to prepare radioisotopes for shipping and to perform chemical analyses to ensure that radioisotopes conform to specifications. The tasks performed by employes in the above five jobs may also be done by chemical process operators.



Hot-cell technician handles radioactive bars with remote-controlled apparatus

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 this *Handbook* under the specific occupations. (See index for page numbers.) 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 1962, nearly 1 in 4 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 not required for many scientific and engineering positions in the atomic energy field, although some basic knowledge of it is preferred. However, specialized knowledge of nuclear energy is essential for some scientists and engineers. For example, health physicists must be specially trained in health physics, and other positions may require chemists with special training in radiochemistry or engineers specially trained in nuclear engineering. This specialized training may be obtained through taking graduate work at a university or through on-the-job training. It emphasizes problems dealing with the properties and control of radiation and its effects on materials or living systems.

Colleges and universities have expanded their facilities and curriculums in order 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 may need more training than most craftsmen in comparable nonatomic jobs. Stricter performance requirements may be needed because of the extreme precision usually required to insure efficient operation of equipment and because complex equipment and machinery must be maintained. For example, pipefitters on atomic projects 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 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. Most AEC installations have apprentice training programs to develop craft skills. Some union craft training programs give particular attention to the special work requirements of the atomic energy field.

The following discussion of training, education, and other qualifications relates to jobs which are unique to the field of atomic energy or which require specialized training which is unique to the field. Such training mainly gives workers an understanding of radiation, methods of handling radioactive materials or radiation-producing equipment, and procedures to follow when working in radioactive areas.

Employers prefer that health physicists have a bachelor's degree in physics, chemistry, or engineering, and a year or more of graduate work in health physics. In some cases, related technical training and experience can be substituted for part of the academic requirement. Under an AEC fellowship program, health physicists attend lectures at a university during the academic year to obtain a fundamental knowledge of radiation physics and biophysics, instrumentation, the interaction of radiation with matter and living systems, and the principles of permissible radiation exposure and prevention of undesirable exposure. During the summer months, they work at Commission installations on problems of monitoring (measurement of radiation level), instrument adjustment, shielding, and waste disposal associated with the operation of nuclear reactors and particle accelerators, the processing of nuclear fuels, and the handling of radioisotopes.

To qualify for on-the-job training as a radiation monitor, a high school education with courses in mathematics, physics, and chemistry usually is sufficient. Completion of some college courses in the physical or biological sciences is preferred and experience in working with laboratory equipment is desirable. 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 use radiation detection instruments.

Nuclear power reactor operators need a basic understanding of reactor theory and a working knowledge of reactor controls. The minimum requirement for an operator trainee usually is a high school education, although college-level training may be required by some employers. To become a fully qualified operator of a reactor in an electric power station, the trainee must get experience in power station operation and complete 6 months to 1 year of intensive on-the-job training in reactor theory and operation. Power reactor operators usually are selected from conventional power plant personnel having experience as boiler or turbine operators. Operators of research and test reactors must also be high school graduates. Preference is given to those who have completed courses in science and engineering at a college level. They need from 2 to 4 years of on-the-job training, covering all phases of reactor operation, before being considered fully qualified. 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 Commission, and a medical examination.

To qualify for on-the-job training as an accelerator operator, a high school education, including courses in mathematics and physics, is usually required. Extensive training in electronics or a bachelor's degree in engineering or physics may be required for operators of very high-energy machines. Accelerator operators receive on-the-job training covering operating, repair, and safety procedures. Such training may last from 2 to 7 months or more, depending on the type of accelerator. To qualify for on-the-job training as radiographers, a high school education, including courses in mathematics, chemistry, and physics is usually sufficient.

High school graduates with some mechanical experience usually can qualify for on-the-job training as hot-cell technicians. They are given about 1 to 2 years of in-plant training. High school graduates can become decontamination men after receiving 3 to 15 months of formal technical instruction and on-the-job training. For the job of radioisotope-production operator, a high school education, with courses in chemistry, is usually required. One or 2 years of on-the-job training may be necessary to become fully qualified. High school graduates can qualify as waste-treatment operators, but experience in reading electronic instruments or in a chemical laboratory is desirable. After 15 to 18 months of on-the-job training in the operation of equipment and use of instruments, they are fully qualified. 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.

Many 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 should have some training in the nature of radiation and the procedures to follow in case of its accidental release. Workers who handle radioisotopes or maintain radioisotope gages need a basic knowledge of health physics in addition to specific training related to their particular jobs. Technicians, chemical process operators, and maintenance craftsmen in nuclear power plants and fuel processing facilities also require some health physics training if they work with radioactive materials or perform work in radiation-contaminated areas. Such training is generally provided through in-plant programs—for example, through apprentice training programs for craftsmen—and may range from less than an hour to several weeks or more, depending largely on the degree of potential exposure to radiation. In some States, workers may obtain such training through adult vocational educational programs.

Individuals who handle data which are classified (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. All employees of the Atomic Energy Commission must have such clearance.

The Atomic Energy Commission supports extensive on-the-job and specialized training programs to help prepare scientists, engineers, technicians, and other workers for the atomic energy field. The AEC offers graduate fellowships in specialized fields, trains people at its contractor-operated facilities, conducts training schools, and provides uranium and other materials as well as financial aid to educational institutions.

Several kinds of graduate fellowships are offered by the AEC. The largest number of fellowships, about 175 for the 1962–63 academic year, are granted for the study of nuclear energy technology. These fellowships are available for first, intermediate, and final years of graduate work at 59 participating universities. The prerequisite is a bachelor's degree in engineering or physical science, with courses in mathematics through differential equations.

Fellowships in radiological (or health) physics provide for 9 months' training at a university, followed by 3 months' training at a Commission laboratory. Approximately 90 such fellowships are available each year to students with bachelor's degrees in biology, chemistry, engineering, or physics with courses in mathematics through calculus. About 10 additional fellowships are available for advanced training in health physics leading to a doctorate. The AEC also offers about 10 fellowships each year leading to the master's degree in industrial hygiene for students who hold bachelor's degrees with a major in physics, chemistry, or engineering.

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 such laboratories.

The AEC sponsors institutes at which college and high school faculty members can obtain training in the latest developments in nuclear energy technology, radiation biology, and the use and safe handling of radioisotopes. Courses in health physics are offered by the AEC to State and local government employees concerned with licensing and inspecting functions in the atomic energy field. The AEC also sponsors the Oak Ridge Institute of Nuclear Studies, which conducts a school to train physicians, scientists, and engineers in radioisotope technology.

Many Commission contractors offer technical and graduate instruction at their own plants or at nearby colleges to prepare new employees for work in their organizations or to give further training to experienced personnel. Some contractors send employees outside the immediate area to receive graduate-level instruction, and pay their transportation, tuition, and other expenses. Contractors often give tuition assistance to employees desiring to attend college and university courses on their own time.

Employment Outlook

Continued employment growth is expected in most atomic energy activities during the 1960's and in the longer run as a result of the growth of existing uses of atomic energy and the development of new applications. Job opportunities will be especially good for professional and technical personnel and for highly skilled craftsmen. In addition to opportunities provided by employment growth, a few thousand additional job openings will result each year from the need to replace workers who transfer to other fields of work, or who retire or die.

Increasing research and development expenditures should lead to further employment growth in laboratories engaged in atomic energy work. More workers are already employed in such laboratories than in any other atomic energy activity. Employment is also expected to continue to increase in the design and manufacture of nuclear reactors and reactor components, in the manufacture of nuclear instruments, and in the processing and packaging of radioisotopes. As more nuclear reactors are built and put into operation, employment will 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. In contrast, employment in the mining, milling, refining, and enrichment of uranium probably will increase little, and may even decline.

The use of nuclear reactors in electric power stations is expected to become more widespread during the next 10 to 15 years, as nuclear energy becomes more cost-competitive for steam generation with fossil-fuel sources, such as coal, oil, and gas. Nuclear energy is expected to find growing applications in the Nation's space and missile program, for rocket engines and for auxiliary power for space vehicles. Additional areas that will expand the applications of atomic power include the Nation's reactor program for submarine and other maritime use, the further development of radioisotope technology and its applications, and the development of nonmilitary uses for nuclear explosives.

Expansion of nuclear energy activities will create an increased need for trained professional and technical workers and skilled craftsmen. Particular need will exist for scientists (such as physicists, chemists, mathematicians, metallurgists, biological scientists, and health physicists); engineers (such as mechanical, electrical and electronics, chemical, reactor, and metallurgical); technicians (such as engineering and physical science aids, draftsmen, electronics technicians, instrument technicians, and radiation monitors); and craftsmen (such as machinery repairmen, machinists, electricians, plumbers and pipefitters, and instrument repairmen).

Earnings and Working Conditions

Information on earnings in individual occupations in atomic energy activities is not available. However, indications are that earnings of the work force as a whole in some nuclear energy activities are higher than in most non-nuclear energy activities. In 1962, blue-collar workers employed by contractors at AEC laboratories and other installations had average straight-time hourly earnings of $2.98. This compares, for example, with an average of $2.39 an hour for blue-collar workers in all manufacturing industries.

Professional workers employed at AEC installations averaged $882 a month in base pay in 1962, and other white-collar workers (largely clerical and other office personnel), $483. (Earnings data for many of the occupations found in the atomic energy field are included in the statements on these occupations elsewhere in this *Handbook*. See index for page numbers.)

Most workers in the atomic energy field receive 2 or 3 weeks' vacation with pay, depending on their length of service. In addition, most firms in this field have group life, health, and accident insurance coverage and retirement plans.

Working conditions in uranium mining and milling, instrument and auxiliary equipment manufacturing, and facilities construction are similar to those in comparable nonatomic energy activities. In other atomic energy activities, in which the major proportion of workers in the field are employed, working conditions generally are unusually good. Buildings and plants are relatively new and are well lighted and ventilated. Equipment, tools, and machines are modern and sometimes the most advanced of their type. The surroundings are also pleasant because the buildings are often spread out over wide land areas. In some cases, plants are located in remote areas.

Extensive safeguards have been established to insure the health and safety of workers in the atomic energy field. However, only a small proportion of employees in the atomic energy field work in areas where direct radiation dangers exist.

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. Because the hazards of radiation are unique, constant efforts are being made to provide better safety standards and regulations.

Workers in uranium mines are subject to some hazard from the presence of radioactive gas in the air, which, if inhaled over a number of years, could cause lung injury. However, practically all mines have mechanical ventilation systems to reduce concentrations of this gas. Uranium mills and other fuel processing facilities employing modern processes usually have no difficulty in maintaining safe working levels of radioactivity.

The AEC and its contractors, who employ more than half of all atomic energy workers, have maintained a good safety record. In 1962, the average number of disabling injuries for all AEC operations was 1.9 for each million employee hours worked, compared with an average of 11.4 for all manufacturing industries.

Most plant hourly paid workers belong to unions. Among unions which have members in the atomic energy field are unions in the Metal Trades Department, AFL-CIO, such as: The International Association of Machinists; the International Brotherhood of Boilermakers, Iron Shipbuilders, Blacksmiths, Forgers and Helpers; the International Brotherhood of Electrical Workers; the International Chemical Workers Union; and the United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the United States and Canada. The Oil, Chemical and Atomic Workers International Union also represents workers in this field.

Where To Go for More Information

Information about employment in the atomic energy field may be obtained by writing to the Division of Labor Relations, U.S. Atomic Energy Commission, Washington, D.C., 20545.

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OCCUPATIONS IN THE BAKING INDUSTRY

The baking industry, which serves an everyday need in every community, is one of the largest food-processing industries in the United States in terms of employment. Occupations in baking establishments provide steady, year-round employment to several hundred thousand workers throughout the country. Replacement needs, as well as the increasing food requirements of a rapidly growing population, will provide thousands of opportunities for young people to find jobs in this industry in the remainder of the 1960's and early 1970's.

The industry employs men and women to make bakery products and to deliver them to stores, homes, and restaurants. For those who like to use their hands, the industry provides hundreds of opportunities each year to learn a skilled trade as a baker or other skilled baking specialist, such as mixer, benchhand, and ovenman. For those who like to meet people and to sell, it offers jobs as driver-salesman and sales supervisor. For the mechanically inclined, the industry has openings for skilled workers who maintain and repair the increasing amount of machinery and equipment used in today's modern bakery. For those who like to work in an office, the industry offers the familiar types of clerical jobs. In addition, large baking firms employ many administrative and managerial specialists to direct operations.

Nature and Location of the Industry

The discussion that follows covers the portion of the baking industry that produces perishable bakery products such as bread, rolls, cakes, pies, pastries, and doughnuts. Most of these products are made by several types of industrial baking firms. Large wholesale bakeries make products for sale to grocers, restaurants, hotels, and other establishments which then resell them to the public. Bakeries owned and operated by grocery chainstores make and distribute baked products to their own stores. Homeservice bakeries deliver their products directly to customers' homes. Multioutlet bakeries make their products in a central bakery for resale through their own retail stores. In addition to industrial bakeries, neighborhood retail shops make bakery products on the premises and sell them to local customers.

In 1962, more than 260,000 men and women were employed in more than 6,000 industrial bakeries; about three-fourths of them were in wholesale bakeries. An additional 85,000 men and women, including shopowners, were employed in nearly 12,000 neighborhood retail bake shops. Dry baked goods, which include products such as crackers, pretzels, and ice cream cones, are not covered in this chapter. About 40,000 workers are employed in the production of dry baked goods.

Most baking plants are small because they serve only their own community or neighborhood. A small number of bakeries serve markets up to 100 miles away; only a few distribute baked foods farther away. Nearly half of the industrial bakeries had fewer than 10 employees each; in contrast, about 10 industrial baking plants employed more than 1,000 workers each. Neighborhood bake shops averaged six employees each.

Almost every community in the United States has at least one bakery. However, nearly 60 percent of all industrial bakeries and the same proportion of the industry's employees are in the following nine States: New York, Pennsylvania, California, Illinois, Ohio, Massachusetts, New Jersey, Michigan, and Texas.

Occupations in the Baking Industry

Nearly 55 percent of the workers in the perishable bakery products industry perform the actual baking operations, receive and store raw materials, or maintain and repair machinery and equipment. About every fourth worker in the baking industry is engaged in sales, mainly as driver-salesmen for bakeries selling to retail stores or directly to homes. Many drivers with no sales duties are employed to deliver bakery products to distribution centers, hotels, restaurants, and stores. The remainder of the work force are employed in administrative, professional and technical and clerical jobs.

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

Production Occupations. In large baking plants, each operation in the baking process is handled by a specialized worker. In general, these workers load and unload machines, watch the operation of the machines, and inspect the output. *Mixers* (D.O.T. 4–01.600 through .700) 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

Dough mixer releases dough in trough

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. 6–02.123) 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. 6–02.124) operate machines which press all the air bubbles from the dough and form it into loaves or rolls. When fancy shaped bread or rolls are made, *bench hands* (D.O.T. 4–01.200) 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 from the proofing room and placed in the oven by a *helper* (D.O.T. 8–02.10). *Ovenmen* (D.O.T. 4–01.800) adjust temperature and timing devices on the ovens.

In small bakeries, *all-round bakers* (D.O.T. 4–01.100) 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 or more operations. 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. 8–02.10) 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. 6–02.420 and .430) 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 waxed paper and labels. The wrapped loaves leave the machines and travel along a conveyor belt to the shipping platform.

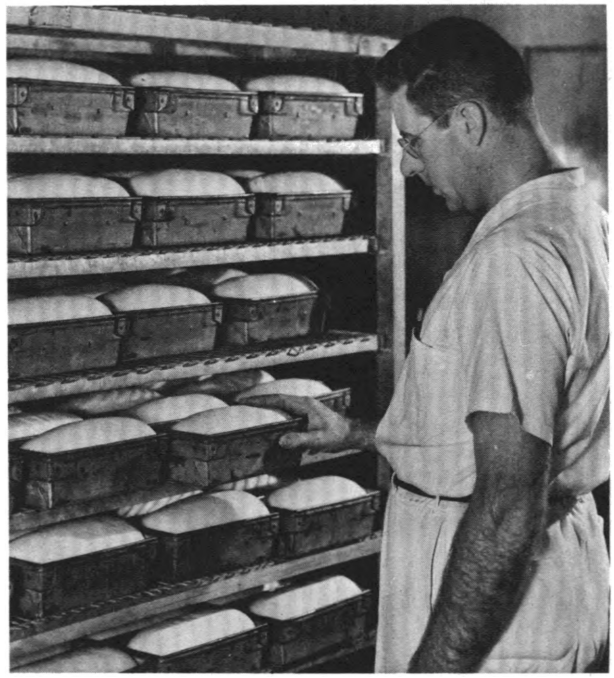
Many bakery employees work in icing departments where they give the finishing touches to cakes, pastries, and other sweet goods. *Icing mixers* (D.O.T. 4–02.321) prepare cake icings and fillings, following special formulas of the bakery. They weigh and measure ingredients and mix them by machine. They also prepare cooked fillings for pies, tarts, and other filled pastries.

In small plants, icing mixers may also spread icing on cakes and cookies. *Hand icers* (D.O.T. 4–02.311 and 6–02.311) and *machine icers* (D.O.T. 6–02.331) cover baked cakes and pastries with icing or frosting, either by hand or by machine, depending on the type of product and the extent of mechanization in the plant.

Bakeries employ many workers in their storage, warehousing, and shipping departments. Receiving and stock clerks check and keep records of incoming supplies and ingredients used in making baked foods and deliver them to various departments. Packers and checkers make up orders of bakery products for delivery by driver-salesmen.

Maintenance Occupations. Baking firms employ skilled maintenance workers and their helpers to keep machinery and equipment in good operating condition. Large plants, which are usually highly mechanized, employ many of these workers, such as electricians, machinists, and stationery engineers. Small- and medium-size plants employ maintenance workers to maintain and repair many types of plant equipment. In addition, since many baking firms have fleets of trucks, a large number of truck mechanics and other personnel are employed to keep the vehicles in good operating condition.

Sales and Driving Occupations. Selling and delivery of finished baked foods to grocers, restaurants, hotels, homes, and other customers provide jobs for many thousands of the industry's workers. Some of these workers sell baked foods and others drive trucks, but most of them perform a combination of these jobs. *Driver-salesmen*, called routemen. (D.O.T. 7–35.100) work for either wholesale bakeries or home-service bakeries. They deliver bread and other baked foods to grocery stores or to homes along their assigned routes and collect payment for delivered



Baker examines bread dough to see if it is ready for oven

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 with a basket of baked foods from which housewives can make their selection. 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 foods. They make up a list of various types of baked foods that represents their estimate of what 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 a group of from 6 to 10 driver-salesmen. In a smaller bakery, one route supervisor may be in charge of all the salesmen. When one of the salesmen 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 chain-store 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 this *Handbook.* See index for page numbers.)

Training, Other Qualifications, and Advancement

Training requirements for the various 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 its equivalent 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 in the shop. By working alongside skilled bakers, helpers are able to acquire baking skills.

Some bakeries train their bakers through formal apprenticeship programs. Apprentices generally are selected from among the helpers in the plant. 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 one of the baking jobs. For anyone handling food, most States require a health certificate indicating that the worker is free from communicable diseases. Good health is also necessary because of irregular working hours and the extremes in temperatures found in bakeries.

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

For jobs as driver-salesmen or truckdrivers, baking firms generally hire inexperienced young men with a high school education. Inexperienced workers often begin as stock clerks, packers, or checkers, and may be promoted to one of the 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 jobs as 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. Others began their careers in sales departments. In recent years, large baking firms have required that their new administrative workers 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 secretarial, stenographic, and other office jobs.

Employment Outlook

Young people will have many thousands of job opportunities in the baking industry during the remainder of the 1960's and in the longer run. Some of these openings will result from the anticipated slow expansion in the industry, but most of them will arise from replacement needs. Retirements and deaths alone may provide about 6,000 jobs each year. Many other opportunities will arise as workers move to other industries or open their own bakeshops.

A continued expansion in the overall demand for bakery products is expected, mainly because population will increase. Also, because of the anticipated rise in income, people will be able to buy more baked foods, including the "brown-and-serve" type.

The total demand for factory-baked foods is expected to rise. It will, however, continue to increase at a slower rate than population. During the past several decades, people have been eating less bread; as a result, consumption per person has dropped. Probably, the main reason for this drop in bread consumption is the increasing weight consciousness of the American consumer. The trend toward the use of prepared flour mixes for baking cakes and pastries at home has also reduced the demand for factory-baked foods.

Employment in some occupations will grow, whereas in others it will decline. For example, as families move into suburbs, salesmen's territories will expand and more driver-salesmen will be needed. Some increases may occur among clerical workers as a result of additional record-keeping requirements. As plants become more mechanized, additional maintenance workers will probably be needed to keep the machinery and equipment in operating order. The anticipated increases in these occupations will more than offset the expected decline in the number of bakery production workers. It is expected that employment in some baking production jobs will continue to decline as a result of the installation of mechanized processing and materials handling equipment. For example, the employment of laborers and helpers has dropped sharply because machines now do many of the tasks formerly done by these workers.

Improvements in the methods of processing baked goods may also reduce employment among bakery production workers. The method of fermenting a yeast broth rather than a dough mixture, for example, has cut processing time from several hours to a matter of minutes. In addition, the freezing of baked goods for storage until ready for sale permits bakeries to prepare a week's requirement at one time rather than small batches daily.

Earnings and Working Conditions

Earnings of production workers in the perishable bakery products industry averaged $92.80 a week, or $2.28 an hour, in 1962. This average was about the same as that for all manufacturing employees. Size of city and geographic location affect earnings of bakery workers. In general, the larger the city, the higher the wage rate. Wage rates also tend to be higher in the Far West and the Northeast than in the South or Southwest. Because of these geographic variations, the highest and the lowest hourly wage rates vary widely. For example, according to 12 union-management contracts covering employees in 42 wholesale bakeries in 1962, hourly wage rates for bench hands ranged from $1.91 to $3.57, and those for mixers ranged from $1.70 to $3.67. Minimum hourly rates in the major baking occupations in these bakeries were concentrated in the following ranges:

Baking foremen (and all-round bakers)	$2.11–$3.83
Mixers (dough or icing)	1.70– 3.67
Dividermen	1.86– 3.67
Benchmen	1.91– 3.57
Ovenmen	1.90– 3.67
Icers and decorators	1.59– 2.94
Slicing and wrapping machine operators	1.59– 2.71
General helpers	1.59– 3.22
Maintenance mechanics	1.59– 2.62
Maintenance helpers	1.59– 2.39

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 nightwork. 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 a recent survey of baking firms in 13 Eastern States, driver-salesmen for both wholesale and home-service bakeries had minimum weekly salaries of from $72.50 to $98.00. 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-1962, the minimum wage rates and hours per week, provided by union-management contracts in 11 selected cities, were as follows:

	Minimum wage rate	*Hours per week*
Atlanta, Ga	$2.42	45
Birmingham, Ala	2.16	48
Cleveland, Ohio	3.03	40
Dallas, Tex	2.32	45
Detroit, Mich. (bread)	2.75	45
Houston, Tex	2.37	45
Little Rock, Ark	2.16	48
New York, N.Y. (cake and pastry)	2.85	40
Oklahoma City, Okla	2.12	48
Pittsburgh, Pa. (bread)	2.35	44
Oakland, Calif. (transport and chain store)	3.75	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 unpleasantly 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. The number of paid holidays ranges from 5 to 11 days, depending on locality. Most baking firms have adopted some type of insurance or pension arrangement for their employees, such as life insurance plans, 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, Chaffeurs, Warehousemen and Helpers of America, Ind. Some maintenance men are members of craft unions such as the International Association of Machinists 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,
20 North Wacker Dr., Chicago, Ill., 60606.

OCCUPATIONS IN BANKING

Banks have been described as "department stores of finance" because of the great variety of financial services which they make available to businessmen and to individuals. They offer regular and special checking account and savings account services; installment and mortgage loans; short-term loans for business and personal needs; and investment and trust services. They accept payment of utility bills; issue traveler's checks, letters of credit, and money orders; and offer safe-deposit rentals. Banks continue to introduce new services; for example, revolving check credit plans and credit cards for individuals, facilities for handling charge accounts for retail stores, and "drive-up" facilities for customers' convenience. The complicated financial transactions of our present day business world could not be carried on without the services provided by banks.

Banks and Their Workers

To handle these and many other services, about 725,000 people, over half of them women, worked in banking organizations in early 1963. Commercial banks, which offer the most varied services, employed 90 percent of the total. Mutual savings banks, offering a more limited range of services—mainly savings deposit accounts, safe-deposit rentals, trust management, and mortgage loans—accounted for about 4 percent of all bank workers; the 12 Federal Reserve Banks, which operate as bankers' banks, employed about 3 percent; and the remainder were employed in foreign exchange firms, clearing house associations, check cashing agencies, and other organizations doing work closely related to banking.

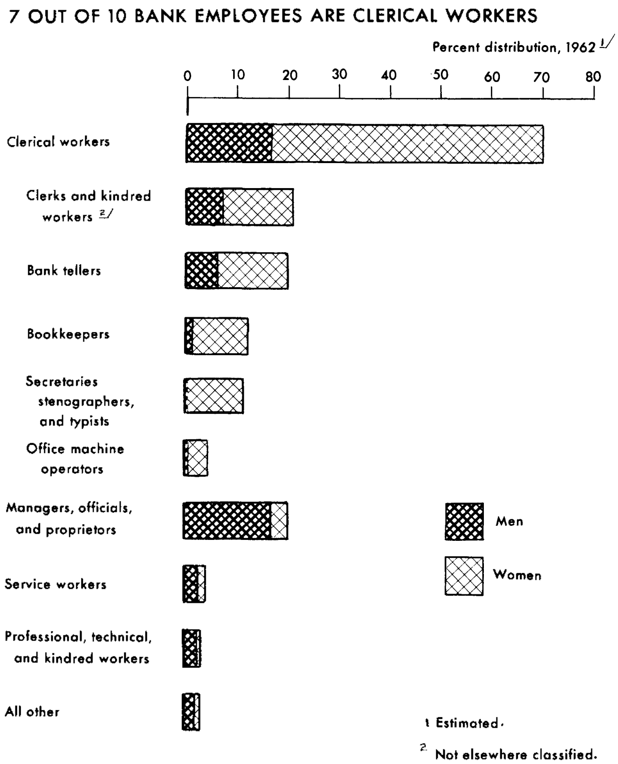
Other types of financial institutions, which require many of the same skills as banks, employed about 275,000 workers in early 1963. Among these institutions are various kinds of loan associations, most of which invest customers' funds in first-mortgage loans on real estate, and personal finance companies, which specialize in making short-term loans to individuals. Some Government agencies also have positions of a banking nature; among these are the housing and farm financing agencies, the Export-Import Bank, the Federal Deposit Insurance Corporation, and the Board of Governors of the Federal Reserve System. The Federal and State agencies concerned with the supervision of banks and the quasi-Government Federal Reserve Banks employed about 4,000 bank examiners.

Banks handle an enormous amount of paperwork. Commercial banks, for example, process about 15 billion checks a year in addition to vast quantities of other documents. About 7 out of 10 bank employees are clerical workers who keep track of these documents and record the transactions they represent. These workers also take care of correspondence, telephone calls and many other kinds of office work. Tellers are the largest specialized occupational group in banks; together with bookkeepers, and secretaries, stenographers, and typists, they make up nearly two-thirds of all bank clerical workers. (See chart 32.) Other large groups of clerical workers include office machine operators, file clerks, telephone operators, messengers, and pages. Still others are interviewers, receptionists, personnel clerks, or mail clerks.

Bank officers—presidents, vice presidents, treasurers, comptrollers, and cashiers—are directly responsible for the management of banks. Along with junior officers, they make up about one-sixth of all bank employees. In addition, a considerable number of accountants and various other professional specialists such as lawyers, statisticians, economists, and programers are employed to make audits or to advise, conduct research, and prepare reports.

About 4 percent of all bank employees are service workers, about half of whom are janitors and cleaners. Other service workers include guards, watchmen, elevator operators, and cafeteria workers.

CHART 32



This chapter gives information about several of the principal occupations unique to banking—Bank Clerks and Related Workers, Tellers, and Bank Officers. Other occupations mentioned previously, which also are found in many other business enterprises, are described elsewhere in this *Handbook.* (See index.)

Where Employed

Virtually all cities and towns have one bank or more. In early 1962, there were about 13,500 commercial banks with approximately 11,500 branches, and more than 500 mutual savings banks with nearly 550 branches. Nearly 40 percent of the employees of commercial banks are in New York, California, Pennsylvania, and Illinois. A substantial majority of the mutual savings banks and their workers are in New York, Connecticut, and Massachusetts. New York City, the financial capital of the Nation, has far more bank employees than any other city.

Bank employment is concentrated, to a considerable extent, in a relatively limited number of very large banks and their branches. At the beginning of 1961, the 31 largest commercial banks (with an average of 5,000 workers each) employed twice as many workers as the 9,200 smallest banks (which averaged only 9 workers each).

Employment Outlook

Employment opportunities in banks are expected to be numerous throughout the remainder of the 1960's and over the longer run. In addition to new jobs that will be created by growth, an even greater number of openings will arise as employees (many of them women) leave their jobs to take care of their families, to retire, or for other reasons. Altogether, banks may have, on the average, as many as 150,000 jobs to fill each year.

Most of the openings will be in clerical occupations. In addition, young college graduates should find an increasing number of opportunities in trainee jobs which may eventually lead to officer positions. There will also be some openings for professional and specialized personnel, including lawyers, accountants, programers, and personnel workers.

Bank employment is expected to increase steadily and may exceed a million workers by the mid-1970's. Population growth and the accompanying rise in production, sales, and national income will lead to expansion in banking business and employment. More jobs will also be created as banks further expand their services. 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 or expanding suburban business centers. The rapid rise in the number of checking accounts and checks handled, which was a significant factor in the growth of bank employment in recent years, is expected to continue. Other services are also expanding rapidly, including special savings plans and personal loans to individuals for travel, education, medical and other bills; and specialized bookkeeping and research and advisory services for business organizations. More employees will also be needed as banks expand their services in such fields as the investment of employee pension funds and trust management for individuals. The list of services is a long and growing one.

At the same time their business is expanding, banks are moving ahead rapidly with the conversion of their major activities to electronic data-processing (EDP) methods. The use of electronic equipment will substantially reduce the number of workers needed for routine and repetitive work, and will bring about important changes in the pattern of occupations in banking. It will also create new jobs, some of them requiring considerable technical skill. The effect of these developments will vary from one occupation to another, as indicated in the statements on specific banking occupations which follow. The net effect of automation will be that banks can add new services and handle existing ones more efficiently with only a moderate increase in the number of employees. It is expected that EDP will slow down, but not halt, the rapid growth in employment which has characterized the banking industry since the end of World War II.

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 quit 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

Average earnings of nonsupervisory bank workers—most of them in clerical jobs—were $71.80 per week in 1962. The most recent information on the earnings in specific clerical occupations is from a 1960 survey of banks in 27 metropolitan areas throughout the country. In these areas, earnings of women employed as routine file clerks—one of the jobs often filled by beginners—averaged from $45.50 to $62 a week; averages for transit clerks were roughly the same or slightly higher, and were a little higher still for proof machine operators and bookkeepers. The highest paid women were secretaries, whose average earnings ranged from $69 to $91 a week. For experienced men tabulating machine operators, the averages were almost as high—$63 to $89 a week. In most cities, the average weekly earnings of men employed as transit clerks and proof machine operators were from $1 to $5 or more higher than those of women in comparable positions.

Among commercial and savings tellers with less than 5 years' service, average salaries ranged from $49.50 to $71.50 a week for women and from $59 to $80 for men. Men employed as note tellers—one of the most responsible of all specialized teller jobs—who had 5 years or more of service earned average weekly salaries ranging from $75.50 to $106.

In the cities surveyed, salaries for nonsupervisory clerical workers as a group were generally highest in New York City and Chicago, and in Los Angeles—Long Beach and San Francisco–Oakland areas, and lowest in Providence, St. Louis, and cities in the South (except for Houston and Washington, D.C.).

College graduates hired as executive trainees in large city banks in 1962 had average annual salaries ranging from about $4,600 to $5,200 a year, depending on size of bank, according to a private survey. A few banks offered trainees salaries ranging up to $6,000 a year. The survey showed that trainees hired 5 years earlier who had attained junior officer positions earned, on the average, $7,300 a year, and earnings of those with 10 years' experience averaged $10,000 to $11,000. Earnings of senior bank officers in large city banks may be several times as great. Salaries for officers, as well as other employees, are generally lower in small town banks than in big city banks.

Most bank employees work a 40-hour week. Many, particularly in the northeastern part of the country, have a scheduled 37½-hour week and a few, principally in the New York City area, a 35-hour week. In some banks, however, daily hours may be irregular. Tellers and other employees may have to work late at least once a week, and accounting department employees may work overtime during peak periods at the end of each month. In very large banks, some workers engaged in check processing operations may be employed on late evening or night shifts. Operators of electronic computer equipment may also work on evening or night shifts, since banks customarily operate expensive computer equipment on a two- or three-shift basis. A small but growing proportion of bank workers, especially tellers, work part time.

The number of paid holidays for bank employees ranges from 5 a year in some cities to 12 or more in others. In the South and North Central parts of the country, it is fairly common for banks to pay their employees for 5 or 6 holidays a year, in the West for 7 or 8, and in the Northeast (and some large cities elsewhere) for 11 or 12.

Usually, bank employees are given a 2-week paid vacation after 1 year's service. Many banks allow 3 weeks of vacation after 10 or 15 years' service, and 4 weeks after 25 years. Group life insurance and hospitalization and surgical benefit plans are available to many employees. Retirement plans, frequently financed jointly by employer and employee contributions, are also common in banking.

Work in banks is generally carried on in clean, well-lighted, and often air-conditioned office space. Most clerical work in banks requires no strenuous physical exertion; a number of jobs can be performed in a limited work area, thus affording some opportunities for people with certain physical handicaps.

Where To Go for More Information

Information on jobs in banking may be obtained from local banks and State bankers' associations. General information on banking occupations and on training opportunities offered by the banking industry is available from:

American Bankers Association,
12 East 36th St., New York, N.Y., 10016.

For additional information on salaries of clerical workers in banking, see:

Wage Structure: Banking Industry, Mid-1960, (BLS Report 179). Bureau of Labor Statistics, U.S. Department of Labor, Washington, D.C., 20210.

Bank Clerks and Related Workers

Nature of Work

Many thousands of employees in banks are bookkeepers, office machine operators, messengers, or clerks who are assigned to specialized functions. Their duties vary with the size of the bank and the nature of its business. In a small bank, a clerk may work as both messenger and clerk, for example, or as proof machine and bookkeeping machine operator. Still other clerks may file materials, operate the switchboard, give routine information to the public, operate duplicating or other office machines, and help with sorting and listing of checks and other items. In large banks, clerks are usually assigned to specific jobs such as those discussed in the following paragraphs.

Bank clerk operates proof machine

Bookkeeping clerks may cancel and file checks, sort and list various items, and alphabetize material for experienced bookkeepers. *Transit clerks* (D.O.T. 1-01.43; 1-06.21, .22, and .24; 1-25.03) sort and list checks and drafts on other banks and prepare them for mailing back to those banks. *Mortgage clerks* (D.O.T. 1-37.34) type legal papers affecting titles to real estate, record the transactions, and maintain a record card file. *Proof machine operators* (D.O.T. 1-25.68) use machines which, in a single operation, sort checks and other items, and add and record the amounts involved.

Bookkeeping machine operators (D.O.T. 1–02 .01, .02, and .03) maintain records of the various deposits, checks, and other items that are credited to or charged against customers' accounts. They may also cancel and file checks, furnish information about balances in customers' accounts and prepare customers' statements for mailing. In their work, they may use conventional or electronic bookkeeping machines. Very few hand bookkeepers are employed.

Bank messengers (D.O.T. 1–06.27) deliver checks, drafts, letters, and other documents to other banking offices, business firms, and often government agencies in the local area. Messengers in many banks are older men who can do only light work. Inside messengers or pages are men or women who run errands within the bank and may also do simple clerical tasks.

New clerical occupations created by the introduction of advanced electronic data-processing methods, and which are unique in banks, include *electronic reader-sorter operator* (operates electronic check sorting equipment), *check inscriber or encoder* (operates machines that print information on checks and other documents in magnetic ink to prepare them for machine reading), and *control clerk* (keeps track of the huge volume of documents flowing in and out of the electronic data-processing division). Other bank clerks are engaged in occupations common in many industries. Information about some of these occupations is given in the chapter on Clerical and Related Occupations. (See index for page references to statements on Bookkeeping Workers, Office Machine Operators, Electronic Computer Operating Personnel, Secretaries and Stenographers, and Typists.)

Training, Other Qualifications, and Advancement

High school graduation is adequate preparation for entry in most clerical jobs in banks. For the majority of jobs, courses in bookkeeping, shorthand, typing, and business arithmetic are desirable. Courses in office machine operation are also helpful. Before an applicant is hired, he may be given an intelligence test and a clerical aptitude test—the latter to determine his speed and accuracy.

Beginners may be hired for jobs such as file clerk, bookkeeping clerk, and transit clerk. Some are trained by the bank to operate proof, bookkeeping, and other office machines. A few start out as pages or inside messengers.

An employee in a routine clerical job may eventually be promoted to a minor supervisory position, or to teller or credit analyst, and eventually to a senior supervisory position. A few opportunities for advancement to bank officer also exist for outstanding clerical employees, although an increasing number of banks prefer persons with college training. Additional education obtained while employed, particularly the courses offered by the American Institute of Banking, may be helpful in advancement. Since most banks follow a "promotion-from-within" policy, length of service is among the factors considered in advancement.

Employment Outlook

Thousands of openings for bank clerks and related workers can be expected each year throughout the remainder of the 1960's and during the early 1970's. Most of them will probably result from high turnover—common in many clerical occupations where the great majority of workers are women. Other jobs will arise as new banks and branch banks are opened, particularly in suburban areas of large cities, and as long-established banks expand their services.

The number of clerical workers will continue to rise with the continued expansion in banking business. However, as more mechanical and electronic data-processing equipment is introduced, some routine and repetitive jobs such as check sorter and bookkeeping machine operator are expected to decline in number. It is anticipated that banks will reassign workers displaced by machines to jobs operating the new equipment, to other new jobs created by the change in processing methods, or to other duties related to the many new functions and services which banks will introduce. 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, though much less rapidly than in the recent past. The sharpest increases in employment are expected in occupations related to electronic data processing, both those unique to banks and those, such as keypunch operator and computer operator, which are also common to EDP installations in other industries.

See introductory section of this chapter for more information on Employment Outlook, Where Employed, Earnings and Working Conditions, and Where To Go for More Information.

Tellers

(D.O.T. 1-06.02 through .04)

Nature of Work

Every bank—no matter how small—has at least one teller to receive and pay out money and record these transactions. *Paying and receiving tellers*, with whom most people deal when they transact business at banks, are mainly occupied with cashing customers' checks and handling deposits and withdrawals during the hours the bank is open to the public. Before he cashes a check, the teller must verify the signature, identity of the person to whom he makes payment, and be certain that the account against which the check is drawn is adequate to cover the payment. He also checks the accuracy of each deposit slip and enters the amount 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 to print a receipt or record in the customer's passbook, simultaneously posting the transactions on the bank's ledger.

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.

Large banks also have other tellers who are identified by the special kinds of financial transactions which they handle. For example, *trust tellers* specialize in receiving and issuing receipts for payments on promissory notes, while the work of *discount tellers* involves issuance and collection of customers' notes.

Approximately 150,000 tellers were employed in early 1963, including a considerable number who worked only part time. About 7 out of 10 tellers were women.

Tellers receive deposits and cash checks for customers

Training, Other Qualifications, and Advancement

In filling teller positions, banks generally follow a "promotion-from-within" policy. Both seniority and ability, as demonstrated in related clerical jobs, are considered in selecting employees for such advancement.

Much of the teller's work involves contact with the public, and it is therefore important that they be neat in appearance, and tactful and courteous in manner. Many customers judge a bank's services principally by the impressions they receive in their dealings with tellers. Accuracy, speed, and a good memory are all important in this job. Also, since they handle large sums of money, tellers must be able to meet the standards established by bonding companies.

A teller who performs ably for several years is in line for promotion to head teller or to some other supervisory position. Experienced tellers may eventually qualify for promotion to bank officer positions, particularly if they have had college training or have taken the specialized courses offered by the banking industry.

Employment Outlook

The number of bank tellers is expected to increase rapidly during the middle and late 1960's and over the longer run, as banks continue to expand their facilities and services for the growing urban population. Although increased use of mechanical and electronic equipment in commercial banks can be expected to take over some of the routine work now done by many tellers, it is unlikely to affect greatly the total number employed. The new equipment, however, will tend to reduce the working hours of tellers and will, therefore, increase the proportion who are employed part time. In large savings banks, electronic data-processing equipment substantially speeds up the work of tellers, making it possible for them to serve many more people.

Many additional employment opportunities will arise as workers retire or leave their jobs for other reasons. Among the thousands of women tellers, many are likely to stop working after a few years because of family responsibilities.

See introductory section of this chapter for further information on Employment Outlook, Where Employed, Earnings and Working Conditions, and Where To Go for More Information.

Bank Officers

(D.O.T. 0-85.10; 0-97.01 through .05, .14; 0-98.01 through .06, .08, .11 through .13)

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 bank managers or have charge of particular departments; and a comptroller or cashier who (unlike cashiers in stores and other businesses) is an executive officer generally responsible for bank funds. Some small banks or branches are managed almost entirely by the cashier or a vice president. Large banks may also have treasurers and other senior officers, as well as assistant officers to supervise various departments such as trust, credit, investment, and real estate.

Bank officers must exercise good judgment in approving loans

A bank officer makes decisions within the framework of policy as 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 involved. For example, the loan officer must exercise his best judgment in approving loans, bearing in mind general business conditions and the local community situation. He must evaluate carefully the reports of credit analysts (who may be executive trainees) on the individual or business firm applying for a loan, and balance the favorable and unfavorable elements in reaching a decision. Similarly, the trust officer must have a thorough understanding of a particular trust agreement, in order to manage a fund or estate properly. Moreover, only the wise investment of trust funds will make it possible to carry out trust agreements, which may involve provision for sending a young person to college or paying pensions to employees. Besides supervising financial services, bank officers are frequently called upon to advise individuals and businessmen and to participate in community projects.

Banking institutions employed about 120,000 officers in early 1963. Women, most of whom were assistant cashiers, represented about one-eighth of the total.

Training, Other Qualifications, and Advancement

In recent years, banks have shown a preference for college graduates in selecting persons to be trained for officer positions. However, outstanding individuals with experience in banking, even though not college graduates, are sometimes considered for executive trainee jobs.

Specialized college education is seldom required for executive trainee positions. A business administration curriculum with a major in banking is excellent preparation. A liberal arts curriculum with courses in accounting, economics, commercial law, finance, political science, and statistics is also good preparation.

Most large city banks have well-organized officer-training programs ranging from 6 months to 2 years in length. Trainees may work as credit or investment analysts, or be rotated among various jobs in several bank departments to get the "feel" of banking and to help bank officers determine the position for which each employee is best suited. Though many small banks cannot operate formal officer-trainee programs, they usually have some plan to help promising employees gain enough understanding of various operations to qualify for later advancement.

Advancement to officer positions may come slowly in small town banks, which are often operated largely as family enterprises and in which little turnover occurs. In large city banks with special training programs, initial promotions may come more quickly. However, many years of service are usually required to obtain the thorough knowledge of bank operations, bank customers and the community essential for senior officer positions.

Although experience, ability, and leadership qualities receive great emphasis when promotions are made, advancement may also be accelerated by special study. Courses in every phase of banking are offered by the American Institute of Banking, a long-established, industry-sponsored school. The courses are usually offered locally, and most banks pay the tuition fees for employees who successfully complete their courses. More advanced training is offered in programs sponsored jointly by universities and bankers' associations.

Employment Outlook

The number of bank officers is expected to increase rapidly throughout the 1960's and the early 1970's. Many new positions will be created by the expected expansion of banking activities. Others will develop because of the increasing use of electronic computers which makes possible more extensive analysis and planning of banking operations and enables banks to provide new kinds of services. In addition, about 5,000 openings can be expected each year because of the need to replace officers who retire or leave their jobs for other reasons.

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 promotion is likely to remain keen, particiularly in the largest banks. Colleges graduates who meet the standards for executive trainees should find good opportunities for entry positions, however.

See introductory section of this chapter for more information on Employment Outlook, Where Employed, Earnings and Working Conditions, and Where To Go for More Information.

CIVIL AVIATION OCCUPATIONS

The widespread use of airplanes provided jobs for about 300,000 persons in a variety of interesting and responsible occupations in late 1962. Some of these jobs, such as pilot, copilot, and stewardess, are especially appealing to young men and women.

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 (crop dusting); 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 Agency (FAA), and the Civil Aeronautics Board (CAB) —both Federal Government agencies. The FAA develops air safety regulations, inspects and tests airplanes and airline facilities, provides ground electronic guidance equipment, and gives tests for licenses to personnel such as pilots, copilots, flight engineers, dispatchers, and airplane mechanics. The CAB establishes policy concerning matters such as airline rates and routes and investigates accidents.

The 52 scheduled airlines were the largest employers of air transportation workers in 1962, with about 172,500 workers. Of these, about 80 percent (140,000) were employed to fly and service aircraft and passengers on domestic routes—between cities in the United States. About 28,500 other workers handled the operations of the scheduled airlines which flew international routes. The remaining workers were employed by airlines that handled only cargo. About half of all scheduled airline employees worked for the four largest domestic airlines.

In addition to scheduled airline employees, about 7,000 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 2,200 workers were employed by 15 supplemental airlines. These workers were in many of the same occupations as scheduled airline workers.

An estimated 70,000 workers—nearly all pilots, copilots, and airplane mechanics—were employed in general aviation operations. Nearly 40 percent of these workers (28,000) were employed in certificated repair stations. Another 25 percent (17,000) were engaged in business flying. About 7,500 worked for firms that gave flight instruction; approximately 5,400 were in crop dusting activities; and nearly 5,000 were employed by air-taxi operators. The remaining 7,000 workers were in other general aviation activities, such as test flying or inspecting pipelines for breaks.

The FAA employed about 45,000 people and the CAB about 1,000, in late 1962. 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.

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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.

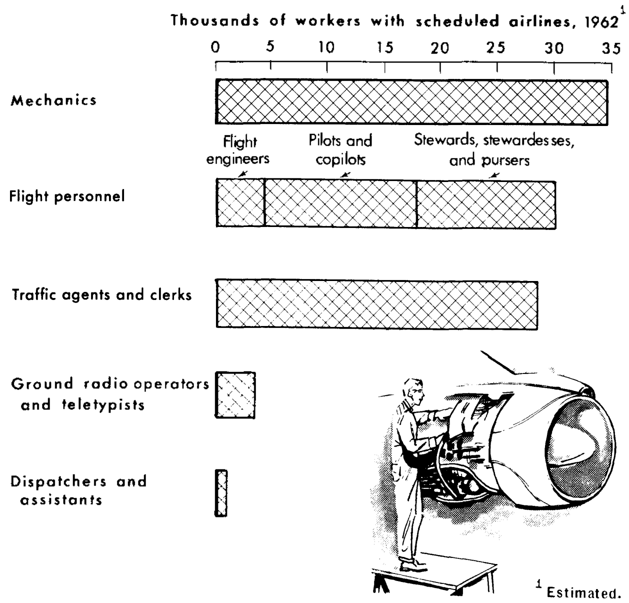
Civil Aviation Occupations

In addition to employing the largest number of air transportation workers, the scheduled airlines employ workers in the widest variety of occupations. Of the more than 170,000 employed by the scheduled airlines in late 1962, about 4 out of 5 worked in ground occupations.

Mechanics and other aircraft maintenance personnel was the largest occupational category, with 20 percent of scheduled airline employment. (See chart 33.) About 17 percent of all scheduled airline workers were traffic agents and clerks, and almost 3 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.

CHART 33

SCHEDULED AIRLINES EMPLOY MORE MECHANICS THAN FLIGHT PERSONNEL....



Pilots and copilots was the largest flight occupation, with about 8 percent of airline workers; stewardesses and stewards comprised another 7 percent; and flight engineers accounted for the remainder.

About 45 percent of general aviation workers were pilots or copilots, and a similar proportion were airplane mechanics. The great majority of the mechanics were employed in certificated repair stations. The remaining 10 percent of 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. Nearly 18,000 workers were employed in this category. Most of these workers—about 12,500—were air traffic controllers. Another group of about 4,500 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) airplane 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 rapidly in the next 10 to 15 years, but the rates of growth among the major civil aviation divisions will differ. By 1970, employment in general aviation and in the Federal Government's civil aviation activities is likely to grow by nearly 50 percent over the 1962 level, and this rapid growth will continue over the longer run. In contrast, by 1970, airline employment is expected to grow only moderately. Over the longer run, the rate of airline employment growth is likely to slow down because the introduction of a supersonic transport plane will enable the airlines to fly more traffic without corresponding expansion in the number of airline planes and workers.

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. More than 100,000 general aviation aircraft will be flying by 1970—an increase of about 25,000 over the number in 1962—according to the FAA. Most of this increase will occur in business flying, which will require about 10,000 new employees, mainly well qualified pilots. A similar number of 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 airplane mechanics. Another 10,000 job openings—practically all for airplane mechanics—will occur in certificated repair stations because of the need for additional maintenance and repair services by a larger general aviation fleet. A few thousand additional employees —mainly pilots—will be needed by crop dusters, and operators who give flight instruction and engage in patrol and survey flying.

Increases in Federal Government employment of civil aviation workers will stem from growth in general aviation activity and airline traffic. About half of the employment increase is expected to be among electronic technicians, engineers, and other personnel who install, maintain, and repair the visual and electronic components of the airways. In addition, there will be thousands of job openings in the FAA and CAB for clerical and administrative personnel, air traffic controllers, and flight service station specialists.

Airline employment growth will result from anticipated increases in passenger and cargo traffic. The FAA estimates that, by 1975, the scheduled airlines will fly about twice the number of revenue passenger miles flown in 1962. 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 low-cost air coach and shuttle 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. Shuttle 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.

Some airline occupational groups, particularly those involving the operation and maintenance of aircraft, are expected to show little or no employment growth over the decade. Jet planes, which will continue to be substituted for piston-engine planes, permit airlines to handle increasing amounts of traffic with no overall increase in the number of planes. However, even in these occupations, continuing replacement needs because of retirements and deaths, for example, will result in thousands of job opportunities for new workers annually in the years ahead.

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, 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 or more of the time. 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-company agreements often stipulate that these people be paid for a minimum number of hours each month, to guarantee a substantial proportion of their 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, employees usually receive 2 or 3 weeks' vacation with pay, depending upon length of service. Most flight personnel in international operations get a month's vacation. Employees also receive paid sick leave and retirement, insurance, and hospitalization benefits. FAA 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 Agency should be addressed to the Personnel Officer, Federal Aviation Agency, at any of the following addresses:

Region 1. Federal Building, New York International Airport, Jamaica, Long Island, N.Y., 11400.

Region 2. Box 1689, Fort Worth, Tex., 46101.

Region 3. 4825 Troost Ave., Kansas City, Mo., 64110.

Region 4. Box 90007, Airport Station, Los Angeles, Calif., 90045.

Region 5. Box 440, Anchorage, Alaska, 99501.

Region 6. Box 4009, Honolulu, Hawaii, 96812.

National Aviation Facilities Center, Atlantic City, N.J., 08400.

Aeronautical Center, Box 1082, Oklahoma City, Okla., 73100.

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 Correspondence Inquiry Branch, MS-126, Federal Aviation Agency, Washington, D.C., 20553.

Pilots and Copilots

(D.O.T. 0-41.10 and .12)

Nature of Work

The men who have the responsibility for flying a multimillion dollar plane and transporting as many as 125 passengers safely are the pilot and copilot. The pilot (called "captain" by the airlines) operates the controls and performs other tasks necessary for getting 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 to operate the controls of the plane. On some jets, there may be two copilots in addition to the other crew members.

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 Agency (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 for 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 perform such duties as rechecking the operation of the landing gear and requesting landing clearance from air traffic control personnel. If visibility, when landing, is limited, the captain must rely solely on instruments, such as radar. 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

Flight crew operate controls of jet airliner

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.

Pilots employed in general aviation usually fly smaller planes that carry fewer passengers and less cargo. 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 nearly 13,500 pilots and copilots in late 1962. In addition, approximately 700 pilots were employed by the certificated supplemental airlines (airlines that provide charter and nonscheduled service).

An estimated 37,000 pilots and copilots (including some who work part time) were employed in general aviation in early 1963. Several thousand worked in business flying and in for-hire operations. About 4,000 pilots were employed as crop dusters. The Federal Government employed approximately 700 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, a few 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, sky writing, 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 pilots who do not work for the airlines, must have a "commercial airplane pilot's" license. In addition, airline copilots, and 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, multiengine, 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 flying time. Applicants for an airline transport pilots' license must be at least 23 years old and have a total of 1,200 hours of flight time, including night flying and instrument 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 meteorology. 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 27 years old, 5 feet 7 inches to 6 feet 4 inches tall, and weigh between 140 and 200 pounds. All applicants must be high school graduates; some airlines require 2 years of college and prefer to hire college graduates. Physical requirements for pilots, especially in scheduled airline employment, are very high. They must have normal (20/20) vision without the aid of glasses, good hearing, outstanding physical stamina, and no physical handicaps that would prevent quick reactions. Since flying large aircraft places 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 in a few airlines they may begin as flight engineers. An applicant for a copilot's job with a scheduled airline often must have more than the FAA minimum qualifications for 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" radio-telephone 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. Because these pilots usually mingle with their passengers, they must 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 is generally 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 with administrative ability to advance to chief pilot, flight operations manager, and other supervisory and executive jobs. Most airline captains, however, spend their entire careers flying. 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 no longer able to fly.

Employment Outlook

Little change in the employment of airline pilots is expected in the next 10 to 15 years. Thus, the only new employment opportunities that are likely to occur in this period will be three or four hundred job openings annually resulting from the need to replace pilots who transfer to other fields of work, retire, or die. The number of pilots will be affected by the larger, faster, and more efficient jet planes being used which enable a pilot to fly many more passenger and cargo miles than he can in piston aircraft. Thus, although the number of passenger and cargo miles is expected to continue to grow in the remainder of the 1960's, employment of pilots will remain about the same. The expected introduction of supersonic transport planes by the end of the decade will result in relatively stable employment of airline pilots and copilots in the longer run.

Employment of pilots outside of the scheduled airlines is expected to grow rapidly, particularly in business flying, crop dusting, air-taxi operations, and patrol and survey flying. Growth in these areas will stem 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 $17,500 a year in domestic air transportation and nearly $23,000 in international operations, in late 1962. Most of the senior captains on large aircraft earned well over $20,000 a year; those assigned to jet aircraft may earn more than $30,000. 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 $20,000 a year in domestic flying and more than $21,500 in international flying in late 1961.

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. In practice, pilots and copilots fly approximately 60 hours a month and spend another 20 to 25 hours a month on ground duties.

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.

Nearly all airline pilots are members of the Air Line Pilots Association International.

Where To Go for More Information

Air Line Pilots Association International,
55th St. and Cicero Ave., Chicago, Ill., 60600.

See the introductory section for additional sources of information and for general information on supplementary benefits and working conditions.

Flight Engineers

(D.O.T. 5–80.100)

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 properly filled. In the plane, he assists the pilot and copilot in making preflight checks of instruments and equipment. Once the plane is in the air, 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 are employed on all commercial planes that have a maximum takeoff weight of more than 80,000 pounds, which includes almost all four-engine planes, and two-engine jet planes. In late 1962, almost all of the nearly 4,300 flight engineers were working for the major scheduled airlines, which operate virtually all such planes. Most flight engineers are 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 Agency (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. A third 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 of a flight engineer and normal and emergency in-flight duties and procedures. He must also pass a rigid physical examination every year. Some airlines give experienced flight engineers employed on jets pilot training to enable these flight engineers to qualify for a commercial pilot's license or an airline transport pilot's license.

Young men can acquire the knowledge and skills necessary to qualify as airline flight engineers through military training as airplane pilots, mechanics, or flight engineers. They may also attend a civilian ground school and then gain experience as an airplane mechanic.

For jobs as flight engineers, airlines generally prefer men 21 to 35 years of age, from 5 feet 7 inches to 6 feet 4 inches tall, and in excellent physical condition. They require a high school education but prefer men with 2 or more years of college. Airlines prefer to hire young men who already have a flight engineer certificate, although they may select applicants who have a commercial pilot's license and give them additional training.

A flight engineer can become a chief flight engineer for his airline. His advancement, however, comes mainly by gaining enough seniority to enable him to select the routes and schedules which offer the highest earnings. In airlines that employ pilot-qualified flight engineers, he can be promoted to copilot, and then follow the regular line of advancement open to other copilots.

Employment Outlook

Employment of flight engineers is not expected to change much during the remainder of the 1960's and in the longer run. (This projection assumes that the scheduled airline flight crew on airplanes weighing more than 80,000 pounds will be made up of three men. It is assumed further that the third man will continue to be classified as a flight engineer even though he has some pilot qualifications.) Increasing use will be made of faster, more efficient jet planes which allow a flight engineer to fly more passenger and cargo miles in the course of a working month than he could in a piston engine plane. The expected introduction of supersonic transport planes by the end of the 1960's will also restrict employment growth.

Some increase in employment in this occupation will result if the airlines replace light aircraft with heavier aircraft weighing more than 80,000 pounds, or if new smaller jets, scheduled for introduction in 1965, require a flight engineer.

Earnings and Working Conditions

The earnings of flight engineers in late 1962 ranged from about $550 a month for new employees to $1,600 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 $1,000; those employed on international flights averaged nearly $1,400. The earnings of flight engineers depend upon factors such as size, speed, and type of the 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 earnings. Their flight time is restricted, under the Federal Aviation Act, to 85 hours a month. Flight engineers in international operations are limited flying to 100 hours a month, 300 hours every 90 days, or 350 hours every 90 days, depending on the size of the flight crew.

Most flight engineers belong to the Flight Engineers' International Association. Some are represented by the International Association of Machinists.

Where To Go for More Information

Flight Engineers' International Association,
100 Indiana Ave. NW., Washington, D.C., 20001.

See the introductory section for additional sources of information and for general information on supplementary benefits and working conditions.

Stewardesses

(D.O.T. 2-25.37)

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 11,300 stewardesses and 1,000 stewards worked for the scheduled airlines in late 1962. About 80 percent were employed by the domestic airlines, and the rest worked for international

Airline stewardess serves dinner

lines. Nearly all stewards were employed on overseas flights. Airliners generally carry one to six 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 contact with passengers, the airlines place great stress on hiring young women who are attractive, poised, tactful, and resourceful. As a rule, applicants must be 20 to 27 years old, 5 feet 2 inches to 5 feet 8 inches tall, with weight in proportion to height (but not to exceed 140 pounds), and in excellent health. They must also have a pleasant speaking voice and good vision. Most major airlines require that stewardesses be unmarried and require them to resign when they marry or shortly afterwards.

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, students 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. 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.

Employment Outlook

Young women will have several thousands of opportunities to get jobs as stewardesses each year in the immediate future and in the longer run. 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 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 1962 beginning stewardesses earned approximately $325 to $395 a month for 85 hours of flying time. Stewardesses with 2 years' experience earned approximately $365 to $415 a month. Those assigned to jet flights usually earned more.

All stewardesses employed on domestic flights averaged $375 a month; those working on international flights averaged about $460.

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 85 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 or more days off each month. Of course, some time off may occur between flights while away from home.

Airlines generally use the seniority bidding system for assigning home bases, flight schedules, and routes. Stewardesses with the longest service, therefore, get the more desirable flights.

The stewardess' occupation is exciting and glamorous, with opportunities to meet interesting passengers and to see new places. However, the work can be strenuous and trying. A stewardess may be on her feet during a large part of the flight. She must remain pleasant and efficient during the entire flight, regardless of how tired she 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 Air Line Pilots Association International.

See introductory section for general information on supplementary benefits and working conditions.

Airplane Mechanics

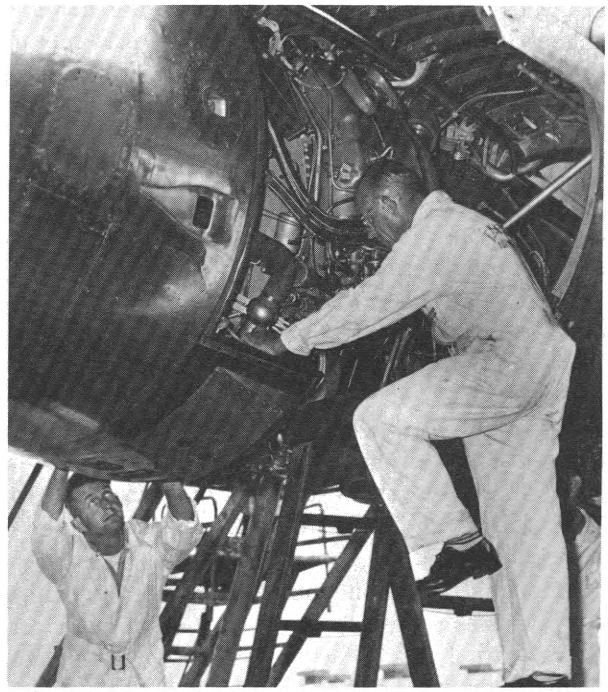
(D.O.T. 5-80.100, .120 and .130)

Nature of Work

Airplane 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 airplane such as propellers, landing gear, hydraulic equipment, radio and radar, instruments, or on sheet metal work. 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 fixed quickly. Line-maintenance mechanics must be all-round mechanics able to make repairs on all parts of the plane. They may also have to do maintenance work such as changing oil or cleaning spark plugs.

Airplane 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 may be 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



Airplane mechanics adjust jet engine

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 doing engine, instrument, or airframe overhaul. (The airframe consists of the plane's fuselage, wings, landing gear, and other parts which are not part of the engine, propeller, or instruments.)

Airplane 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 and magnetic and black light inspection equipment designed to detect flaws and cracks in metal parts.

Where Employed

Nearly 34,200 mechanics were employed by the scheduled airlines in late 1962. An estimated 25,000 mechanics and supervisory mechanics were employed by independent repair shops. A few thousand mechanics also were employed by certificated supplemental airlines, crop-dusting and air-taxi firms, and businesses that use their own planes to transport their key employees, or cargo. Many other airplane 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. See index for page numbers).

About 17,500 civilian airplane mechanics were employed by the Air Force in late 1962. 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 500 airplane 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 Aeronautics and Space Administration.

Most airline mechanics are employed in the larger cities on the main airline routes. Each airline usually has one main overhaul base where more than half of its mechanics are employed. 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); "power-plant 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 tune radio or radar 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 overhaul 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 airplane mechanics employed by the scheduled airlines is not expected to change much during the remainder of the 1960's or in the longer run. The number of airplane mechanics depends primarily on the size of the airline fleet. During recent years, a large number of piston engine planes have been replaced by a smaller number of jet planes. Because this trend is expected to continue, the size of the scheduled airline fleet will be about the same in 1970 as in 1962.

The rapid growth anticipated in the amount of general aviation flying will lead to an increase in the number of planes. 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 airplane 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 airlines earned, on the average, $580 a month in late 1962. Other airplane mechanics generally had lower average earnings.

Airline mechanics work in hangers 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. Many others belong to the Transport Workers Union of America.

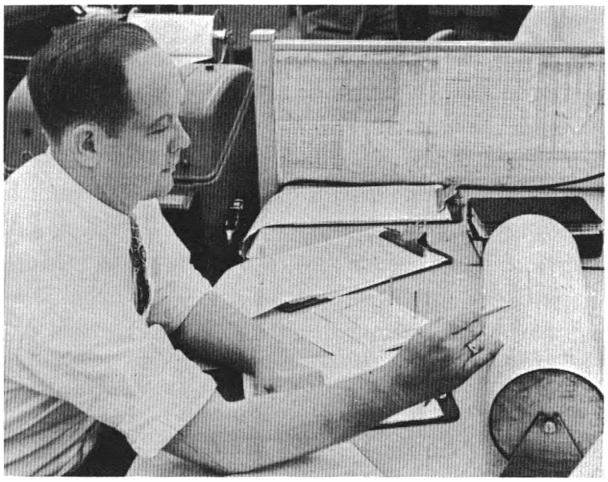
See introductory section for sources of additional information and for general information on supplementary benefits and working conditions.

Airline Dispatchers

(D.O.T. 0–61.61)

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 and to make sure that all Federal Aviation Agency (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



Airline dispatcher calculates quantity of fuel needed to complete a flight

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 plane; 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.

The assistant dispatcher helps the dispatcher plot the progress of flights, secure weather information, and handle communications with aircraft.

In late 1962, only about 700 dispatchers and 200 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, in part, 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 none of this schooling or experience, he may also qualify if he has spent 2 of the previous 3 years in air traffic control work, or in such airline jobs as dispatch clerk, 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 Civil Air 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. Some experienced 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 flight 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 increase in airline traffic anticipated during the remainder of the 1960's and in the longer run is expected to result in a slight increase in the number of workers employed in this very small occupation. Most of the new workers 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 $600 and $700 a month in late 1962. Dispatchers with 10 years' service earned between $900 and $1,200 a month. Assistant dispatchers earned $400 to $500 a month to start and $455 to $625 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,
4620 Lee Highway, Arlington, Va., 22207.

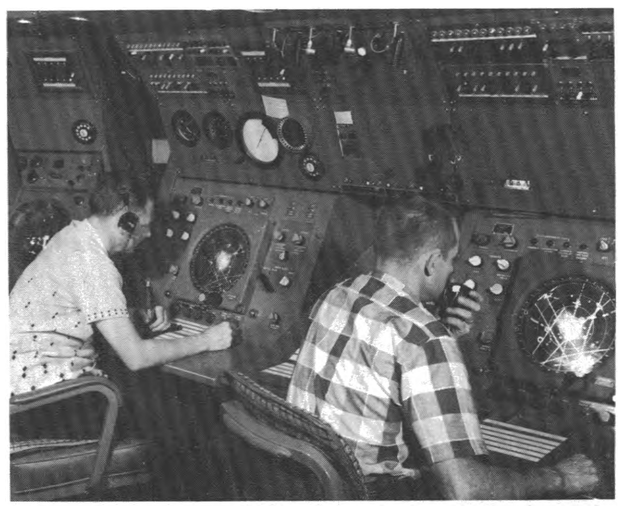
See introductory section for additional sources of information and for general information on supplementary benefits and working conditions.

Air Traffic Controllers

Nature of Work

Air traffic controllers are the guardians of the airways. These employees of the Federal Aviation Agency (FAA) give instructions, advice, and information by radio to pilots in order to avoid collisions and minimize delays as planes fly between ariports 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* (D.O.T. 0–61.60); those who guide planes 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.



Courtesy of Federal Aviation Agency

Airport traffic controllers use radar and radio to guide airplanes

Air-route traffic controllers are stationed at air traffic control centers to coordinate the movements of planes which are being flown "on instruments." They use the written flight plans which are filed by pilots and dispatchers before planes leave the airport. To make sure that planes 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 from FAA or airline communication stations.

Where Employed

About 12,500 air traffic controllers were employed by the FAA in early 1963. 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 a small number of towers and centers outside the United States. About 6,400 air-route traffic controllers worked in the 35 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 have had from 2½ to 3 years' experience in one or a combination of several fields, such as military air traffic control experience, piloting, flight communication, radar operations, or dispatching.

Successful applicants for airport traffic controller jobs are given 8 weeks of formal training at the FAA aeronautical center in Oklahoma City, 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 at the center where they will be working. 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 remain about the same over the next 10 to 15 years. The number of airport traffic controllers will grow moderately during this period while the number of air-route traffic controllers will decline slightly.

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 their 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 by the mid-1960's, employment of air-route traffic controllers is expected to decline in the longer run.

Several 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.

Competition for jobs as air traffic controllers will continue to be great. For example, FAA estimates that there were approximately 5,000 qualified applicants for air-traffic controller jobs in 1962. By contrast, in that same year, only about 1,500 men began their careers as air traffic controllers.

692-408 O—63——38

Earnings and Working Conditions

The monthly salary for air traffic controllers during their first 6 to 12 months of training was about $420 in late 1962. After this training period, they receive about $500 monthly during their first year as an assistant air traffic controller. Air-route traffic controllers earn about $610 to $790 a month depending on the type of work they do. Airport traffic controllers earn between $555 and $960 a month depending on the amount of traffic handled at their station and how long they have been on the job. In addition, all traffic controllers may receive automatic wage increases every 12 months. In areas that handle extremely large volumes of air traffic, a chief controller may earn from $1,200 to $1,300 a month. These employees receive the same annual, sick leave, and other benefits as 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 planes 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. 0-61.33 and 1-37.33)

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 Agency (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

More than 8,000 ground radio operators and teletypists were employed in air transportation in late 1962. Flight service station specialists employed by the FAA made up about half of these employees. The scheduled airlines employed about 3,200 radio operators and teletypists. An additional 400 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 cites.

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 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 18 years old and have from 2½ to 3 years' experience in some phase of air communications, traffic control, or flying. 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

There will be several hundred opportunities each year during the remainder of the 1960's and in the longer run for new workers to get entry jobs as radio operators or teletypists, 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 allows 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 probably will decrease 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 $350 and $400 a month in late 1962. Workers who held a second-class license generally received $10 or $25 more a month. The beginning salary for teletypists ranged from $325 to $345 a month. Beginning FAA flight service station specialists receive between $380 and $460 a month, depending on the amount of traffic for which they are responsible; experienced communicators earned up to $730 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. 1-44.12, .27, and .32)

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 agents and clerks give customers flight schedule and fare information over the telephone. They record reservations as they are made and report the reservations by teletype machine 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

Ticket agent weighs passenger's baggage

space. 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 annoucements and prepare the weather forms that pilots use when they plan their routes.

Where Employed

About 28,000 men and women were employed as traffic agents and clerks by the scheduled airlines in late 1962. 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 transportation," 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 positions as traffic representative and supervisor. A few may eventually move up to jobs as city and district traffic and station manager. Some are able to transfer to better paying jobs with travel agencies or to the traffic departments of big corporations.

Employment Outlook

There will be many thousands of opportunities for new workers to get jobs as traffic agents and clerks throughout the remainder of the 1960's and in the longer run, mainly because of high turnover as young women leave their jobs to marry or rear children. Total employment in these jobs is expected to grow slightly.

Only a slight increase in traffic personnel will be required to handle the large increase in passenger and cargo traffic expected to occur in the next 10 to 15 years because of the increased use of electronic equipment to process information.

Most of the major airlines are installing new machines to record and process reservations, keep records, and perform a variety of other routine tasks. The job of reservation clerk, in particular, will be affected by this mechanization. The employment of ticket agents, however, whose main job involves personal contacts, will not be affected very much, although their paper work will be reduced considerably. The small group of traffic representatives probably will increase substantially as the airlines compete for new business.

Earnings and Working Conditions

Wage data collected from union-management contracts covering reservations and ticket agents employed by several airlines indicate that their beginning salaries ranged from $295 to $355 a month in early 1963. Those workers with 5 to 8 years or more of experience earned between $390 and $460 a month. Station and operations agents started at about $325 a month and progressed to about $420 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 Employes. The Air Line Agents Association also represents some of these workers.

See introductory section for sources of additional information and for general information on supplementary benefits and working conditions.

OCCUPATIONS IN THE ELECTRIC LIGHT AND POWER INDUSTRY

Electricity, as a source of energy, is vital to our Nation's economic development and standard of living. It powers the industrial machines that produce our goods, makes possible our vast network of electronic communications, and provides energy to heat, cool, and light our homes, and to run the wide variety of household appliances we depend upon. Nearly all of America's electricity is produced by electric utility systems which served approximately 60 million customers in early 1963.

Many types of workers are needed to provide and maintain electric utility services. These include power plant operators, linemen, meter readers, electricians, engineers, research scientists, technicians, and workers in office occupations. In many communities, the local utility system offers interesting and steady jobs for men and women.

Nature and Location of the Industry

The electric light and power industry is made up of approximately 3,300 private and government (Federal, State, and municipal) utility systems. These systems include powerplants which make (generate) electric energy, substations which increase or decrease this energy (measured in volts), and a vast network 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 efficiently stored but must be used at the same moment it is produced. Because a customer can begin or increase his use of electric power at any time, by merely flicking a switch, a 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 electrical energy; others produce both electricity and gas. This chapter is concerned with employment opportunities only in those jobs relating to the producing and sending of electric power in both types of companies.

In early 1963, private and government utility systems employed approximately 440,000 workers to provide electric light and power. Privately owned systems which generate and distribute electricity only, employed about 252,000 of these workers. Private systems which produce both gas and electricity employed about 122,000 workers in connection with electric services. Federal, State, and municipal government systems employed the remainder—an estimated 65,000 workers. A few large manufacturing industries which produce electric power for their own use also employed some electric light and power workers.

Three principal groups of consumers—industrial, residential, and commercial—purchased more than 90 percent of all electricity sold in 1962. Industrial customers such as chemical, steel, and automobile plants purchased almost half of all the electric power sold. Residential customers purchased more than 25 percent, and commercial customers such as stores, hotels, and office buildings purchased over 15 percent.

Electric utility service now reaches almost every locality, and electric utility jobs are found in small towns, rural areas, and cities. Most of these jobs, however, are in the more heavily populated urban areas, especially where there are many industrial users or where a large utility has its headquarters. The continuing extension of electric service into rural areas has brought more utility jobs into the smaller towns. Hydroelectric power projects have created some electric utility jobs in relatively isolated areas.

Electric Light and Power Processes and Activities

Producing and distributing large quantities of electric energy involves many processes and activities. Chart 34 shows how electric energy is generated and how it travels from the generating station to the users.

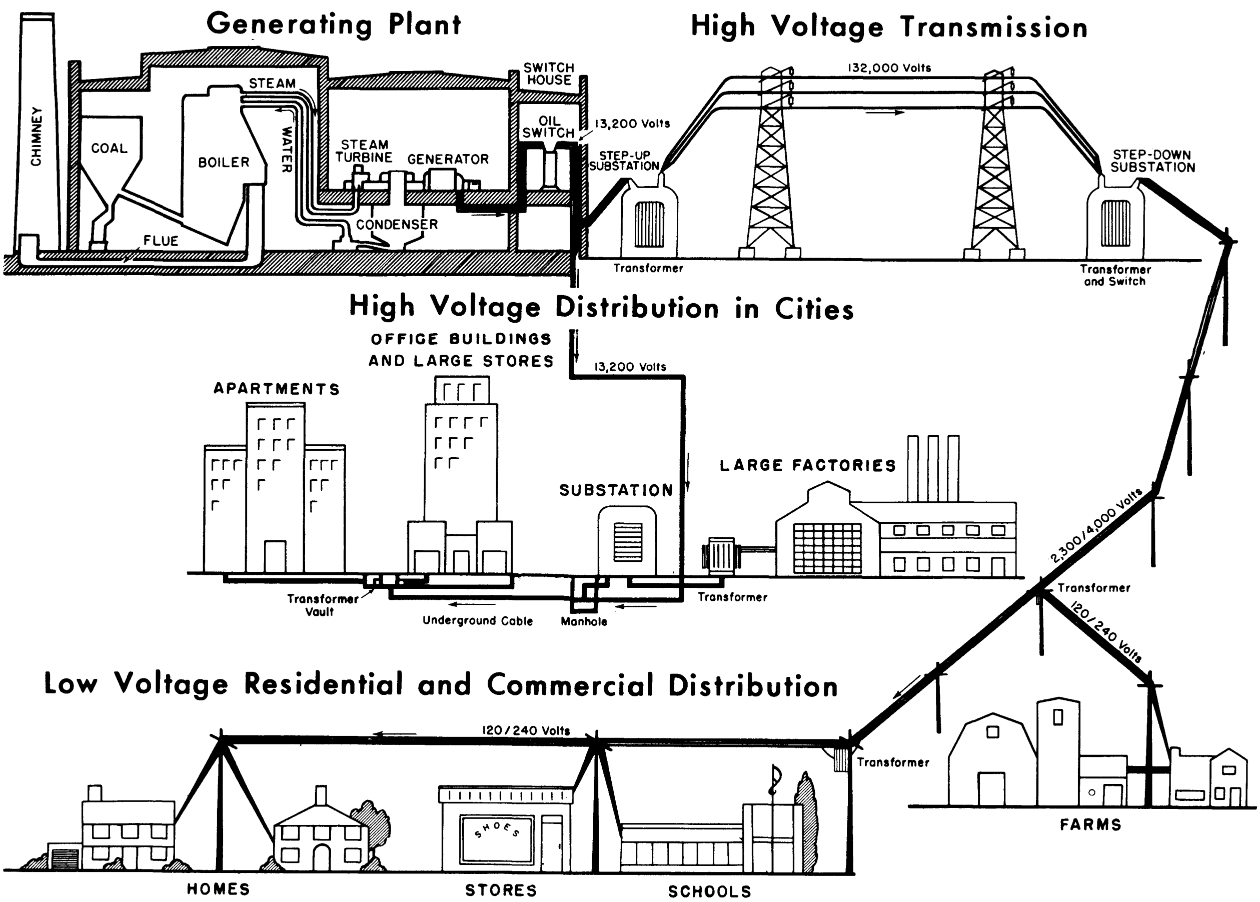
The first step in providing electric energy takes place in a generating station or plant, where generators convert mechanical energy into electricity. The energy for most generators is furnished by steam- or water-powered turbines. Some generators are operated by internal combustion engines. Electricity is primarily produced in steam-powered generating plants which use coal, gas, or oil for fuel. A few new generating stations use nuclear energy as fuel. A considerable amount of electricity is also produced in hydroelectric generating stations where water power is used to operate the turbines.

After electricity is generated, but before it flows through the powerlines leading away from the station, 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 energy 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 to meet varying demands.

Workers are needed in many different occupations to produce electric power and make it available at the instant the user requires it. About

CHART 34

HOW ELECTRICITY IS MADE AND BROUGHT TO THE USERS.....



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 light and power industry employs large numbers of workers in maintenance, engineering, scientific, administrative, and clerical occupations. The latter occupations are discussed briefly below. Detailed discussions of these and other occupations which are in the electric light and power industry and in many other industries are given in the *Handbook* sections covering the individual occupations. (See index for page numbers.)

Maintenance and Other Activities. A considerable number of workers are engaged in maintaining and repairing the equipment used by the electric utilities. The duties of these skilled craftsmen are similar to those of maintenance workers in other industries. Among the more important skilled workers are electricians, instrument repairmen, maintenance mechanics, machinists, plumbers, and boilermakers. Some of the other workers employed are guards, watchmen, and janitors.

Engineering and Scientific Activities. Many interesting job opportunities are available for engineers and technical workers in electric utilities. Engineers plan generating plant additions and installations of new transmission and distribution equipment, and supervise their construction and installation. They develop improved operating methods and test the efficiency of the many types of electrical equipment. They may also plan entire utility systems. In such work, engineers deal with problems such as the selection of plant sites, type of fuel, and type of plant. 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 Activities. 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

Several thousand job opportunities for new workers will occur each year during the remainder of the 1960's and in the early 1970's, because of the need to replace workers who retire, die, or leave the industry for other work. Total employment in the electric light and power industry is expected to remain relatively stable, although the production of electricity will continue to increase substantially.

Employment of workers in the industry generally has grown at a much slower rate than the production of power because of the use of large and highly mechanized equipment. 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. Fewer men will be needed in crews working on powerlines because of the increasing use of mechanical equipment for setting poles and stringing and maintaining lines. This equipment enables smaller crews to do as much work as larger crews, by eliminating much of the time-consuming physical labor. Employment decreases in generating, transmission, and distribution operations may be offset by the expected growth in the number of repair and maintenance craftsmen needed to keep the industry's increasing amount of complex machinery in good working condition.

Because of more efficient billing and record-keeping systems and the increasing use of electronic data-processing equipment in the larger offices, 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, and scientific, engineering, and other technical jobs.

The production of electric power will continue to show significant gains. Industrial customers are expected to use more electricity because of the increasing application of electric power to industrial processes. Use of electricity by residential customers will increase because the rapid growth in population and household units will stimulate the use of more electric power for residential heating and air conditioning as well as wider use of appliances. The construction of new stores and offices and modernization of existing structures will increase the use of electricity by commercial customers.

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 January 1963, nonsupervisory employees of electric light and power utilities averaged $2.93 an hour or $120.13 a week.

Most nonsupervisory electric utility workers in the 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, both affiliated with the American Federation of Labor—Congress of Industrial Organizations (AFL-CIO). Some utility workers are represented by independent, unaffiliated unions.

Because supplying electricity is a 24-hour, 7-day-a-week activity, some employees must work schedules which include 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 early 1963, workers on the second shift received from 7 to 15 cents an hour more than the basic day rate, and those on the third shift, from 9 to 22 cents an hour more.

Overtime work is sometimes 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, and travel time to and from the job is counted as worktime.

In addition to these provisions which affect the workers' pay, other benefits are provided by electric utilities. Annual vacations are granted to workers according to length of service. Usually, contracts provide for a 1-week vacation for 6 months to 1 year of service, 2 weeks for 1 to 10 years, 3 weeks for 10 to 20 years, and a number of contracts provide for 4 weeks for 20 years or more. The number of paid holidays ranges from 5 to 12 days a year, depending on locality. Nearly all companies have benefit plans for their employees. A typical program provides life, hospitalization, and surgical insurance and paid sick leave. Retirement pension plans supplement Federal social security payments, and are generally paid for 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. Utility companies have set up safety rules for employees to follow. Strict adherence to these safety standards is required. As a result, the industry's accident rate has been declining in recent years.

Where To Go for More Information

More information about jobs in the electric light and power industry may be obtained from local electric utility companies or from the local offices of unions which have electric utility workers among their membership. If no local offices of the unions are listed in the telephone directory, write to the national headquarters of the following unions and ask them to refer your letter to their nearest branch:

International Brotherhood of Electrical Workers,
1200 15th St. NW., Washington, D.C., 20005.

Utility Workers Union of America,
1725 K St. NW., Washington, D.C., 20006.

Powerplant Occupations

Nature of Work

The key workers in a powerplant are the operators who watch, check, control, and keep records of the operation of various kinds of equipment. They must see that the equipment is functioning efficiently and detect instantly any trouble which may arise. There are four basic classes of operators—boiler, turbine, auxiliary equipment, and switchboard operators. In many new plants, the duties of these operators are combined, and operators and their assistants are known as steam operators, powerplant operators, or centralized 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 coal equipment operators and cleaners, and, in hydroelectric plants, gate tenders who open and close the headgates which 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.

Boiler operators (D.O.T. 5-72.930) 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 control valves, 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, produced in boilers, is used to generate electricity. None are needed in hydroelectric plants, since these plants use waterpower to generate electricity.

Turbine operators (D.O.T. 5-51.120) 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. 5-51.115) operate pumps, fans, and blowers, condensers, evaporators, water conditioners, compressors, and coal pulverizers. They check and record the reading of instruments which show how the equipment is functioning. Since auxiliary equipment may go out of order occasionally, the operators must be able to detect trouble quickly, make accurate judgments, and sometimes make repairs. This equipment, which is used only in steam operating plants, is essential to the powerplant operations since it is directly connected with the operation of the boilers and the turbines. As powerplants become larger, auxiliary equipment increases in complexity and size and more of it is required to operate the plants.

Some of the smaller plants do not employ auxiliary equipment operators. Their duties are performed by turbine operators who do both types of work. In large plants, however, auxiliary equipment operators often outnumber turbine operators.

Switchboard operators (D.O.T. 5–51.130) 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.

The 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, switchboard operators keep records of all switching operations and of load conditions on generators, lines, and transformers. They obtain this information by making regular meter readings.

Plants with high generating capacity generally have more varied and complex equipment than smaller plants. Disturbances in the system may have far-reaching effects, and cause interruptions in service over a large area. Therefore, switchboard operators in large plants check their lines and test their equipment more frequently than operators in small plants, and thus must have a greater degree of skill.

In some new powerplants, the duties of the switchboard operator are combined with those of boiler operator, turbine operator, and auxiliary equipment operator. In such cases, he is called a central control room operator or powerplant operator. Generally, these powerplants have controls for all departments centralized in the control room. From this central control room, through closed television circuits, the control room operator, with several assistants, watches all powerplant controls and reports to the supervisor when the instruments show that such equipment is not operating properly.

Watch engineers (D.O.T. 5–95.320) are the principal supervisory workers in a powerplant. They supervise the employees responsible for the operation and maintenance of boilers, turbines, generators, auxiliary equipment, switchboards, transformers, and other machinery and equipment. Watch engineers 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 a fully qualified auxiliary equipment operator and from 4 to 8 years to become a boiler operator, turbine operator, or switchboard operator. A person learning to be 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.

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. In the larger plants, switchboard operators can advance to the job of chief switchboard operator.

Watch engineers are selected from among experienced powerplant operators. At least 5 to 10 years of experience as a first-class operator are usually required to qualify for a watch engineer's job.

Employment Outlook

Several hundred job openings for new workers will occur each year during the remainder of the 1960's and in the early 1970's because of the need to replace operators who retire, die, or leave the industry for other work. However, the total number of jobs for powerplant operators is not expected to increase, and may even decrease somewhat, although the capacity and production of electric utility systems is expected to double during the decade ahead.

Control room operator regulates output of generating unit

The use of larger and more efficient equipment makes possible great increases in capacity and production without corresponding increases in the number of workers. For example, one operator can control a large modern turbogenerator unit which produces 200,000 kilowatts as well as he can control a much smaller one. Also, the growing use of new equipment which has many automatic operating features reduces the number of operators needed. For example, in some generating plants, all operating processes are directed from a central control room. In this room, electronically operated instruments report and make a permanent record of the operations of boilers, turbines, and auxiliary equipment. Television screens even make it possible to watch the boiler fires from the control rooms. In plants with such highly automatic equipment, a control room operator and his assistants do the work of boiler operator, turbine operator, auxiliary equipment operator, and switchboard operator.

The number and skill requirements of employees in powerplants that use atomic energy as fuel do not differ greatly from operators in powerplants using other fuels. Generally, about the same number and types of operators will be required to run an atomic-powered steam-generating plant as are required to operate steam-generating plants using more common fuels.

Earnings and Working Conditions

The earnings of powerplant workers depend on the type of job they have, the part 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 with 100 or more employees in mid-1962:

	Average hourly earnings
Auxiliary equipment operator	$2.78
Boiler operator	3.10
Control room operator	3.49
Switchboard operator:	
Switchboard operator, Class A	3.25
Switchboard operator, Class B	2.94
Turbine operator	3.15
Watch engineer	3.96

A powerplant is typically well lighted and ventilated and its interior is clean and orderly. Even steam plants that use coal are generally clean, since coal is handled by mechanical equipment separated from principal work areas. The turbine room is airy and clean, but there is considerable 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

A fifth of the workers employed by electric light and power systems are in transmission and distribution jobs. These workers are primarily employed in getting 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. 5-51.520) (sometimes called system operators or power dispatchers) are the key operating workers of the transmission and distribution departments. They control the flow of electricity. The load dispatcher's room is the nerve center of the entire utility system. From this location, the dispatcher controls the plant equipment used to generate electricity and directs its flow throughout the system. He telephones his instructions to the switchboard operators at the generating plants and the substations. His instructions tell operators how power is to be routed and when additional boilers and generators are to be started up or shut down 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, but boilers often must be heated for 2 hours before they are ready to produce sufficient steam for generating. Therefore, the load dispatcher must keep in touch with weather reports from hour to hour. He must also be able to direct the handling of any emergency situation, such as a transformer or transmission line failure, and to route current around the affected area. Load dispatchers are also in charge of the interconnections with other systems, and they direct the transfer of current between systems as the need arises.

The load dispatcher's source of information 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. Meters on the board show the output of individual power stations, the total amount of power being produced, and the amount of current flowing through the principal transmission lines. Red and green lights may show the positions of switches which control generating equipment and transmission circuits as well as high voltage connections with substations and large industrial customers. The board may also have several recording instruments which make a graphic record of operations for future analysis and study.

Substation operators (D.O.T. 5–51.210) are generally in charge of a substation and are responsible for its operation. Under orders from the load dispatcher, they direct the flow of current out of the station by means of a switchboard. Ammeters, voltmeters, and other types of instruments on the switchboard register the amount of electric power flowing through each line. The flow of electricity from the incoming to the outgoing lines is controlled by the 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 simultaneously.

In addition to switching duties, the substation operators check the operation of all equipment to make sure that it is in good working order. 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. 5–53.420) construct and maintain the network of powerlines which carry electricity from generating plants to consumers. However, construction of transmission lines—the erection of the steel towers and the stringing of the lines between them—is generally contracted out to companies specializing in this work.

Groundmen (D.O.T. 9–54.10) 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, linemen attach a wide variety of equipment to the poles and towers, such as lightning arresters, transformers, and switches.

Linemen's 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. 5–53.422) are linemen with several years of experience who are assigned to special crews which handle emergency calls for service. They move from one special job to another, as ordered by a central service office which receives reports of line trouble. Often troublemen receive their orders by direct radio communication with the central service office.

These workers must have a thorough knowledge of the company's transmission and distribution 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.

Cable splicers (D.O.T. 5–53.950) install and repair underground lines, performing about the same service as the linemen do on the overhead lines. When cables are installed, the cable splicers pull the cable through the conduit in which the cable is carried and then join the cables at connecting points in the transmission and distribution systems. At each connection in the cable, they wrap insulation around the wiring. They splice the conductors leading away from each junction of the main cable, insulate the splices, and connect the 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 is 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. It usually takes 3 to 7 years of on-the-job training to advance to the job of operator in a large substation.

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 with classroom instruction. Such instruction includes courses in blueprint reading, elementary electrical theory, electrical codes, and methods of transmitting electrical currents. At the beginning of 1963, 856 linemen were receiving training under formal apprenticeship programs.

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.

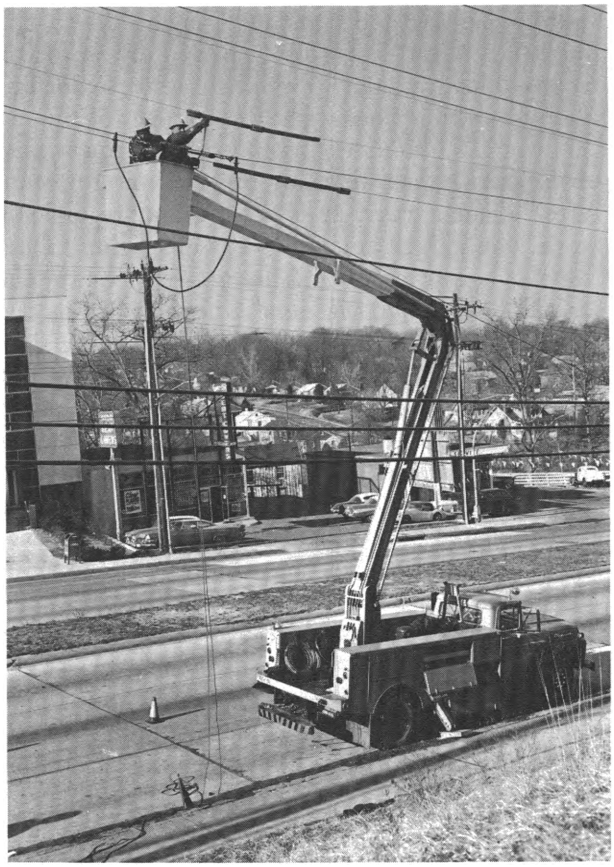
Candidates for linework should be strong and in good physical condition, since climbing poles and lifting lines and equipment is strenuous work. They must also have steady nerves and good balance to work at the tops of the poles and to avoid the hazards of live wires and falls.

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.

At the beginning of 1963, there were about 117 cable splicers receiving training under formal apprenticeship programs.

Employment Outlook

Several thousand job opportunities are expected to be available in transmission and distribution occupations during the remainder of the 1960's and in the early 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.



Linemen work from aerial basket to repair electric power line

A continued slow increase in the employment of transmission and distribution workers is expected. However, employment trends will differ among the various occupations in this category. In spite of the need to construct and maintain the growing number of transmission and distribution lines which are anticipated, the number of linemen and troublemen is expected to increase only slightly. Fewer men will be needed in crews working on distribution lines because the increasing use of mechanical equipment enables smaller crews to do as much work as larger crews did formerly. Much transmission line construction work is contracted out to line construction companies. Little increase in the number of cable splicers is expected because most large cities are already equipped with underground line installations. However, some expansion of underground installation is anticipated in the suburban areas. The need for substation operations will be substantially reduced because of the introduction of improved and more automatic equipment, and the growing number of completely automatic substations.

Earnings and Working Conditions

The earnings of transmission and distribution workers depend on the type of job they have and the part 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 with 100 or more employees in mid-1962:

	Average hourly earnings
Groundman	$2. 28
Lineman	3. 33
Load dispatcher	4. 00
Substation operator	3. 24
Troubleman	3. 34

No recent earnings data are available for cable splicers; however, their earnings are about the same as those for linemen.

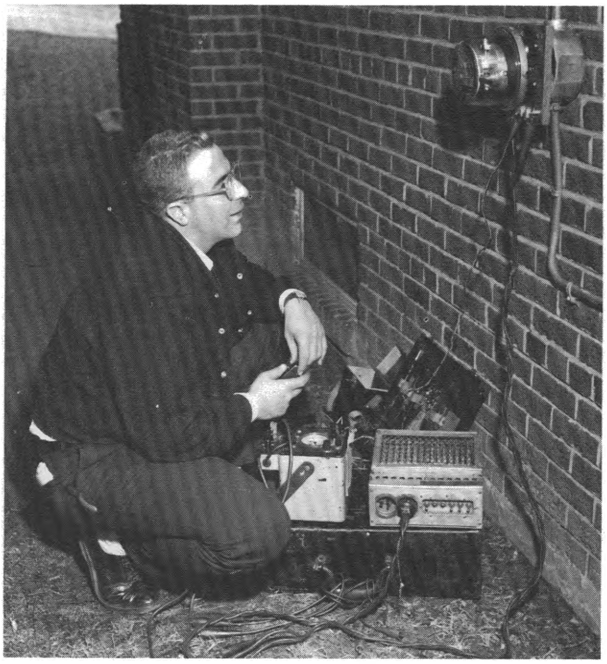
Load dispatchers and substation operators generally work indoors in pleasant surroundings. Linemen, troublemen, and groundmen work outdoors and, in emergencies, in all kinds of weather. Cable splicers do most of their work in manholes beneath city streets—often in cramped quarters. Safety standards developed 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. 5–83.456) (or meter repairmen) are the most skilled workers in this group. They install, test, maintain, and repair meters



Meterman checks accuracy of customer's meter

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. 5–83.450, .451) and *meter testers* (D.O.T. 5–83.452). Meter installers put in and take out meters. Meter testers specialize in testing the small meters on homeowners' property and the more complicated ones used in relay testing and control operations of the utility systems.

Meter readers (D.O.T. 1–49.94) 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 on them. 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 is 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

A slight increase in employment is expected in customer service occupations during the remainder of the 1960's and in the early 1970's. Because many new customers—homes, offices, factories, hotels, and stores—will be served by utility systems, a larger number of meters will be needed. However, this will require only a slight increase in the number of meter readers because of the trend toward reading meters less frequently. Furthermore, since new meters are better constructed and require less maintenance, there will be only a slight growth in the number of metermen needed. The need to replace metermen and meter readers who retire, die, or transfer to other fields

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of work will provide a small number of job openings for new workers each year.

Earnings and Working Conditions

The earnings of customer service workers vary according to the type of job they have and the part of the country in which they work. The following tabulation shows the average hourly earnings for major customer service jobs in privately operated utilities with 100 or more employees in mid-1962.

	Average hourly earnings
District representative	$3. 11
Meterman A	3. 25
Meterman B	2. 88
Appliance serviceman	2. 97
Meter reader	2. 52

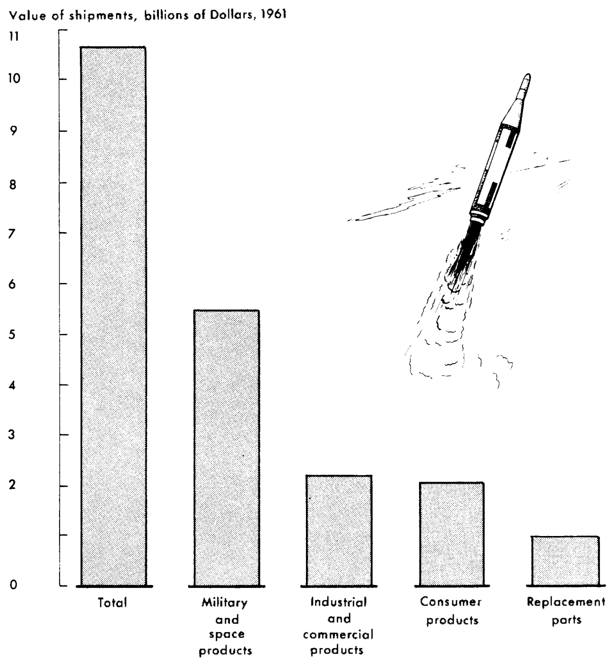
The job of the meter reader is not physically hard, but involves considerable walking and some stair climbing. Metermen and appliance servicemen work indoors under typical repair shop conditions except when repairing or installing meters or appliances on customers' premises.

ELECTRONICS MANUFACTURING OCCUPATIONS

Job opportunities in electronics manufacturing are expected to continue to expand rapidly during the remainder of the 1960's and in the longer run. More than 900,000 workers were employed in this field in 1962, about $3\frac{1}{2}$ times the number in 1950. Electronic products, such as radar, television, radio, and computers, are used increasingly in the Nation's military and space programs, and in factories, offices, homes, schools, and hospitals. Opportunities in electronics manufacturing during the next 10 to 15 years will be particularly good for scientists, engineers, and technicians, as well as for skilled craftsmen. Women will find many opportunities in this field, mainly in production jobs such as that of assembler, and in clerical work.

CHART 35

MILITARY AND SPACE PRODUCTS ACCOUNT FOR ABOUT HALF OF TOTAL ELECTRONICS SHIPMENTS.....



Source: Estimates based on Electronic Industries Association data.

Nature and Location of Electronics Manufacturing

Before World War II, 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 an electronic circuit or system which includes electron (vacuum or gas filled) tubes, semiconductors, or photosensitive devices. These tubes and other electronic devices discharge, 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. For example, they are used in computers which can perform hundreds of thousands of calculations per second; in control systems which guide missiles traveling at supersonic speed; and in equipment which can transmit, over hundreds of miles, clear pictures of events as they happen.

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. Military and space products accounted for approximately half of the estimated $10.7 billion in total electronics shipments in 1961, industrial-commercial equipment and consumer products each accounted for roughly one-fifth, and components produced as replacement parts made up the remaining one-tenth. (See chart 35.) (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 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, high fidelity and stereophonic equipment, 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, and rectifiers. "Other components" include such items as capacitors, resistors, transformers, relays, connectors, and switches.

Of the more than 900,000 workers in electronics manufacturing occupations in 1962, about 850,000 were employed in manufacturing plants. The remaining employees worked in the Federal Government, universities, and nonprofit research centers, in such activities as research, development, and the negotiation and administration of contracts. Of the 850,000 employed by manufacturers, an estimated 300,000 produced components for use in military-space, industrial-commercial, and consumer products; 300,000 produced military and space end products; 150,000 manufactured industrial and commercial end products; and 100,000 produced consumer end products.

Electronics manufacturing plants are located in nearly every State, but about three-fourths of electronics manufacturing workers are employed in the following seven States: California, New York, Illinois, New Jersey, Pennsylvania, Massachusetts, and Indiana. Metropolitan areas with large numbers of electronics manufacturing workers include Chicago, Los Angeles, New York, Philadelphia, Newark, Boston, Baltimore, and Indianapolis.

How Electronic Products Are Made

Many plants manufacturing electronic products specialize in one type of end product, such as television sets, radios, and electronic computers; or one type of component, such as television picture tubes, power tubes, and 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.

In assembling radios, television sets and other end products produced in large quantities, circuit boards or panels, transformers, tuners, speakers, and other major subassemblies 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 side 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 soldered to the etched circuits in one continuous operation (called "dip" or "wave" soldering).

Inspector uses magnifying glass to check negative used in printing electrical circuits on circuit boards

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 transistors 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. Approximately 3 out of every 5 workers in electronics manufacturing are in plant jobs (production, maintenance, transportation, and service); the rest are in white-collar jobs (engineering, scientific, and other technical jobs, and administrative, clerical, and sales jobs). Approximately half of all the white-collar workers are engaged in research and development work and related activities.

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 in establishments producing consumer products is generally higher than in establishments manufacturing military and space products. This may be seen from the following occupational distributions of the work force in military-space and consumer products manufacturing establishments in 1962.

Occupation	*Electronics establishments manufacturing:* Military and space products	Consumer products
	(Percent of workers)	
All occupations	100.0	100.0
White-collar workers	60.0	30.0
Engineers and other technical workers	33.4	11.0
Engineers and scientists	21.0	6.0
Technicians (including draftsmen)	12.4	5.0
Administrative and supervisory workers	13.2	12.0
Clerical and stenographic workers	13.4	7.0
Plant workers	40.0	70.0
Skilled	12.6	6.8
Assemblers	5.2	-------
Inspectors and testers	1.1	5.1
Processing workers	.2	-------
Machinists and repairmen	3.7	.3
Sheet-metal workers	.8	-------
Tool and die makers	.3	.4
Welders	.6	.1
Carpenters	.2	.2
Electricians	.2	.2
Plumbers and pipefitters	.2	.1
Other	.1	.4
Semiskilled and unskilled	27.4	63.2
Assemblers	11.0	42.0
Inspectors and testers	3.1	14.4
Fabricating workers	3.7	1.2
Processing workers	3.1	1.2
Shipping and receiving workers	1.3	1.2
Material handlers (including truckdrivers)	.3	2.2
Custodial and janitorial workers	1.5	.4
Other	3.4	.6

More than two-fifths of the workers employed in electronics manufacturing plants are women. In some plants, particularly those producing 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 also as office workers. Opportunities for women exist in nearly all types of jobs in electronics, however.

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 every 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 are 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 engineers 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. A large proportion of 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 field of quality control. 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 every 10. They mainly assist engineers and scientists.

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.

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 manufacturers of other types of electronic products.

Courtesy of National Aeronautics and Space Administration

Technicians install electronic equipment in communications satellites

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. A large number of workers in electronics manufacturing plants are in administrative or other office jobs. Administrative workers include purchasing agents, sales executives, personnel workers, and advertising personnel. 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, sales, and inventory data.

Plant Occupations. About three-fifths of electronics manufacturing employees are plant workers. They 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 consumer end products than in plants producing military and space equipment. It is also higher in plants producing semiconductors and receiving tubes than in plants making other electronic components. The proportion of machining and fabricating workers is usually higher among manufacturers of military and space equipment than of other types of products. Plants making components, particularly those making semiconductors, generally employ a higher proportion of processing workers than plants making end products.

Assembly occupations (D.O.T. 6–98.010 through .350; 7–00.007 through .970). 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 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.

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 transistors 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 usually 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 glasses 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 as many as 100 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

Assemblers use microscopes to put together transistors in dust-free room

routine performance tests, to pinpoint the exact cause of faulty operation.

Machining occupations. Metal machining jobs account for a significant number of plant jobs in electronics manufacturing plants. 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. Many different fabricating occupations are found in electronics manufacturing, but the number of workers in each of these jobs is not large. Among the fabricating workers are sheet-metal workers who make frames, chassis, and cabinets. Glass blowers and *glass lathe operators* (D.O.T. 7-00.035) are used 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* (D.O.T. 8-98.01), and shear operators.

Some fabricating jobs involve the molding, firing, and glazing of ceramics used as insulating materials in many components. Workers may also mold plastic components. In tube manufacturing, special fabricating workers are employed. For example, *grid lathe operators* (D.O.T. 6-98.251) 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. 6-98.250 and 6-99.013 through .016) and *crystal grinders* and *finishers* (D.O.T. 6-98.080, .084, and .085).

Processing occupations. A relatively small but important group of electronics manufacturing workers are engaged in processing activities, chiefly in plants producing electronic components. Electroplaters and *tinners* (D.O.T. 6-74.120) coat many parts with metal. *Anodizers* (D.O.T. 4-74.910) treat parts in electrolytic and chemical baths to prevent corrosion. Silk screen operators print patterns on circuit boards and on parts of electronic components. Etching equipment operators 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.

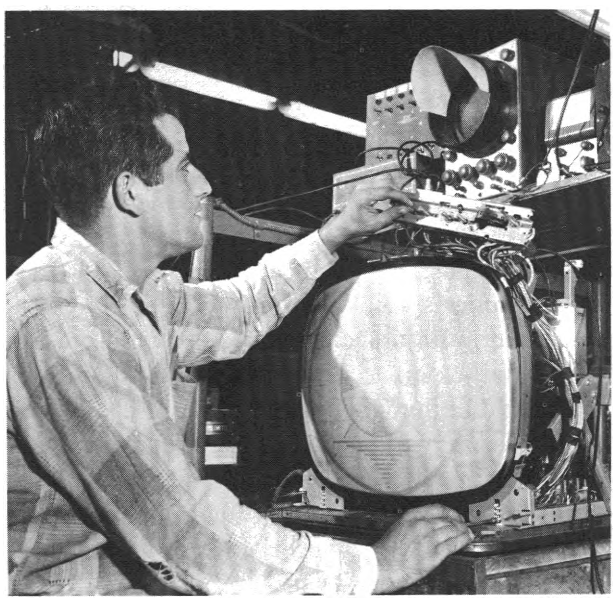
Another group of processing workers operate furnaces, ovens, and kilns, used chiefly to harden ceramics, bake on coatings, and eliminate contamination by gases and foreign materials. *Operators of infrared ovens* and *hydrogen furnace firers* (D.O.T. 6-98.280) rid tubes of foreign deposits. In tube manufacturing, *exhaust operators* (D.O.T. 7-00.018) and *sealers* (D.O.T. 7-00.025 and .054) 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, subassemblies, 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 20 or more component characteristics and produce a punched tape of test results. 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.



Tester checks and adjusts test pattern on TV picture tube

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. 4–98.101) 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 glasses, 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 is another important occupation in electronics manufacturing plants. These workers repair assembled electronic products which have been tagged for replacement of 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 as well are given elsewhere in this *Handbook*, in sections covering the individual occupations. See index for page numbers.)

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 classifications 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 attend either a public, private, or Armed Forces technical school. Some obtain 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 or more years 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 electronics 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

Many thousands of job opportunities will be available for new workers in electronics manufacturing plants each year during the remainder of 1960's and in the longer run. During the next 10 to 15 years, electronics employment is expected to grow more rapidly than manufacturing employment as a whole. In addition to the jobs created by expanding electronics activity, many thousands of openings will become available each year as a result of the need to replace workers who transfer to jobs in other industries, or who retire or die. Retirements and deaths alone are expected to result in roughly 12,000–16,000 job openings annually, and many additional workers will be hired to replace the large number of women workers who leave their jobs to marry or to raise families.

Rising expenditures for military and space electronic equipment represent one of the main reasons for anticipated expansion in electronics employment. Major factors expected to boost military and space electronics spending during the years ahead include: (1) The growing complexity of not only spacecraft but also missiles, aircraft, and other defense items; (2) the national effort to complete a manned lunar expedition by 1970; and (3) the increasing size and importance of the military space program.

Substantial growth in electronics production for industrial and commercial use is also anticipated. Businessmen are expected to spend increasing amounts for electronic equipment to automate and mechanize production processes, especially for such items as computers and numerical controls for machine tools. Demand is also expected to grow for products such as radio communications equipment, test instruments, and navigational equipment. For example, the use of two-way radio communications equipment by police and fire departments, public utilities, taxicab and trucking companies, pipeline firms, and others is expected to spread rapidly. Production of electronic equipment for the medical and atomic energy fields will also expand greatly.

More home television sets (including color television), radios, phonographs, and stereophonic and high fidelity equipment are expected to be purchased in the years ahead as population and living standards continue to rise. Other electronic consumer products, such as electronic ovens and dishwashers, may become standard household equipment.

Expenditures in electronics research and development work are expected to contine to increase. This also is expected to result in expanded employment because such activities usually result in new and improved electronic products and new uses and markets for them.

The increase in electronics employment probably will not be so great as the expansion in sales and output, because technological improvements in production methods are expected to increase output per worker. For example, increasing mechanization of operations formerly done by hand tends to reduce labor requirements. However, mechanized and automated manufacturing processes are difficult to adapt to the fabrication of many types of highly complex electronic products made in small quantities and subject to frequent design changes.

Although the demand for workers in all occupational groups in electronics manufacturing except unskilled laborers is expected to grow during the next 10 to 15 years, rates of employment growth will vary. The demand for engineers, scientists, and technicians is expected to increase at an especially rapid rate, because of rising expenditures for research and development and the trend toward production of increasingly complex equipment. The demand for skilled assembly, inspecting, and testing work is also expected to grow at an above-average rate, for much the same reasons. The demand for semiskilled workers may rise more slowly because assembly line operations are expected to become more mechanized and automated.

Earnings and Working Conditions

The following figures provide a comparison of average hourly and weekly earnings in 1962 between production workers in major types of electronics manufacturing and production workers in all manufacturing industries.

Type of production	*Average hourly earnings*	*Average weekly earnings*
Military-space and industrial-commercial electronic end products	$2. 56	$105. 22
Electron tubes	2. 27	92. 84
Radio and television receiving sets, and phonographs	2. 17	86. 15
Semiconductors and other components, except tubes	1. 95	77. 61
All manufacturing industries	2. 39	96. 56

Earnings of an individual production worker may differ from the averages shown above since such earnings depend not only on the type of plant in which he works but also on factors such as the required skill level and experience, 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 pay a differential 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.

Working conditions in electronics manufacturing compare favorably with those in other industries. Plants are usually well lighted and relatively clean and quiet. Some plant departments are air conditioned, where sterile conditions or air temperature control is necessary for the manufacture of certain types of electronic equipment. The work in most electronics occupations 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 the United Electrical, Radio and Machine Workers of America (Ind.).

FOUNDRY OCCUPATIONS

The metal castings produced by foundry workers are essential parts of thousands of products ranging from automobile engines to cooking utensils. In early 1963, an estimated 375,000 workers were employed in the Nation's more than 5,000 foundries. Many of these workers were employed in skilled occupations. Hourly earnings in many foundry occupations were above the average for factory work as a whole.

In casting metal objects, a mold is prepared with a cavity in the shape of the casting to be made; metal is then melted and poured into the cavity where it cools and solidifies. (Other metal shaping methods include machining, forging, stamping, and rolling.) The casting process is an economical and fast method of forming metal into a wide range of intricate shapes. Castings have considerable strength and rigidity and range in size from a fraction of an inch to many feet. They may weigh anywhere from less than an ounce to many tons. Among the thousands of articles made by the casting process are machinery bases, ship propellers, bearings, water faucets, water mains, bathtubs, automobile engine blocks, pipe, and aircraft and missile components.

Nature and Location of Foundry Work

About 280,000 of the foundry industry's workers were employed in ferrous foundries—those that make castings of iron and steel. About 60 percent of these workers were in ferrous foundries that produce gray iron castings and the remainder were employed in steel and malleable iron foundries. About 95,000 were employed in nonferrous foundries. Most of this group worked in foundries that made copper-base alloy (bronze and brass), aluminum, magnesium, and lead castings. Most foundries specialize in casting a particular metal since somewhat different methods and equipment are needed for melting and casting the different metals. However, many shops cast several metals. With additional training, many foundry workers can transfer from foundries casting one type of metal to foundries casting a different metal.

In general, foundries are either small- or medium-size shops. More than 90 percent employ fewer than 250 workers each. However, large foundries employ almost 40 percent of all workers. More than two-thirds of the foundry workers are employed in independent foundries (shops which sell their castings to other firms). The remaining workers are employed in foundries that are departments of plants using castings in the manufacture of their own products.

There are five principal methods of casting based primarily on different types of molds. By far the most common of these is green-sand-molding. In this method, sand composed chiefly of silica and clay is packed in a boxlike container, called a flask, around a pattern (a model of the object to be cast). The pattern is withdrawn and molten metal is poured into the mold cavity to form the desired metal shape. The sand mold can be used only once, but the sand can be reclaimed.

A second method, known as 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.

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 wax or plastic is melted and drained out, leaving a mold cavity into which the casting metal is poured. Castings obtained from these molds are very exact and need little machining.

Shell molding, a fourth process, was introduced after World War II and is becoming increasingly important. In this method, a heated metal pattern is placed in a mixture of sand and resin. The mixture sticks to the metal pattern, forming a shell mold. After curing, the mold is stripped from the pattern. Castings produced from these molds are more precise, have a smoother surface, and are less costly when produced in quantity. They also are easier to handle, because of the lighter weight of the mold compared with other types.

Die casting is a process in which molten metal is forced under high pressure into steel dies from which the castings are later automatically ejected. Because die casting is done entirely by machines operated by die-casting machine operators, it is different from other casting methods. The work performed by die-casting machine operators is not described in this chapter, but these workers are included in the total employment estimate for foundries.

Small foundries generally use the sand-molding method, and produce small amounts of different kinds of castings for local metal fabricating plants. These foundries ordinarily use little mechanized equipment. They employ all-round molders (the key foundry occupation) and a substantial number of unskilled laborers.

Some large foundries are highly mechanized and produce great quantities of identical castings. In such shops, cranes, conveyors, and other types of materials-handling equipment are used to move castings, equipment, and materials. These shops employ relatively few unskilled laborers. Also, they employ proportionately fewer skilled workers than small, unmechanized shops, because the job duties of the all-round molder, coremaker, and other skilled workers are divided into specialized functions performed by semiskilled workers.

There are foundry jobs in every State and almost every large- or medium-size city in the country. Frequently, foundries are located near plants where their castings are used. As a result, foundry jobs tend to be concentrated in areas where there is considerable metalworking activity. The greatest numbers of foundry workers are employed in Ohio, Michigan, Pennsylvania, Illinois, and Indiana.

Foundry Occupations

More than four-fifths of the approximately 375,000 workers in foundries or foundry departments in early 1963 were employed in plant occupations. More than half of the plant workers were employed in occupations not found in other industries. It is these occupations that are chiefly discussed in this chapter of the *Handbook.*

To explain more clearly the duties of foundry workers, a brief description of the jobs involved in the most common casting process—sand casting—follows.

The first step in foundry work after the casting has been designed is for the *patternmaker* to make a wood or metal pattern in the shape of the final casting desired. Next, a *hand molder* makes a sand mold by packing and ramming sand, specially prepared by a *sand mixer* (D.O.T. 4–82.310; 6–82.310 and .320), around the pattern. A *molder's helper* (D.O.T. 8–82.10) sometimes assists in these operations. Where large numbers of identical castings are made, molding machines are used to perform many operations 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 *sand mixers*, into a core (a body of sand designed usually to create a hollow space in the casting). The core is baked in an oven by a *core-oven tender* (D.O.T. 6–82.120). Core parts or sections are put together by a *core assembler*

Pourer fills mold on conveyor line with molten metal

(D.O.T. 6–82.060). The core is then placed in the mold and the mold is ready for the metal pouring.

A *melter*, or *cupola tender* (D.O.T. 4–91.351, .411, .441, and .572), operates a furnace that melts the metal. The metal is customarily poured into the mold by a *pourer* (D.O.T. 6–91.612, and .613), although in some small foundries it is part of the molder's job. When the casting has cooled, it is taken out of the mold by a *shake-out man* (D.O.T. 8–82.10) and sent to the cleaning and finishing department.

Chippers (D.O.T. 6–82.910) and *grinders* (D.O.T. 6–82.330) use pneumatic chisels, powered abrasive wheels, powersaws, and handtools, such as hammers, chisels, and files, to remove excess metal and to finish the casting. The rough surface of the casting may be cleaned by sandblasting. *Sandblasters* (D.O.T. 6–82.720) operate machines which blast the casting with air mixed with abrasive particles. The casting surface may be smoothed by tumbling. In this process, 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 men who control these barrels are called *tumbler operators* (D.O.T. 6–82.730). Sandblasters and tumbler operators may also operate a machine that both tumbles and blasts the castings.

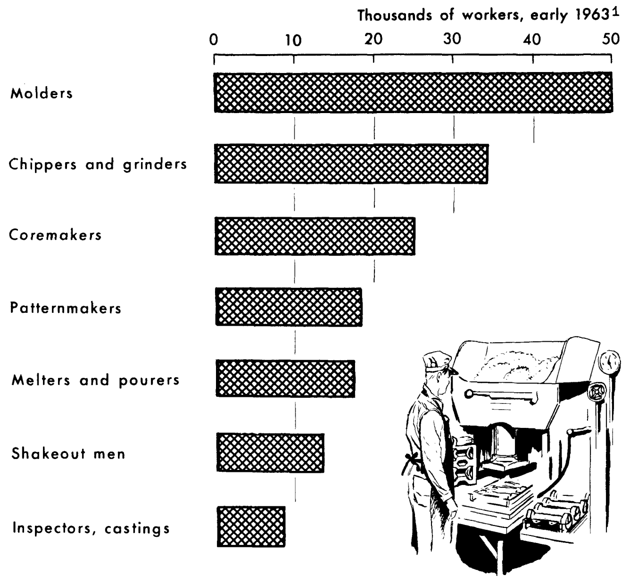
The casting may be placed in heat treating furnaces to improve the physical properties of the metal; *heat treaters*, such as *annealers* (D.O.T. 6–87.110), run these furnaces. *Casting inspectors* (D.O.T. 6–82.920) then check finished castings for structural soundness and properties, and determine whether their dimensions meet blueprint specifications.

The estimated numbers of workers in the principal occupations unique to the foundry industry are shown in chart 36. Detailed discussions of the duties, training, and other qualifications; earnings; and employment outlook for three of these occupations—molders, coremakers, and patternmakers—are given at the end of this chapter.

Many foundry workers are employed in occupations that are common to other industries. In early 1963, more than 25,000 workers such as maintenance mechanics, machinists, carpenters,

CHART 36

EMPLOYMENT IN SELECTED FOUNDRY OCCUPATIONS ....



[1] Estimated.

and millwrights were employed in foundries to maintain and repair plant and equipment. The industry also employed about 10,000 crane and derrick operators and truckdrivers. In many foundries, some of the castings are machine finished. An estimated 8,000 machine tool operators were employed to do this work. Foundries also employed about 83,000 workers in relatively unskilled jobs, such as guard, janitor, laborer, and helper.

More than 45,000 foundry workers were employed in professional, office, managerial, or sales jobs. Included in this group were approximately 14,000 engineers, chemists, metallurgists, and other technical workers. Some were employed in research activities. In recent years, increasing numbers of engineers and other technical personnel have been employed by foundries to improve the quality of castings and increase the efficiency of production operations. These workers have already developed methods of reducing the weight of castings without impairing strength or other important characteristics. They have also devised new production techniques that have increased the degree of accuracy obtainable in the molding process. Other engineers and scientists were employed by foundries to design and layout machinery and equipment and to supervise plant operation and maintenance.

About 2,000 of the industry's professional and technical workers were technicians who worked in a variety of functions concerned with the control of quality in casting production. In this group are workers who test molding and coremaking sand, make chemical analyses of metal, and operate machines which test the strength and hardness of castings. Some use X-ray or magnetic apparatus to inspect the internal structure of castings.

The foundry work force is predominantly male. Women, who make up only about 6 percent of the industry's work force, are employed primarily in office jobs, but some are employed in plant jobs such as semiskilled coremaker.

Training, Other Qualifications, and Advancement

Most foundry plant workers start in unskilled jobs, such as laborer or helper. Specialized jobs in the plant are frequently filled by promotion. 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.

The majority of skilled foundry workers—particularly hand molders, hand coremakers, and patternmakers—learn their jobs through formal apprenticeship. In this type of training, the young worker is given supervised on-the-job training for a period of 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.

Employment Outlook

The foundry industry will hire, or rehire, thousands of workers during the remainder of the 1960's and in the longer run, 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 from 7,000 to 10,000 job openings annually.

A sizable increase in foundry production is expected to result from the expansion of industries that use castings—such as construction, electrical equipment, and machinery manufacturing. However, foundry employment is expected to rise at a much slower rate than production. 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 worker.

The employment of scientists, engineers, and other technical personnel is expected to increase more rapidly than other foundry occupations as a result of expanding research activity in such areas as quality control and casting methods. Technicians—particularly sand technologists and metallurgical assistants—also will be employed in greater numbers as the foundry industry introduces 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.

Employment in foundries has been sensitive to changes in general business conditions, and it is expected that substantial year-to-year changes in the level of foundry employment will continue.

Earnings and Working Conditions

Wages in foundries are somewhat above the average for all manufacturing. In May 1963, production workers in iron and steel foundries earned an average of $111.76 a week or $2.68 an hour (including pay for overtime and night work). In nonferrous foundries, the average was $105.47 a week or $2.56 an hour. These averages compare with average weekly earnings of $99.47 or average hourly earnings of $2.45 for production workers in all manufacturing industries in the same month.

Working conditions in foundries have improved greatly in recent years. In many new foundries, the heat, fumes, smoke, and noise that are part of foundry operations have been reduced. Progress has also been made in reducing the foundry industry's injury-frequency rate (the average number of disabling work injuries for each million employee-hours worked). However, this rate is higher than the rate for manufacturing industries as a whole. From 1947 to 1962, the injury-frequency rate in independent gray-iron and malleable-iron foundries was reduced from 44.5 to 24.9, and from 27 to 21.2 in independent nonferrous foundries. The rate for all manufacturing industries was 11.4 in 1962.

Patternmaking and coremaking generally have the lowest injury rate among the different foundry production operations; molding has a somewhat higher rate. Jobs in melting and chipping tend to have the highest injury rates.

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

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

National Foundry Association,
4321 St. Charles Rd., P.O. Box 172, Bellwood, Ill. 60104.

Non-Ferrous Founders' Society, Inc.,
509 Terminal Tower, Cleveland, Ohio, 44113.

Gray 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,
Union Commerce Bldg., Cleveland, Ohio, 44114.

Steel Founders' Society of America,
606 Terminal Tower, Cleveland, Ohio, 44113.

Detailed discussions of professional, technical, mechanical, and other occupations found in the foundry industry as well as in many other industries are given in the sections of this *Handbook* covering the individual occupations. See index for page numbers.

Molders

Nature of Work

The *molder* prepares a mold, made of specially prepared sand, which contains a hollow space in the shape of the item to be made. The mold is made by packing and ramming prepared sand around a pattern—a model of the object to be duplicated—in a molding box called a flask. A flask is usually made in two parts which can be separated to allow removal of the pattern by the molder without damaging the mold cavity. Molten metal is poured into the cavity which, when solidified forms the casting. The sand is prepared by adding water and other substances so it will hold its shape and not crumble when molten metal is poured into the mold. A molder uses rammers, trowels, shovels, mallets, and other handtools in the handling, compacting, and smoothing of sand in molds made by hand.

The nearly 50,000 workers in this occupation in early 1963 were classified either as hand or machine molders. *Hand molders* use mainly hand methods to make the sand molds. Molds for small castings are usually made on the workbench by *bench molders* (D.O.T. 4–81.010); those for large and bulky castings are made on the foundry floor by *floor molders* (D.O.T. 4–81.030). Skill requirements in this occupation 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.

Machine molders (D.O.T. 4–81.025 and .050; 6–81.010 and .020) operate machines which simplify and speed the making of large quantities of

Hand molders use trowels to finish floor mold

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. These workers are usually semiskilled, and their duties are limited to operating the machines which are set up for them. Sometimes they are journeymen molders who set up and adjust their own machines with little supervision.

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 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 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 works in other foundry departments to develop all-round knowledge of foundry methods and practice. He is taught to prepare sand, to melt metal, and to clean and finish castings. In addition, 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, while on the job, and then seek jobs as journeymen. However, this is often a lengthier and less reliable way of learning the trade than through 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 roughly similar, without close supervision.

The more difficult and responsible types of machine molding jobs also require formal or equivalent training. However, machine molders whose jobs require less skill ordinarily learn their jobs 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 learners of 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 during the next 10 to 15 years. Retirements and deaths alone will provide about 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.

Little increase in the total number of molders is expected, despite the anticipated increase in foundry production. The continuation of the trend toward more machine molding and less hand molding, and the increasing use of permanent molds and shell molds, will result in a greater output per molder.

Earnings and Working Conditions

In late 1962, machine molders had straight-time hourly earnings of $2.92. However, hourly wages by metropolitan area, where most foundries are located, varied significantly. For example, machine molders in gray iron foundries earned $2.65 an hour in Pittsburgh, Pa., and $3.27 in San Francisco–Oakland, Calif., and hand, bench molders in gray iron foundries earned $2.66 an hour in Philadelphia, Pa., and $2.94 in St. Louis, Mo.

Most molders are members of labor unions. Many of them have been organized by the International Molders' and Allied Workers' Union of North America. Others are members of 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.

See introductory section of this chapter for where to go for more information.

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. 4–82.010) and bulky cores are made on the foundry floor by *floor coremakers* (D.O.T. 4–82.010). There is a wide range of skill requirements in this occupation. All-round hand coremakers (journeymen) prepare 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. 6–82.010, .020, and .030) operate machines which make sand cores by forcing sand into specially shaped hollow forms. 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. Machine coremakers are employed mainly in foundries where large quantities of identical castings are made.

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 operating machine which 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

During the 1960's and in the longer run, employment of hand and machine coremakers is expected to increase slowly above the early 1963 level of about 25,000.

The trend from hand-made to machine-made cores is expected to continue in the years ahead. The anticipated increase in output per worker is expected to limit the growth in the number of coremakers. The need to replace experienced workers who retire or die will create about 500 additional job openings annually for new workers. Other new workers will be required to replace coremakers who transfer to other fields of work.

Earnings and Working Conditions

In late 1962, straight-time average hourly earnings were $2.75 for machine coremakers and $2.69 for hand coremakers. Hourly wages by metropolitan area, however, varied significantly. For example, machine coremakers in gray iron foundries earned $2.67 in St. Louis, Mo., and $3.19 in San Francisco–Oakland, Calif., and hand coremakers in gray iron foundries earned $2.51 in Philadelphia, Pa., and $3.15 in San Francisco–Oakland, Calif.

Most coremakers are members of labor unions. Many of them have been organized by the International Molders' and Allied Workers' Union of North America. Other unions which have coremakers in their membership include 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.

See introductory section of this chapter for where to go for more information.

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. 5–17.010). A large proportion are *wood patternmakers* (D.O.T. 5–17.020) and a small number work with other materials such as plaster and plastics.

Patternmakers work from blueprints prepared by the engineering department. 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, more commonly, from rough castings made from an original wood pattern. He uses a variety of metalworking machines, including the engine lathe, drill press, shaper, milling machine, power hacksaw, and grinder, to shape and finish the patterns.

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

Throughout his work, the patternmaker carefully checks each dimension of the pattern. A high degree of accuracy is required, since any imperfection in the pattern will be reproduced in the castings made from it. Patternmakers also may make core boxes (in much the same manner as patterns are constructed) and repair patterns and core boxes.

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.

Patternmaker uses gouge to carve wood pattern

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 720 hours of classroom instruction in related technical subjects is normally provided. 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

Employment of foundry patternmakers is expected to increase slowly during the remainder of the 1960's and in the longer run. The trend toward the production of large numbers of identical castings will result in greater use of metal and plastic rather than wood patterns. As the more durable metal patterns can be used many times in the making of identical molds, the number of individual patterns required for a given number of castings has declined.

Replacement needs will provide some job opportunities for new workers to be trained as patternmakers. It is estimated that a few hundred new patternmakers will be needed annually to replace workers who transfer to other fields, retire, or die. Most of the job openings will be in metal patternmaking.

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

Earnings and Working Conditions

In late 1962, straight-time average hourly earnings were $3.72 for metal patternmakers and $3.27 for wood patternmakers. However, hourly wages by metropolitan area varied significantly. For example, wood patternmakers in gray iron foundries earned $3.14 an hour in Pittsburgh, Pa., and $4.18 in San Francisco–Oakland, Calif. Hourly wages also varied within metropolitan areas, mainly on the basis of differences in workers' skills. For example, in Chicago, Ill., hourly wages of some wood patternmakers averaged $3 and those of others averaged more than $4.20.

Many patternmakers are members of the Pattern Makers' League of North America.

See introductory section of this chapter for where to go for more information.

HOTEL OCCUPATIONS

Everywhere people travel in the United States, whether for business or pleasure, they find hotels and motels ready to provide them with a "home-away-from-home." Operating these hotels, motels, and related businesses required approximately 600,000 people in 1962. Roughly 4 out of every 5 of these workers were employed in the Nation's nearly 30,000 hotels and motor hotels, chiefly in urban areas. Of the remainder, most worked in the substantially larger number of motels and tourist courts located on the outskirts of large cities, along major highways, and, to some extent, in resort areas. A few hotel workers were employed in related businesses such as summer camps and dude ranches. About half of all the employees in hotels and related businesses were women.

Many hotel workers are in occupations which can be entered with little or no specialized training. However, in many kinds of hotel work, the demand for specially trained people is increasing. Hotels are complex organizations and need some personnel with specialized training, as well as long experience in the business, to direct and coordinate operations which may involve thousands of guests annually and millions of dollars' worth of property and equipment.

This chapter deals with employment opportunities in hotels, motels, and related businesses. Following the introductory sections are separate statements on several occupations unique to hotel operations.

The Hotel Business and Its Workers

Hotels are of three main 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 of one or a few nights. 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 lodgings mainly for vacationers. Motor hotels, motels, and other establishments catering especially to motorists accommodate vacationers and other travelers, but rarely have guests who stay for long periods. 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 of these establishments are remaining open the year round.

Hotels range from modest two- or three-story establishments to towering buildings covering large areas. There are small commercial and residential hotels with less than 25 rooms and only a few employees, and there are some large ones with 1,000 or more rooms and many hundreds of workers. Resort hotels range from the small "family-operated" type to those employing several hundreds of workers during their peak seasons. In the past few years, an increasing number of motor hotels, some with a hundred or more rooms, have been built, and these may have large staffs. Most motels, however, are relatively small, including a sizeable number which are run by the owners without any paid help or possibly with one employee.

Most hotels have restaurants, ranging from simple coffee shops to vast dining rooms, wine cellars, and elaborate kitchens. Large city hotels and motor hotels also 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, 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 supply baby sitters. Often there are newsstands on the premises and gift shops, barber and beauty shops, laundry and valet services, and railroad and airline ticket reservation offices. Motels and tourist courts typically offer fewer services than hotels. The number with restaurants, swimming pools, and other conveniences for guests is steadily increasing, however. The new deluxe motor hotels provide the same variety of services as other high-class hotels.

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.

A uniformed staff performs services "up front" in the hotel lobby. This staff includes the bellmen who, directed by bell captains, carry baggage for guests and escort them to their rooms. Doormen are also a part of the uniformed staff, as are elevator operators, who are gradually being replaced by self-service elevators.

The front office staff, most of whom are men, work in hotel lobbies as room clerks, key clerks, mail clerks, and information clerks. Their chief duties are to greet guests, assign rooms, and furnish information. Perhaps half of all hotel clerical workers are front office employees. The remainder of the clerical workers, mainly women, are employed in a variety of office occupations such as bookkeeper, cashier, telephone operator, secretary, stenographer, and typist. These occupations are discussed elsewhere in this *Handbook*. (See index for page numbers.)

Managers and their assistants are a relatively small group with the highly important task of supervising hotel operations and making them profitable. A general manager is in overall charge of hotel operations. Sometimes general managers have executive assistants who may be in charge of the front office or help with other phases of hotel management. Some assistants may be responsible for specific operations; they may be, 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 numerous other types of workers who are also found in other industries. Among these are accountants and auditors, personnel workers, musicians and entertainers, and recreational workers. There are also maintenance workers such as carpenters, electricians, stationary engineers, plumbers, and painters. Still other types of workers employed in hotels include detectives, barbers, beauty salon operators, valets, tailors, seamstresses, and gardeners. (See index for separate statements on many of these and other occupations found both in hotels and in other industries.)

Employment Outlook

A moderate increase in employment is likely in this industry during the middle and late 1960's. In addition, many thousands of workers will be required each year to replace those who retire, die, transfer to other kinds of employment, or leave for other reasons. Most of the anticipated growth in employment will stem from the need to staff the new hotels, motor hotels, and motels being built in and around major cities all over the country. Limited expansion will probably also take place in older hotels that take steps to meet the challenge of increasing competition for business by modernizing their facilities and expanding their services. Hotels that are unable to update their facilities, however, are likely to experience low occupancy rates and may be forced to reduce overhead costs by eliminating services and the workers who provide them. 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.

Over the long run, the demand for hotel rooms and other lodgings is expected to increase as the country's population grows and travel for business and pleasure increases. On the other hand, this demand will be limited somewhat by the increasing use of 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. Employment is likely to rise more rapidly in motels, motor hotels, and other businesses catering especially to motorists than in commercial hotels. This trend, which has been evident for some time is likely to 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 workers (not counting the new owners) will be in housekeeping and food-service occupations such as maid, cook, and waitress.

Most of the job openings in hotels will continue to be in occupations which can be entered with little specialized training, such as maid, porter, houseman, kitchen helper, and some dining room jobs. These jobs not only account for a large proportion of all hotel workers, but also 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. Furthermore, many of the workers are women, who often leave their jobs to stay at home and take care of their families. In a few of these occupations, however, 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 young people will also be needed every year in front office jobs, in which some vacancies can be expected to arise owing to promotion of clerks to managerial posts as well as from the increase in the number of hotels and motor hotels. Good opportunities are also expected for young people who acquire the training and experience necessary to qualify for jobs as cooks and food managers. In addition, there will be openings for some clerical workers, although the use of office machine may continue to affect clerical employment in hotels. (Food service workers and office workers are discussed in the chapters on Restaurant Occupations and Clerical and Related Occupations. See index for page numbers.)

Earnings and Working Conditions

Hotel workers' earnings depend not only on their occupations but also on the location, size, and type of the hotel. These factors largely determine both the workers' wages and the amount received in tips—a major part of earnings for many hotel workers, including bellmen, waiters, and waitresses.

Salaries of hotel employees in managerial positions have an especially wide range, mainly because of great differences in the duties and responsibilities of such personnel. Management trainees who had graduated from colleges offering specialized hotel management programs had beginning salaries of approximately $5,000 in early 1963. Increases are usually given trainees periodically for the first year or two, and thereafter may be granted as the employees are advanced to more responsibile positions. 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 the tips they receive, it is difficult to obtain meaningful data on their income. In New York City, wages of bellmen who were union members ranged from $33.45 to $36.35 in mid-1962 for a 40-hour week. With tips, earnings were probably considerably higher. In large luxury hotels and in resort areas, bellmen may earn $100 or more a week (including tips).

Data on the earnings of nonsupervisory workers in several hotel occupations are available from a 1961 survey made by the Bureau of Labor Statistics in 23 large cities. Except for bellmen, waiters, and waitresses, who usually receive tips which add substantially to their salaries, maids typically received the lowest pay of any of the occupations surveyed, and room clerks the highest. In practically all occupations, earnings were generally lower in southern cities than elsewhere and highest in cities in the West.

The average earnings of maids (some of whom may also receive tips) ranged from 46 cents an hour in Atlanta to $1.54 an hour in the San

Francisco–Oakland area. For housemen and lobby cleaners, the averages were generally a little higher. For elevator operators they were a little higher still—ranging from less than $1 an hour in some cities to $1.66 for men in San Francisco, and Oakland and $1.71 for women in New York City. Men room clerks averaged from $1.27 an hour in Indianapolis to $2.14 in San Francisco and Oakland; the relatively few women room clerks made somewhat less. Key, mail, and information clerks are usually paid lower salaries than room clerks.

The scheduled workweek for most front office clerks 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. Housemen and most other nonsupervisory employees generally work a 40-hour week, except in the South where the scheduled week is usually 48 hours.

Since hotels are open round the clock, workers may be employed on any one of three shifts, beginning early in the morning, in mid-afternoon, or at midnight. Staffs are usually smaller on night than on day shifts, and additional compensation may be paid for work during late hours. Managers and housekeepers who live in the hotel usually have regular work schedules but may be on call 24 hours a day, 7 days a week.

Cooks, pantry workers, dishwashers, and other kitchen help commonly receive two free meals a day; in a few hotels, maids, elevator operators, and room clerks also receive free meals while on duty. Many workers receive a week's vacation with pay after 1 year of service and 2 weeks after 3 or more years. Paid holidays—frequently, 4 to 6 a year—are usually provided. Group life insurance, hospitalization, and surgical insurance plans are frequently provided hotel workers.

The Hotel and Restaurant Employees and Bartenders International Union is the major union in the hotel business. Uniformed staffs, such as bellmen and elevator operators, may be members of the Building Service Employees International Union.

Where To Go for More Information

Information on jobs in hotels may be obtained directly from personnel departments of hotels.

Information on 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.,
Kettering Memorial Hospital, 3535 Southern Blvd.,
Kettering, Ohio, 45643.

Information on courses relating to hotel work may be obtained from the local Director of Vocational Education, the Superintendent of Schools in the local community, or the State Director of Vocational Education in the Department of Education in the State capital.

Bellmen and Bell Captains

(D.O.T. 2–22.11; 2–22.01)

Nature of Work

Bellmen, also called bellboys or bellhops, carry baggage and perform a variety of other services for hotel guests. After a guest has registered, a bellman obtains the room key, takes the guest to his room, and deposits his baggage. The bellman checks the lights and the supply of towels and soap, and sees that everything is in order in the room. He may suggest the use of various hotel services, including the dining room and the valet service. Bellmen also deliver packages and perform other errands for guests. In large hotels, special baggage porters are usually employed to carry baggage for guests who are checking out. In smaller hotels, bellmen carry baggage for outgoing as well as incoming guests and may also

Captain inspects bellmen

relieve the elevator operator or switchboard operator.

Bell captains are employed in large hotels and many medium-size ones, to supervise the bellmen. They assign work to these employees, keep their time records, and instruct new bellmen in their duties. In addition, they handle complaints from guests regarding the work of their department, and take care of unusual requests for service. They may also help guests arrange for transportation by giving them information on train and plane schedules and sending a baggage porter or a bellman to pick up the transportation tickets. At times, bell captains may also perform the duties of bellmen.

Training and Other Qualifications

Bellman jobs are filled, in many hotels, either by promoting men employed as elevator operators or by hiring experienced bellmen from the outside. Some hotels, particularly the smaller ones and resort hotels, hire inexperienced young men as bellmen.

Young men seeking work as bellmen may apply to personnel departments of hotels in their own community, where their knowledge of the local area will be helpful in giving guests information. Applicants are often referred to bell captains for an interview. Work and character references of job applicants are carefully checked prior to hiring. Since bellmen are in frequent contact with the public it is important that they be neat, tactful, and courteous. They must also be able to be on their feet all day and to carry heavy baggage.

No specific educational requirements exist for bellman jobs. However, courses covering bellman work, which are offered by a small but growing number of trade and vocational schools, are generally helpful in obtaining jobs. Graduation from high school is also valuable because outstanding bellmen with this educational background may be transferred to front office clerical jobs, which offer better opportunities for promotion. (See statement on Front Office Clerks in this chapter.)

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, it may be a number of years before an opening occurs. Opportunities for advancement to the position of superintendent of service are even more limited. Men in this job—which is found in only a few hotels with large service departments—supervise elevator operators and starters, doormen, and washroom attendants, as well as bellmen.

Employment Outlook

A few thousand openings for bellmen are expected each year throughout the remainder of the 1960's mainly because of the need to replace young men who shift to other kinds of work. Since a promotion-from-within policy is followed by many hotels in advancing men from elevator operator to bellman jobs, chances for outsiders to enter year-round jobs as bellmen will be best in hotels which employ women as elevator operators, and in the increasing number of hotels with automatic elevators. Many opportunities will also arise in resort hotels which are open only part of the year and hire college students and other young men for temporary jobs. Vacancies for beginners will also occur in small hotels, as experienced bellmen shift to jobs in better hotels where earnings from tips may be higher. Competition among employed bellmen for the relatively few bell captain jobs that will become available in the future is expected to remain keen.

Only slight growth in employment of bellmen is likely in the long run. Some additional jobs will open up as new hotels and motor hotels are built and additions are made to existing hotels. The fast growing motel business will also provide some new 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 Where Employed, Earnings and Working Conditions, Where To Go for More Information, and for additional information on Employment Outlook.

Front Office Clerks

(D.O.T. 1–.07.)

Nature of Work

Most hotels employ one or more front office clerks to greet guests, rent rooms, handle mail, and do other work related to assigning rooms. Working "up front" in hotel lobbies, they deal directly with the public and help build a hotel's reputation for courteous and efficient service. In small hotels and in motels, a front office clerk (who may be the owner) may not only rent rooms, issue keys, sort mail, and give information, but also 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 (D.O.T. 1–07.60) mostly men, have the responsible job of filling the available rooms. They usually are the first of the front office clerical staff to greet guests. In assigning rooms, they must consider any preferences guests may express, and at the same time try to obtain maximum revenues for the hotel. Room clerks give information about hotel 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. *Key clerks* (D.O.T. 1–07.20) issue and receive room keys. *Reservation clerks* (D.O.T. 1–07.50) 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* (D.O.T. 1–07.40) insert or remove forms indicating when rooms become occupied or vacant or when they are closed for repairs. They also keep housekeepers, telephone operators, and other personnel informed about changes in room occupancy.

Room clerk receives hotel guest's registration form

Other special clerks, such as *mail and information clerks* are employed in some hotels. In the largest hotels, *floor supervisors* or *floor clerks* (D.O.T. 1–07.10) are assigned on each floor to handle the distribution of mail and packages and perform other incidental duties.

In all but the very largest hotels, 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. Men are generally preferred as room clerks and, in some hotels, for more routine front office jobs, since hotel managers, most of whom are men, are often selected from among the front office clerks. 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, where the front office clerks often handle a variety of jobs. Although education beyond high school is generally not required for front office work, hotel employers are placing increasing emphasis on college training in selecting personnel, who may later be advanced to managerial positions. Front office clerks may improve their opportunities for promotion by taking home study courses, such as those sponsored by the 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 background information about the hotel, such as the location of rooms and the types of services offered. After new employees begin work, they receive help when necessary from the assistant manager or some experienced front office worker.

Front office workers usually start out as key clerks or mail clerks, or in other fairly routine jobs. Sometimes outstanding employees in other types of hotel work—for example, bellmen or elevator operators—may be transferred to such front office jobs. Most hotels have a promotion-from-within policy for front office workers. Advancement depends on the individual's personal characteristics, his on-the-job performance, and, of course, on the number of openings that arise. A typical line of promotion might be from key or rack clerk to room clerk, to assistant front office manager, and later to front office manager. Further opportunities exist for promotion to top managerial posts which usually require many years of hotel experience. (See statement on Hotel Managers and Assistants later in this chapter.)

Employment Outlook

A limited number of openings in this relatively small occupation will probably arise each year throughout the remainder of the 1960's. Most of them will be in beginning jobs which become vacant as a result of promotions. Some new jobs will become available in cities where new hotels will be built or existing ones expanded. In addition, there will be new front office jobs in the hundreds of motor motels and large motels that will open for business in the years ahead.

Hotel employers will continue to hire women in a few front office jobs such as those of mail and information clerk and reservation clerk, but women's chances for advancement to room clerk jobs and to managerial posts will probably remain limited. Women will find somewhat better opportunities in resort than in commercial hotels.

Front office clerks have relatively stable employment. The number of workers employed in this occupation does not tend to expand or contract as sharply with changes in general economic conditions as employment in many other hotel occupations and many other industries.

See introductory section to this chapter for information on Where Employed, Earnings and Working Conditions, Where To Go for More Information, and for additional information on Employment Outlook.

Housekeepers and Assistants

(D.O.T. 2-25.21, .22)

Nature of Work

Hotel housekeepers are responsible for the many kinds of work that must be done to keep the hotel clean and attractive. They hire and discharge maids, housemen, and other employees in their department—which is, in many instances, the largest department in the hotel. They help train new employees, 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 supervise the cleaning staffs and 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 may 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; take periodic inventories; and have responsibility for interior decorating work. Some executive housekeepers employed by large hotel chains may have special assignments such as reorganizing housekeeping procedures in an established hotel or setting up 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 or more floors. Large hotels may also employ assistant executive housekeepers. The great majority of housekeepers and their assistants are women.

Executive housekeeper supervises houseman cleaning woodwork

Training, Other Qualifications, and Advancement

No specific educational requirements exist for housekeepers. These positions are usually filled by promoting assistant or floor housekeepers, or by hiring people who have held positions of this kind in other hotels or in hospitals. Maids and linen room attendants are sometimes considered for jobs as floor or assistant housekeepers.

Specialized training in hotel administration, including courses in housekeeping, was available at several colleges in 1962, and at least two offered a bachelor of science degree with a major in housekeeping. In addition, some universities offer short summer courses or conduct evening classes in cooperation with the National Executive Housekeepers Association. Probably 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

Several hundred openings for housekeepers and their assistants are expected each year during the middle and late 1960's. Most openings are expected to result from the need to replace workers who retire or leave the occupation for other reasons. However, some new positions for housekeepers will also become available in newly built hotels and motor hotels in cities, as well as in the growing number of large luxury motels. In established hotels, most openings for housekeepers and their assistants will be filled from within by promotion of assistant housekeepers and maids. However, since only one top job as housekeeper exists in each hotel, it is sometimes many years before an opening of this kind occurs in a given hotel. Housekeepers with hotel experience will also find employment opportunities in hospitals, clubs, college dormitories, and a variety of welfare institutions.

See introduction to this chapter for information on Earnings and Working Conditions, Where To Go for More Information, and for additional information on Employment Outlook.

Managers and Assistants

(D.O.T. 0–71.13, .15; 0–97.63)

Nature of Work

Hotel managers have overall responsibility for operating their hotels profitably and at the same time providing maximum comfort for guests. Within the framework of policy set by owners or boards of directors, managers direct and coordinate the activities of the front office, kitchen and dining rooms, and the various departments such as housekeeping, service, accounting, personnel, purchasing, publicity, and maintenance. They make decisions on room rates, establish credit policy, introduce improvements in operations, and have final responsibility for dealing with many other kinds of problems that arise in connection with operating their hotels. Like many 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 may perform much of the front office clerical work in addition to his administrative duties. In the smallest hotels and in many motels, the owners—often a husband-and-wife team—do all the work necessary to run the business.

The general manager of a large hotel may have several assistants, each assigned an area of responsibility. An executive assistant may be employed to manage one or more departments and to assume general administrative responsibility when the manager is absent. Because food preparation and service is such an important part of the operation of most large hotels, a special manager is usually in charge of this department. (The occupation of restaurant manager is discussed in the chapter on Restaurant Occupations. See index for page number.) Managers of large hotels usually also employ a special assistant, known as sales manager, whose job is to promote maximum use of hotel facilities. Much of the sales manager's time is spent traveling about the country explaining to various groups the facilities his hotel can offer for meetings, banquets, and conventions.

Since large hotel chains often centralize certain activities such as purchasing supplies and equipment and planning employee training programs, managers of these hotels may have fewer different duties than managers of large independently owned hotels. In hotel chains, managers may be assigned on a temporary basis to help organize work in a newly acquired hotel, or they may be transferred to established hotels in different States or in foreign countries.

Hotel manager helps guest make arrangements for dinner party

Training, Other Qualifications, and Advancement

Managerial positions are usually filled by experienced men who have come up from the ranks. In accordance with the promotion-from-within policy followed by most hotels, individuals who have proved their ability, usually in front office jobs, may be promoted to assistant manager positions and eventually to general manager.

Although successful hotel experience is genally the first consideration in selecting managers, employers are placing increasing emphasis on a college education. Many believe the best educational preparation is that provided by the few colleges in the country which offer a specialized 4-year curriculum in hotel administration, including study in the field of food management. Specialized courses in hotel work, available in a few junior colleges, and home study courses given by the Educational Institute of the American Hotel and Motel Association are also regarded as 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 engineering (plumbing and heating systems, refrigeration, and electrical equipment). In addition, students are encouraged to study foreign languages and other subjects of cultural value such as history, philosophy, and literature. They are also required to spend three summer vacations working in hotel or restaurant jobs—for example, as busboys or bellmen, room clerks, or sometimes as assistant managers. The experience and contacts with employers gained in these jobs may enable young people to obtain better hotel positions after graduation.

College graduates who have specialized in hotel administration usually begin their hotel careers by working in front office clerical jobs; after several years of experience, they may advance to top managerial positions. An increasing number of employers are requiring some experience in food operations. Chances for advancement may be somewhat better in hotel chains than in independent hotels, since persons may be selected to fill vacancies which arise in any hotel in the chain as well as on the central management staff.

Company training programs for managers are a recent development in hotels. Some large 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 good opportunities throughout the remainder of the 1960's to obtain entry positions that offer the possibility of promotion to managerial work. There is likely to be keen competition for the relatively few promotional opportunities that become available each year, however. Young men with college degrees in hotel administration will have preference for good entry positions and later advancement, particularly if they can handle food management or can qualify as sales managers. Most openings for management personnel will probably result from the need to fill vacancies resulting from turnover. For general managers, a limited number of openings can be anticipated, primarily because of retirements and deaths; for assistant managers, a somewhat greater number of openings will arise, principally because of promotions or transfers to other fields of work.

The number of hotel managers is expected to increase moderately over the long run. New positions will arise as additional hotels are built and old ones enlarged, and as the number of luxury motor hotels and motels expand. Salaried hotel managers make up a relatively small occupational group, however, and only a limited number of job opportunities for newcomers, can be expected.

See introductory section of this chapter for information on Where Employed, Earnings and Working Conditions, Where To Go for More Information, and for additional information on Employment Outlook.

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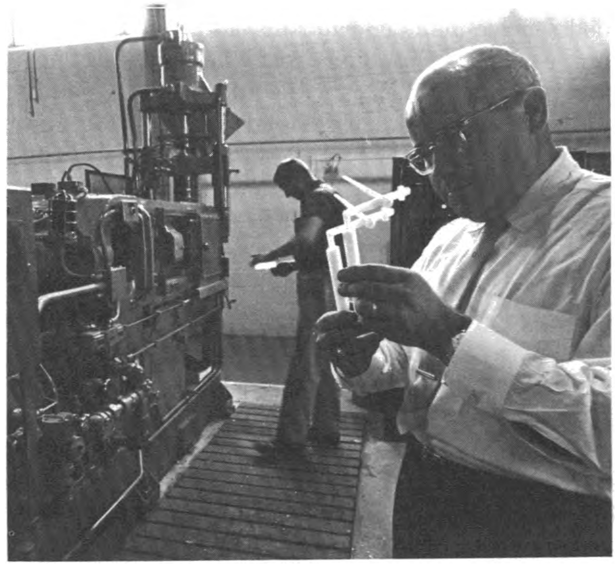
OCCUPATIONS IN THE INDUSTRIAL CHEMICAL INDUSTRY

The industrial chemical industry has developed, in just a few decades, into one of the great manufacturing industries in the country. The products of this industry, estimated at more than 10,000, are used by almost all other manufacturing industries. The industrial chemical industry is also important to our defense and space activities since materials for munitions, launching vehicles for missiles and spacecraft, and other military and space supplies require many types of industrial chemicals.

In early 1963, about 450,000 wage and salary workers were employed in the industrial chemical industry in a wide range of occupations. Job requirements vary from graduate college degrees for some scientists and engineers to a few days of on-the-job training for some plant workers.



Chemical engineer examines parts developed from new plastic formulation

Nature of the Industry

The industrial chemical industry is made up of plants which manufacture basic and intermediate organic and inorganic chemicals. These chemicals are used mainly by other industries as raw materials or as processing agents to make their own products. Industrial chemicals are unlike other chemical products, such as drugs, paints, and fertilizers, which are sold directly to the consumer without further processing.

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 (nylon, rayon, and orlon), 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 steel, glass, paper, gasoline, and other products.

The manufacture of chemicals differs from the manufacture of other types of products. Most industries start with a raw material (such as wood or metal) and make it into a product (such as a chair or a nail). The raw material can be identified in the final product. The chemical industry, however, makes products completely unlike the raw materials used to make the products. For example, by combining and rearranging molecules (the smallest particles of a compound) found in coal, air, and water, the chemical industry can produce nylon, a product with no resemblance to any of 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 are usually in liquid or gas form, flow through pipes. 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.

Approximately 2,500 plants in the United States make industrial chemicals. Chemical plants are usually located on the outskirts of industrial centers. Sometimes plants are built near the source of raw material; for example, plants which produce chemicals made from petroleum and natural gas are located near the oilfields of Texas, California, and Louisiana.

Industrial chemical workers are employed in many States, but nearly half of them are in the following 10 States: Tennessee, New Jersey, Texas, Ohio, West Virginia, Virginia, New York, Michigan, Louisiana, and Illinois.

Occupations in the Industry

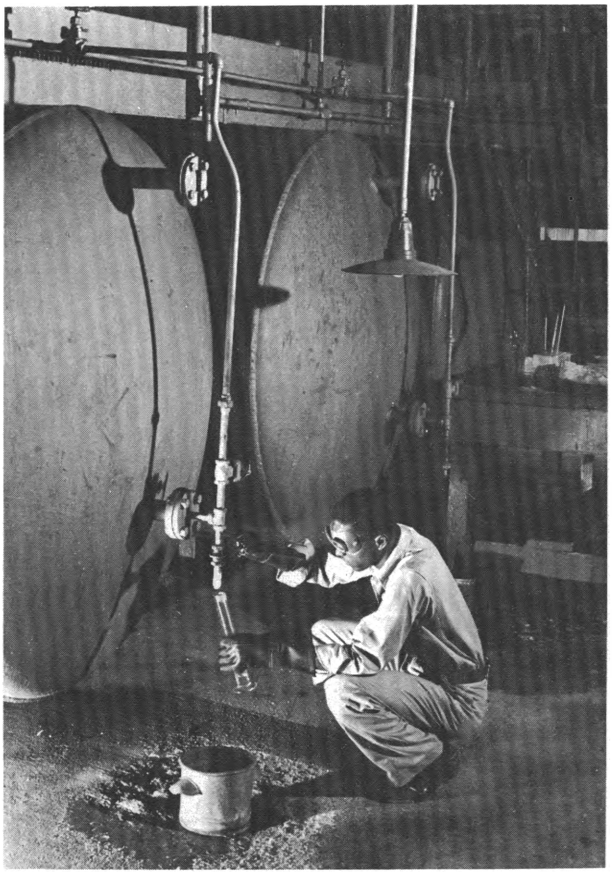
Workers with many different levels of skill and education are employed in the plants, offices, and laboratories of industrial chemical firms. More than three-fifths of the employees work in plant occupations, mainly in processing and maintenance jobs. Because of the highly technical nature of its products and methods of production, the industrial chemical industry employs a large number of chemists; chemical, mechanical, and electrical engineers; laboratory assistants; draftsmen; and other scientific and technical personnel. Employees in some administrative jobs, such as purchasing agent, salesman, and patent attorney, often have some scientific background. Chemical companies have many other administrative and professional employees, including accountants, personnel officers, and lawyers. Also employed are large numbers of clerical workers, such as bookkeepers, stenographers, typists, and office machine operators.

About 1 out of every 8 workers in industrial chemical plants 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. 4–51.600 through .699, 4–51.700 through .949, 4–52.350 through .399, 4–52.500 through .899, 6–51.600 through .699, 6–51.750 through .949, 6–52.350 through .399, 6–52.500 through .899) 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 other 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.

The industry employs many skilled maintenance workers because the manufacture of industrial chemicals requires a large amount of complicated equipment and because high temperatures and pressures greatly increase the wear on this equipment. Included among maintenance workers are *pipefitters*, who lay out, install, and repair pipes and pipefittings; *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 electric and



Chemical operator draws chemical samples for laboratory testing

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 jobs are similar to those 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 8 employees in this industry is in some activity requiring scientific, engineering, or technical training. About half of these employees work in laboratories to develop new chemical products and new methods of production as well as to perform basic research. About a fourth supervise the production of chemicals and other plant operations. The remaining scientific and technical personnel are in analysis and testing work, and in administrative or sales positions requiring technical background.

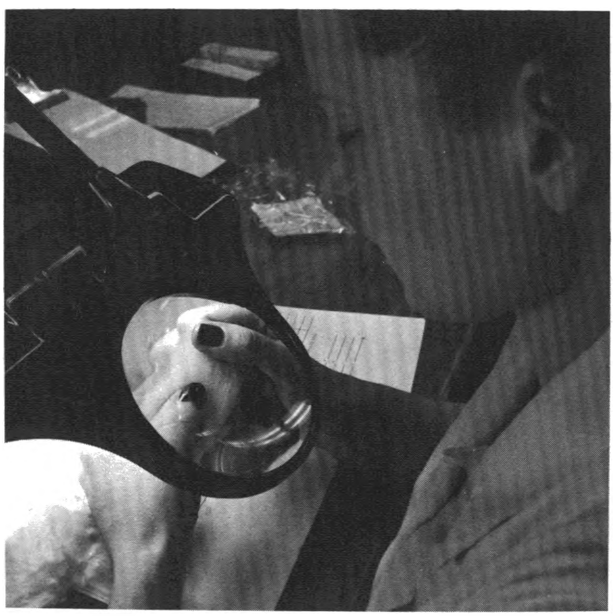
Chemists and chemical engineers make up the largest proportion of scientific and technical personnel in the industrial chemical industry. Many *chemists* work in research and development laboratories. A large number work in production departments, analyzing and testing chemicals in order to control their 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 technical selling and writing jobs.

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 also build nuclear reactors which are used in research laboratories for the study of chemical reactions. 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, chemical technicians, draftsmen, and engineering aids. *Laboratory technicians* assist chemists and engineers in research and development work and in production 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 4 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. 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.



Laboratory technician magnifies synthetic fiber to check for dyeing defects

(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.)

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. Experienced men are sometimes hired when no qualified trainees are available. 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.

The minimum educational requirement for entry into scientific and engineering jobs in the industrial chemical industry is a bachelor's degree in chemistry, engineering, or other professional field. 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. 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 working at one of the technician jobs. Sometimes, technicians may be sent to a technical institute for training, usually at company expense. Other men and women qualify for such jobs by obtaining formal education in technical institutes or junior colleges. 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 during the remainder of the 1960's and in the longer run. Some of these openings will result from the expected rapid expansion of industrial chemical output. Large numbers of job openings for new workers will also be created by retirements. deaths, or transfers to jobs in other fields of work. Retirements and deaths alone probably will provide, on the average, about 7,000 to 9,000 openings for new workers each year during the next 10 to 15 years.

The industrial chemical industry has vast potential for further growth from its research activities. This dynamic industry 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 in these markets. A plentiful supply of the raw materials used in chemical manufacturing is also favorable to the industry's future growth.

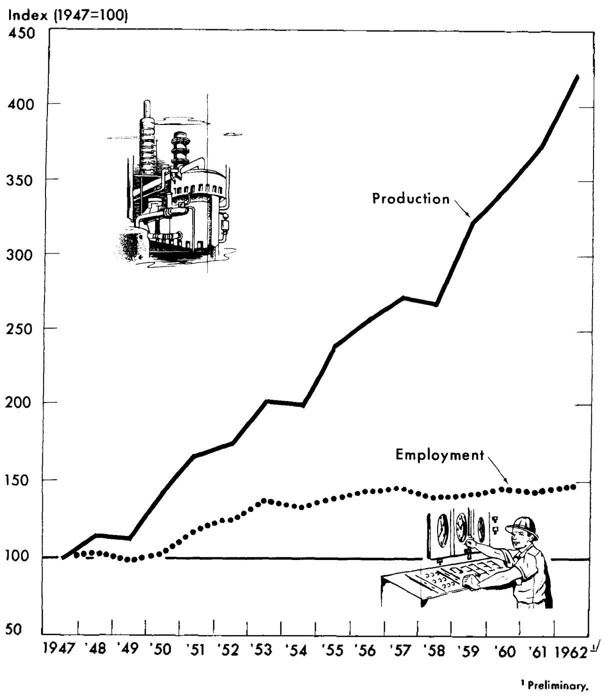
The continued rapid growth of the Nation's space and missile program will greatly stimulate expansion in the industrial chemical industry during the years ahead. Large quantities of industrial chemicals are used for the liquid and solid propellants needed to power rocket engines and also in connection with other aspects of spacecraft and missiles, such as structural materials, lubricants and fluids, auxiliary power systems, and systems to support life in the space environment. The atomic energy field is another area of economic activity whose 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 in the past 15 years, employment has increased at a much slower rate. Between 1947 and 1962, the number of industrial chemical workers rose nearly 50 percent in contrast with output, which increased more than fourfold. (See chart 37.) 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 addition of labor. Increases in output per worker are expected to continue in the years ahead.

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, continuing recent trends in this industry. Continued emphasis on research and development

CHART 37

PRODUCTION HAS BEEN INCREASING MUCH FASTER THAN EMPLOYMENT IN THE INDUSTRIAL CHEMICALS INDUSTRY.....



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 1962, production workers in plants producing basic inorganic and organic chemicals had average earnings of $124.68 a week or $2.99 an hour and those in plants producing plastics materials and synthetic rubber, resins, and fibers had average earnings of $110.35 a week or $2.64 an hour. In comparison, average earnings in 1962 for production workers in manufacturing industries as a whole were $96.56 a week or $2.39 an hour.

Entry salaries for chemists and chemical engineers in the chemical industry are among the highest in American industry, according to a 1962 survey conducted by the American Chemical Society. In this industry, the average starting salary was $530 a month for chemists with a bachelor's degree and $560 a month for chemical engineers with a bachelor's degree. Chemists and chemical engineers with graduate degrees received higher starting salaries. Earnings data for other engineers and scientists in this industry are not available.

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

A majority of the workers are covered by insurance plans. These plans include life, sickness, accident, hospitalization, 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, usually 7 to 10 cents more an hour for the second shift, and 12 to 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, 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 of 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 INSURANCE BUSINESS

Insurance is a multibillion dollar business which employs more people than such great industries as automobile or aircraft manufacturing, banking, or hotels. It offers many employment opportunities both for young men and women who have just finished school and for experienced workers.

There are almost 1,500 life insurance companies and approximately 3,500 property and casualty insurance companies. They conduct their businesses in main offices, commonly called "home" offices, and in thousands of local sales offices or agencies in cities and towns throughout the country. Local offices may be branches operated by the insurance companies whose policies they sell, 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 casualty insurance. Practically all companies specialize in one of these types. However, companies in both fields may sell health insurance.

Life insurance companies sell policies which give not only basic life insurance protection, but also several other kinds of protection. For example, some policies provide an income when policyholders reach retirement age or in the event that they become disabled and stop working; other policies may help meet the costs of educating children when they reach college age, or may give extra financial protection while the children are young. Life insurance companies may also sell accident and health insurance, which assists policyholders in meeting medical expenses and sometimes provides them with other kinds of benefits when they are injured or ill.

Policies sold by property and casualty insurance companies provide financial protection against loss or damage to the policyholder's property—from hazards such as fire, theft, and windstorm. This insurance field includes workmen's compensation and other liability insurance which gives financial protection to policyholders when they are responsible for injuries to other people or damage to other people's property. Property and casualty insurance companies may also sell health insurance. In addition, they sell fidelity bonds, which protect employers against theft by employees who handle large sums of money.

Many policies sold by life and by property and casualty companies are written to cover groups of people—anywhere from a few individuals to many thousands. Group policies, which are usually issued to employers for the benefit of their employees, most often provide retirement income, life insurance, or health insurance. They have gained great popularity in recent years. Group policies providing life insurance, for example, protected more than 2 out of every 3 nonfarm workers in 1961, and the number of master policies in force—although still very small compared with individual policies—was three times what it had been 10 years earlier.

Insurance Workers

The insurance business provided jobs for about 1.1 million people in early 1963. The great majority were clerical and sales workers. (See chart 38.) Clerical occupations afforded jobs for more than 4 out of every 5 women employed in the business; sales work occupied more than half of the men.

Salesmen are a key group of employees in insurance companies. Almost 365,000, or 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. (Statements on Life Insurance Agents and on Property and Casualty

CHART 38

AMONG THE 1 MILLION WORKERS IN THE INSURANCE BUSINESS-- about one-half are in clerical occupations and one-third are sales workers

Source: U.S. Bureau of the Census.

Insurance Agents and Brokers are included in the chapter on Sales Occupations. See index for page numbers.)

Every policy offered by an insurance company must be based on a carefully planned insurance program which is financially sound and meets legal requirements. Also, after a policy is sold, the insurance company must keep records of premiums paid and services rendered and must deal with claims made by the policyholder and benefits paid to him. Most of this planning, recordkeeping, and other behind-the-scenes work is done in home offices and requires the services of three employee groups—company officials and others in managerial positions; professional and technical employees; and clerical workers.

About 1 out of every 10 insurance workers is in a managerial position. Managers who are in charge of local offices, through which most insurance policies are sold, 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 every 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 on each type of policy should be. 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 to do work in connection with the processing of data on this equipment.

Keeping track of millions of policies involves a vast amount of paperwork and occupies the time of hundreds of thousands of clerical workers. About 500,000, or almost half of all insurance company employees, are in jobs classified as clerical—a much larger proportion than in most other industries. The majority are secretaries, stenographers, and typists, or 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

Insurance companies employ half a million clerical workers

typists known as *policy writers* (D.O.T. 1–37.32) 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. 1–08.12) enter changes in beneficiaries and coverage on policies, in accordance with the instructions given by agents. *Insurance checkers* (D.O.T. 1–03.02) check the information entered on policies by other clerical workers, to be certain that the work is accurate.

Some clerical workers are in positions of considerable responsibility which require extensive knowledge of one or more phases of the insurance business. *Home office underwriters* (D.O.T. 1–57.30) review applications for insurance to decide the class of policy involved and select the appropriate premium rates. *Claim adjusters* (D.O.T. 1–57.40) 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 casualty business are generally field personnel.

In addition to the four major groups of employees discussed above, insurance companies employ thousands of mechanics and 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 every 40 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. (See index for page numbers.)

Where Employed

The greatest concentration of insurance workers is in Connecticut, Massachusetts, New Jersey, and New York, where many home offices are located. However, many insurance workers are also employed in agencies, brokerage firms, and other sales offices in cities and towns in every section of 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 agencies. Companies which deal mainly in property and casualty insurance, although more numerous than the life insurance companies, tend to be smaller. The vast majority of local agencies and sales offices are 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 know-how; others require college training in fields such as mathematics, accounting, and engineering; and still others involve 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 subjects such as typing, business arithmetic, and the operation of office machines may also be valuable. These special skills are often required for jobs in insurance company offices, and this kind of training also provides a background of information which helps employees advance to more responsible positions. Home office positions such as underwriter and claim adjuster may be filled by promotion in this way. For a position as a claim adjuster, some legal training in a college or university may also be helpful.

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 customers' 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. Several 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

Many thousands of job openings can be expected in the insurance field each year during the remainder of the 1960's. The number of workers in insurance has risen rapidly during recent years and will probably continue to mount at a faster rate than in many other industries. Besides needing workers for new jobs, insurance firms are likely to require many thousands each year to fill vacancies as employees retire, die, or leave for other reasons. Turnover is particularly high among clerical workers, because this group includes many young women who are likely to work a few years and then leave to take care of their families. Turnover is also relatively high among insurance salesmen during their first years in the business, and many vacancies can also be expected in this work.

Employment is expected to rise in both major branches of insurance, because of a greater volume of business. With population growth, more individuals will purchase life insurance and policies providing retirement income and funds for their children's education. Others who do not have insurance may become policyholders. Advances in medical science, for example, are making life insurance available to persons who were formerly rejected as poor insurance risks; and a rising standard of living is enabling increasing numbers of individuals and families to own one or more automobiles, buy homes, and make other major purchases which are usually insured. The need for property and casualty insurance will increase in the business world also, as new plants are built, new equipment is installed, and more goods are shipped throughout the country and the world; and, as the coverage of State workmen's compensation laws is broadened, more employers may need workmen's compensation insurance.

Insurance employment will probably 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 somewhat the workload of sales personnel in local offices and clerical employees in home offices. The anticipated increase in group policies will have a similar effect on employment. Also likely to bring about changes in insurance company employment is the probability that more companies will install electronic computers and other equipment to process some of the routine paperwork now done by clerks. The total number of insurance company clerical workers is likely to continue to rise, but routine jobs will probably be proportionately fewer than in the past, and jobs requiring special training—including machine operator positions for the new mechanical equipment—will be more numerous.

Insurance workers have better prospects of regular employment than workers in many other industries. Most businessmen regard property and casualty insurance as a necessity during economic recession as well as in boom periods, and private individuals also attempt to retain as much basic financial protection as possible, even when incomes decline.

Earnings and Working Conditions

The many thousands of clerical employees in insurance companies include some in beginning, routine jobs, who earn less than $50 a week, and other experienced employees who may earn up to four times as much.

Information about the earnings of office workers in life insurance companies is available from a 1961 survey conducted by the Bureau of Labor Statistics. The survey covered nonsupervisory employees in almost 200 life insurance company home offices and regional head offices. The average earnings of junior file clerks—generally the lowest paid of the occupations surveyed and one of the largest—ranged from $48 a week in the Southwest to $56.50 in New England. Practically all the junior file clerks were women. Home office underwriters, with average earnings which ranged up to $184.50 a week in the Middle Atlantic States, were generally the highest paid of the clerical workers included in the survey. (The chapter on Clerical and Related Occupations gives additional information about the earnings of workers in other office occupations found in insurance companies. See index for page numbers.)

Starting salaries for professional workers are generally comparable to those for similar positions in other industries and businesses. It is not uncommon for specialists with 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 index for page references to reports on Life Insurance Agents and Property and Casualty Insurance Agents and Brokers.)

Except for agents and brokers, who must sometimes plan their working hours to meet the convenience of prospective clients, insurance company employees usually work regularly scheduled hours. Weekly work schedules of 36 to 37½ hours applied to the great majority of the employees covered by the 1961 survey. The number of holidays with pay was somewhat more liberal than in most other industries; one-third of all workers covered received 12 or more holidays yearly. Two-week paid vacations were generally allowed employees after 1 year of service; in most companies, vacations were extended to 3 weeks after 15 years and to 4 weeks after 20 years. Practically all of the life insurance company workers covered by the survey also shared in group plans providing hospitalization, life, sickness and accident, and surgical insurance, and 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,
488 Madison Ave., New York, N.Y., 10022.

Insurance Information Institute,
110 William St., New York, N.Y., 10038.

For additional information on the salaries of clerical workers in life insurance company home offices and regional head offices see:

Industry Wage Survey: Life Insurance, May–July 1961, Bureau of Labor Statistics Bulletin 1324 (1962), Superintendent of Documents, Washington, D.C., 20402. Price 30 cents.

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 quantities of steel. In 1962, steelmakers produced more than 98 million tons of steel—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 600,000 wage and salary workers were on the payrolls of the industry's more than 700 plants in 1962. 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, steelworks, and rolling and finishing mills, including mills engaged in rolling and finishing steel products from purchased sheets, strips, bars, rods, and other materials. (Employment in finishing mills was not included in discussions of the industry in earlier editions of the *Handbook*.) 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 39.) Molten iron or pig iron is then converted into steel in various types of steelmaking 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 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 classified in the iron and steel industry.)

Because iron and steel are produced in huge quantities, the industry uses gigantic processing equipment. Modern blast furnaces are sometimes more than 150 feet tall (about as high as a 15-story building). A single blast furnace may produce up to 500 tons of iron in each production cycle of about 4 to 5 hours. 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 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. Seven or 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.

The rolling equipment which forms steel into various shapes is hundreds of 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 purchased from other companies. A third group rolls and finishes purchased steel. A fourth type makes only pig iron to be sold to small steel plants and foundries.

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, pipes, and nails, are produced in their final form at the mills. The leading steel consuming industries are: Automobile, construction and building materials, containers, machinery and machine tools, 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 two-thirds 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. The Pittsburgh–Youngstown, Pa., area is the country's largest steel-producing area. Elsewhere in the East, there are large plants in Buffalo, N.Y., and Johnstown, Bethlehem, and Morrisville, Pa. The Nation's largest steel plant is located at Sparrows Point, near Baltimore, Md. The Great Lakes region has many important steel centers, particularly the Chicago and Cleveland areas. Much of the steelmaking in the South is in the vicinity of Birmingham, Ala. Important steelmaking facilities are also located in the Far West.

About 7 out of every 10 of the industry's workers are employed in 5 States—Pennsylvania, Ohio, Indiana, Illinois, and New York. Nearly 3 out of every 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 directly 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 and technical, administrative, and supervisory work connected with the operation of steelmaking plants.

About four-fifths of all employees in the iron and steel industry in 1962 were plant workers. These workers were directly concerned with the production and finishing of iron and steel, the maintenance of plant equipment, and the movement of materials within and among plant departments. Semiskilled workers made up almost half of all production workers; skilled workers, including foremen, approximately three-tenths; and unskilled workers, about one-fifth.

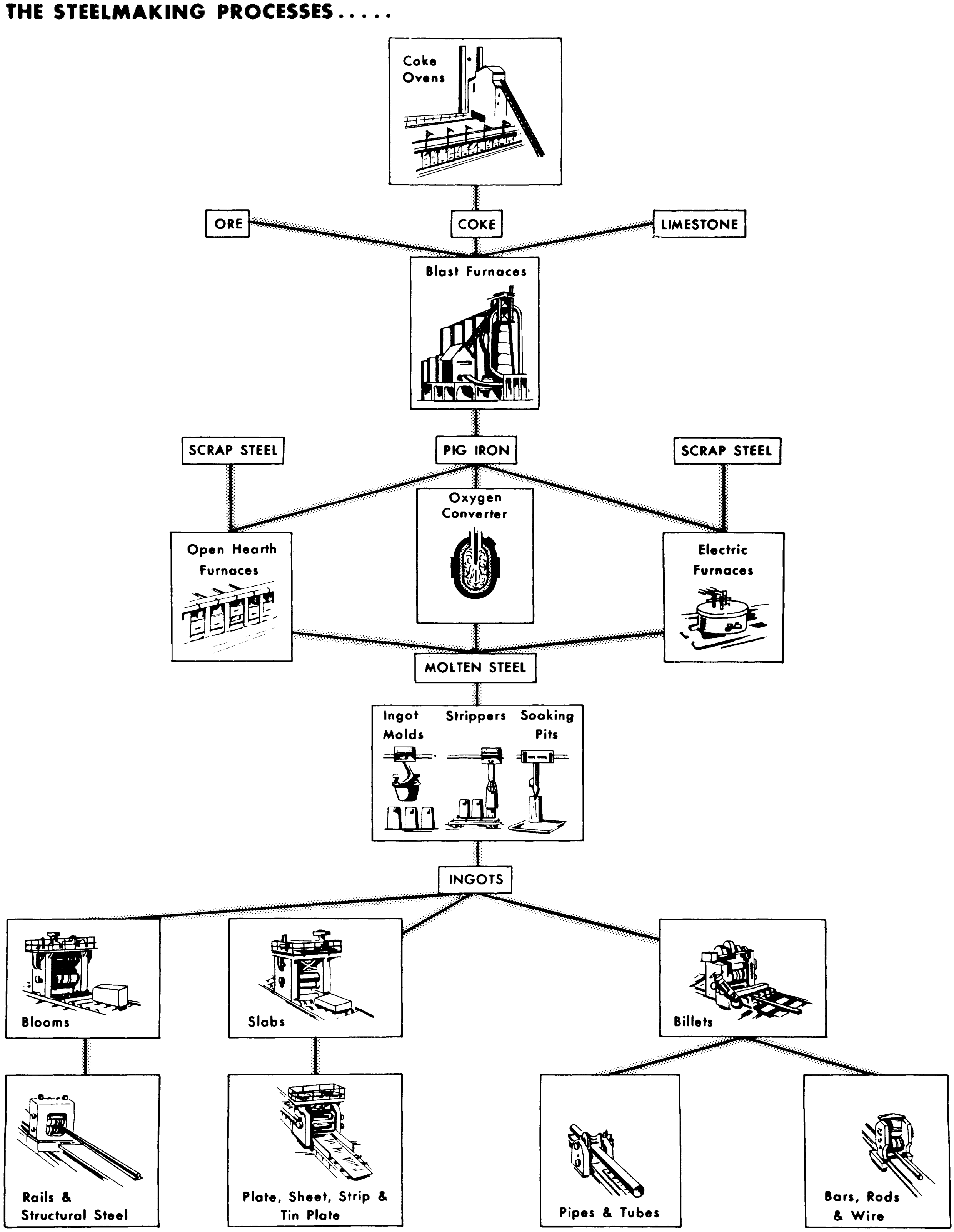
Clerical and sales workers accounted for roughly 2 out of every 3 office workers in this industry. About 1 out of every 4 of the office workers were employed in professional and technical jobs, and roughly 1 out of every 10 in administrative, managerial, and supervisory occupations.

Nearly all iron and steel plant workers are men, since much of the work is strenuous. However, the physical labor involved in steelmaking has been reduced through mechanization. About half of the industry's women workers are employed in production jobs such as craneman, machine operator, assorter, and inspector; the rest are in office jobs, including research and other technical work.

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 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 extract molten iron from iron ore. Alternate layers 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

CHART 39


THE STEELMAKING PROCESSES.....
Coke Ovens
ORE
COKE
LIMESTONE
Blast Furnaces
SCRAP STEEL
PIG IRON
SCRAP STEEL
Oxygen Converter
Open Hearth Furnaces
Electric Furnaces
MOLTEN STEEL
Ingot Molds
Strippers
Soaking Pits
INGOTS
Blooms
Slabs
Billets
Rails & Structural Steel
Plate, Sheet, Strip & Tin Plate
Pipes & Tubes
Bars, Rods & Wire

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 4 or 5 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. 7–40.050) load traveling stock or larry cars with raw materials from storage bins. They weigh all raw materials in accordance with a prearranged schedule, which depends upon 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 stockhousemen or *skipmen* (D.O.T. 5–73.550), stationed on the ground below, control the skip cars through electric and pneumatic controls. *Stove tenders* (D.O.T. 6–91.311) 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 who are responsible for the quantity and quality of iron produced are called *blowers* (D.O.T. 4–91.311). 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. 4–91.321), under the direction of the blower, are responsible for tapping the furnace. They direct their helpers and *cindermen or slaggers* (D.O.T. 8–92.01) in lining (with 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 "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; electric furnace; basic oxygen furnace; and Bessemer converter.

Open-hearth steel, which accounts for more than four-fifths 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 450 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 so named because the saucer-shaped hearth, or floor of the furnace, is exposed to the sweep of the flames which melt the steel.

A *melter* (D.O.T. 4–91.444) is in charge of one or more open-hearth furnaces 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 carbon, manganese, silicon, copper, or aluminum. He supervises three grades of helpers—first (D.O.T. 4–91.445), second (D.O.T. 6–91.183), and third (D.O.T. 8–92.01). These helpers prepare the furnaces for the heat, regulate furnace temperatures, take samples of molten steel for laboratory tests, direct the loading 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. 6–91.181) runs an electrically controlled machine with a long steel arm which picks up, one by one, long

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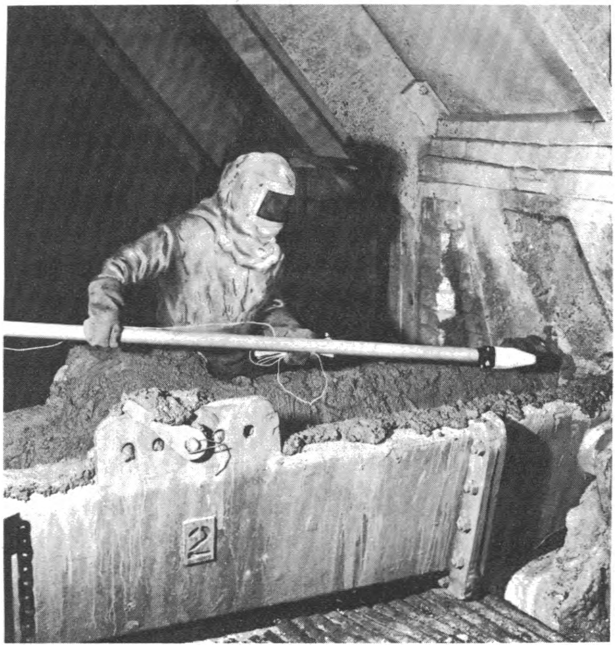


Melter's helper inserts jet tapper into open hearth furnace tap hole

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. 5–73.030) 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. 5–73.030) 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. 4–91.651) 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. 5–73.010 and .020), 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).

More than one-eighth of all steel made in 1961 was produced in electric and basic oxygen furnaces, and this proportion is expected to increase rapidly in the years ahead. In electric furnaces, steelmaking can be controlled very closely. Consequently, such furnaces are being used increasingly to produce high quality and high alloy steels. Oxygen furnaces can make steel faster than any other furnaces currently in use. Steel made by the Bessemer process accounts for less than 1 percent of the total amount of steel produced in this country each year, having declined steadily over the past half century.

Rolling and finishing. The three principal methods of shaping metal in steel plants are rolling, casting, and forging. About three-fourths of all steel products are shaped by the rolling process. In this method, heated steel ingots are squeezed 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. 4–88.081) 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. 5–73.010) 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 machinery. 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 and thinner than blooms. Billets are the smallest of these three shapes.

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. 5–92.301), the man in charge of the mill, works in a glass-enclosed control booth, or "pulpit," located above and directly over 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. 4–88.012) 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. 6–88.664) 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

Speed operator (one type of roller) controls continuous butt weld pipe mill while helper knocks off scale

the entire rolling process. This consists of heating, rolling, and shearing.

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, 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 are frequently employed in these jobs.

An important occupation in wire making is the *wire drawer* (D.O.T. 4–88.511). 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. 6–88.351) 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. 4–78.011) 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 electronic 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 (D.O.T. 5–24.130) 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, locomotive boilers, storage tanks, stationary boilers, and condensers. Locomotive engineers and other train crew members operate steam, 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 approximately one-fifth of the industry's total employment in 1962. Of these, the majority were clerical workers, such as secretaries, stenographers, typists, accounting clerks, and general office clerks.

Engineers, scientists, and technicians made up approximately one-fourth of the industry's "white-collar" employment. Several thousand of these workers were engaged in research and development. The work of these employees is aimed at improving iron and steel products and processes. For example, research and development workers are now developing alloy steels that are highly resistant to heat, extremely strong, and relatively light in weight.

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 and 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.

Employees in administrative, managerial, and supervisory occupations made up about 1 out of every 10 of the industry's white-collar workers. Among these employees were office managers, personnel workers, purchasing agents, plant managers, industrial engineers, and other supervisory workers. Working closely with these personnel were several thousand professional workers, other than scientists and engineers. By far, the largest group of these professional workers 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 this *Handbook*, in the sections covering the individual occupations. See index for page numbers.)

Training, Other Qualifications, and Advancement

New workers in processing operations are usually hired at the unskilled level, as laborers. Openings in higher rated jobs are usually 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 and "know-how." 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 departments, a man may begin by doing general cleanup work around the furnace and then generally 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 is usually 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 are generally 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 scientists or engineer is assigned directly to a specific research, operating, maintenance, administrative, or sales unit. Engineering graduates are frequently 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 is usually preferred for entry into most of the office occupations. Office jobs requiring special knowledge of the steel industry are generally filled by promoting personnel already employed in the industry.

Employment Outlook

The iron and steel industry will provide thousands of job opportunities for new workers during the remainder of the 1960's and in the longer run, primarily as a result of the need to replace experienced workers who transfer to other fields of work, retire, or die. Retirements and deaths alone in this large industry will probably provide more than 12,000 job openings annually.

Employment in the industry is expected to increase somewhat above the 1962 level of about 600,000, in the years ahead. Although a rise is anticipated in the number of white-collar workers, little, if any, increase is expected in the employment of production workers. Among the white-collar workers, employment of engineers, chemists, physicists, mathematicians, laboratory aids, and other technical personnel probably will increase because of the industry's expanding research and development program. Among the skilled plant personnel, maintenance mechanics are expected to be needed in greater numbers because of the increasingly complex machinery and equipment used in the industry. In contrast, the number of less skilled processing jobs is expected to decline. The rise in employment anticipated over the long run assumes the realization of high rates of economic growth. If these high levels of economic activity are not realized, employment will fall short of the anticipated level.

The industry is expected to continue to expand steelmaking facilities and steel production during the years ahead. Many of the industries which purchase large quantities of steel are expected to require increasing amounts. The population of the United States will continue to rise, resulting in greater demand for automobiles, highways, and houses, which require great amounts of steel. New machinery will also be needed to produce the growing quantity of goods needed to feed, clothe, and otherwise satisfy the requirements of our expanding population.

Employment in the iron and steel industry is expected to rise at a much slower rate than steel production because of increasing efficiency in steelmaking operations. The use of high pressure in blast furnaces, the introduction of oxygen into open-hearth and electric furnaces, and the use of basic oxygen furnaces are examples of the new techniques that have reduced substantially the time needed to produce a ton of iron or steel.

The trend toward more automatic production operations and the greater use of instruments to control the quality of steel will also result in increased operating efficiency. Automatic processing techniques are now evident in rolling mills, in tin coating processes, and in heating and controlling furnaces, and these techniques are being improved and extended to other operations. Other new steelmaking processes still being developed include making iron without using conventional blast furnaces and converting molten steel into semifinished shapes without using ingot molds, soaking pits, and some types of rolling equipment.

Employment in the iron and steel industry fluctuates widely with changes in general business conditions and demand for capital goods. During periods of prosperity, production and employment generally rise substantially but drop off during business recessions. These fluctuations occur because a large proportion of the industry's output goes to industries that are particularly sensitive to changes in economic conditions. For example, about two-fifths of the steel produced in this country is used by the automobile, construction, and machine tool industries.

Employees in the industry have not all been equally affected by employment cutbacks. In general, production workers have had more irregular employment than professional, clerical, and other white-collar workers.

Earnings and Working Conditions

Earnings of production workers in iron and steelmaking establishments are among the highest in manufacturing. In 1962, their earnings averaged $126.75 a week, or $3.25 an hour. This compares with average earnings of $96.56 weekly, or $2.39 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*
Blast furnaces		
Keeper	14	$2.94
Stockhouse man	10	2.66
Cinderman	6	2.38
Steelmaking		
Charging-machine operator, open hearth	16	3.08
Ingot stripper, open hearth	12	2.80
Helper, third, open hearth	6	2.38
Rolling and finishing mills		
Roller, blooming mill	26	3.78
Manipulator, blooming mill	13	2.87
Assorters, tin plate	5	2.31

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

These rates are from the wage agreement between the company and the United Steelworkers of America, effective July 1, 1962. Basic hourly wage rates for skilled processing jobs ranged from about $2.73 to $4.20; for semiskilled jobs, from approximately $2.31 to $2.66; and for unskilled jobs, from $2.10 to about $2.24. (The individual worker's rate depends on his particular job classification.) These rates were representative of those for processing jobs throughout the industry and were guaranteed minimums 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, steel workers receive premium pay for overtime work and for work on Sundays and holidays.

For a number of years, agreements between most steel companies and the United Steelworkers have included provisions for various "fringe" benefits, such as vacation pay, retirement pensions, and unemployment benefits. Most workers receive vacation pay ranging from 1 to 4 weeks based on length of service. Retiring workers are eligible for a company-paid pension, in addition to any benefits for which they may be eligible. Workers 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 company, and accident and sickness, hospitalization, surgical, and life insurance benefits financed by the company.

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

The iron and steel industry is a leader in the development of safety programs for workers, emphasizing the use of protective clothing and devices on machines to prevent accidents. In 1961, steel plants had an injury frequency rate (injuries per million hours of work) that was less than one-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.

MOTOR VEHICLE MANUFACTURING OCCUPATIONS

The motor vehicle industry (automobile industry), one of America's most important manufacturing industries, employed nearly three-quarters of a million workers to produce about 8.2 million motor vehicles (mainly automobiles) in 1962. The industry has helped to develop existing industries and create new ones. Many businesses, including automotive repair shops, service stations, and truck and bus transportation facilities, have been created as a result of the automobile. Moreover, the automobile industry is the most important consumer of steel, rubber, and plate glass.

Like other large industries, the automobile industry is a source of employment for workers with widely different levels of education and skill. Requirements for jobs vary from college degrees for engineers and other professional and technical personnel to a few hours of on-the-job training for some of the less skilled assemblers, material handlers, and custodial workers. The largest number of employees work in factory (or plant) occupations. Plant jobs range from the skilled tool and die maker, millwright, and electrician to the less skilled machine tender, assembler, material handler, and custodial worker. A great number of automotive employees also work in administrative and office jobs.

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 workers whose duties are limited to one or a few operations. These mass-produced parts are then put together by other workers to form the completed vehicle. Because of the minute division of labor, cars can be driven off assembly lines at the rate of faster than one a minute.

The automobile industry in 1962 consisted of about 2,100 plants which manufactured parts of subassemblies and assembled these parts into cars, trucks, buses, and special-purpose vehicles such as ambulances, fire engines, and taxicabs. These plants ranged in size from huge assembly plants employing many thousands to parts plants employing less than a hundred workers. About three-quarters of the 725,000 automobile workers in 1962 were employed in establishments with 1,000 or more employees.

Thousands of companies supply the parts of subassemblies for new vehicles and also produce the replacement parts necessary to keep the millions of vehicles already on the road in good repair. These firms often specialize in producing certain parts—for instance, brakes, clutches, and passenger car or truck body parts. About 60 percent of the automobile workers are employed in these manufacturing plants. Only a few companies produce the completed vehicles.

About 90 percent of automobile manufacturing workers were employed in 10 States. Michigan alone accounted for nearly 45 percent of the industry's employment in 1962. Ohio, Indiana, Wisconsin, and New York together had another third. The other five States with large concentrations of motor vehicle manufacturing employment were California, Missouri, Illinois, New Jersey, and Pennsylvania.

In Michigan, the Detroit metropolitan area is the center of the industry. About one out of every three of the Nation's automobile workers is employed within its industrial area, which includes 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; South Bend, Indianapolis, and Fort Wayne, Ind.; Chicago, Ill.; Buffalo, N.Y.; and Milwaukee and Kenosha, Wis.

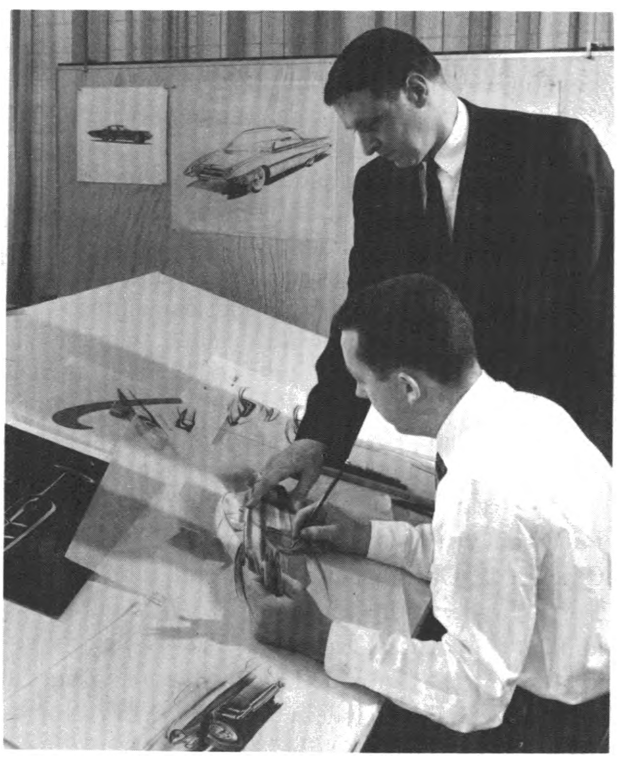
Much of the automobile manufacturing on the East Coast is centered in the New York–Northeastern New Jersey–Philadelphia industrial area in such localities as Newark, Paterson, Linden, and New Brunswick, N.J.; and New York, N.Y.

The Los Angeles industrial area is the leading automobile manufacturing center in the Pacific Coast region. The Bay area (Oakland) 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 3 to 4 years of designing, planning, and testing often precede the actual production of each year's model automobile. 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 creative designs of the stylists are transferred to drafting boards. Then skilled modelmakers convert the blueprints into 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.



Stylist consults with engineer regarding automobile designs

Throughout this initial stage of producing an automobile, companies that produce parts work closely with the automobile manufacturers on questions of designing, engineering, and tooling. Problems of production methods, costs, and scheduling also are worked out long before the actual manufacturing process begins.

Production of Motor Vehicle Parts. After the design of the new model automobile is developed, automobile parts plants begin production of the various components of the car. Because parts are made by many different firms, rigid quality control is maintained so that the parts fit properly on the final assembly line and the safety of the automobile is ensured.

Motor vehicle parts are made of many different materials. Although most parts are made from steel, other metals such as aluminum, copper, and zinc also are used. Other parts are made from plastic, rubber, fabric, or glass.

Metal parts for motor vehicles are shaped in one of several ways depending upon the purpose for which the part is to be used, the size of the part, and the type of metal used. The principal methods of shaping metal are casting, forging, machining, and stamping. Most metal parts are produced by foundry workers, forge shop workers, and machining workers, and operators of stamping or pressing machines.

Castings are made in foundries where molten metal is poured into molds and allowed to cool and harden into the desired shape. Bulky parts, such as engine blocks, generally are made by the casting process.

The forging process shapes metal objects which are required to withstand great stress, such as automobile crankshafts, axles, and connecting rods. Generally, parts that are produced by casting or forging must undergo further processing, usually machining, before they are ready for assembly.

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

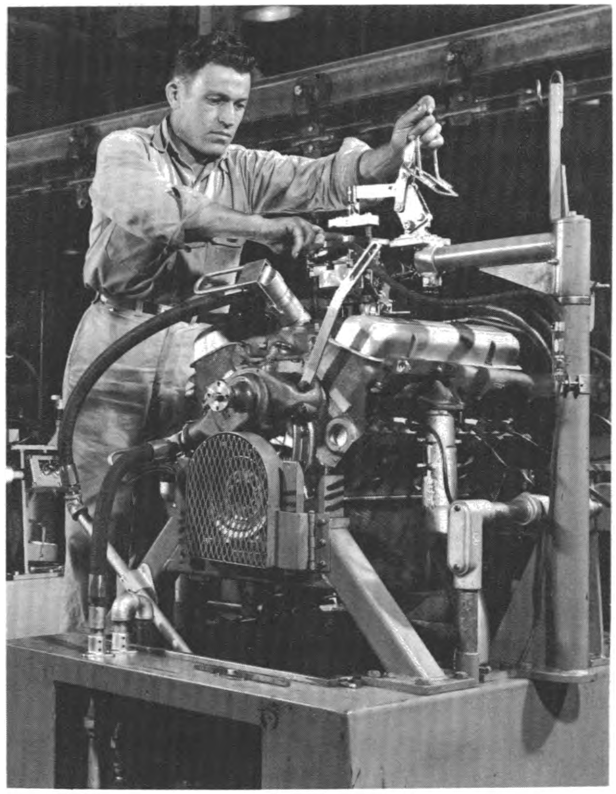
The automobile industry has taken the lead in trying to develop continuous automatic production for many machining operations. This approach to production has been called "automation," which is the use of instruments to direct and control manufacturing processes. In applying automation to machining processes,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

For example, in one automated engine plant, a rough engine block goes through hundreds of different cutting, drilling, and grinding operations with the use of little or no manual labor. The engine block is moved into and out of load stations mechanically, machined automatically by a battery of machine tools, and transferred by conveyors to the next machining operation. Much of the inspection is done automatically. The machine tools, the conveyors, and the inspection equipment often are controlled by electronic, 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.

The production of parts does not entirely consist of metalworking operations. For example, body parts are made rustproof and attractive by spray painting them and then baking them in ovens lined with infrared lights. Also, upholstery for the car interior is cut, sewn, and installed.

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

Assembling the Final Product. The final step in motor vehicle manufacturing is to put together the individual parts and the subassemblies to make the finished motor vehicle. Generally, large and heavy subassemblies, such as the engine and



Inspector checks engine before installation in automobile

the body, are lowered by hoists into position on the chassis as it comes down a moving assembly line. A conveyor carries the motor vehicle forward while men at work stations attach the necessary parts and subassemblies in proper sequence. Overhead wires feed electric power to nut tighteners, welding equipment, and other tools used by workers on the assembly line. Bumpers, hubcaps, floor mats and other finishing parts are added near the end of the line. Finally, headlights are adjusted, wheels alined, and gasoline is pumped into the fuel tank. Thus another new motor vehicle is driven off the production line. The finished car is inspected before it leaves the factory.

As the chassis move down the assembly line, parts and subassemblies are continually supplied to the assemblers from nearby "banks" in accordance with a schedule arranged by materials control men.

Modern mass production methods make it possible for different colored cars, equipped with different features and accessories, to follow each other along the assembly line. The information on color and on the special equipment for each car is determined from automobile dealers' orders. It is transmitted to the various stations along the assembly line by either teletype or telautograph.

Automobile Manufacturing Occupations

Workers in assembling, inspecting, material handling, and other semiskilled plant jobs comprised nearly half of all automobile manufacturing workers in 1960. Another quarter were employed as foremen, mechanics and repairmen, machinists, tool and die makers, and in other skilled occupations. Clerical workers were about a tenth of total employment. The remaining workers were employed in professional, technical, sales, and managerial occupations and as laborers and guards.

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. See index for page numbers.)

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 automobile companies. About 21,000 scientists and engineers were employed in the automobile industry in 1960. Engineers make up the largest group of professional and technical workers in the automobile industry. Automobile 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 metallurgists and civil, chemical, and ceramic engineers.

Although most of these professional workers are employed in research and development departments, some also supervise the more technical production jobs. For example, a metallurgist may be employed to supervise the melting operations in the precision casting and forging departments.

The industry also employs many semiprofessional workers or technicians, such as draftsmen, engineering aids, and laboratory assistants, and to assist engineering and scientific workers. About 13,000 technicians and draftsmen were so employed in 1960.

Administrative, Clerical, and Related Occupations. Many types of workers are employed in the industry to perform the great variety of administrative functions needed by the automobile companies. Included are executives who determine, among other things, how many vehicles to produce, what styles to make, what prices to charge, which parts the company should produce and which parts it should buy, and where it is best to locate plants. On the second level of administrative jobs are those such as personnel manager and purchasing agent, who direct individual departments or special phases of operations. Among those who assist the administrators are accountants, lawyers, market analysts, economists, statisticians, and industrial relations experts. This large industry also has many supervisory employees in charge of specific groups of office or plant workers.

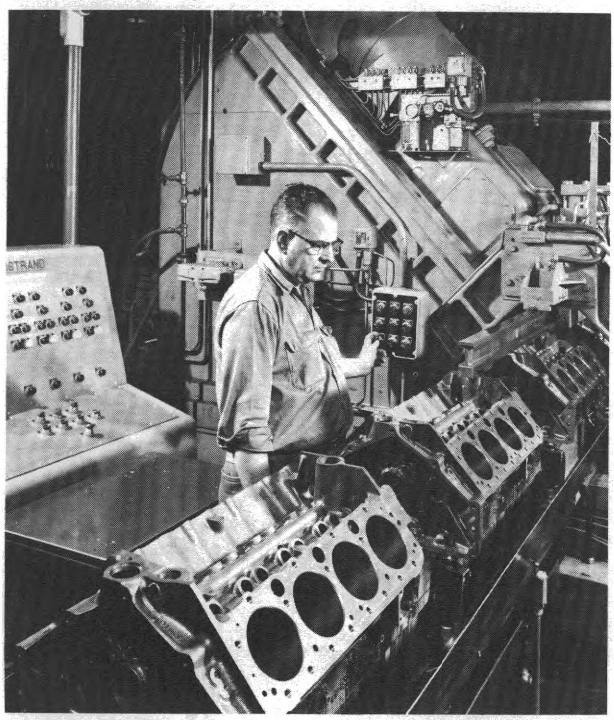
A large staff of clerical workers, including secretaries, stenographers, bookkeepers, clerks and typists, key punch operators, and business machine operators, also is employed. A large proportion of these are women.

Plant Occupations. About three-fourths of the workers in the automobile industry are employed in plant jobs. Most of these workers make automobile parts, assemble them into the complete vehicles, and put the finishing touches on the cars and trucks. Other plant workers service and maintain the vast amount of machinery and equipment needed for automobile manufacturing. The plant work force is predominantly male.

After the stylists, engineers, and draftsmen have planned and designed the new model car, the production process gets under way. First, the parts must be made. Parts are principally metal and are shaped by a variety of metal-forming processes which require workers in a number of metalworking occupations. For example, bodies must be stamped out by huge presses, cylinder blocks must be cast in foundries, crankshafts must be forged in forge shops, and pistons must be ground by machine tools.

Machining occupations. 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. The job titles of these workers depend on the type of machine tool they operate, for example, engine lathe operator, drill press operator, and milling machine operator.

The most highly skilled workers who use machine tools are the tool and die makers. Toolmakers make the jigs, fixtures, and other accessories that hold the work being machined. Diemakers construct the dies that are used in stamping, pressing, forging, and other metal-forming operations. Tool and die makers read blueprints, set up and operate machine tools, use precision-measuring instruments, and make shop computations in their work. They must work to closer tolerances (more exact dimensions) and do more precision handwork than most other machining workers. (Detailed discussions of machine tool operators, tool and die makers, and other machining occupations appear elsewhere in this *Handbook*. See index for page numbers.)



Machine tool operator uses highly automatic machine which bores cylinders in engine blocks

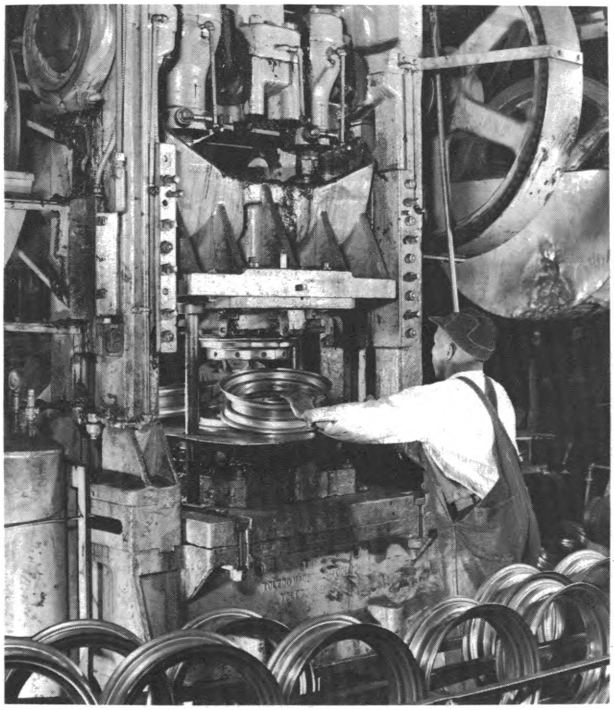
Foundry occupations. Some parts of the automobile are made in foundry departments which make castings for such units as engine blocks. Castings are produced by pouring metal into molds where it cools and hardens in the shape of the molds. Patternmakers make a wood or metal pattern in the shape of the final casting desired. 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. Some automobile parts, such as crankshafts and connecting rods, which must withstand great stress, are shaped by forging hammers and presses in the forge shop. Hammermen operate drop hammers which pound metal into various shapes between closed dies. The hammermen are assisted by heaters who heat the metal stock in a furnace to prepare it for forging and then pass the stock to the hammermen. Other forge shop workers are engaged in cleaning, finishing, heat treating, or inspecting forgings.

Other metalworking occupations. The automobile industry employs large numbers of workers in other metalworking occupations such as punch press operators who run power-driven presses.

Automobile plants employed nearly 40,000 welders in 1960 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 equip-



Press operator removes a wheel rim

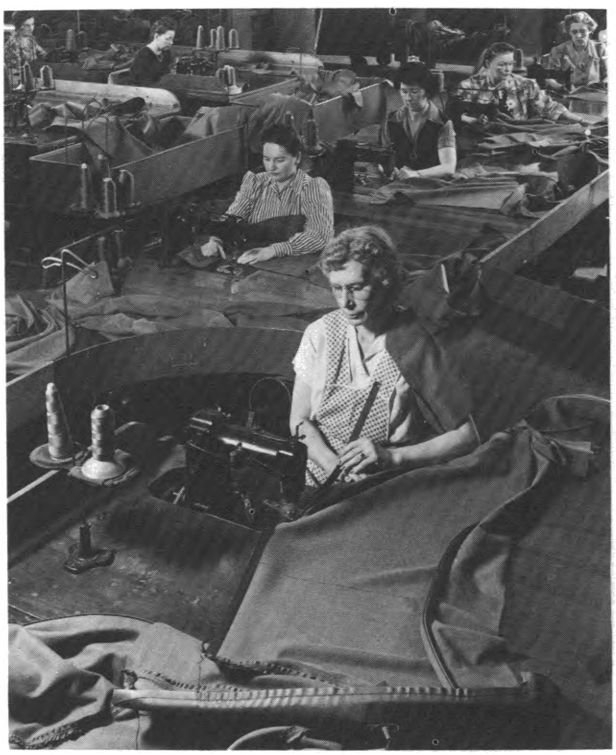
ment. Machine (resistance) welders are primarily employed on the assembly lines to weld the separate parts of the bodies and subassemblies.

Inspection occupations (D.O.T. 5–02.700 through .799, 5–81.630, 6–78.671, and 7–02.700 through .799). Automobiles are 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 those employed in the finishing departments are metal finishers, platers, sprayers, polishers, sanders, trim cutters, sewing machine operators, and trimmers. *Metal finishers* (D.O.T. 6–77.040, and .530 and 8–77.10) file and polish rough surface areas of metal parts in preparation for painting. *Platers* put a thin coat of chrome on automobile bumpers and "hardware" for ornamentation and protection against corrosion. *Sprayers* (D.O.T. 7–16.210, and .500 through .629) operate spray guns to apply paint or other finishes to the metal parts. *Polishers* (D.O.T. 6–77.020, .025, .080, and .330) rub the finished surfaces by hand or polish them with a portable motor-driven buffing wheel.

Cutters, sewing machine operators, and trimmers combine their skills to provide comfortable and attractive interiors. With hand shears or an electric knife, the *cutter* (D.O.T. 4–62.020 and 6–27.054) cuts fabric or leather to the specific shape according to a pattern. The *sewing machine operator* (D.O.T. 6–27.503), using a power-driven machine, sews together the uphol-



Sewing machine operators sew fabric sections for interiors of automobiles stery sections after they have been cut to size. *Trimmers* (D.O.T. 4–35.610) 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. 5–02.300 through .399, 5–25.570, 7–02.300 through .399, and 9–02.01, and .81). The workers who do the assembling make up the largest occupational group in the automobile industry. 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 worker is assigned a job to be done while the automobile is passing his work station. For example, one worker may start nuts on bolts and the next worker may tighten the nuts.

Material handling, custodial, and plant protection occupations. The production of motor vehicles by the assembly-line process requires an elaborate system of material movement to supply the assembly lines and to remove finished products. A considerable number of workers are employed to move materials in automobile and automobile parts plants. Drivers operate power trucks which deliver parts or subassemblies to the assembly line or move materials between plants. Material handlers load and unload parts from trucks or into and out of containers. Crane operators use machines to move raw steel stock, heavy dies, and other materials that cannot be lifted by hand.

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

The automobile industry also employs many workers in plant protection and custodial work. These workers include plant patrolmen, gatemen, janitors, and porters.

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

Training, Other Qualifications, and Advancement

The training requirements for jobs in the automobile 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 years in training for their occupations.

The automobile industry's emphasis upon new design and mechanical improvements has made it an important employer of persons with engineering and scientific backgrounds. The minimum requirements 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. It is from this group of professional workers that some companies have selected many of their top executives.

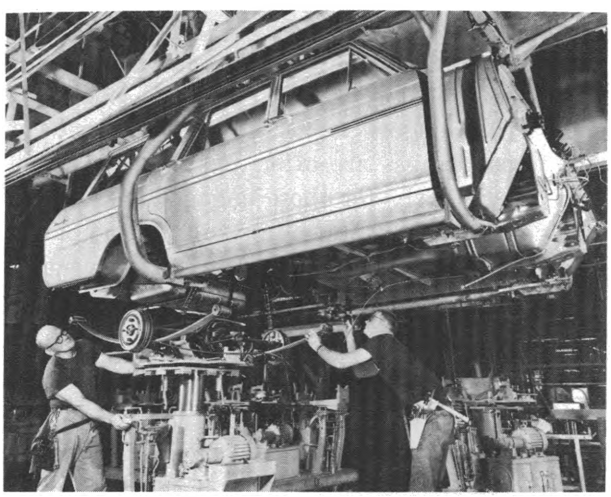
The requirements for other technical workers vary according to their specialties. For example, engineering aids, laboratory assistants, and draftsmen are often technical institute or junior college graduates. Some automobile companies train their own semiprofessional technical workers at company-run schools or subsidize students at local junior colleges or technical institutes. These workers may also take 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 workers in these specialties. Most of the top administrative jobs are filled by promotion from within the organization.

Most automobile 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 workers 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 automobile 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.



Automobile assembly workers attach rear suspension to car body

Applicants for apprenticeship training are generally required to be between the ages of 18 and 26 (50 percent 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, while the operation and use of tools of a particular trade are learned in the shop.

Most automobile companies select their foremen from among workers already employed. Frequently, persons who have completed 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 automobile industry will provide many thousands of job opportunities for new workers during the remainder of the 1960's and in the longer run, primarily as a result of the need to replace experienced workers who transfer to other fields of work, retire, or die. Retirements and deaths alone, in this large industry, will probably provide between 14,000 to 16,000 openings annually.

Other job openings will occur because employment in the automobile industry is expected to rise somewhat above the 1962 level of 725,000 in the years ahead. Two major factors affecting employment in this industry are automobile sales and the number of man-hours required to build a motor vehicle. Automobile sales and, consequently, employment fluctuate sharply in response to such factors as the level of economic activity, consumer preference, and the availability of credit. In the future, the anticipated high rate of economic growth and the achievement of full employment, together with growth in population, income, family formation, and multicar ownership, and the continuation of the movement to the suburbs, will result in greatly increased sales of automobiles, trucks, and buses. As the number of motor vehicles in use increases, sales of replacement parts will also grow.

The number of man-hours required to build a motor vehicle, a second major factor determining employment in the motor vehicle industry, has declined significantly in recent years and has exerted a downward pressure on employment. Employment in the industry in 1962 was about 11 percent lower than in 1950, although the number of motor vehicles produced was somewhat higher. In the years ahead, the industry's emphasis upon mechanized production methods, such as automatic assembly operations, is expected to continue to increase output per worker. New and modernized plants are also expected to lead to further efficiencies in production which will tend to reduce labor requirements. However, improved, more complex, motor vehicle equipment, such as air conditioners and power brakes, and additional models and continuing style changes are expected to offset to some extent the effect of increased production efficiency.

Taking into account all of these factors, and assuming the realization of high rates of economic growth, it is probable that over the long run employment in the motor vehicle manufacturing industry will rise somewhat over the 1962 level. If these high levels of economic activity are not realized, then employment in this industry will fall short of the level anticipated for the future.

The distribution of employment in the 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, between 1953 and 1962, white-collar employment in this industry increased from 20 percent to nearly 25 percent of total employment.

Continuing recent occupational trends, the number of engineers, scientists, and other professional and technical personnel is expected to increase at a faster rate than other occupational groups because of the anticipated expansion in research and development activities. 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. Because the industry is expected to expand its use of electronic data-processing equipment in the future, programers will be employed in greater numbers. The employment of clerical and administrative workers is expected to increase at a somewhat faster rate than some other occupational groups although the introduction of data-processing equipment may limit the growth of some types of clerical workers. There will be a growing need for stenographers and typists.

The employment of skilled workers, such as tool and die makers, millwrights, pipefitters, electricians, and machinery repairmen, will grow at a relatively faster rate than many other occupational groups. Little increase is expected among semiskilled workers, such as assemblers and machine operators.

Earnings and Working Conditions

The earnings of production workers in this industry are among the highest in manufacturing. In 1962, production workers employed in the automobile industry earned, on the average, $127.37 for 42.6 hours a week, or $2.99 an hour. This compares with the average earnings of $96.56 for a 40.4-hour week, or $2.39 an hour, for pro-

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duction workers in all manufacturing industries in the same month.

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, weekly accident and sickness benefits for temporary disability, which are paid for by employers and employees. Hospitalization, surgical, and medical benefits, which are provided as a result of collective bargaining, are usually financed solely by employers or jointly by employers and employees. Supplemental unemployment benefits plans (paid for solely by the employers) cover the majority of workers. These plans provide cash payments ranging from $2 to $40 a week to all hourly rated employees and up to $50 a week for some salaried employees with at least 1 year of service. In most States, these benefits are in addition to those received from State unemployment compensation plans. Most employees also receive paid vacations (or payments in lieu of vacations) ranging from 1 to 3 weeks, depending on length of service, and an average of 7 paid holidays a year.

A great majority of the automobile workers are covered by pension programs, almost all of which 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 $84 in addition to his Federal social security benefits.

The great bulk of the production and maintenance workers in the automobile 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 employees. Other unions with membership in the automobile industry include the International Association of Machinists; the Pattern Makers' League of North America; the International Molders and Allied Workers Union of North America; the Metal Polishers, Buffers, Platers and Helpers International Union; the 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 automobile 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.

Automobile 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 automobile plants was less than half that of all manufacturing industries in early 1962. Some automobile plants have fully equipped hospital facilities with doctors and nurses in attendance.

PETROLEUM PRODUCTION AND REFINING OCCUPATIONS

The petroleum industry provides the fuel to run millions of cars and trucks and great fleets of military and civil aircraft; the oil to heat millions of homes and to supply the power for thousands of locomotives and ships; the lubricants for machinery in factories; the asphalt to cover thousands of miles of highways; and hundreds of other products ranging from insecticides to plastic materials.

In 1962, about 465,000 workers, with a wide range of educational backgrounds and skills, were employed in petroleum production and refining. Earnings were relatively high and jobs were located in different parts of the country.

Nature and Location of the Industry

Thousands of companies are in the oil business, most of them specializing in a single activity such as exploring for crude oil; drilling wells; producing, transporting, or refining oil; or operating gasoline service stations. Much of the oil business, however, is done by a small number of large firms that conduct all activities from exploring for crude oil to selling finished petroleum products. These firms provide a large share of the industry's jobs.

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

Petroleum Production. In 1962, about 305,000 wage and salary workers were employed in petroleum production, including the production of natural gas, in the United States. Although drilling for oil goes on in 35 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, California, Oklahoma, Wyoming, Kansas, New Mexico, Illinois, Mississippi, and Colorado. Many additional American workers are employed overseas by United States oil companies, particularly in the Middle East, but also in other places, such as Venezuela and other South American countries and Canada.

The jobs and processes in the petroleum production branch of the industry 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.

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 activities involves using scientific methods to search for oil. Although some of this work is done by exploration departments of major oil companies, most of it is done by firms under contract to major oil companies or by individuals seeking appropriate places to drill for oil. Approximately one-sixth of all petroleum production workers are engaged in exploration. After these workers make scientific tests which indicate the possible presence of oil beneath the surface of the earth, the drilling process begins.

About one-third of the workers in petroleum production are engaged in drilling for oil and in providing directly related oilfield services. 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 of the rigs used today are portable ones brought to the drilling site, but some rigs are built at the site. In 1962, about 46,000 wells were drilled in the United States, with an average depth of over 4,000 feet. Although a few large oil firms do some of their own drilling, most of this work is contracted out to more than 1,000 specialized drilling contractors.

A number of other services are performed in connection with oilfield drilling. These include hauling supplies, cementing wells, cleaning wells with chemicals, and other special operations. Most of this work is also 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 nearly 600,000 oil-producing wells in the United States. These wells are operated by thousands of companies, ranging in size from large firms with wells all over the world to small firms with only a single well. After crude petroleum is brought out of the ground, it is transported to refineries by pipelines, ships, 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 vacuum, or treated with chemicals. This processing, called refining, is done in plants known as refineries.

About 275 refineries were in operation in the country in late 1962, employing about 160,000 wage and salary workers. Refineries range in size from small plants with fewer than 50 employees each to plants with several thousand employees each. Although refineries are located in 40 States, nearly 80 percent of refinery workers are employed in only 8 States: Texas, California, Pennsylvania, New York, Louisiana, Indiana, Illinois, and New Jersey. Refineries are located near deepwater ports where tankers can dock, or near oilfields.

Employment Outlook

Several thousand job openings in petroleum production and refining are expected each year during the remainder of the 1960's and in the longer run. These openings, which will be mainly for scientists, engineers, technicians, and highly skilled craftsmen, will result from the need to replace workers who die, retire, or transfer to other industries. Not all vacancies created by job turnover may be filled, since it is expected that total employment in petroleum production and refining may drop slowly during the next 10 to 15 years, continuing a decline which began during the 1950's.

Employment is expected to be somewhat lower over the next 10 to 15 years, despite the fact that the demand for oil products will continue to increase. The lower employment level will arise from the continuance of technological improvements in methods of producing and refining oil, which will lead to increases in output per worker.

Most of the factors responsible for past growth in the demand for oil products will continue to influence future growth. For example, gasoline consumption is expected to rise steadily with the expected expansion in numbers of automobiles, trucks, buses, and airplanes. The demand for jet fuels will increase as the use of jet planes expands. The demand for fuels for home heating units and for industrial uses such as steam generation is expected to rise. The growing use of factory, construction, farm, and other industrial machinery will require many oil products, such as diesel oil and lubricants. Demand for asphalt will be higher as highway construction expands. Petroleum will continue to be an important source of raw materials in the manufacture of chemical products. (See pages 657 and 660 for additional discussions of the employment outlook in petroleum production and refining.)

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 Petroleum Institute,
1625 K St. NW., Washington, D.C., 20006.

Petroleum Production Occupations

Nature of Work

Workers in the petroleum production branch of the oil industry explore for crude oil, drill wells, and operate and maintain them. These activities require workers with a wide range of education and skills.

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. 0–35.63), study the surface and subsurface compositon of the earth. Geologists seek clues to the possibility of oil traps by examining types of rock and rock formations on and under the earth's surface. Besides making detailed, foot-by-foot surveys, petroleum geologists depend on aerial photographs for a broad picture of the surface features of the area being explored. Geologists often determine the age of rocks by measuring their radioactivity. Subsurface evidence is collected by making test drills and bringing up sample 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 study geological maps. They also analyze 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. 0–36.03), who study fossil remains in the earth in order to locate oil-bearing sands; and *chemists* (D.O.T. 0–07.03) and *mineralogists* (D.O.T. 0–35.63), who study physical and chemical properties of minerals and rock samples. *Planetable operators* (D.O.T. 0–64.30), *draftsmen* (D.O.T. 0–48.50), and *rodmen* (D.O.T. 7–87.100) assist in surveying and mapping operations. A drilling crew may also be part of the party.

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 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 caused 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. 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. 0–35.65). Other members of the seismograph crew may include *computers* (D.O.T. 0–66.67), who prepare maps from the information recorded by the seismograph; *observers* (D.O.T. 0–66.66), who operate and maintain seismic equipment; *prospecting drillers* (D.O.T. 5–75.050) and their *helpers* (D.O.T. 7–75.050), who operate portable drilling rigs to make holes into which explosive charges are placed; and *shooters* (D.O.T. 5–74.030), 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. 0–98.22 and 1–48.21) 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. 1–48.22). He keeps

Seismograph crew checks seismic record for information about underground formations 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. 0–20.11). 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. 5–20.840) and a crew of *helpers* (D.O.T. 7–20.850) 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 such as those found in Texas, California, and Oklahoma. This method was used for about 85 percent of the wells drilled in the United States in 1962.

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 3 crews, generally are required to operate a rig 24 hours a day, 7 days a week. A *rotary driller* (D.O.T. 5–75.050) is in charge of the work of the crew during his tour of duty. His major duties include operating the drilling machinery 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. 5–20.825), 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 pulls them over to a rack beside his platform. He often has several miles of drill pipe racked up before the worn bit is brought to the surface.

Other members of a typical rotary drilling crew include *rotary floormen* (D.O.T. 7–75.050), who guide the lower end of the pipe to and from the well opening and connect and disconnect pipe joints and the worn drill bit. Helpers, called *roughnecks* (D.O.T. 7–20.910), assist floormen in handling these heavy pipes. A *fireman* (D.O.T. 7–70.070) (if steam is used) or *engineman* (D.O.T. 5–72.915) (if diesel or electric power is used) operates the engines which provide power for drilling and hoisting.

An important oilfield worker is the *tool pusher* (D.O.T. 5–93.310), 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. 9–20.10), or general oilfield laborers, are

Riggers assemble mast of drilling rig

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. 5-75.270) 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. 5-75.280), 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 struck. 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." Gas pressure in the well forces crude oil to the surface, through the Christmas tree, and into storage tanks. If not enough natural pressure exists to force the oil to the top, a pump is used to produce an artificial flow of oil.

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 aids 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. 5-72.570) and their *helpers* (D.O.T. 7-72.570) 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* (D.O.T. 5-20.600 through .699 and 7-20.610) 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. 6-55.060) 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. 7-20 .410) 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, one man may perform any combination of jobs of pumping, switching, gaging, or treating. Roustabouts perform various field and well-maintenance jobs which require little skill, but often involve heavy, hazardous work.

Many workers are employed in maintenance operations in oilfields. Welders, carpenters, electricians, and machinists repair and install pumps, gages, pipes, and other oilfield equipment.

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. 5-20.020), 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. 5-20.420), who force acid into the bottom of the well to increase the flow of oil; *perforator operators* (D.O.T. 5-74.040), 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. 5-74.042 and 5-20.156), who obtain samples of soil and rock formations from wells to help geologists determine the presence of oil; and *well-pullers* (D.O.T. 5-20.010), 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 wells have been drilled as far as 100 miles from shore in water more than 200 feet deep. In addition to the same types of workers employed in land operations, the industry employs, for work on crew boats, barges, and other craft, radio men, able-bodied seamen, cooks, and mess boys.

(Detailed discussions of professional, technical, mechanical, and other occupations found not only in the petroleum 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 are usually 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 are often 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 and know-how, 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. Many 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 fifty 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

Rotary drill crew puts new drill bit into operation type of work is less strenuous and offers the advantage of a fixed locale, members of drilling crews or exploration parties who prefer not to travel often transfer to well operation and maintenance jobs.

New workers may start as roustabouts and advance to jobs as switchers, gagers, or pumper helpers, and later to pumpers. Training is usually acquired on the job; at least 2 years of experience is 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, are sometimes 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

Only a few thousand new workers will be hired each year in crude petroleum production during the remainder of the 1960's and in the longer run. These job openings will result from the need to replace workers who die, retire, or transfer to other industries. Not all job vacancies created by turnover may be filled, since it is expected that employment in petroleum production may fall slowly during the next 10 to 15 years, continuing a decline which began in the late 1950's.

Employment is expected to be somewhat lower despite the fact that the demand for oil products will continue to increase in the years ahead. (See p. 652 for a discussion of some of the factors which will influence future demand for oil products.) The lower employment level will arise from the continuance of technological improvements in methods of producing oil, which will lead to increases in output per worker.

Production of crude oil within the United States may increase at a slower rate than overall consumption, because rising costs of finding oil and bringing it to the surface may result in a larger proportion of future domestic oil needs being supplied by imports.

Most of the job opportunities created by turnover in petroleum production will be concentrated in the 10 States which together account for nearly 90 percent of oilfield jobs—Texas, Louisiana, California, Oklahoma, Wyoming, Kansas, New Mexico, Illinois, Mississippi, and Colorado. Although offshore activities still account for only a small portion of total production employment, they are expected to increase greatly in the next 10 to 15 years, particularly off Texas and Louisiana.

Earnings and Working Conditions

Earnings of oilfield workers are among the highest in American industry. In 1962, earnings of nonsupervisory employees averaged $114.93 a week, or $2.81 an hour for a 40.9-hour workweek, compared with an average of $96.56 a week, or $2.39 an hour for a 40.4-hour workweek, for production workers in all manufacturing industries.

The average starting salary in 1963 for geologists with a bachelor's degree and no experience was about $450–$500 a month in the petroleum industry, according to the American Geological Institute. Graduates with a master's degree started at about $540–$580 a month, and those with a doctor's degree earned considerably more. Graduates with job-related experience and special skills were paid above-average entrance salaries. Salaries for overseas assignments ranged from 20 to 25 percent more than those for comparable assignments in the United States.

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 a differential pay of 8 cents an hour for work on the second shift and 16 cents an hour 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 sizable 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 are usually 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. Living quarters, as well as meals, are provided by the employer, generally without charge. Tours of duty vary from 3 to 12 or more consecutive days, depending upon company policy and distance from shore, with an equal number of days off on land.

Compared with the injury-frequency rate for all manufacturing industries as a whole, the injury-frequency rate in crude oil exploration is relatively low and that in well operation and maintenance is about average. Oil drilling, however, is much more hazardous, although improved equipment and methods and special safety training have reduced injuries in recent years.

Petroleum Refining Occupations

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, 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.

About a third of the plant workers in refineries are employed in processing work. A key worker in converting crude oil into usable products is a *stillman* (D.O.T. 4–55.030), or chief operator. He is responsible for the efficient operation of one or more distillation units. The stillman watches instrument readings for any changes in temperature, pressure, and oil flow. In the more modern refineries, the stillman 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 stillman patrols all units for which he is responsible to check their operating condition and to take samples for testing. He may have one or more *assistants* (D.O.T. 6–55.020), 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. 5–72.550) and their *helpers* (D.O.T. 6–55.930), who maintain and operate power-driven pumps which circulate petroleum products, chemicals, and water through units during processing; and *treaters* (D.O.T. 4–55.310), who operate equipment to remove impurities from gasoline, oil, and other petroleum products.

In a typical refinery more than half of the plant workers repair, rebuild, and clean the highly complicated refinery equipment. 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, sheet-metal workers, and welders. Many helpers and trainees are also in

Pumpman adjusts flowmeter, one of many automatic instruments used in modern refinery

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 may also 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.

The petroleum refining industry employs many workers with chemical, engineering, and other professional or technical backgrounds. Among these are chemists, chemical engineers, mechanical engineers, petroleum engineers, laboratory technicians, and draftsmen. Chemists 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 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.

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 are also 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 in other industries as well are given in the sections 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 or 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 stillman to stillman. Skilled processing workers are rarely recruited from other plants.

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 may also 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.

A bachelor's degree in science or engineering usually is the minimum educational requirement for scientists and engineers. 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 small number of job openings are expected for new workers in petroleum refineries during the remainder of the 1960's and in the longer run. These will result from the need to replace workers who die, retire, or transfer to other industries. Not all job vacancies created by turnover may be filled, since it is expected that during the next 10 to 15 years total employment in petroleum refining will continue a decline which began during the early 1950's.

This decline is expected despite an anticipated increase in consumption of petroleum products in the years ahead. (See p. 652 for a discussion of some of the factors which will influence future demand for oil products.) A lower employment level is expected despite the anticipated expansion of refinery output because of the industry's emphasis upon improved methods of refining crude oil. The trend toward larger, more highly automated, and fewer refineries is expected to continue.

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 1962, production workers in petroleum refining averaged $131.02 a week, or $3.18 an hour for a 41.2-hour workweek, compared with an average for all manufacturing industries of $96.56 a week, or $2.39 an hour for a 40.4-hour workweek. The higher average earnings 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 the highest in American industry, according to a survey conducted by the American Chemical Society in 1962. The survey showed that in this industry the average starting salary for chemists with a bachelor's degree and no experience was $520 a month and for chemical engineers $560 a month.

Most petroleum refinery workers receive a 2-week vacation with pay after 1 year of service; 3 weeks, after 10 years; and 4 weeks, after 20 years. A large number of 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 refining is a continuous, round-the-clock operation, processing workers may be assigned to any one of three shifts, or they may be rotated on various shifts and be subject to Sunday and holiday work. Employees usually receive 8 to 16 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 PAPER PRODUCTS INDUSTRY

In early 1963, the pulp, paper, and paper products industry employed about 600,000 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. Production of paper and paperboard in 1962 amounted to more than 400 pounds for each person in the country. The industry employs both men and women in occupations ranging from unskilled to highly specialized professional and technical jobs. Many of these occupations are found only in the pulp, paper, and paper products industry.

Nature and Location of the Industry

The pulp, paper, and paper products industry (the paper industry) is highly mechanized. Pulp and paper and many finished paper products are manufactured by machines—some as long as a city block—in a series of nearly automatic operations, with very little handling of material by workers. Plants in the paper industry are engaged in one or more of three different operations: The manufacture of pulp (the basic ingredient of all paper) from wood, rags, or other raw materials; the production of paper or paperboard (thick paper) from pulp; or the conversion of rolls of paper or paperboard into products. Some of the larger plants produce pulp as well as paper or paperboard. A few very large plants also produce finished paper products.

About 50 percent of the workers in the industry in 1962 worked in mills that made pulp, paper, or paperboard. The remaining workers were about equally divided between plants that made paperboard boxes and other types of containers, and those that produced a variety of other paper products. More than 90 percent of the pulp, paper, and board mill workers 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. However, in 1962, about half of the workers were employed in eight States: New York, Pennsylvania, Wisconsin, Ohio, Massachusetts, Illinois, Michigan, and New Jersey. Few paper industry workers were employed in the Mountain or Southwestern States.

Occupations in the Industry

Workers with different types of skill and levels of education are employed in the industry. Most of them work in production, maintenance, and other plant jobs. Many compositors, pressmen, and other printing workers are employed in converting plants. Because of the complex processes and equipment used, large numbers of chemical and mechanical engineers, chemists, laboratory technicians, and pulp and paper testers and inspectors are employed. Purchasing agents, accountants, personnel managers, salesmen, and other administrative personnel are also employed, as are clerks, stenographers, bookkeepers, business machine operators, and other office workers.

About 125,000 women (more than 1 of every 5 workers) were employed in this industry in 1962. Most of them worked in plant jobs, mainly as machine operators in paper finishing and converting plants; others were in office jobs. Few women were employed in the actual making of pulp or paper.

Plant jobs in the paper industry differ somewhat, depending on the type of paper products made and the raw materials and equipment used. Such jobs, however, may be classified into three broad groups. Production workers operate and control specialized papermaking, finishing, and converting machines (such as printing presses, cutting presses, and gluers). Maintenance workers install, maintain, and repair machinery, pipes, and equipment. Other workers are engaged in a variety of tasks. Truck and tractor drivers make deliveries to and from plants, and other workers load and unload trucks, trains, and ships. Many workers keep inventory records of stock and tools. Guards, watchmen, and janitors do custodial work.

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 40.) 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.

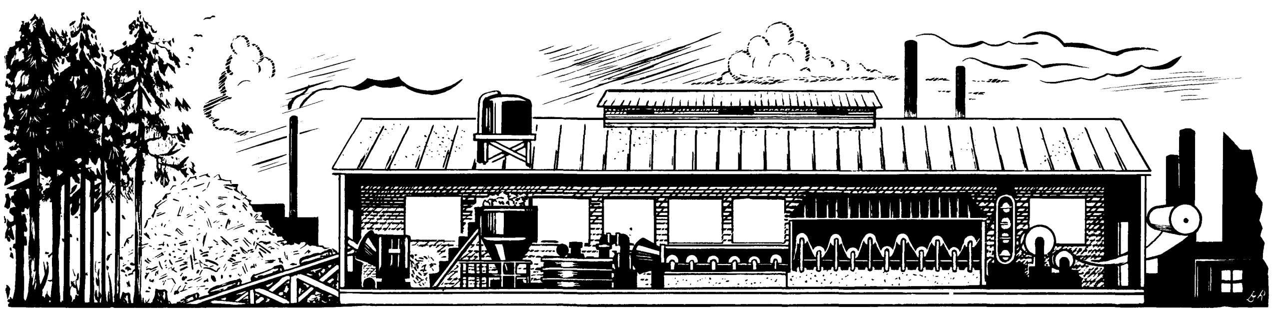
After the pulpwood logs are received at the pulp mill, the bark is removed. One machine used for this operation is a large revolving cylinder known as a "drum barker." Logs are mechanically fed into this machine by a semiskilled worker called a *barker operator* (D.O.T. 6–41.011). The machine cleans 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.

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. 8–41.01). The machine cuts the pulpwood into chips the size of a quarter. These wood chips are "cooked" with chemicals under high temperature and pressure in a "digester," a kettle-like vat several stories high. The digester is operated by a skilled worker called a *digester operator* (D.O.T. 4–41.050) (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, when the contents are ready for removal. When the pulp fibers are removed from the digester, they are washed to remove chemicals, uncooked 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.* 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.

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 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 board paper. It differs from the Fourdrinier machines in the paperforming

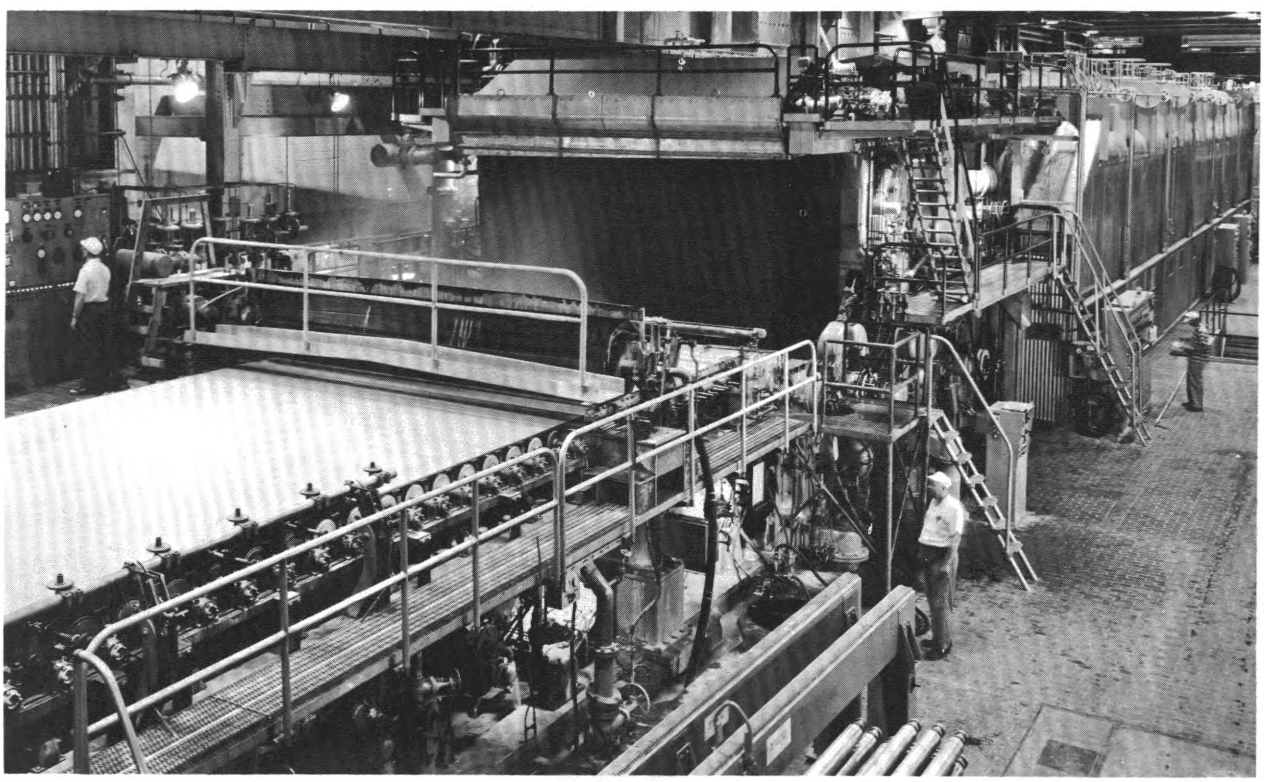
CHART 40

THE PAPERMAKING PROCESS.....



Tree farm ■ Pulpwood ■ Chipper ■ Digester ■ Beater ■ Fourdrinier paper machine ■ Paper 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 which 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. 4–41.420) (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 moisture content 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 belts and wire screens on which the paper is formed and dried. The *backtender* (D.O.T. 6–41.420), 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 paper 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 tightly wound onto rolls. The backtender also adjusts the machinery which 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. 6–41.450),



Machine tender and helper regulate and control flow of pulp onto papermaking machine

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. 6–41.940), 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 board into paper products such as envelopes, napkins, and containers. 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. 6–42.621) who feeds and tends an automatic machine that makes envelopes from either rolls of paper or prepared envelope blanks. He loads the rolls or 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. 4–42.932) 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 cartons. Another of the few skilled workers in a converting plant is the *printer-slotter operator* (D.O.T. 4–42.315) who sets, adjusts, and operates a machine which cuts and creases corrugated or paperboard sheets, 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. 4–42.301) who makes cutting dies used on machines that produce "set-up" cartons (the familiar collapsible cartons used by clothing stores to pack purchases).

Converting plants employed more than 28,000 workers in early 1963 to print text, designs, and lettering on paper products such as boxes, bags, wallpaper, and envelopes. Among these workers were 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 and paper. The job of instrument repairman will become increasingly important with the greater use of automatic control equipment in pulp and paper manufacturing.

Other important maintenance employees are 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 by the paper industry 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 11,000 scientists and engineers and 7,000 technicians were employed by the paper industry in early 1963.

A large number of *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 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 large-scale production methods. Some chemical enginers 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 elec-

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trical and electronic instruments and power-generating and distributing equipment.

Packaging engineers (D.O.T. 0–68.60) design and supervise the production of paper and paperboard containers and packages. A few box manufacturers also employ artists who work out the lettering, 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.

Frequent tests are performed during the manufacturing of pulp or paper to determine whether the size, weight, strength, color, or consistency of the material meets desired 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 mechanical 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 technical or analytical work. Technicians working in laboratories conduct tests and record the results on charts or graphs for interpretation by engineers and chemists.

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 policy decisions. Many of these are technically trained men. To reach decisions, executives require information which 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.

(Detailed information on some of the professional, technical, mechanical, and other occupations referred to above are given elsewhere in this *Handbook*. See index for page numbers.)

Paper tester determines bursting strength of newly made corrugated paperboard

Training, Other Qualifications, and Advancement

The training for new workers in the pulp, paper, and paper 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 or 4 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 *paper engineers* and *paper chemists*) have specialized training in paper technology. A listing of the schools offering such training is available from the American Paper and Pulp Association, 122 East 42d St., New York, N.Y., 10017. 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, for the most part, 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 frequently filled 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 typing 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 seniority 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.

Employment Outlook

There will be thousands of opportunities annually for young people to find jobs in the pulp, paper, and paper products industry during the remainder of the 1960's and in the longer run. Although the industry is expected to increase its employment by a few thousand workers each year, most job opportunities will result from the need to replace experienced workers who retire, die, or transfer to other fields of work. Deaths and retirements alone are expected to provide more than 10,000 job openings annually.

Employment in this industry is expected to grow fastest in the South and West as the paper industry expands in these areas. Employment prospects, however, will remain good in the Northeast and North Central areas, which have large numbers of paperworkers, because of the need to replace experienced workers.

The principal reason for the anticipated employment growth in the paper industry is the expected increase in the production of paper. Employment will increase at a slower rate than production, however, because of the increasing use of more efficient, laborsaving machinery and automatic control equipment.

The production of paper is expected to increase for several reasons. Growing school enrollments and rising levels of education will create a greater demand for textbooks, writing papers, periodicals, and newspapers. Rising population and consumer purchasing power will increase the use of paper products. The development of new paper products and new uses for existing paper products will also stimulate paper production. Examples of new products include tents made of waterproof paper; lightweight, paper sleeping bags; and disposable clothing made from paper "fabrics." Public acceptance of new products such as these should stimulate production growth in the years ahead.

Occupational groups in the industry are expected to grow 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 and 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 $2.41 an hour, or $102.67 for a 42.6-hour workweek, in 1962. In the same year, earnings of production workers in all manufacturing industries averaged $2.39 an hour, or $96.56 for a 40.4-hour workweek.

Highly skilled machine operators and many of the skilled maintenance workers have the highest paying plant jobs. In 1962, some skilled paper machine tenders earned more than $4 an hour, and many maintenance workers received more than $3 an hour.

The following data collected from a number of union-management collective bargaining contracts 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 1962. Local wage rates within these ranges will depend on factors such as type and size of mill and kind of machines used.

Pulpmaking occupations	*Hourly rate ranges*
Drum barker operator	$1. 90–$2. 70
Chipper operator	1. 80– 2. 60
Digester operator	2. 10– 3. 50
Beater engineer	2. 90– 3. 40
Pulp tester	1. 75– 2. 60
Papermaking occupations	
Paper machine operator	2. 50– 4. 70
Back tender	2. 00– 4. 30
Paper tester	1. 75– 2. 60
Converting occupations	
Corrugating machine operator	1. 80– 2. 90
Printing slotter operator	1. 90– 2. 80
Printing pressman and compositor	1. 75– 4. 80
Die maker	2. 00– 3. 20
Maintenance occupations	
Maintenance mechanic (also millwright, welder, pipefitter, sheet-metal worker, machinist, blacksmith, and boilermaker)	1. 90– 3. 45
Painter	2. 25– 3. 35
Carpenter	1. 90– 3. 30
Electrician	2. 15– 3. 55

Many 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 10 cents an hour more for work on the evening shift and between 8 and 15 cents an hour extra 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 for first-shift workers is in effect in most mills. (A few plants in the industry have a standard workweek of 35 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 or more years. Many companies give 4 weeks' vacation to employees who have been with them at least 25 years, but a few provide such vacations after 20 years. Nearly all workers receive paid holidays; the number of days range from 4 to 10 a year, with most mills granting 6 or 7 paid holidays.

Insurance or pension plans, financed at least partially by employers, are in effect in the majority of plants. These plans 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. Pulp and paper companies, however, have made intensive efforts in recent years to reduce heat and unpleasant odors by improved plant ventilating systems.

The injury frequency rate in this industry (number of injuries per million man-hours worked) approximates the rate 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,
1816 N St. NW., Washington, D.C., 20036.

American Paper and Pulp Association,
122 East 42d St., New York, N.Y., 10017.

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

Folding Paper Box Association of America,
222 West Adams St., Chicago, Ill., 60606.

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 are also an attraction. In early 1963, there were more than 75,000 full-time and more than 15,000 part-time staff employees in commercial broadcasting, of whom 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, many thousands of freelance performers, such as actors, singers, dancers, comedians, and top-level announcers, work on specific assignments from stations, networks, and other program producers. (Several thousand other employees worked 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 to get entry jobs are best in stations in small population centers. Generally, the most specialized and best paying jobs are in large population centers, especially with national networks. Nevertheless, the talented individual will have many opportunities to advance to good paying jobs in stations located in smaller population centers.

Nature and Location of the Industry

At the end of 1962, more than 3,700 AM (amplitude modulation) radio stations, over 250 FM (frequency modulation) radio stations, and more than 700 combination AM–FM radio stations were operating commercially in the United States. AM stations broadcast on the standard radio band and are heard on most radio sets. FM stations provide better reception, but cannot broadcast as far.

Over 560 commercial television stations were in operation at the end of 1962. Most were VHF (very high frequency) stations whose broadcasts were received on ordinary television sets—those with channels 2 through 13. Over 80 UHF (ultra high frequency) stations could be received only by television sets with channels 14 through 83. UHF stations usually employed fewer workers than VHF stations and served smaller areas.

In addition to commercial stations, there were more than 250 noncommercial radio stations (mostly FM) and about 80 noncommercial television stations. These stations generally were operated by educational institutions and had relatively few full-time employees (about 1,500) because teachers and students helped to operate them. However, a few large noncommercial television stations had over 100 employees each.

Most broadcasting stations are small, independent businesses. In early 1963, the average AM radio station had less than 15 employees and the average television station about 55. FM-only stations usually had about five employees each. Half of all radio stations had fewer than 10 full-time staff employees and less than 10 percent had more than 25. Most television stations had fewer than 50 full-time staff employees although a few of the largest television stations employed more than 200 workers.

Commercial radio stations are served by 4 nationwide networks and more than 80 regional networks. Stations can affiliate with a network by agreeing to broadcast network programs on a regular basis. National radio networks have affiliated stations in almost every large metropolitan area, although the majority of radio stations are not affiliated with a national network. Regional radio networks have fewer affiliated stations and their activities usually consist of merely interconnecting member stations for special events such as baseball games. Regional networks have few full-time employees because their programing is conducted by staff employees of affiliated stations. The four national radio networks together employed about 1,000 workers in late 1962.

Three nationwide television networks provide program service to affiliated commercial stations. Because television programing is very expensive, most television stations are affiliated with a network which enables them to broadcast programs that would be too expensive for them to originate individually. Networks, in turn, can offer advertisers national coverage. Because some small cities have only one or two television stations, these stations often affiliate with two or three networks in order to offer their viewers a wider variety of programs. Many network television programs are broadcast simultaneously from more than 150 stations throughout the Nation. In late 1962, the three television networks employed about 9,000 workers, or 1 of every 5 staff employees in television.

Almost every population center of over 10,000 has at least 1 broadcasting station (usually radio) and a few of the largest cities have more than 20. Nearly one-third of all radio stations are located in population centers of less than 10,000 and most of these are in 1-station communities. Generally, television stations are located in centers of more than 25,000 population. Seventy percent of all television stations are in centers of more than 100,000. In contrast, 60 percent of all radio stations are in population centers of less than 100,000.

Practically all large broadcasting stations are located in metropolitan areas, but small stations are found in big cities as well as in small communities. About 1 out of 4 broadcasting jobs are in New York and California. These two States have large numbers of broadcasting employees in New York City and Los Angeles, the two major centers originating 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.

Broadcasting Occupations

Broadcasting employees do four general types of work. Those concerned with programing prepare and produce programs; engineering workers operate and maintain the equipment which 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 activities.

More than 40 percent of all full-time staff employees are in programing work. Personnel in the engineering department make up over 20 percent of staff employment. Workers in the sales, publicity, and promotion departments account for about 15 percent, and the remaining workers—about 25 percent—are engaged in business management. These percents 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, and they perform a variety of tasks. The station manager, who in many cases is also the owner, may act as business and sales manager, or perhaps as program director, announcer, and script writer. Announcers in small stations usually do their own writing, often operate the studio control board, and may even act as salesmen. The engineering staff may consist of only one full-time broadcast technician assisted by workers

Television cameraman films scene for show from the other departments on a part-time basis. In large radio and television stations, jobs are more specialized and are usually 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 for specific broadcasts or series of broadcasts or for special assignments. These performers work on a contract basis for either the station or network or for an advertising agency, a sponsor, or an independent company which specializes in producing programs. Many entertainers in radio and television are also employed outside the broadcasting industry—in stage plays, motion pictures, nightclubs, and other entertainment areas.

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 network shows. In small stations, the program functions are handled by a few people who make commercial announcements, read news and sports summaries, select and play recordings, and introduce network programs. A large television station, on the other hand, may have a program staff consisting of more than 75 people in a wide variety of specialized jobs.

Responsibility for the overall program schedule of a large station rests with 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.* These books contain the script and commercials for each program along with their sequence and length.

Engineers and program director in television control room

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.* Selecting appropriate artists and studio personnel, scheduling and conducting rehearsals, coordinating the efforts of all the people involved in the show to produce effective entertainment, and directing the on-the-air show are the director's major responsibilities. He may be assisted by an *associate director*, who takes over such tasks as working out detailed schedules and plans, arranging for distribution of scripts and changes in scripts to the cast, and assisting in directing the on-the-air show. To aid in carrying out the orders of the director and his associates, some stations employ *program assistants*, who help assemble and coordinate the various parts of the show. They arrange for obtaining props, makeup service, art work, and film slides. They assist in timing the on-the-air show, preparing cue cards from the scripts and using them to cue the performers. *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. (Detailed information on the duties, training, employment outlook, earnings, and working conditions of 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. 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 are frequently combined.

Staging a television show is similar in many respects to producing a professional stage play. Stations which originate live television shows must have staff members capable of handling the staging jobs. The *studio supervisor* plans and supervises the setting up of scenery and props and other studio and stage equipment for broadcasts. The *floor* or *stage manager* plans and directs the actors' positions and movements on the set in accordance with the director's instructions, relaying stage directions, station breaks, and cues. The jobs of studio supervisor and floor manager are often combined. *Floormen* set up props, hold cue cards, and do the unskilled chores around the studio. This job is frequently held by beginners in programing departments. *Makeup artists* prepare personnel for broadcasts by applying proper makeup, and maintain supplies and facilities necessary for this work. *Scenic designers* plan and design settings and backgrounds for programs. They select furniture, draperies, pictures, and other properties to help convey the visual impressions desired by the director. *Sound effects technicians* operate special equipment to simulate sounds, such as gunfire, thunder, or falling water, during rehearsals and broadcasts.

In late 1962, almost half of all television programing was on film, over one-quarter was live, and the remainder was 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 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.

Film editor prepares film for television presentation

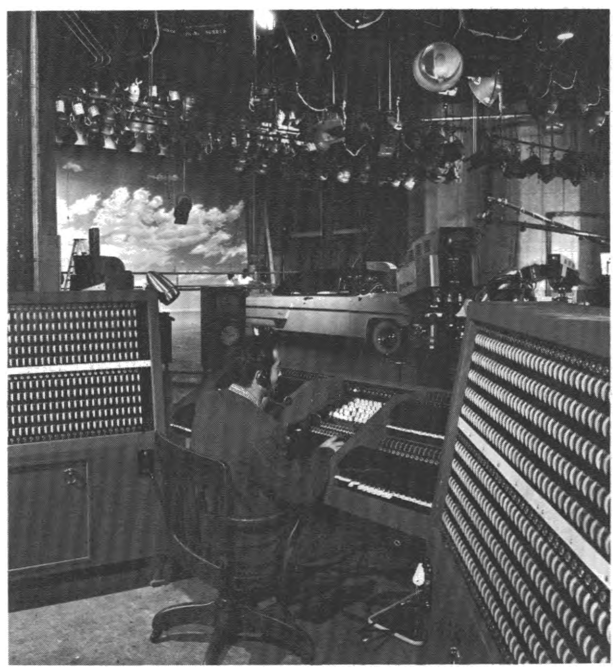
Engineering Department. The engineering department of a broadcasting station is responsible for converting the sounds and pictures making up programs into electronic impulses that can be received on home radio and television sets. Placing microphones, adjusting levels of sound, keeping transmitters operating properly, moving and adjusting television cameras to produce clear, well-composed pictures, and lighting television scenes and performers are the main tasks of the engineering staff. They also install, maintain, and repair the many types of electrical and electronic equipment 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 may also 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 small number of *development engineers* is employed by the networks to design and develop new electronic apparatus to meet special problems.

Sales Department. Broadcasting stations earn their income by selling services to advertisers. These services consist of time on the air which 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 station's operations and the characteristics of the area it serves that are of most interest to advertisers, such as population, number of radio and television sets in use, income levels, and



Light control man in color television studio consumption patterns. Time salesmen in large stations often maintain a close relationship 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 may also handle other functions. Many stations sell a substantial part of their time, particularly to national advertisers, through independent sales agencies known as station representatives, which act as intermediaries 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 may also handle a few of the largest accounts personally. Some large stations employ statistical clerks and research personnel to assist the sales staff by analyzing and reporting the market data relating to the community served, the significance of the ratings of the station's programs reported by the rating services, and other 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. In large stations, executives, such as station managers, have wide responsibilities. 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 in the large stations 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 interest in many areas.

Training in specialized areas such as writing, public speaking, dramatics, designing, makeup, or electronics may be required of beginners in these areas 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, messenger, 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 daylight-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 electronics at a recognized technical institute is probably the best way of preparing for the FCC test.

Specific training or experience is usually not required for entry jobs as announcers in the smaller stations, but applicants must have a good voice, a broad cultural background, and other characteristics that make them dramatic or attractive personalities. 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 an opportunity 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.

Many high-level jobs in broadcasting are held by people who started out in low-level jobs and moved up to more responsible jobs over the years. Advancement was especially rapid during the years following World War II when television and radio were growing rapidly, and people skilled and experienced in broadcast work were in short supply. However, since the mid-1950's, the rate of employment growth has declined and competition for new job openings and promotion has grown keener. As a result, educational and experience requirements have risen.

Women make up about a fourth of broadcasting staff employment. They are seldom employed as technicians, announcers, or salesmen, but frequently work as production assistants, producers, newswriters, continuity writers, casting directors, costume or set designers, supervisors of religious and children's programs, as well as 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. Transferability is 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 broadcasting occupations is expected to increase slightly during the 1960's and in the longer run. Approximately 1,000 new staff broadcasting jobs will be added each year. Employment in existing television stations is expected to remain relatively unchanged. In existing radio stations, the number employed may decline slightly. In addition to the job opportunities to be provided by the industry's slight growth, about 2,000 openings will arise each year because of retirements and deaths. Some openings will also occur when workers in the industry transfer to other fields of work.

Staff broadcasting employment more than doubled between 1945 and 1954. Since then, employment and the number of radio and television stations have increased less rapidly as the number of stations increased enough to serve nearly all communities. Increasing automation of equipment also slowed employment growth.

In the next 10 to 15 years, the rate of growth in commercial broadcasting employment will slow considerably. Although many new stations will be established, most will be small and require few employees. Although the number of noncommercial educational television stations is expected to increase rapidly, most of these stations will be small and will employ a relatively small number of additional workers.

Employment in existing radio stations may decline slightly because many stations are introducing equipment which allows control of transmitters from the studio and eliminates the need for a technical crew at the transmitter site. Automatic programing, another relatively recent technical advance, could reduce employment requirements because it permits radio stations to provide unattended programing service. Employment in existing television stations probably will remain about the same. The trend away from live network television programing to filmed and video taped presentations prepared by independent producers is expected to reduce network employment and increase employment by the independent producers. The effect of increased color television broadcasting will be limited to a small expansion in the number of programing and technical workers.

Competition will be 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 1962 earnings of broadcasting workers ranged from about $50 a week for beginning clerical workers in small stations to more than $15,000 a year for established and highly skilled announcers, engineers, directors, and time salesmen in large stations. The following table of weekly earnings, based on a survey by a private organization, presents national averages for selected broadcasting occupations.

Average gross weekly earnings for selected broadcasting occupations, late 1962

Occupation	Television	Radio
Sales manager	$276	$174
Chief engineer	196	118
Program director	192	122
Salesman	176	124
News director	167	111
Staff announcer	149	99
Producer-director	132	--------
Technician	123	97
Art director	118	--------
Film department head	112	--------
Staff photographer	107	--------
Cameraman	97	--------
Traffic manager	89	69
Continuity writer	85	70
Floorman	76	--------

Wages of individuals in broadcasting vary considerably. Employees in large cities earn much more than those in the same kinds of jobs in small towns. Wages are higher in large stations than in small stations 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 because of the glamour attached to this field of work and the opportunities it affords for high earnings and artistic expression.

Most broadcasting employees have a scheduled 40-hour workweek. Sales and business services workers generally work in the daytime hours common to most office jobs. However, program and engineering employees must work shifts which may include evenings, nights, and weekends. 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. Some employees, particularly in the small stations, work 42- to 48-hour weeks regularly.

Many unions operate in the broadcasting field. They are most active in the network centers and large stations. The National Association of Broadcast Employees and Technicians and the International Brotherhood of Electrical Workers both organize all kinds of broadcasting workers, although most of their members are technicians. The International Alliance of Theatrical Stage Employes 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.

Radio and Television Announcers

(D.O.T. 0–69.21)

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.

More than 12,000 staff announcers were employed on a regularly scheduled, full-time basis in radio and television broadcasting stations in late 1962. About 85 percent of them were employed in radio. In addition to staff announcers, an estimated 10,000 to 15,000 freelance 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.

Training, Other Qualifications, and Advancement

Announcing is a job in which personal characteristics are very important. 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 must also be met. When on the air, an announcer must be able to react quickly and imaginatively in unusual situations. He must also 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 an audience. 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 vocational 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 announcers.

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 enables them legally to operate a transmitter and, therefore, makes them much more useful to these stations. (For information on how to obtain such a license, see p. 675.)

Announcers usually work in several different stations in the course of their careers. After acquiring experience in a station in a small community, an ambitious and talented announcer may move to a better paying job in a larger population center. He may also advance by working into 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 at least 5 years of successful announcing experience before he will be given an audition. Some announcers become well-known and highly paid personalities.

Employment Outlook

Employment of announcers will increase moderately in the 1960's and in the longer run as new radio and television stations are opened. The

National network correspondent presents news broadcast gains in employment resulting from the new radio and television stations expected to go on the air during the next 10 to 15 years will be slightly reduced 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, about 500 openings for announcers each year in the years ahead.

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 beginning jobs.

Earnings and Working Conditions

In the fall of 1962, average earnings of staff announcers were $100 a week in radio and $150 in television. Earnings of individual announcers depend primarily on the size and location of the population center in which they work. As a rule, wages increase with size of the population center. In centers of comparable size, wages are somewhat lower in small stations than in large stations. Earnings of radio announcers ranged from about $75 per week in small communities to approximately $215 in large metropolitan areas. Earnings of television announcers ranged from about $110 a week in small communities to about $230 in large metropolitan areas.

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 are generally paid a fixed weekly or monthly salary. Announcers who work into 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. In medium and large communities, some of these personalties earn more than $15,000 a year. Top announcers in the largest metropolitan areas sometimes earn more than $50,000 a year.

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 generally pleasant because of the variety of work and the many personal contacts which are part of the job. Announcers also receive some satisfaction from having their names become well known in the area their station serves.

Broadcast Technicians

(D.O.T. 0–66.00 through .09)

Nature of Work

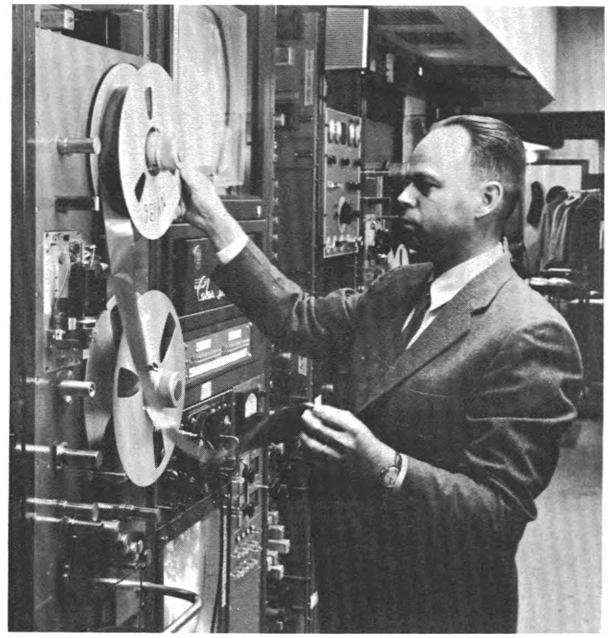
Broadcast technicians set up, operate, and maintain the electronic equipment used to record or transmit radio and television programs. They work with such equipment as microphones, sound recorders, lighting equipment, sound effects devices, television cameras, magnetic video tape recorders, and motion 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 duties of control room technicians 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.)

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 late 1962, about 9,000 nonsupervisory broadcast technicians were employed in radio stations and more than 6,000 in television stations. Most radio stations are small enterprises employing fewer than 4 technicians, although a few large radio stations may employ more than 15. Nearly all television stations employ at least 5 broadcast technicians with the average large station having about 25. 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.



Broadcast technician removes video tape reel from machine following recording of program

In addition to the nonsupervisory technicians, an estimated 5,000 supervisory personnel with job titles such as chief engineer, assistant chief engineer, director of engineering, technical director, and supervisory technician work in engineering departments. Many of these supervisors have worked their way up from technician jobs, but an increasing number have college degrees in engineering. 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, trigonometry, physics, and other science courses provide valuable background for young men anticipating a career 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 at large stations are instructed and advised by the chief engineer or other experienced technicians concerning the work procedures of the station. In small stations, they may start by operating the transmitter and handling other technical duties after a brief instruction period. As they acquire more experience and skill, they are assigned to more responsible jobs. Men who demonstrate above-average ability may move into the top-level technical positions, such as supervisory technician and chief engineer.

Employment Outlook

The number of broadcast technicians is expected to increase only slightly in the next 10 to 15 years. Retirements, deaths, and transfers to other jobs will result in some additional job openings.

Some new 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, which probably will become more widespread in the years ahead, may slightly increase the need for technicians. The color television pickup and transmitting equipment which will have to be added is much more complicated than black and white and requires more maintenance and technical "know-how." However, technical advances, such as automatic switching and programing, automatic operation logging, and remote control of transmitters will limit the increase in job opportunities in new radio and television stations and replacement needs in existing stations.

Earnings and Working Conditions

In late 1962, weekly earnings of broadcast technicians averaged about $95 a week in radio and about $125 in television. However, earnings varied greatly depending on such factors as size and location of the community a station serves, the size of the station, and the experience of the individual. As a rule, technicians' wages are highest in large cities. Beginning wages for technicians in small radio stations, where most of them start, ranged from $60 to $80 per week. Experienced technicians in radio earned from about $80 a week in small towns to more than $175 in larger communities. Earnings of experienced broadcast technicians in television ranged from $110 a week in small towns to more than $200 in large cities. Many broadcast technicians in the networks and largest cities earned more than $200 a week. Supervisory technicians below the rank of chief engineer in the networks and large city stations often earned in excess of $225 a week. Chief engineers earned still higher salaries.

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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 37½-hour week and in many instances 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 800,000 railroad workers were employed in 1962, 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 chiefly 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 600 of these railroad companies were operating in 1962. In addition, the Pullman Co. performed special services for passengers traveling on these railroads.

Slightly more than 100 line-haul railroads and about 40 switching and terminal companies are in a group called class I railways. (Each of these companies has operating revenues of $3 million or more a year.) The remaining companies in the industry are in the class II group. Most of these are the so-called shortline railroads; the others are engaged in switching and terminal operations.

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 93 percent of all railroad workers. With about 29,000 locomotives, about 24,000 passenger train cars, and about 1.7 million freight cars, they transported almost 2.3 billion tons of freight and over 312 million passengers in 1962. 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, accounts for the great bulk of railroad revenue and employment. Passenger service is also important, although it has declined substantially during the past decade. 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, Pittsburgh, Philadelphia, Los Angeles, Toledo, and St. Louis. "Railroad towns," where locomotive and car shops are located, such as Altoona, Pa., and Roseville, Calif., also have relatively large concentrations of railroad workers.

Railroad Occupations

The work force of the railroad industry can be divided into five main groups—employees who (1) operate trains, (2) handle luggage, prepare and serve food, and provide other personal services to passengers, (3) perform communications, station, and office work, (4) build and maintain locomotives, cars, and other rolling stock, and (5) build and maintain tracks, structures, and other railroad property. In 1962, 94 percent of the workers in railroad jobs were men.

Most women employed by the railroads do office work.

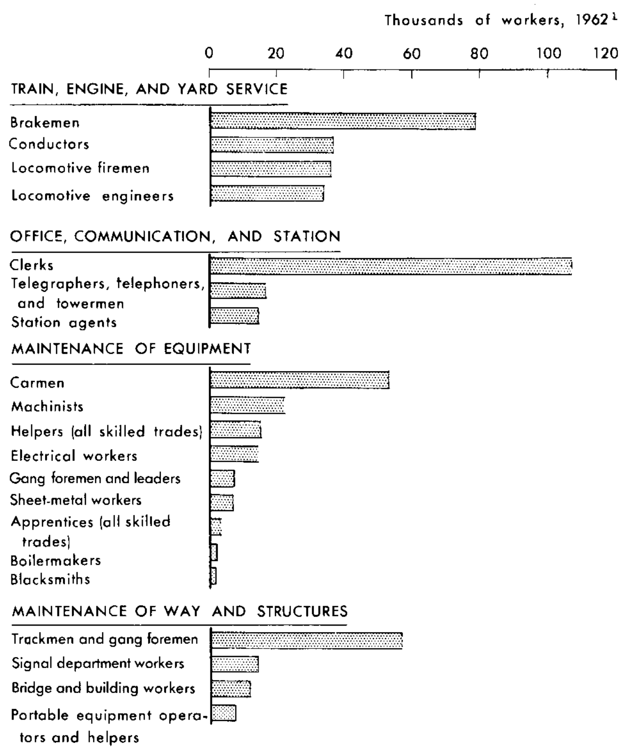
Chart 41 shows the number of employees in some of the principal railroad occupations. Other occupations in which large numbers of workers are employed but which are not shown on the chart, range from unskilled laundry and cleaning jobs to professional positions such as accountant, engineer, and statistician. (Information about some of these jobs is given elsewhere in this *Handbook*. See index for page numbers.)

The workers directly engaged in running the trains are known as "operating employees." They represent about one-fourth of all railroad workers. Class I line-haul railroads had nearly 200,000 operating employees in 1962. 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, more than 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 1962, class I line-haul railroads employed about 177,000 persons in such jobs. Communications are handled by dispatchers who coordinate the movement of trains and issue train orders, and by telegraphers, telephoners, and towermen who either pass train orders and other instructions to the train crews or carry them out by setting signals and track switches. At all stations, station agents are in charge of the railroads' business affairs. Railroad clerks work in stations and company offices where they may do secretarial and other kinds of office work, assist station agents, deal with customers, sell tickets, tend baggage rooms, keep records, and perform related tasks. Also included in this group of

CHART 41

EMPLOYMENT IN SELECTED RAILROAD OCCUPATIONS .....



[1] Estimated from Interstate Commerce Commission Class I railroad data and other sources.

railroad workers are claims investigators, accountants, lawyers, motor vehicle operators, patrolmen, and watchmen.

Another 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 161,000 workers in this group in 1962. Carmen perform a variety of repair and maintenance tasks necessary to keep railroad freight and passenger cars in good operating condition. Electrical workers, machinists, boilermakers, blacksmiths, and sheet metal workers are also employed in car shops.

A considerably smaller group of railroad workers, about one-eighth of the total, maintain and construct tracks, bridges, stations, signals, and other railroad property. The class I line-haul railroads employed about 102,000 in work of this kind in 1962. 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 provide personal services to passengers at stations and aboard trains. With 13,700 employees in 1962, or little more than 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 services 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 this *Handbook*. See index for page numbers.)

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 instruction 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 also available. 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 jointly planned and operated by the companies and the railroad workers' unions. Of the several thousand men who were taking this kind of training in 1962, 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 are generally 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 always 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 with respect to 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 total number of people employed by the railroad industry is expected to continue to decrease during the remainder of the 1960's but the rate of decline is expected to slow down. The employment decline may level off around the end of the decade, if anticipated higher levels of freight traffic are realized. Job opportunities for employees in some railroad occupations may be affected by union-management negotiations relating to work rules and the effects of technological changes, underway in the spring of 1963.

Despite prospects for declining employment in the immediate years ahead, 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 many thousands of job openings each year during the next 10 to 15 years.

Opportunities for applicants probably will be most numerous in construction and maintenance work along the right-of-way, in signal and communications jobs, 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, only a small proportion of new workers can expect to have year-round employment during the first few years on the job.

Jobs in specialized railroad work, such as that done by telegraphers and towermen, and train and engine crews, will be more difficult to obtain on some railroad divisions and in some geographical locations. This is because many specialized railroad workers, furloughed in recent years, may find it relatively difficult to obtain jobs at the same skill level outside the railroad industry and may return to their railroad jobs when recalled. Opportunities in specialized trades will also be limited because efforts are being made to use furloughed workers in other railroad occupations or on other railroad divisions before new workers are hired.

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.

Technological innovation and changing patterns of transportation and production have resulted in a substantial decline in railroad employment in recent years. Between 1955 and 1962, employment in class I line-haul railroads dropped 36 percent, from nearly 1.1 million to 700,000. Such developments as the conversion from steam locomotives to diesel power, and the use of machines for roadway upkeep, have had a considerable impact. The railroad workforce also declined as competition from other modes of transportation—notably automobiles, trucks, buses, airplanes, and pipelines—resulted in a steep drop in railroad passenger travel and little or no growth in freight traffic.

Most of the factors which have led to reduced employment in the past will continue to depress railroad employment during the 1960's. In addition, mergers of two or more competing railroads serving the same general area 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 may be likely. Employment opportunities for some workers may be affected by changes in work rules resulting from negotiations underway in the spring of 1963.

In contrast with the trend in recent years, railroad freight traffic is expected to rise substantially over the next 10 to 15 years. About the end of the 1960's, the need for new workers due to increasing freight traffic is expected to about offset declines in railroad employment resulting from increasing efficiency and 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 during the remainder of the 1960's. Even higher levels of railroad freight traffic may also result if improved railroad freight handling methods and equipment are introduced on a large scale. For example, 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.

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 $2.74 an hour and $121 a week in 1962, whereas production workers in all manufacturing industries averaged $2.39 an hour and $96.56 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.)

The great majority of railroad workers are members of trade unions and many of the conditions under which they work are regulated by collective bargaining agreements. Contracts between the unions and the railroad companies contain clauses dealing with wage rates, hours of work, vacation pay, seniority, and other matters. (The principal unions representing each occupational group are listed in the sections of this chapter which deal with individual occupations.)

The work schedules of railroad employees and the conditions under which they are paid for overtime work depend upon the type of operation in which they are employed. The great majority of railroad employees work at terminals—in yards, stations, and railroad offices. In 1962, 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, was usually 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 directly concerned with looking after the needs of passengers aboard trains—dining car cooks and waiters, Pullman porters, and train attendants—are set on a monthly basis. In 1962, workers in these jobs received time and one-half pay for hours worked over 240 a month. Those employed on regular assignments were guaranteed at least 205 hours of work a month.

Because freight shippers and the traveling public must be served 24 hours a day, the members of train and engine crews, as well as hostlers, telegraphers and telephoners, and station agents, are often required to work nights, weekends, and on holidays. Irregular work schedules are particularly common for extra board workers, since they have no 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, and 3 weeks after 15 years. On many roads, nonoperating employees and some classes of yard workers receive pay for 7 holidays a year.

Under the federally administered Railroad Retirement Act, all employees with more than 10 years of service in the railroad industry receive pensions upon retirement. They receive full pensions when they reach age 65 and partial pensions at age 60, provided they have worked for the railroads for at least 30 years. Employees with 10 or more years of service who become disabled and are unable to continue to work, and dependent wives and husbands of railroad workers who have died, also receive pensions. In January 1963, the average pension paid to railroad workers who retire because of age or disability was about $135 a month; the average pension paid to survivors of railroad workers, about $56 a month.

Another Federal law, the Railroad Unemployment Insurance Act, provides benefits for railroad workers who become unemployed. In 1962, these benefits ranged from $22.50 to $51.00 a week depending on earnings. In January 1963, the average daily unemployment benefit paid was $10.07 (equal to $50.35 for 5 benefit days per week). Unemployment benefits are paid for a period up to 26 weeks, but workers with 10 or more years 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 January 1963, the average daily sickness benefit paid was $10.08.

Other insurance programs are operated under agreements with trade unions and provide group life insurance to nonoperating 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. 5-41.010)

Nature of Work

The engineer is responsible for running the locomotive safely and efficiently. He operates the throttle, air brakes, and other controls, and he supervises the work of the fireman (helper) who works in the cab with him. The engineer may work in a railroad yard or on the road in passenger or freight service.

The yard engineer operates the locomotive or 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 yard mechanical defects needing attention. With the assistance of the fireman or helper, he reads wayside signals and watches for obstructions on the track.

In 1962, about 34,000 engineers were employed by class I line-haul railroads, and a few thousand

Engineer checks conditions by radio with freight train crew

more were employed by short-line railways and switching and terminal companies.

Training, Other Qualifications, and Advancement

Vacancies in engineer positions are filled by firemen who have qualified for promotion. Selection is on a seniority basis. In order to qualify, a fireman (helper) must pass comprehensive examinations which deal with the train's mechanical and electrical equipment, and with fuel economy, safety, timetables, train orders, and other operating rules and regulations. He must also be able to operate any kind of locomotive in service on his road.

A newly promoted engineer starts out as an extra board man without any 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. It is particularly important that they 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

Under present work rules, the number of job openings available as locomotive engineers in the 1960's will be limited. Virtually all openings during the remainder of the 1960'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. Future employment opportunities in this occupation may also be influenced by union-management negotiations underway in the spring of 1963.

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 about 34,000 in 1962 and some further decrease is expected during the remainder of the 1960's.

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 $825 a month in 1962. In through-freight service, engineers averaged $920 a month and in local and way freight service $1,142 a month. The earnings of passenger service engineers averaged about $1,084 a month in 1962.

In 1962, 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 period of time at the end of a run before he makes the return trip back to his home terminal. At such times, he must pay for his own meals and other living expenses that he may incur.

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 also likely to have less work, with the result that their earnings may be lower than those of men with regular assignments.

On all major railroads, wages and the conditions under which engineers work are agreed upon by employers and unions. The great majority of engineers are represented by the Brotherhood of Locomotive Engineers (Ind.). Some are represented by the Brotherhood of Locomotive Firemen and Enginemen.

Locomotive Firemen (Helpers)

(D.O.T. 5-42.100)

Nature of Work

The locomotive fireman (helper) works with the engineer either in the railroad yards or in road service. At the beginning of each 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 responsible for operating the equipment which supplies heat to the train.

From his position at the left side of the cab, the fireman (helper) also 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 may be called upon to relieve the engineer at the controls for brief periods, or to take the controls for a "practice run."

Class I line-haul railroads employed about 36,500 firemen in 1962, and short-line railways and switching and terminal companies a few thousand more.

Training, Other Qualifications, and Advancement

Most railroads prefer that applicants for positions as firemen (helper) 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 as to 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 the position of 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 with the longest seniority are placed on the engineers' extra board.

Employment Outlook

Under present work rules, there will be some opportunities for new workers to obtain jobs as locomotive firemen during the remainder of the 1960's. Job openings will arise chiefly because of the need to replace firemen who transfer to other kinds of work, advance to jobs as engineer, or who retire, or die. However, future employment opportunities in this occupation may be influenced by union-management negotiations underway in the spring of 1963.

Changes in road equipment and yard-operating methods, together with the decline in railroad traffic, caused the number of locomotive firemen employed by class I line-haul railroads to decline from about 45,400 in 1955 to 36,500 in 1962. During the 1960's, continued decline in passenger service and further changes in yard-operating methods probably will result in a further decline in the number of firemen employed. Opportunities for new workers to obtain jobs as firemen will also be limited by the practice of transferring engineers, whose jobs are terminated because of reductions in railroad services, to positions as firemen.

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 $649 a month in 1962. Freight service firemen averaged $927 monthly on local and way freight trains, and $710 monthly on through freight trains. Road passenger firemen averaged $917 monthly.

In 1962, firemen in yard service worked a basic 8-hour day and 40-hour week, and one and one-half times the basic hourly rate was paid for work beyond these hours. Firemen in road service received extra pay under certain conditions; for example, when they traveled more than 100 miles during a run. 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; on these occasions, firemen must pay their own living expenses. 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. 0–92.00 through .29)

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 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, they operate the car retarders by means of which the movement of cars is controlled electronically.

Conductor and brakeman make out freight train trip reports

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 brakeman. 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

Under present work rules, there will be a moderate number of opportunities for brakemen to be promoted to jobs as conductors during the remainder of the 1960's, even though the total number of conductors is expected to decline during this period. Conductors comprise one of the oldest age groups in the Nation's work force, and job openings will develop to replace those who retire, die, or leave railroading for some other reason. Future employment opportunities in this occupation may also be influenced by union-management negotiations that were underway in the spring of 1963.

The number of conductors on class I line-haul railroads declined from about 45,200 in 1955 to 37,000 in 1962, owing to the decline of passenger traffic and 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, it is expected that the number of conductors will continue to decline in the 1960's.

Earnings and Working Conditions

The type of service in which they are employed and the number of cars in their trains determine the basic earnings of conductors. They receive extra pay for work in the mountainous regions. In 1962, yard conductors employed by class I line-haul railroads earned an average of $753 a month. In road freight service, conductors on local and way freight trains averaged $1,056 monthly, and conductors on through freight trains averaged $869 a month. The average for passenger conductors was $950 and for assistant passenger conductors and ticket collectors $837 a month.

In 1962, conductors in yard service worked a basic 8-hour day and 5-day week. For work beyond these hours, they were paid one and one-half times their basic wage rates. 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. During the time spent "laying over," after one run has been completed and before the conductor makes the return trip to his home terminal, he must pay for his own meals and any other living expenses. Conductors on extra board work often have very 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 principally by the Order of Railway Conductors and Brakemen (Ind.) or 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. 5-38.010 and .020)

Nature of Work

Brakemen work with the conductors as members of the train crews on freight and passenger trains and in the railroad yards. One brakeman (or "flagman") is generally stationed in the rear of each freight and passenger train; his duties include seeing that the proper flags, warning lights, and other signals are displayed at the rear of the train in order to protect it while it is in motion and at stops. Most freight and 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 their 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. They are responsible for regulating the air-conditioning, lighting, and heating equipment in passenger cars. Brakemen in passenger service (often known as "trainmen") sometimes have the added duty of assisting the conductor by collecting tickets and generally looking after the needs of the passengers. Yard brakemen (frequently called "switchmen" or "helpers") assist in making up and breaking up trains by throwing switches, coupling and uncoupling freight and passenger cars, and applying or releasing handbrakes on cars to control car movement.

Yard brakemen may advance to positions as yard conductors; usually they stay in yard service throughout their railroad careers. On some roads, brakemen in road service may move from freight 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 positions as 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

Under present work rules, several thousand opportunities for new workers to obtain jobs as brakemen will develop during the remainder of the 1960's, even though the total number of brakemen employed by the railroad industry is expected to decline during this period. Job openings will develop almost entirely as a result of retirements and deaths of conductors and brakemen and because of promotions and transfers to other work. Future employment opportunities in this occupation may also be influenced by union-management negotiations underway in the spring of 1963.

The number of brakemen employed by class I line-haul railroads declined from about 101,000 in 1955 to 80,000 in 1962. During the 1960's, work in railroad yards is expected to become increasingly mechanized, with the use of automatic car retarders, automatic switching, and other devices. These developments are expected to result in a further decline in the employment of brakemen.

Earnings and Working Conditions

The number of cars in the train and the type of service in which he is employed determine the earnings of a brakeman; extra pay is given for work in mountainous country. The average monthly earnings of yard brakemen employed by class I line-haul railroads were $616 in 1962. Brakemen on through freight trains averaged $691 a month and those employed on local and way freight trains averaged $910 monthly in 1962. The monthly average for passenger train brakemen was $810 in 1962.

In 1962, brakemen in yard service had a 5-day, 40-hour basic workweek, and for work beyond this they were paid one and one-half times their regular hourly rates. 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. They pay their own living expenses while on duty away from their home terminals. Brakemen who are on the extra board and have been employed by the railroad for only a short time tend to have less steady work and lower earnings than men with regular assignments, and they may also work more irregular hours. Yard and freight brakemen face considerably greater accident risks than most other railroad workers.

The great majority of brakemen are represented by the Brotherhood of Railroad Trainmen. The Order of Railway Conductors and Brakemen (Ind.) has organized freight and passenger brakemen on some roads, and the Switchmen's Union of North America has organized some yard brakemen.

Telegraphers, Telephoners, and Towermen

(D.O.T. 1-41.22 and 5-44.020)

Nature of Work

Telegraphers, telephoners, and towermen are concerned with controlling the movement of trains in accordance with instructions issued by the train dispatchers. Telegraphers and telephoners receive train orders from the dispatchers and pass them on to the train crews. Towermen operate the controls which throw track switches and set signals in order to route traffic according to train schedules or special orders. To some extent, the three jobs are interchangeable. For example, many towermen also act as telegraphers and telephoners in transmitting orders, and some telegraphers and telephoners spend part of their time operating signals. Telegraphers, telephoners, and towermen work either in railroad stations or in towers located in yards, terminals, and other important junction points along the railroad's right of way. Often, at the 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 generally 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 16,900 workers in the telegrapher, telephoner, and towerman group in 1962. About 1,100 were chief telegraphers and telephoners, 300 were chief towermen, and about 15,500 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 positions as 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 a position as station agent or train dispatcher.

Employment Outlook

There will be some opportunities for new workers to become student operators each year during the remainder of the 1960's, even though employment in this occupational group is expected to decline somewhat. The openings that occur will result primarily from the need to replace experienced workers who retire or die.

Employment on class I line-haul railroads in the telegrapher, telephoner, and towerman group dropped from about 24,400 in 1955 to 16,900 in 1962, and it is expected to continue to decline in the 1960's. 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 1962 were $2.58; telegraphers, telephoners, and towermen averaged $2.62. Chief telegraphers and telephoners and chief towermen averaged, respectively, $2.90 and $3.44 an hour.

Telegraphers worked a basic 40-hour week of five 8-hour days in 1962, 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 Order of Railroad Telegraphers.

Station Agents

(D.O.T. 1-44.22)

Nature of Work

Station agents are the railroads' official representatives in dealing with the public at railroad stations. Most agents work at small stations where they sell tickets, check baggage, calculate freight and express charges, load and unload freight and express packages, and perform many other tasks. They may also serve as telegraphers and telephoners, receiving and delivering train orders and other messages pertaining to the company's business. At stations where supervisory agents are employed, some of this work may be done by railway clerks, telegraphers, and other employees working under the station agent's supervision. In major freight and passenger stations with many railroad employees, the duties of the station agent are primarily administrative and supervisory.

About 14,500 station agents were employed by class I line-haul railroads in 1962. About 12,600 worked in small stations (9,700 of them acting as telegraphers and telephoners in addition to their other duties), and 1,900 had supervisory positions at major stations. The short-line railways employed several hundred other agents, chiefly at small stations.

Training, Other Qualifications, and Advancement

Positions as agents in small stations or assistant agents in larger ones are usually filled by assigning experienced telegraphers. Assignment to an agent's position, requires, in addition to the necessary seniority, 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 positions as assistant agents to agents. They may be promoted to supervisory positions such as stationmaster or inspector.

Employment Outlook

A limited number of opportunities for assignment to station agent jobs will arise each year during the remainder of the 1960's, principally because of the need to replace agents who retire or die. For some years the number of station agents employed by class I line-haul railroads has been declining; between 1955 and 1962, employment dropped from about 19,600 to 14,500, principally because some local passenger and freight services were discontinued. It is expected that the railroads will discontinue additional passenger services during the 1960's, with the result that the total number of station agents employed will decline further.

Earnings and Working Conditions

The earnings of station agents vary. In 1962, the earnings of agents who also served as telegraphers and telephoners on class I line-haul roads averaged $2.61 an hour; other agents at small stations who did not act as telegraphers averaged $2.78 an hour. Agents at major stations earned a straight-time average of $3.35 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, with the exception of some supervisory agents, are members of The Order of Railroad Telegraphers.

Clerks

(D.O.T. 1-01.31; 1-11.02 through .15; 1-18.74, .93, .97; 1-26.03; 1-31.01, .10; 1-34.02, .04; 1-36.01)

Nature of Work

Railroad clerks handle the huge volume of paper work necessary to keep an account of each piece of rolling stock, and transact business with freight shippers and the traveling public. They work in railroad stations, freight houses, yards, terminals, and company offices. Clerks make up the largest single group of railroad employees—class I line-haul railroads employed about 107,000 of these workers in 1962, and short-line railways, thousands more.

The majority of railroad clerks—66,000 on class I line-haul railroads in 1962—do clerical work connected with business transactions such as collecting bills, investigating complaints, adjusting claims, tracing shipments, compiling statistics, selling tickets, and keeping books. In small offices and stations, one man may perform duties related to several of these jobs, but in large offices with many employees, each clerk usually handles a specialized job.

A second group, totaling 18,900 in 1962, 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 this *Handbook*. See index for page numbers.)

Nearly 10,000 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 12,700. 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

Railroad clerk checks car numbers in freight yard may lead eventually to positions as auditors or statisticians. Railroad clerks may also be promoted to jobs as traffic agents, buyers, storekeepers, or ticket and station agents.

Employment Outlook

Even though employment in clerical positions is expected to decline during the remainder of the 1960's, several thousand job opportunities for new workers will become available each year. 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 1962, their number was 107,000. A continued decrease in the employment of these workers is expected, 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.

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 $2.59 an hour in 1962. Secretaries, stenographers, typists, and office machine operators averaged $2.57 an hour; senior clerks and specialists averaged $2.91 an hour; and supervisory and chief clerks, $3.10 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 and Steamship Clerks, Freight Handlers, Express and Station Employees represents the railroad clerks on all major roads.

Shop Trades

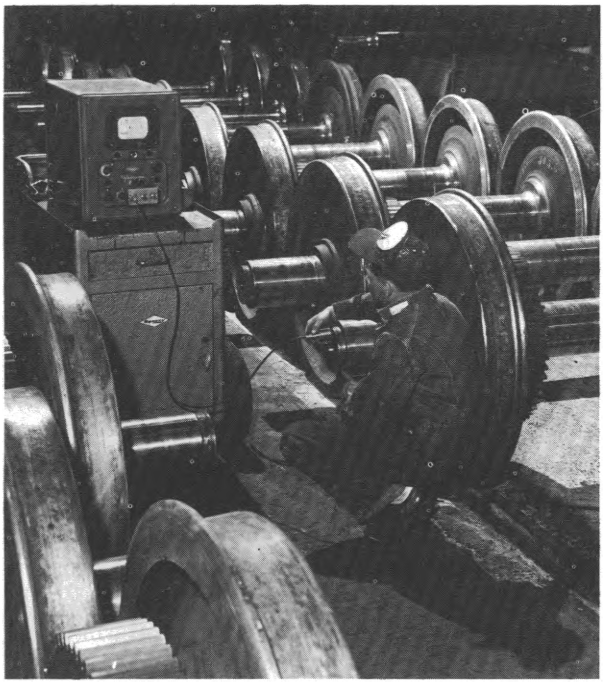
Nature of Work

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. 5–79.020), *machinists*, *electrical workers*, *sheet-metal workers*, *boilermakers*, *and blacksmiths*. They work in railway shops, enginehouses, yards, and terminals.

In 1962, about 102,000 journeymen mechanics in these six crafts were employed by class I line-haul railways. Working with them were 6,900 gang foremen and leaders, 15,100 helpers, and 3,200 apprentices. Several thousand more workers in the same occupations were employed by short-line railways.

Carmen, who numbered about 53,000 on class I line-haul railroads in 1962, 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. Most carmen are skilled in carpentry and can use power equipment as well as handtools. A few are skilled only in specialities such as upholstering, car painting, and patternmaking. Some carmen work as car inspectors in the railroad yards and stations, examining cars for defects that might lead to accidents or delays.

Machinists are the second largest group of skilled shop workers. About 23,000 were employed in 1962, doing such work as assembling and dismantling equipment, and replacing and repairing parts. Electrical workers, who numbered about 15,000 in 1962, 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 2,300 in 1962—employed mainly away from the shop, lay power and communications lines for equipment used by the railroads.) Sheet-metal workers, numbering about 6,700, install and maintain light sheet-metal parts and do pipefitting on cars, locomotives, and other equipment. Boilermakers, of whom there were about 2,000, maintain and repair stationary boilers, tanks, and other parts made of sheet iron



Shop worker checks for flaws in locomotive axles

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 this *Handbook*. See index for page numbers.)

Training, Other Qualifications, and Advancement

Apprenticeship is the usual way of entering the shop trades. 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, with no previous experience in their chosen trades, take this training as regular apprentices, generally for a 4-year period. Men with at least 2 years of previous work experience in the trade train as helper apprentices for a 3-year period.

To become a regular apprentice, the applicant must be at least 16 and not over 21 years of age. The railroads prefer that helpers entering the 3-year apprentice training be no older than 30 or 35. On some roads, applicants for regular apprentice training are required to pass 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 remainder of the 1960's. In 1962, apprenticeship programs operated by class I line-haul railroads were training about 3,200 new workers, 2,900 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 147,000 in 1955 to 102,000 in 1962, and some further decline appears likely in the remainder of the 1960's despite the fact that more rolling stock will be needed to handle the anticipated increase in freight traffic. Among the factors which are making it possible for the railroads to handle a given amount of work in the shops with a 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 in the individual shop crafts has not been affected in the same way by changes in equipment and operating methods, nor is it likely to be in the future. Two extremes in shop craft employment trends are represented by electrical workers and boilermakers. During the 1955–62 period, when the total number of skilled craftsmen in the six principal shop trades decreased by one-third, the number of electrical workers declined only 18 percent. Some increase in employment of electrical workers may occur during the next 10 to 15 years because of the widespread 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 2,000 in 1962—is expected to continue, because the skills of these workers are not required as much in the repair of diesel locomotives as in the repair of steam locomotives. In the case of carmen and machinists, who together account for about three-fourths of all journeymen mechanics employed in the shop crafts, the decline since 1955 in the number employed has been roughly one-third; some further decline, although less pronounced, is expected during the 1960's.

Earnings and Working Conditions

Straight-time average hourly earnings of journeymen employed by class I line-haul railroads in the shop trades in 1962 were: Carmen $2.69; machinists $2.73; electrical workers $2.73; sheet metal workers $2.73; boilermakers $2.75; and blacksmiths $2.73. Straight-time earnings of helpers in all shop crafts averaged $2.43 an hour; regular apprentices, who spend part of their time in classroom instruction and the rest of it on the job, averaged $2.29 an hour; and helper-apprentices, who also worked on the same basis, averaged $2.49 an hour; gang foremen and gang leaders averaged $3.10 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 work.

Major repairs on locomotives and cars are generally made 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 of Railway Carmen of America; International Association of Machinists; 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 Employees' Department of the AFL–CIO.

Signal Department Workers

(D.O.T. 5–79.170 and 7–79.170)

Nature of Work

Workers in railroad signal departments construct, install, maintain, and repair the signaling systems which control the movement of trains and assure the safety of railroad travel.

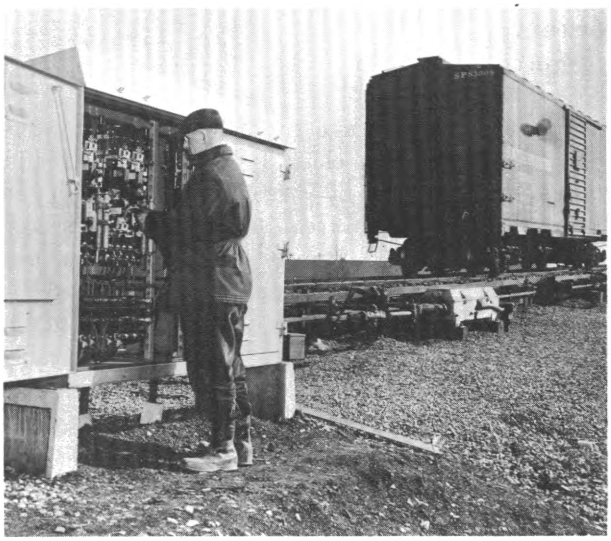
One group of skilled workers, known as signal maintainers, is responsible for keeping wires, lights, switches, and other controlling devices in good operating condition. The work requires a thorough practical knowledge of electricity and considerable mechanical skill. Work on the newer signaling systems also requires a knowledge of electronics.

A second skilled group, known as signalmen, generally has the same skills and knowledge required of maintainers, but is primarily concerned with constructing and installing new signals and signal systems. Signalmen work as members of crews which also include unskilled and semiskilled workers. The crews travel from one part of the road to another, wherever construction work is 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 1962, class I line-haul railroads employed about 13,900 men in this kind of work; included were about 9,000 signalmen and signal maintainers, about 1,500 semiskilled assistants, and 1,130 unskilled helpers. Several hundred workers in these groups were also 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



Signal maintainer checks board which controls speed of cars

years of age and have a high school education or its equivalent. Knowledge of electricity and mechanical skill are assets to young men seeking these jobs.

New employees start as helpers doing unskilled work under the direction of experienced men, or as semiskilled assistants, if they have had previous experience in signal work. Helpers, after about 1 year of training on the job, usually advance to the job of assistant. Openings for signalmen and signal maintainers are filled, as they occur, by promoting qualified assistants according to seniority rules. It generally takes at least 4 years for an assistant to work up to a position as signalman or signal maintainer.

Both signalmen and signal maintainers may be promoted to more responsible positions such as those of inspectors or testmen, gang foremen, leading signalmen, or leading signal maintainers. A few may advance to positions as assistant supervisors or signal engineers.

Employment Outlook

There will be some opportunities for new workers to obtain entry jobs as helpers or assistants during the remainder of the 1960'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 4,641 in 1955 to 2,600 in 1962, and the number of skilled signalmen and signal maintainers declined from about 10,400 to 9,000. These occupations are expected to continue to decline during the 1960's. While the installation of new equipment has initially increased signal work opportunities, the overall effect has been declining maintenance and repair requirements.

Earnings and Working Conditions

The average straight-time hourly earnings of signalmen and signal maintainers employed by class I line-haul railroads in 1962 were $2.78. Assistant signalmen and signal maintainers averaged $2.55 and helpers $2.42 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 tend to have fairly steady work, because the amount of work required for maintaining railroad signal systems does not change greatly with variations in traffic or with the seasons. Signalmen and other crew members, particularly on some northern roads, may have less work during periods of especially bad weather. Workers in both of these occupations do most of their work out of doors, and maintainers must be prepared to make repairs regardless of the time of day or the weather conditions. Both maintainers and signalmen, 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. Maintainers are generally able to live at home, since they maintain signals only over a limited stretch of track.

Most signal workers are members of the Brotherhood of Railroad Signalmen.

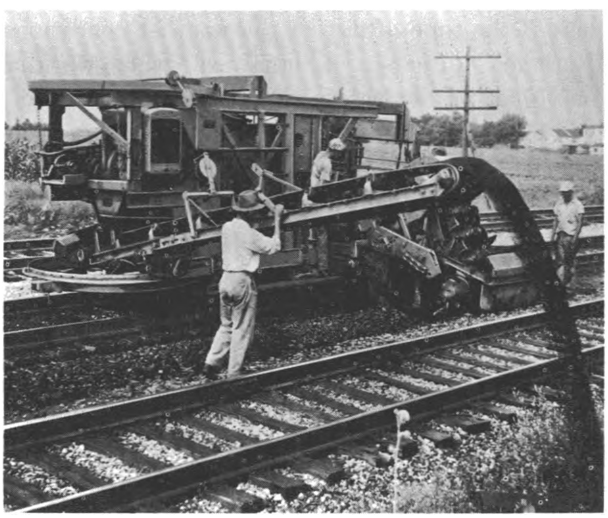
Track Workers

(D.O.T. 0–98.71, 7–23.121, 9–32.01, and 9–49.30)

Nature of Work

Trackmen and portable equipment operators construct, maintain, and repair railroad tracks and roadways. Many of them work in section crews which patrol and maintain a limited section of the railroad's right-of-way. Some roads combine the section crews with 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 motor cars, make regular inspections of the right-of-way, looking for cracked rails, weak ties, washed-out ballast, and other track and roadway defects. Trackmen and portable equipment operators working in the crews then make the necessary repairs. Roadway maintenance machines, such as multiple tie tampers, power wrenches, and ballast cleaners, have been gradually displacing 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.



Track workers operate ballast cleaning machine

In 1962, an average of 66,000 track workers were employed by class I line-haul railroads. They included 45,600 trackmen working in crews, 8,000 portable equipment operators and helpers, and 12,500 gang foremen. Additional thousands of these workers were employed by the short-line railroads. The size of this maintenance-of-way work force varies considerably during the year because many construction and repair jobs are done in the summer months when the weather is best.

Training, Other Qualifications, and Advancement

Most track workers are trained on the job, and it takes up to 2 years to acquire the skills necessary to become an all-round trackman. Machine operating jobs in track maintenance work are assigned to qualified trackmen on the basis of seniority.

Most roads prefer workers between the ages of 21 and 45 for their track work forces. Men seeking work as trackmen must be able to read and write and do heavy work. Applicants are often required to take physical examinations. A high school education is desirable for workers who are seeking to advance to positions as portable equipment operators and gang foremen.

Trackmen and portable equipment operators with the necessary seniority and qualifications may advance to positions as gang foreman 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 remainder of the 1960's even though employment in such work is expected to decline. Most of these new workers will be hired for the seasonal rush during the summer months, particularly in northern sections of the country. Comparatively few openings that occur will offer steady year-round employment.

For some years, the use of mechanized equipment and new kinds of materials in roadway construction has been substantially reducing the number of men employed by the railroads in maintenance-of-way work. At the same time, however, the use of mechanized equipment has been creating a limited number of maintenance-of-way jobs involving the operation of roadway machines. Between 1955 and 1962, as the number of trackmen and foremen in section and other kinds of crews dropped from about 144,000 to 66,000, the number of portable equipment workers rose from 7,500 to about 8,000. 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 $2.21 an hour in 1962. Portable equipment operators and helpers averaged $2.53 and crew foremen averaged $2.58 an hour in 1962. A basic 5-day, 40-hour week was in force for most classes of track workers. Time worked in excess of 8 hours a day was paid for at time and one-half rates, and after 16 hours of continuous service, double time rates usually were paid.

Since most section men inspect and maintain only a few miles of track, they are usually able to 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 Employees.

Bridge and Building Workers

Nature of Work

These workers construct, maintain, and repair tunnels, bridges, stations, railway shops, and a variety of other structures owned by the railroads. In 1962, class I line-haul railroads employed in this kind of work about 10,000 skilled craftsmen, 2,900 helpers, and 2,400 foremen. Among the skilled craftsmen were about 6,300 carpenters working as all-round mechanics in a variety of construction trades in addition to carpentry; about 2,600 masons, bricklayers, plasterers, and plumbers; and about 700 painters and 500 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 this *Handbook*. See index for page numbers.)

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 remainder of the 1960's, even though the overall number of these workers is expected to decline. 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 15,500 in 1962. 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.

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 1962 were $2.52. Masons, bricklayers, plasterers, and plumbers averaged $2.68, iron workers $2.71, painters $2.55, helpers $2.36, and foremen $2.81 an hour in 1962. 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 usually 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 Employees represents the bridge and building workers on most roads.

OCCUPATIONS IN RESTAURANTS

Every day, millions of Americans eat in restaurants, cafeterias, snack bars, and other eating places. There are about 350,000 establishments whose main business is to serve food and beverages. According to the Census of Population, almost 2 million people worked in these establishments in 1960. Thousands of food-service workers were also employed in establishments which serve meals in connection with some other business activity—for example, drug and department stores, hotels, hospitals, schools operating lunchrooms for students, and factories operating cafeterias for employees.

Nature and Location of the Restaurant Business

Establishments that cater to the American custom of "eating out" range from roadside diners to luxurious and expensive restaurants. The kind of food offered and the way it is served depend primarily on the type of customer the restaurant seeks to attract. For example, cafeterias where many people eat lunch on workdays emphasize rapid service and inexpensive meals, whereas in restaurants which cater to customers who have the time to eat in a more leisurely manner, meals may be served elaborately and include unusual dishes which are "specialties of the house."

Most restaurants are small independent 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. Only a small proportion of all restaurants are run by proprietors or business firms owning more than one restaurant. However, this small group includes some very large restaurants and employs thousands of restaurant workers.

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

Restaurant Workers

Approximately three-fourths of all the people who work in restaurants are employees who prepare and serve food or do other kinds of service work. The two largest groups, each with several hundreds of thousands of workers, are waiters and waitresses, and cooks and chefs. In addition to these two principal groups of service workers, there are counter attendants who serve food to customers in cafeterias; 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. Many of these workers operate mechanical equipment such as powerdriven dishwashers, floor polishers, vegetable slicers and peelers, and garbage disposal equipment, which eliminates much drudgery and physical exertion. Different kinds of service jobs such as these are likely to be found only in the largest restaurants, however. In many

Restaurants employ thousands of dishwashers and other kitchen workers small eating places, waiters and waitresses clear and set up tables, sometimes prepare certain kinds of dishes, help in the kitchen when they are not busy with customers, and do other kinds of work.

Another large group of restaurant workers—about one-sixth of the total—consists of managers and proprietors. Most are owners and operators of fairly small restaurants and, in addition to acting as managers, do cooking and other work. Some are salaried employees who spend all of their time managing the affairs of the larger restaurants.

All other restaurant workers combined account for about one-tenth of total employment in the industry. They are employed principally in large restaurants. Most of them 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. Large restaurants also employ mechanics and other maintenance workers, and professional employees such as accountants, personnel workers, and musicians and other entertainers.

Three key restaurant occupations—waiters and waitresses, cooks and chefs, and restaurant managers—are discussed in this chapter. The work of many clerical and professional restaurant employees is similar to that done by workers in other industries and is described elsewhere in this *Handbook*. (See index for page numbers.)

Employment Outlook

Many thousands of openings in restaurant occupations are expected each year during the remainder of the 1960's. Although many new jobs will be created by the growth of the restaurant business, most openings will result from turnover. Turnover is always high among waitresses, primarily because many women work a short time and then leave to take care of their families. Turnover is also high among kitchen helpers and others in jobs requiring little training or skill. Therefore, 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 are also 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.

In the long run, the business done by establishments which serve meals is likely to increase substantially, and the number of workers will rise fairly rapidly. More people will require restaurant services as the population increases and income levels rise. Fewer meals will be eaten at home as more housewives take outside employment and more people travel on jobs and vacations. Restaurants, hotel and motel dining rooms, school and factory lunchrooms, drug store fountains, and even vending machines which dispense prepared foods will share in the increased business. However, within the restaurant industry, where businesses are operated primarily to serve meals, employment is likely to rise only moderately.

Among the major factors which will tend to limit the increase in employment are the probable expansion in eating facilities available in hotels, retail stores, and other establishments outside the restaurant industry, and changes taking place within the industry itself which 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 their 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, a moderate increase in the number of restaurant employees is expected as the volume of business expands to meet the population's need for restaurant services.

Earnings and Working Conditions

Information about wages of nonsupervisory employees in restaurants with 10 or more workers is available from a study of 27 metropolitan areas made by the Bureau of Labor Statistics in

1961. Wage levels were generally lowest in southern cities and highest on the West Coast, as shown in the following tabulation which gives the lowest and highest average wages for workers in some of the principal restaurant occupations. (For earnings of waiters and waitresses, cooks and chefs, and restaurant managers, see statements on these occupations.) In restaurants and communities smaller than those included in the BLS survey, wage levels may be somewhat lower than the averages given.

	Average hourly wages, 1961	
Men	*Highest*	*Lowest*
Busboys	$1.54 (San Francisco-Oakland)	$0.44 (Memphis)
Cafeteria counter attendants	1.72 (St. Louis)	1.00 (Baltimore)
Porters	1.75 (San Francisco-Oakland)	.58 (Memphis)
Dishwashers	1.63 (San Francisco-Oakland)	.46 (Memphis)
Kitchen helpers	1.84 (San Francisco-Oakland)	.63 (Memphis)
Pantrymen	2.27 (San Francisco-Oakland)	.79 (Atlanta)
Women		
Busgirls	1.63 (San Francisco-Oakland)	.48 (Memphis)
Cafeteria counter attendants	1.72 (San Francisco-Oakland)	.79 (Memphis)
Porters	1.35 (Chicago)	.75 (Newark-Jersey City)
Kitchen helpers	1.94 (San Francisco-Oakland)	.54 (Memphis)
Dishwashers	1.78 (San Francisco-Oakland)	.48 (Memphis)
Checker-cashiers	2.06 (San Francisco-Oakland)	1.09 (Denver)
Food checkers	1.96 (San Francisco-Oakland)	.95 (Atlanta)
Pantrywomen	2.02 (San Francisco-Oakland)	.69 (New Orleans)

Within each of the metropolitan areas surveyed, the wages of individual workers in the same occupation differed considerably, depending on the size and type of restaurant in which they were employed. In the San Francisco–Oakland area, for example, some men employed as dishwashers were paid less than $1 an hour, and others received $2 or more an hour. In addition to wages, restaurant employees usually receive at least one free meal each day and are often provided uniforms.

Most of the restaurant workers included in the 1961 survey worked 40 hours or more a week; many, especially in southern cities, worked a scheduled 48-hour week. In one area—San Francisco–Oakland—the workweek of most employees was 37½ hours. Restaurant employees often work on split shifts; 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 evening and on holidays and weekends. A majority of restaurant workers in the 27 areas surveyed received 1 week of paid vacation after 1 year of service and 2 weeks after 2 years. Provision for paid holidays and various types of health and insurance benefits were also common in many areas.

Many restaurants are air conditioned, have convenient work areas, and are furnished with the latest equipment and labor-saving devices. In other restaurants—particularly small ones—working conditions may be less desirable. In all restaurants, workers often 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 and injury from knives, broken glass or china, or mechanical equipment.

The principal union organizing waiters and waitresses and cooks and kitchen workers in restaurants is the Hotel and Restaurant Employees and Bartenders International Union.

Where To Go for More Information

Additional 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.

Information on food service occupations is also available in:

Food Service Industry: Training Program and Facilities, U.S. Department of Health, Education, and Welfare, Bulletin 298, 1961. Superintendent of Documents, Washington, D.C., 20402. Price 65 cents.

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.

Additional information about wages in restaurants is available in:

Industry Wage Survey: Eating and Drinking Places, June 1961, BLS Bulletin 1329, 1962. Superintendent of Documents, Washington, D.C., 20402. Price 40 cents.

Waiters and Waitresses

(D.O.T. 2-27.01 through .12)

Nature of Work

Waiters and waitresses spend most of their time taking guests' orders, serving food and beverages, making out checks, and, sometimes, collecting payments. The way they go about this work is largely determined by the type and size of the establishment in which they work. In diners, coffee shops, and many other small restaurants, the emphasis is on quick service with a minimum of frills. Waiters and waitresses in these places may clear tables, carry soiled dishes to the kitchen, and clean equipment, in addition to serving food. Sometimes they combine counter service, cashiering, preparing certain foods, or other duties with waiting on tables. In other kinds of restaurants, waiters and waitresses may serve food at a more leisurely pace and are expected to observe certain rules of correct food service. They may advise guests on the choice of wine or answer questions about how the food is prepared. They are sometimes assisted by busboys or busgirls who carry used dishes to the kitchen, set tables, and perform other duties incidental to meal service.

In large restaurants, waiters and waitresses may be supervised by captains, hostesses, headwaiters, or headwaitresses, who greet guests and escort them to tables; in small eating places, they may work directly under the supervision of the owner or manager.

Where Employed

More than 600,000 waiters and waitresses were employed in 1960 in establishments operated primarily to serve food and beverages. In addition, many thousands worked in railroad dining cars, hotels, stores, and other establishments whose primary business was something other than operating a restaurant. Women far outnumber men in this occupation. Many of the men are waiters in expensive restaurants where meals are served in a formal manner.

Training, Other Qualifications, and Advancement

Although many people with little formal schooling enter this occupation, more and more employers, in hiring inexperienced workers, prefer people with at least 2 or 3 years of high school. Special courses for waiters and waitresses, such as those given by vocational schools and restaurant associations, are considered good preparation by most employers. Some restaurants hire inexperienced workers and give them a few weeks of on-the-job training, often first as busboys or busgirls and later as waiters and waitresses. On the other hand, many restaurants—especially those with the more formal type of service—hire only experienced personnel.

Waitress serves in restaurant featuring foreign specialties

Waiters and waitresses must be able to do the simple arithmetic needed to add food checks and compute taxes. They should speak English reasonably well, have a friendly manner, know how to put people at ease, and be neat in personal appearance. In a few restaurants, knowledge of a foreign language is important. Health certificates are often required of waiters and waitresses to indicate that they are free from communicable diseases.

Experienced waiters or waitresses may transfer to jobs in better paying restaurants and advance to supervisory positions such as headwaiter or hostess. Supervisory workers may sometimes advance to managerial positions.

Employment Outlook

Many jobs for waiters and waitresses are expected to become available during the remainder of the 1960's. Most openings for beginning waitresses will probably continue to arise from turnover in the relatively low-price restaurants. Competition for waitress jobs will remain keen in higher price restaurants, because the rate of turnover is relatively low in such establishments. Moreover these restaurants usually prefer to hire experienced waiters. Many temporary jobs for both waiters and waitresses will become available each summer in resort areas. College students and temporary workers who live nearby are usually hired for these jobs.

Over the long run, employment in this occupation is expected to rise fairly rapidly. Many thousands of new positions will open up in restaurants, in hotel dining rooms, and other types of eating places. As in the past, an even larger number of openings are likely to occur because of the need to replace workers who leave the occupation.

Earnings and Working Conditions

Waiters and waitresses usually receive only a small wage from their employers. For practically all workers in this occupation, total earnings depend not only on wages but also on customers' tips. In most large city restaurants, the value of tips is generally greater than the wages. However, the amount received in tips varies considerably and depends, to a great extent, on the worker's skill, the size, type, and location of the restaurant, and the tipping customs of the community.

A Bureau of Labor Statistics survey covering 27 metropolitan areas provides information about the average wages of almost 100,000 table waiters and waitresses. In the great majority of the areas, wages averaged less than $1 an hour in 1961. Wage levels were lowest in the South, where the averages for all but a few cities were less than 50 cents an hour. They were highest on the West Coast, where citywide averages ranged from $1.10 to $1.40 an hour for waitresses, and from $1.20 to $1.47 for waiters. In many restaurants—particularly in small cities and towns—wages are often less than in the metropolitan areas covered by this survey.

Waiters and waitresses are employed under much the same conditions as other restaurant workers. However, many are part-time workers.

See introductory statement for additional information on earnings and working conditions and on where to go for more information.

Cooks and Chefs

(D.O.T. 2–26.)

Nature of Work

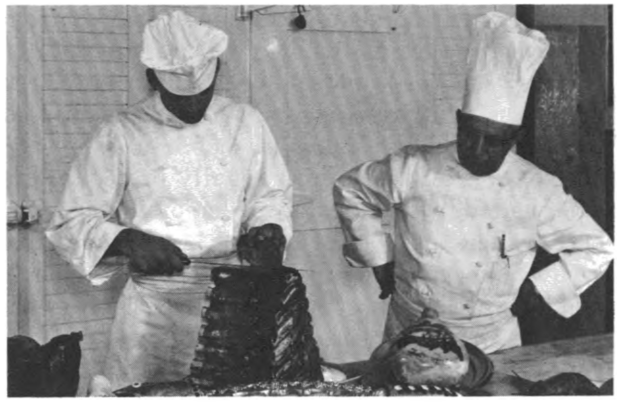
Cooks and chefs (head cooks) help to establish a restaurant's reputation through their skill. The type of cooking they do and the skill they need depend on the size and type of restaurant.

Large and exclusive restaurants may employ several cooks, each a specialist in preparing a particular type of food—soups, meats, vegetables, sauces, pastries, or ice cream. The chef supervises the staff of cooks and kitchen helpers and has overall responsibility for all food prepared. He also helps train other cooks, estimates food consumption (to assist managers in purchasing food and planning and pricing menus), creates new dishes, and decides on the size of food portions. Many small restaurants, on the other hand, have only one cook—perhaps assisted by one or two helpers—who prepares all the food. In inexpensive eating places, menus may have little variety and the cook's work is likely to be standardized and involve the preparation of only a few kinds of dishes, often cooked on a "short order" basis, one serving at a time, as customers order them.

To assist cooks, many large restaurants employ pantrymen or salad makers who prepare and mix ingredients for salads, certain desserts, and some other types of food; but in a small restaurant, the cook usually does this work and many other kinds of work incidental to food preparation.

Where Employed

About 300,000 cooks and chefs were employed in 1960 in establishments which were primarily eating and drinking places. A little more than half of these employees were women. Many chefs occupy supervisory positions, particularly in expensive restaurants. "Name" chefs, most of whom are European trained, are very few in number. In addition to cooks and chefs employed in restaurants, many thousands work in institutions such as hospitals and schools, and in hotels, department stores, and private clubs, aboard ships, on railroad dining cars, and in other eating places. The majority of hotel cooks and chefs are men. In institutions such as hospitals and schools most cooks are women.



Chef instructs beginner in carving

Training, Other Qualifications, and Advancement

Cooks generally learn their trade either by on-the-job training or, less often, by a more formal type of apprenticeship. Years of experience are required to become a skilled cook.

Although there are no specific educational requirements for this work, employers are giving increasing consideration to applicants who have taken courses in restaurant cooking. Such courses are offered in some public vocational schools, private trade schools, and a few colleges. Other specialized cooking courses are sometimes given by local restaurant associations, with advice and assistance from the National Restaurant Association. All of these training programs are particularly valuable because the student spends a major portion of his time in well equipped school kitchens and acquires skill through actual practice cooking. Courses include study in the use and care of equipment; food standards (selecting, preparing, and serving food and determining the size of servings); proper sanitation procedures, including public health aspects of food handling; cooking methods such as broiling and use of steam; and the preparation of soups, roasts, sauces, and other special dishes.

Experienced cooks may advance to more responsible cooking jobs in their place of employment or may transfer to better paying jobs in other restaurants, especially if they have become skilled in preparing certain types of food. Promotion to chef or head cook may take as long as 15 to 20 years; in some instances, less time may be required, depending on the individual's qualifications and the situation in the restaurant where he is employed. In most large restaurants, the head cook or chef is a man. In addition to being an expert cook, a chef must have supervisory ability and a thorough knowledge of all types of foodstuffs and kitchen equipment, in order to organize and direct kitchen operations efficiently. Cooks in supervisory positions may sometimes advance to positions as executive chefs or to other types of managerial work.

Cleanliness, the ability to work under pressure during busy periods, physical stamina, and a keen sense of taste and smell are among the characteristics required for the jobs of cook and chef. Health certificates which indicate that cooks are free from communicable diseases are frequently required.

Employment Outlook

Well-qualified cooks are expected to be in strong demand throughout the remainder of the 1960's. Although there is always keen competition for the best jobs, well-trained cooks will find many opportunities for employment in the better type of restaurants. Experienced but less skilled cooks will find an even greater number of jobs available in other restaurants. Most of the openings in all types of eating places will arise from the need to replace cooks who retire, resign, or die.

Even though the number of top-ranking chefs is comparatively small, continued improvement is expected in opportunities for American-trained cooks to eventually advance to positions of this kind. A relatively large proportion of experienced chefs are at or near retirement age, and many employers find it difficult to replace them, particularly because few chefs are available from foreign countries—the traditional hiring source.

Young people will find many opportunities for employment as kitchen helpers, doing work which will enable them to gain experience helpful in later qualifying as cooks.

Employment of cooks and chefs is expected to increase fairly rapidly in the long run. Opportunities for employment are expected to be good both in restaurants and in institutions and other places which maintain eating facilities—hospitals, schools, department stores, industrial establishments, hotels, passenger ships, and private clubs.

Earnings and Working Conditions

Information about the 1961 earnings of cooks in restaurants is available from a Bureau of Labor Statistics survey covering 27 metropolitan areas. For men employed as assistant cooks, average hourly wages ranged from $1.04 in Memphis to $2.63 in the San Francisco–Oakland area; for short order cooks, the lowest average was $1.06 in Dallas and in Houston, and the highest was $2.33 in the San Francisco–Oakland area. Women employed as assistant cooks and short order cooks usually earned from 10 to 80 cents an hour less than men. Salary levels were largely determined by the part of the country and the type of restaurant where these workers were employed. In general, wages were lowest in the South and highest on the West Coast.

The average hourly wages of men employed as head cooks ranged from $1.30 in Memphis to $3.31 in the San Francisco–Oakland area (approximately $3,000 and $7,000 a year). Chefs and head cooks may earn up to $15,000 annually, depending upon their training and experience; some chefs with national reputations receive more than $25,000 a year.

See introductory statement for additional information on earnings and working conditions and on where to go for more information.

Managers and Assistants

(D.O.T. 0–71.21 through .23)

Nature of Work

Restaurant managers have overall responsibility for the operation of establishments which serve food. They coordinate and direct the work of cooks, chefs, kitchen helpers, waiters, waitresses, and other employees to insure that food is properly prepared and served. Managers also direct such activities as hiring and training personnel, purchasing food and kitchen equipment, keeping cost accounts, taking inventories, approving menus, and making sure that health and sanitation regulations are observed. Their work usually involves frequent contacts with customers, to get their suggestions on food and service, create a friendly atmosphere, and handle complaints.

In many large restaurants, the managers are salaried employees; head cooks or chefs, head waiters, or dietitians may act as assistant managers. An increasing number of very large restaurants employ specially trained assistants—often called food managers—to supervise the kitchen staff and be responsible for all food preparation. In other restaurants—including very small ones—the business is managed by the proprietor or owner. The owner-manager of a small restaurant often directly supervises the preparation and service of all meals, operates the cash register, and even takes customers' orders during busy periods. Occasionally, he may have an experienced kitchen or dining room worker perform certain managerial jobs.

Food manager and cook discuss the day's menu

Where Employed

According to the U.S. Census of Population, in 1960, there were more than 70,000 salaried managers and more than 200,000 proprietors of eating and drinking places. In addition, thousands of managers were employed in dining rooms and cafeterias of hotels, department stores, factories, schools, hospitals, private clubs, and other types of establishments which also serve food.

Although opportunities for managers exist in cities and towns of all sizes, most salaried managers work in big cities, where the greatest number of large restaurants are located. Some large eating places which employ managers are in remote resort areas and on main highways.

Training, Other Qualifications, and Advancement

People usually become managers by starting in a job such as cook or waiter and working their way up, or by starting as management trainees. In either case, several years of experience in restaurant work are usually necessary to qualify for a top managerial job. A good education is an asset to an employee who hopes to attain this kind of position.

In a large restaurant, the line of promotion for restaurant workers with a knowledge of kitchen operations may be from a position such as pantry supervisor to food manager, then to assistant manager, and later to restaurant manager; top positions as executives in restaurant chains may also be attained. Similar advancement is possible for those dining room workers who have a knowledge of kitchen operations. Experience in all aspects of restaurant work is important, since managers must be familiar with the duties performed and the equipment used by all the workers engaged in food preparation and service. They also must be able to apply their knowledge about food to such matters as purchase, storage, inventory, and cost control. Poise, self-confidence, and the ability to get along with people are desirable personal characteristics for restaurant managers.

Employers differ with respect to the education and specialized training they require of restaurant managers. In many cases, no specific requirements exist. Vocational or technical school training in quantity food preparation and restaurant management is helpful in qualifying candidates for entry jobs in most types of eating places. In large restaurants, employers are showing an increasing preference for college-trained personnel. Work-and-study programs—offered by some colleges with specialized 4-year curriculums in institutional, restaurant, and hotel management—are generally recognized as the best preparation. The curriculum at these colleges usually includes basic and advanced courses in food preparation; specialized courses in restaurant accounting, catering, management, and sanitation; and courses such as economics, business law, marketing, and finance. Also required for a degree in some of these schools is summer work in restaurants or hotels in jobs such as food checker, waiter or dining room captain, and assistant manager. The practical experience gained by students, and the contacts they make with employers are often helpful in obtaining desirable positions after graduation. Individuals who enter restaurant work with this combination of education and experience are usually able to take over managerial responsibilities much more rapidly than those who qualify through on-the-job experience alone.

College graduates with less specialized training—especially those with degrees in business administration—may also be hired as trainees. They usually receive on-the-job training by rotating through all phases of restaurant work. Some go through an industry-sponsored program of "executive apprenticeship" under which participating restaurants cooperate with the National Restaurant Association in preparing employees for management positions.

Employment Outlook

Opportunities for well-qualified people to obtain managerial jobs in restaurants will be good throughout the 1960's. Most of the openings will continue to arise from the vacancies created as assistants are promoted to top managerial posts to replace managers who retire or leave their positions for other reasons. Many new openings for managers and assistants will also be created as the number of restaurants and other eating places increases. Opportunities for experienced kitchen and dining room workers with outstanding qualifications to move up through the ranks to managerial jobs will be good. College students seeking practical experience in restaurant work which will help them to qualify eventually for managerial work will also have good chances for employment, particularly in summer jobs in resort areas.

In the long run, the number of salaried managers employed in restaurants is expected to increase moderately. Many of the new positions will be with restaurant chains which expand their operations. In addition, openings can be expected as business firms and other enterprises open new eating facilities for employees and customers. The best opportunities will be for people who have taken specialized training for managerial work in the food service industry, or who have had the years of practical experience necessary to qualify for positions in large restaurants.

There will be many opportunities, in both the short and long run, for experienced people with business ability and the necessary capital to establish and manage their own restaurants. However, operating one's own restuarant involves considerable risk of financial loss until the business is firmly established.

Earnings and Working Conditions

Many college graduates with specialized training in restaurant management received starting salaries of $4,800 or more in 1962. Trainees without this background who were hired for managerial positions often started at lower salaries.

Most experienced restaurant managers receive salaries between $5,000 and $10,000 a year, depending on the size, location, and type of restaurant. Salaries below this range may be paid to managers of small restaurants, and considerably higher salaries are particularly likely to be paid managers of exclusive restaurants and large restaurant chains. Most restaurants furnish free meals to managerial personnel while they are on the job, and provide for laundering any uniforms which they may wear. Some restaurant managers receive annual bonuses and are included in group plans providing pensions, hospitalization, and medical and other benefits.

The earnings of restaurant managers who own and manage their own businesses vary even more than the earnings of salaried managers. In a small, moderate-price restaurant with counter service, for example, the proprietor-manager may have only a very modest income from his business. On the other hand, many restaurants where food is prepared and served in a more elaborate manner provide the owners who run them with incomes considerably higher than $20,000 a year.

Salaried managers often work longer than 40 hours a week—sometimes 48 hours or more, including work in the evenings and on weekends and holidays. The working hours of many people who own and manage their own restaurants are even longer. Generally, the evening hours worked by restaurant managers depend on the type of restaurant. For example, in city cafeterias which close shortly after most of the workers in nearby businesses have gone home, managers may have little or no evening work. On the other hand, in places serving late dinners, they work mainly in the evening.

See introductory statement for additional information on working conditions and on where to go for more information.

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TELEPHONE INDUSTRY OCCUPATIONS

As our population and economy grow and technology improves, the need to communicate increases. More than 300 million telephone calls are made daily in the United States, locally and for long distances to different parts of the country and overseas. To provide this service in 1962, about 690,000 employees were required.

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 several years to learn.

Nearly 3 out of every 5 telephone workers are women, who are mainly telephone operators or clerical workers. Men are usually 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. More than 77 million telephones were in use in the United States in 1962, about 70 percent of them by residential customers.

Telephone jobs are found in almost every community in the United States. Most telephone workers, however, are employed in large cities with concentrations of population and industrial and business establishments. Nearly three-fifths of them work in the 10 States with the largest number of telephones: New York, California, Pennsylvania, Illinois, Ohio, Michigan, Texas, New Jersey, Massachusetts, and Florida.

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 or signaling the operator, travels from the caller through wires and cables to the cable vault in the central office. From the cable vault, thousands of pairs of wires fan out to a distributing frame where each set of wires is attached to switching equipment. To join the caller's telephone to the telephone he is calling, connections are made automatically, mainly by 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 1962, more than half of all telephone users could dial long-distance calls directly. Information needed to bill the customer may be recorded automatically or, especially in smaller exchanges, may be written on a ticket by the operator.

Some customers make and receive so many calls that they cannot 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, and department stores.

Other communication services provided by telephone companies include conference equipment installed at a PBX to permit conversations among several telephone users simultaneously; mobile radiotelephones in automobiles, boats, airplanes, and trains; and telephones equipped to answer calls automatically and to give and take messages by recordings.

Telephone companies also build and maintain the vast networks of cables and radio-relay systems which join the thousands of television and radio 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.

Telephone companies in major population and industrial centers are generally affiliated with the

Bell System which, in early 1962, accounted for about 85 percent of all telephone workers and of all telephones in use (more than 65 million). About 3,000 independent companies provided more than 12 million telephones, mainly in smaller communities and rural areas. Several of the independent companies are sizable, the largest providing about 4½ million telephones.

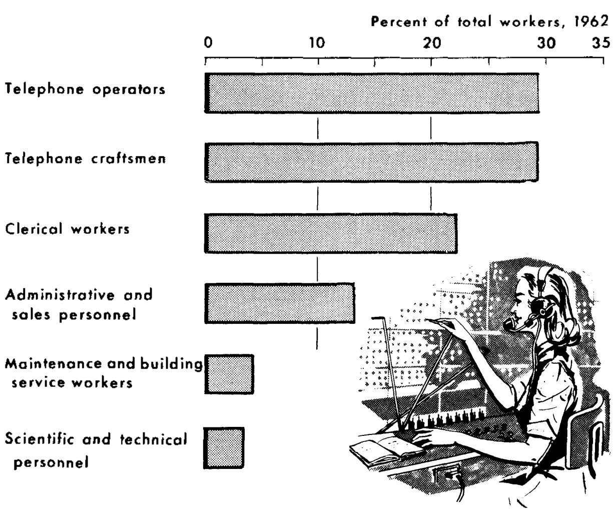
Telephone Occupations

Making a telephone call requires workers in many occupations as well as a vast amount of communications equipment. Chart 42 shows the percentage distribution of telephone employment by occupational group.

Nearly 3 of every 10 workers in the industry (29 percent) are telephone operators and the same proportion are telephone craftsmen. 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 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 who place, splice, and maintain telephone wires and cables; (2) installers and repairmen who 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 who test, maintain, and repair equipment in central offices. (Telephone operators and telephone craftsmen are discussed in detail later in this chapter.)

CHART 42

TELEPHONE INDUSTRY EMPLOYS AS MANY CRAFTSMEN AS OPERATORS.....



Source: Based on data from the Federal Communications Commission.

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 only briefly in this chapter, in the paragraphs immediately below, but some of them are discussed in greater detail elsewhere in this *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 13 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 proportion (3 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 communications 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.

The rest of the telephone industry's workers (about 4 percent) 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 hired by telephone operating companies each year during the remainder of the 1960's and in the longer run, mainly to replace the large numbers of women telephone operators and clerical workers who leave the industry to marry, raise a family, or for other reasons. Some of these new workers, however, will be hired for craft jobs, to replace skilled workers who die, retire, or shift to other work. Telephone craftsmen are expected to retire in somewhat larger numbers than usual during the later 1960's, as those hired in the 1920's, when employment in the industry expanded greatly, reach retirement age. 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 during the next 10 or 15 years is expected to continue the slight downward trend which started in the late 1950's. This is because technological improvements are permitting more calls to be made without any assistance from an operator. Most local calls and a large proportion of long distance calls can now be dialed directly. However, operators will continue to be needed to handle the more complex calls. Skilled craftsmen and clerical workers are also being affected by technological changes expected to reduce the total number of workers required for efficient telephone service during the next decade. The only occupational groups expected to grow in number as the volume of business increases are sales, administrative, professional, technical, and scientific personnel.

Telephones in use are expected to continue to increase in number during the next 10 years at about the 5 percent annual rate of growth that prevailed during the 1950's. Part of the expansion will result from expected increases in population, number of households, and number of business and industrial establishments. The 12 million households in the United States still without telephones probably will be another important factor in the demand for telephone service, especially as family income rises.

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. Also, there is growing use of specialized equipment, such as telephone instruments with volume controls to compensate for impaired hearing, and instruments containing 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 facsimile are types of special services which are becoming more important. With high speed data transmission, for example, it is possible to publish the text of 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 such as Telstar come into 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 size of 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 hourly earnings in December 1961 for all telephone employees except officials and managerial assistants amounted to $2.67. Earnings of these workers ranged from an average of $1.56 an hour for telephone operator trainees and $1.90 for experienced telephone operators, to $4.93 for professional and semiprofessional workers. Clerical workers in nonsupervisory positions averaged $2.05 an hour, while earnings of the various telephone craft groups ranged from $2.69 to $3.13 an hour.

A telephone employee usually starts at the minimum wage for his particular job. Pay increases are given periodically until the top of the grade is reached, usually in about 5 or 6 years. Telephone craftsmen at the top of the grade may receive further merit increases, based on job performance and length of service.

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 employees belong to the International Brotherhood of Electrical Workers or to an independent union, such as 1 of the 14 unions which combined to form the Alliance of Independent Telephone Unions.

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. These 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 that the rate of pay for nightwork shall be 5 or 10 percent above the basic day rate. Travel time to and from the job 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 15 years, 3 weeks for 15 to 25 years, and 4 weeks after 25 years. The number of paid holidays ranges from 6 to 11 days a year depending on locality. Nearly all contracts contain sick leave provisions. A typical program provides that payments for sick leave up to 7 days be paid to employees with at least 2 years of service, after a waiting period of 1 to 3 days depending on length of service. Provisions for paid sick leave beyond 7 days are covered in benefit plans adopted by most companies. The majority of telephone workers are covered by 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; in 1961, for example, the number of disabling injuries was less than one-sixth of the average for all U.S. industries.

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., NW., Washington, D.C., 20006.

International Brotherhood of Electrical Workers,
1200 15th St., NW., Washington, D.C., 20005.

Telephone Operators

Nature of Work

About 220,000 women, including several thousand part-time workers, were employed in operating jobs by telephone companies in early 1962. *Telephone operators* (D.O.T. 1-42.00 through 1-42.09) assist customers and other operators to make connections for specialized types of calls. Because local calls and the majority of long-distance ones—those known as station-to-station calls—can be dialed directly by customers, most telephone operators are either long-distance or information operators.

Long-distance operators help to complete long-distance calls which customers cannot dial themselves, such as person-to-person, reverse-charge, and other special types. They also assist when customers have difficulty in dialing and in emergencies. The operator completes calls through use of a key set, a kind of push button dial. She records details of long-distance calls for billing purposes. *Information operators* answer customers' and long-distance operators' requests for telephone numbers by looking in telephone directories and other records, such as lists of newly connected telephones and frequently called establishments.

Service assistants, another type of telephone operator, conduct the initial training of operators and continue with followup training as required. They may also assist other telephone operators or customers in completing the more difficult calls.

In addition to the operators employed by telephone companies, an estimated 100,000 workers operate PBX's in office buildings, hotels, and other places. PBX jobs, which frequently include secretarial or receptionist duties as well as switchboard operation, are not covered in this chapter.

Training, Other Qualifications, and Advancement

Women with a high school education are preferred for telephone operator jobs. Most local companies hire high school students or former telephone operators for part-time work. Applicants are given physical examinations and are checked for good eyesight and hearing. In most companies, they are also required to take pre-

Long-distance operator selects circuit to complete customer's call

employment tests for spelling, arithmetic, and learning ability. A pleasing voice, alertness, legible handwriting, a willingness to cooperate with other operators, an even disposition, tact, and good judgment in dealing with customers are the main personal qualifications for the job of operator.

One or two new employees are generally assigned to a service assistant for training purposes. She teaches them individually for a period of 1 to 3 weeks. Trainees practice handling common types of calls on dummy switchboards and progress to more difficult types of calls. After they develop speed and skill in making calls without the help of the instructor, trainees are assigned to a regular position at the switchboard.

Service assistants continue to instruct new operators in handling other types of operating services, such as supplying information on rates and routing long-distance calls. Because of changes that occur in the methods of handling calls and installations of new central office equipment, operators receive additional training throughout their careers.

A switchboard operator may be promoted to service assistant and then to group or assistant chief operator. Eventually she may become the *chief operator* (D.O.T. 0-99.53), who plans and directs activities of a central office and is responsible for overall efficiency of the office and for all personnel matters involving employees there. A service assistant may also become a PBX service adviser who instructs customers' employees in the efficient operation of their PBX equipment. The job of chief operator is usually the highest level to which telephone operators may advance within a central office, but they may find related job opportunities elsewhere. For example, an experienced operator may transfer to work in the administrative office of the traffic or other department, or to a job as service representative in the business office. Many such jobs are filled by recruiting from the operating staff, since knowledge of operating procedures is often useful in this work. In addition, some telephone operators may find jobs such as PBX switchboard operators outside the telephone industry.

Employment Outlook

Women will have tens of thousands of opportunities to become telephone operators each year during the remainder of the 1960's and the early 1970's, mainly to fill vacancies. Most telephone operators are young women who remain in the industry for only a few years, leaving when they marry or start to raise a family. Opportunities for minority groups are increasing in this occupation. Some part-time jobs will also continue to be available.

Even though many thousands of job opportunities for telephone operators will be created by employee turnover, the total number of operators is expected to decline during the next 10 or 15 years, continuing the trend begun in the 1950's. Technological advances within the telephone industry enable customers to complete many calls without an operator's assistance. The most important technological change affecting operators has been the conversion from manual systems to automatic dial service. Nearly all local calls are now dialed automatically and, starting in the late 1950's, automatic dial service was extended to long-distance calls as well. By early 1962, more than half the country's telephone subscribers could dial station-to-station long-distance calls directly, and eventually all subscribers will be able to do so. Even where direct dialing service is available, however, many types of long-distance calls, such as those from coin telephones, person-to-person, credit-card, and reverse-charge calls, require the assistance of an operator. The introduction of electronic devices also has reduced the amount of clerical work formerly done by operators.

Earnings and Working Conditions

In December 1961, major telephone companies in the United States paid an average of $2.28 an hour to service assistants and instructors, $1.90 to experienced telephone operators, and $1.56 to operator trainees. Average hourly earnings vary geographically; for example, those of experienced telephone operators ranged from $1.64 to $2.07, depending on the locality in which they worked.

Earnings of telephone operators increase as they gain experience and skill. For example, under a 1962 union-management agreement in one of the higher pay scale cities, telephone operators start at $63.50 a week and receive periodic increases to a maximum of $83 after a period of about 5½ years. Service assistants receive from $6.50 to $10 a week above the operator's weekly wage.

According to the same union agreement, operators whose tours of duty end after 7 p.m. receive extra pay ranging from 40 to 80 cents for each evening worked. Operators on all-night tours of duty receive $1.20 extra for each night worked. Telephone operators are covered by the same provisions governing overtime pay, vacations, holidays, and other benefits that apply to telephone workers generally. (See p. 716.)

Rooms in which telephone operators work are generally well lighted, well ventilated, and air conditioned. Adjustable chairs are provided for operators. Most companies provide pleasant, attractive lounges for operators to relax in during rest periods. Large central offices usually have cafeterias where inexpensive hot foods and drinks are served throughout the day.

The basic workweek for telephone operators is 40 hours. However, since the telephone industry gives service 24 hours a day, many operators work night and evening hours, Sundays, and holidays. Other operators work split shifts or "tours" to handle peak calling loads in late morning and early evening hours. Split tours usually total 7 to 7½ hours in length. For example, an operator may have a tour of duty from 8 a.m. to noon and from 6 p.m. to 9 p.m. In general, choice of hours is by seniority. Telephone operators may also be called to work during emergencies.

Linemen and Cable Splicers

Nature of Work

The vast network of wires and cables which connects telephone central offices to the millions of telephones and switchboards in customers' homes and buildings is constructed and kept in good operating order by linemen and cable splicers and their helpers. Telephone companies employed about 43,000 such workers in early 1962—16,000 linemen, 18,000 cable splicers, 6,000 foremen, and 3,000 cable splicers' helpers and laborers.

In constructing new telephone lines, *linemen* (D.O.T. 5-53.410) place wires and cables leading from the central office to customers' premises. They dig holes with power-driven equipment 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 in 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. 5-53.950) 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 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 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. It usually takes about

6 years for linemen to reach the top pay for the job. Other trainees are assigned as cable splicers' helpers. They acquire the skills of the trade by working with experienced cable splicers. After working 3 or 4 years as cable splicers' helpers, they may advance to the job of cable splicer and reach top pay for the job in another 2 or 3 years.

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 the job of telephone installer and later to that of telephone repairman or other higher rated jobs.

Employment Outlook

Hundreds of job openings for linemen and cable splicers are expected to become available during the remainder of the 1960's and in the longer run to replace workers who transfer to other jobs within the telephone industry, leave the industry, retire, or die. The total number of linemen and cable splicers is expected to continue to decline during these years, however, despite the fact that telephone companies probably will continue to extend lines and cables into suburban areas at about the same rate as during the past 10 years. Redesigned equipment and various new devices introduced in the late 1950's have enabled these craftsmen to work more efficiently. Examples of recent technological developments include a device for splicing cable without removing the insulation; an instrument to identify types of wires in cables; use of gas-filled cables whose failure can be pinpointed by detecting devices located in the central office; mechanical drills for digging; mechanical lifts operated from service trucks which reduce or eliminate pole climbing while providing greater mobility than stationary platforms; and use of helicopters for maintenance and repair work in remote areas.

Earnings and Working Conditions

Cable splicers have higher earnings than linemen. In December 1961, in the United States as a whole, cable splicers averaged $3.05 an hour, linemen averaged $2.69, and cable splicers' helpers averaged $2.05. Average hourly earnings ranged from $2.78 to $3.22 for cable splicers; from $2.34 to $2.93 for linemen; and from $2.02 to $2.47 for cable splicers' helpers, depending on locality.

Pay rates within the jobs also depend to a considerable extent upon length of service. For example, according to a 1962 union-management agreement, new workers in line construction jobs in one of the higher pay scale cities begin at $66.50 for a 40-hour week. Linemen can reach the maximum of $127.50 after 6 years of service; cable splicers' helpers can reach a maximum of $100.50 in less than 4 years. (However, before cable splicers' helpers reach this maximum, many are reclassified as cable splicers and are transferred to a new pay schedule.) The maximum basic weekly rate for cable splicers is $137, based upon a combined total of at least 6 years' work as a helper and as a splicer. Linemen and cable splicers are covered by the same contract provisions governing overtime pay, vacations, holidays, and other benefits that apply to telephone workers generally. (See p. 716.)

Lineman works on cable from aerial lift

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 those of 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; 83,000 were employed in early 1962. More than two-thirds of these men mainly install telephones or private branch exchanges. About 15,000 of them repair and maintain this equipment, and approximately 11,000 are foremen. 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. 5-53.030) 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. 5-53.020) 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. 5-53.240), with the assistance of testboardmen in the central office, locate trouble on customers' telephones 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. 5-53.240), 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

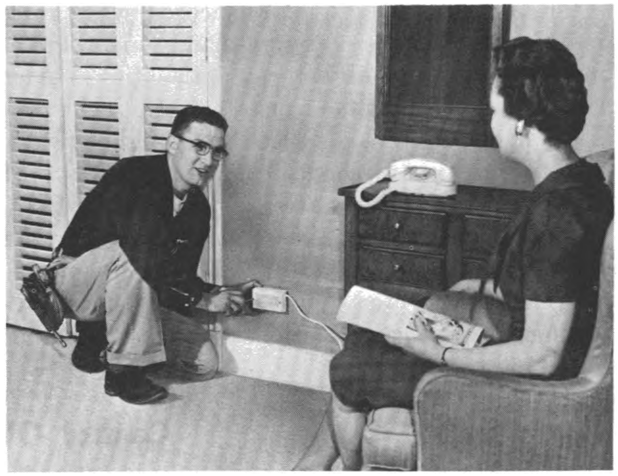
Telephone companies hire inexperienced men and train them for telephone and PBX installation and repair jobs. Since much of the work requires personal contact with customers, applicants who have a pleasing appearance and the ability to deal effectively with people are preferred. Applicants for these skilled jobs must have a high school or vocational school education. To help determine applicants' aptitudes, preemployment tests are sometimes given.

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. It usually takes a month or more of such experience before new workers can do installation work alone.

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 the 1960's and in the longer run. These opportunities will result from the need to replace workers who retire, die, transfer to other telephone jobs, or leave the industry. Retirements and deaths alone may result in more than 3,000 job openings each year during the next 10 years. More than the usual number of telephone craftsmen are expected to retire during the later 1960's as those who were hired in the 1920's, when the industry's employment expanded greatly, reach retirement age. Some job openings created by turnover may be filled by workers transferring from other telephone craft jobs, such as linemen



Telephone installer mounts connecting block for residential telephone

and cable splicers, but many will be open to new employees.

The total number of telephone and PBX installers and repairmen is not expected to increase during the next 10 or 15 years, although some expansion is anticipated in the volume of service handled by these craftsmen. The increased volume is expected because of factors such as 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. As in other types of telephone work, however, recent technological changes have resulted in increases in 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; and the combining of installation and repair work into a single job.

Earnings and Working Conditions

In December 1961, PBX repairmen earned an average of $3.13 an hour and telephone and PBX installers earned $3.05. Average hourly earnings in most of the country ranged from $2.90 to $3.24 for PBX repairmen and from $2.05 to $3.16 for telephone and PBX installers, depending on locality.

The effect of length of service on wage rates is illustrated by a 1962 union-management agreement in one of the higher pay scale cities. Under this agreement, telephone installers and repairmen have a starting rate of $66.50 for a 40-hour week with periodic pay increases until a maximum of $130 a week is reached after about 6 years. PBX installers and repairmen also have a starting rate of $66.50 and progress to $137. Installers and repairmen are covered by the same provisions governing overtime pay, vacations, holidays, and other benefits that apply to telephone workers generally. (See p. 716.)

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.

Central Office Craftsmen

Nature of Work

Central office craftsmen test, maintain, and repair mechanical and electronic switching equipment and other central office equipment. It is their duty to keep this telephone equipment in operating condition and to locate potential trouble before service is affected. Telephone companies employed about 71,000 central office craftsmen in early 1962. These skilled workers included approximately 9,000 foremen, 18,000 testboardmen, 41,000 central office repairmen, helpers, and framemen, and 3,000 others.

Frameman (D.O.T. 7-53.020) is usually the beginning job from which a worker may advance to a more skilled central office craft job. Framemen do most of their work at distributing frames or panels where customers' lines come into the central office. Framemen string these wires to the proper terminals on the frames and then solder the connections. Connections are made according to worksheets prepared by others or according to oral directions of testboardmen.

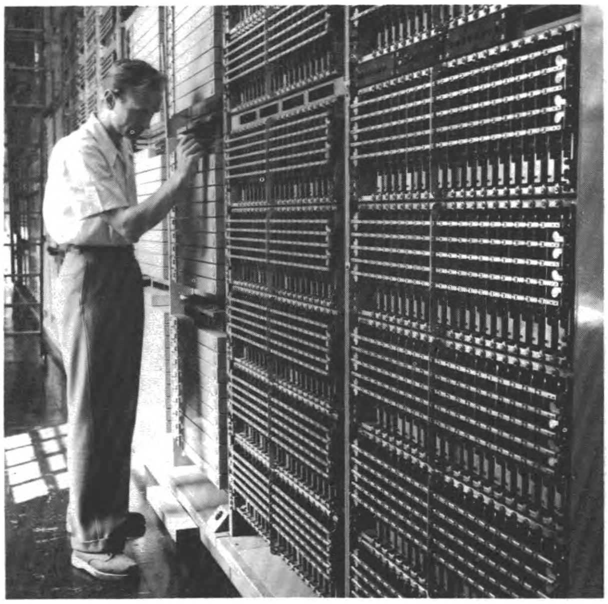
Central office repairmen (D.O.T. 5-53.235), often called switchmen, maintain and repair switching equipment and automatic message accounting systems in central offices. They check switches and relays, using special tools and gages and their knowledge of electricity. They also locate and repair trouble spots on customers' lines in central office equipment as reported by testboardmen.

Testboardmen (D.O.T. 5-53.310) 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, they direct the repair activities of line and cable crews or installer-repairmen (if the breakdown is outside the central office), or of central office repairmen (if the trouble is inside).

Training, Other Qualifications, and Advancement

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 is generally required. 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 are usually 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. He is usually 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



Central office repairman adjusts relay in central office panel

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 may, 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 craftsmen during the remainder of the 1960's and in the longer run. These 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 about 3,000 job openings each year during the next decade. Many more than the usual number of central office craftsmen are expected to retire in the later 1960's, when those hired during the 1920's—a period of increased employment—will reach retirement age. Some job openings created by turnover may be filled by workers who transfer from other telephone craft jobs, but many will be open to new employees.

The total number of central office craftsmen is expected to remain about the same during the next 10 or 15 years, despite the anticipated expansion of the number of telephones in use and the increasingly complex nature of central office equipment. Recent technological developments, such as electronic switching and various automatic testing devices, will reduce the amount of maintenance and repair work to be done in central offices.

Earnings and Working Conditions

Central office craftsmen are among the highest paid group of skilled workers in the telephone industry. In December 1961, average hourly earnings in large telephone companies in the United States were $3.05 for testboardmen and $2.96 for central office repairmen; average hourly earnings ranged from $2.96 to $3.31 for testboardmen and from $2.73 to $3.09 for central office repairmen, depending on locality.

Earnings increase considerably with length of service in central office jobs. According to a 1962 union-management contract in one of the higher pay scale cities, craft employees start at $66.50 for a 40-hour week. Framemen can work up to a maximum of $111.50 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 $137 a week after 6 years of periodic increases. Craftsmen who transfer to engineering assistant jobs can earn a maximum of $149.50 a week after 8 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 which include evenings, nights, and weekends, 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 p. 716.) Employees in central offices work in clean and well-lighted surroundings.

Central Office Equipment Installers

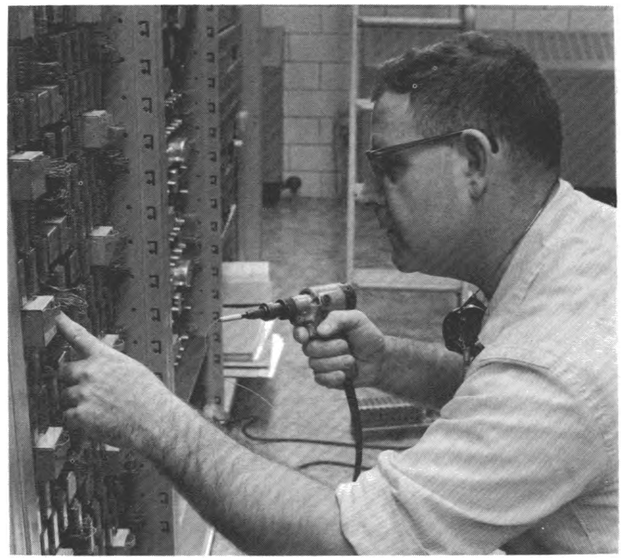
(D.O.T. 5-53.010)

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, 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.

More than 18,000 installers were employed in late 1962. Unlike 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.



Central office installer uses wire-wrapping tool to wire equipment panel

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. Applicants must be willing to travel.

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 in the longer run, 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 present levels 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 will be somewhat less than in recent years, however, because many new central offices were built during the 1950's 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 September 1962, average hourly earnings of installers amounted to $2.93. According to the major union contract in effect for this occupation in late 1962, inexperienced installers start at $1.65 to $1.72 an hour, depending on locality. The contract provides for periodic increases until employees reach rates of $2.65 to $2.77 an hour after 5½ 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 $3.28 to $3.47 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 11 paid holidays a year, depending on the locality. Vacations are provided according to length of service. Workers with 1 year of service receive 1 week's vacation; 2 to 15 years of service, 2 weeks; 15 to 25 years of service, 3 weeks; and 25 years and over, 4 weeks.

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, as well as 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.

Occupations in Agriculture

As a way of life, farming offers advantages that are attractive to many families. Some people like the greater independence and freedom associated with various phases of farm work and also the variety of jobs associated with farming. They like living on farms or in small communities and are willing to accept lower incomes than they would consider satisfactory in an urban environment. With modern transportation and communication, many of the differences that once existed between rural and urban living are vanishing. Many farmers consider the country a better place to rear children. Some remain on farms because they are either unsuited or unadapted to other kinds of work.

Despite increasing specialization and mechanization in agriculture, the farmer still functions in many different capacities and makes many independent decisions. The typical farmer is manager, supervisor, and laborer; in some respects, he acts also as bookkeeper and financier. He also has to know insects, bacteria, fungi, and viruses, as well as a wide variety of crops and animals. He buys many items from various types of dealers. He is a producer with many competitors, and sells his products in many kinds of markets. (Migrant farm workers, whose earnings and living conditions differ greatly from those of the farm operator and the year-round farm worker, are not discussed in this chapter.)

Significance of Agriculture in the Economy

The Nation's agricultural economy, its methods of farming, and the resources required to finance a farm business have changed greatly during the past century—and especially during the past 20 years.

The national economy is no longer predominantly agricultural. Only about 8 percent of the total population now live on farms, compared with 65 percent in 1860. Less than 8 percent of total civilian labor force is employed on farms. Whereas one farm worker was able to produce enough food and fiber for himself and only 4 other people a hundred years ago, today he can produce enough for himself and 26 others.

Although the number of farm workers has declined, there has been a sharp increase in the number who work off the farm in jobs closely related to agriculture. These include the workers in feed mills, fertilizer plants, farm machinery industries, 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 constantly rising.

OPPORTUNITIES ON FARMS

The typical farm of today is much larger and more highly mechanized than the farm of 20 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 and for the tenant farmer, however, have become very limited.

Investment Per Worker on Farms

Since before World War II, American agriculture has experienced a spectacular increase in the value of productive assets relative to the number of workers. This increase has resulted chiefly 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 $23,300 per farm worker in 1962, compared with less than $4,000 in 1940. In physical terms (valued at 1947–49 prices), the quantity of all productive assets per farm worker has doubled since 1940; the quantity of farm machinery and equipment alone has more than tripled. Technological progress has brought to the farmer many new labor-saving devices and production-expanding aids; it has also increased the skills required for many farm jobs and has raised the amount of capital needed to operate a farm profitably.

Size of Farm Operations

Farms in the United States are classified by the Bureau of the Census according to the value of their annual sales. They vary greatly in size of operation. In 1959, about 65 percent of all farms were classified as commercial (those providing the farmer with his major source of income), but fewer than 40 percent of all farms reported sales of $5,000 or more. These data indicate that many farms are too small to provide more than part of the income needed to support a satisfactory standard of living. However, the trend is toward fewer and larger farms, and for farm operators, this means that more managerial skills, more capital, and more mechanical equipment are needed.

Farm Employment Outlook

The employment situation for farm workers is becoming less favorable because mechanization is rapidly displacing labor and because the number of people available for such employment is greater than the number of available farm jobs. As the size of farms increases and as further mechanization takes place, the number of desirable openings for new workers will be fewer each year than the number of workers who retire, die, or leave the farm for other reasons. Probably the number of farm operators and other farm workers will continue to decline. By 1975, the number of persons employed on the farm may be a fifth less than the 5.2 million employed in 1962.

Between 1963 and 1970, an estimated 155,000 operators of medium-size to large farms (those selling at least $5,000 worth of farm products annually) are expected to leave the occupation because of retirement or death. Consequently, only a small proportion of the 1.5 million farm boys 10 to 19 years of age in 1959 will have the opportunity to become operators of such farms. Other young men who have not grown up on farms and acquired a farmer's skills will have even less chance of becoming farm operators.

Agriculture cannot expect the same kind of general 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 will nevertheless continue to be highly competitive because of the rapid advances in technology, faster com-

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munication and transportation, and better informed producers and consumers. For the next decade or so, no great need for increased farm output is anticipated and, as a result, prices of many important farm products may not be attractive to farm operators. Despite concerted effort to improve farmers' economic position in recent years, real incomes of farmers have tended to decline relative to those of industrial workers.

Agriculture will nevertheless remain one of the largest areas of employment in the economy. Moreover, if farmers' needs for machinery, equipment, and supplies and consumers' requirements for processed and packaged farm products are to be met, job openings in fields closely related to agriculture will expand. In 1962, when 5.2 million persons (operators, unpaid family workers, and hired workers) worked on farms, about an equal number were engaged in closely related activities. Some were producing farm supplies such as fertilizer, processed feed, and machinery. Others were engaged in transporting, storing, processing, packaging, or otherwise fabricating or handling farm products along the route from the farmer to the consumer. Still others were servicing farmers. Increased employment in these areas will provide opportunities for some workers who are unable to obtain farm jobs because of declining employment or who prefer employment closely associated with farming.

Courtesy of U.S. Department of Agriculture

Farmer and family members load legume hay for feed on dairy farm

Opportunities for Hired Workers on Farms

Most of the workers on farms are either self-employed operators or members of farm families. The number of hired workers (including family members who are paid wages) fluctuates seasonally from 800,000 in January to 2.7 million at the peak of the harvest in September. Roughly 750,000 hired workers are employed on farms for at least 150 working days each year. Others, including many students and housewives, work chiefly during the harvest season.

Although farm wage rates in 1962 were more than four times as high as in 1940, they were still low in relation to earnings of factory workers. Ordinary farm work is excluded from the coverage of the Fair Labor Standards Act. Average farm wage rates for full-time workers in the United States, as of October 1, 1962, were:

Per month with house	$198. 00
Per month with board and room	155. 00
Per week with board and room	37. 25
Per week without board or room	46. 00

Employment opportunities for hired farm workers vary from season to season and from one part of the country to another. Specific information concerning the kinds of jobs available and current wage rates may be obtained from the local offices of the State employment services.

Training Opportunities Available for Farming

The best initial training for farming is to grow up on a farm. The necessary experience may also 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 Smith-Hughes Act, which, among other things, provides for the teaching of agriculture in high schools. The training may be given in:

1. All-day programs supervised by teachers who are agricultural college graduates.
2. Young farmer programs consisting of short courses during the day, with 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) giving 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 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 overall number of openings in farming is decreasing, a considerable number of desirable and rewarding openings nevertheless occur from time to time. Thus, each year, many young people must decide whether to go into farming. For some, the decision to enter farming may be made simply because an opening exists on the family farm or on one nearby. If the decision is to be sound, however, it should be based on a careful appraisal of the particular requirements in specific types of farm operations, and the prospects for success in them. Each person must make this appraisal in the light of his aptitudes, interests, preferences, experience, knowledge, and skills in directing labor and handling livestock and machinery. His choice must take into account also his family labor supply and his financial resources, as the labor and capital requirements for an operation of adequate size vary widely from one type of farm to another.

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 some of the more common farm types, from an occupational standpoint. 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. On most of the farms, the major part of the work is done by the farm operator with help from his family. Whereas, some of the smaller farms hire help only during peak labor season, large ones often use hired labor the year-round.

The figures in the table on capital invested do not mean that the operator must have that amount of money to get started. They do mean that, on these farms, 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 own 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.

It may be well to mention here the question of specialization versus diversification in farm operations. No brief general statement can be made that would apply in all parts of the country, but the general trend is in the direction of more specialized farming. Farms that produced many products a generation ago may now produce only two or three; efficient production of most farm products requires substantial investment in specialized equipment, and, 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. Relatively few farmers, however, find it to their advantage to produce only one product. The main reasons for this are the spreading of price and production risks and the more effective use of labor, particularly family labor, and other resources that might be virtually wasted or ineffectively used in a one-product system.

Dairy Farms

Dairy farms are found in most parts of the country. Despite modern methods of processing and transporting milk, dairy production is still concentrated near the large population centers. A large part of the total national production of dairy products is concentrated in the Northeastern and the Great Lakes States. However, many areas in the Far West and the South are also becoming large producers of dairy products. While many of these are "drylot" operations, on dairy farms in the Lake States and to a lesser extent in the Northeast, crops are important. This

SIZE OF FARM, LABOR USED, CAPITAL INVESTED, AND NET FARM INCOME ON COMMERCIAL FARMS, BY TYPE, SIZE, AND LOCATION, 1960–62 AVERAGE

Type of farm and location	Size of farm in 1962 as measured by—	Total labor used (hours)	Capital invested in—				Total farm capital	Net farm income
			Land and buildings	Machinery and equipment	Livestock	Crops		
Dairy farms:								
Central Northeast	31.4 milk cows	4,480	$21,670	$7,400	$9,600	$2,600	$41,270	$4,093
Eastern Wisconsin:								
Grade A	31.7 milk cows	4,470	35,890	11,240	11,490	4,390	63,010	6,258
Grade B	21.4 milk cows	3,690	26,290	6,310	6,240	3,140	41,980	3,118
Western Wisconsin, Grade B	22.7 milk cows	4,200	19,110	4,020	7,330	2,910	33,370	4,125
Dairy-hog farms, Southeastern Minnesota	21.3 milk cows	4,080	33,910	7,180	6,680	3,410	51,180	4,276
Hog and grain farms, Corn Belt:								
Hog-dairy	108 acres of cropland	4,470	39,040	7,310	7,000	4,170	57,520	5,391
Hog fattening-beef raising	119 acres of cropland	3,570	35,160	5,960	7,390	3,430	51,940	3,628
Hog-beef fattening	147 acres of cropland	4,260	60,240	7,860	13,920	6,670	88,690	7,811
Cash grain	198 acres of cropland	3,160	101,250	7,470	2,890	1,680	113,290	8,576
Poultry farms:								
Broilers:								
Maine	63,244 produced annually	2,040	22,780	7,980	0	0	30,760	3,882
Delmarva	44,426 produced annually	2,150	26,390	7,130	10	10	33,540	5,494
Egg production, New Jersey	5,050 layers	5,130	34,540	2,160	7,570	0	44,270	4,378
Cotton farms:								
Southern Piedmont	100 acres of cropland	4,690	22,920	2,050	1,020	490	26,480	2,430
Mississippi Delta:								
Small	39 acres of cropland	3,280	10,200	3,070	500	190	13,960	1,928
Large scale	640 acres of cropland	31,110	172,000	31,500	7,490	1,910	212,900	28,604
Texas:								
Black Prairie	220 acres of cropland	3,150	41,440	5,640	2,080	510	49,670	3,246
High Plains (nonirrigated)	373 acres of cropland	3,790	52,370	7,770	690	310	61,140	9,688
High Plains (irrigated)	349 acres of cropland	7,060	101,030	14,510	1,210	380	117,130	19,186
San Joaquin Valley, Calif. (irrigated):								
Cotton-specialty crop	325 acres of cropland	12,880	238,610	23,850	0	0	[1] 285,400	28,310
Cotton-general crop (medium-size)	325 acres of cropland	10,080	238,670	24,780	0	0	[2] 282,660	25,422
Cotton-general crop (large)	1,136 acres of cropland	30,810	857,670	66,520	0	0	[3] 970,580	78,305
Peanut-cotton farms, Southern Coastal Plains	76 acres of cropland	3,960	12,640	2,870	1,310	470	17,290	3,692
Tobacco farms:								
North Carolina Coastal Plain:								
Tobacco-cotton	47 acres of cropland	6,960	22,100	4,450	520	520	27,590	6,445
Tobacco	53 acres of cropland	6,220	20,360	4,190	500	540	25,590	6,423
Kentucky Bluegrass:								
Tobacco-livestock, inner area	62 acres of cropland	4,720	86,600	5,190	6,920	1,950	100,660	7,327
Tobacco-dairy, intermediate area	25 acres of cropland	3,530	15,700	2,980	2,720	820	22,220	2,709
Tobacco-dairy, outer area	42 acres of cropland	4,690	30,250	5,450	4,510	1,270	41,480	5,052
Spring wheat farms:								
Northern Plains:								
Wheat-small grain-livestock	581 acres of cropland	2,650	36,190	11,120	3,610	1,760	52,680	5,438
Wheat-corn-livestock	383 acres of cropland	3,640	34,870	8,500	7,780	2,700	53,850	5,615
Wheat-roughage-livestock	531 acres of cropland	3,060	31,740	8,070	6,760	2,370	48,940	5,588
Winter wheat farms:								
Southern Plains:								
Wheat	601 acres of cropland	3,000	79,210	10,220	6,550	1,980	97,960	10,873
Wheat-grain sorghum	677 acres of cropland	3,370	92,110	10,020	7,230	1,340	110,700	12,561
Pacific Northwest:								
Wheat-pea	541 acres of cropland	3,550	162,410	17,290	2,460	1,930	184,090	13,318
Wheat-fallow	1,007 acres of cropland	3,730	120,600	18,010	4,380	1,410	144,400	13,229
Cattle ranches:								
Northern Plains	90.8 cows	3,810	50,180	7,920	21,710	3,550	83,360	6,170
Intermountain Region	145.2 cows	5,120	36,360	5,960	39,270	5,170	86,760	10,146
Southwest	150.7 cows	3,660	125,770	4,580	30,400	1,590	162,340	7,960
Sheep ranches:								
Northern Plains	1,294 sheep	7,680	65,050	6,800	24,490	1,360	97,700	8,904
Southwest	1,309 sheep	5,840	176,910	4,700	25,130	1,040	207,780	9,347

[1] Includes $22,940 cost of irrigation system.
[2] Includes $19,210 cost of irrigation system.
[3] Includes $46,390 cost of irrigation system.

NOTE: Prepared in the Farm Production Economics Research Division, Economic Research Service, U.S. Department of Agriculture.

causes peak labor loads, especially at harvest-time. 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 presents no great hardship for the man who likes livestock and 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 keep it from becoming monotonous.

The dairyman's sales, and therefore his income, are fairly evenly distributed throughout the year. Moreover, the prices he receives are usually less subject to the marked year-to-year fluctuations which affect some other types of farms. The accompanying table shows the average net farm income in the 1960–62 period on dairy farms in the Central Northeast and mid-West.

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, buy a larger proportion of their feed, and are more likely to buy rather than raise their herd replacements. Exceptions are the specialized dairy farms on the Pacific Coast and in a few other isolated areas. Perhaps the most highly specialized producing area is the drylot dairy area near Los Angeles. In this area, 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. These highly specialized operations are virtual "milk factories."

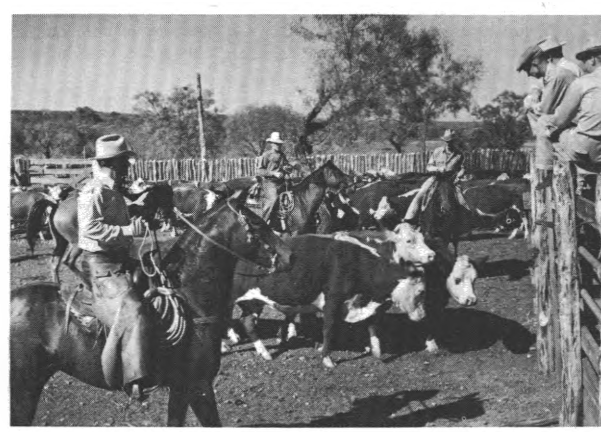
Net farm income represents the return to the farm operator for his own and his family's labor, and for the capital invested in the farm business—provided he owns his land and is free from debt. If he rents part or all of his farm, not all of net farm income is available for family living; part of it must be used for rent. Similarly, the farmer who is in debt must use part of this net farm income for interest and principal payments.

Lenders usually consider a 2 to 1 ratio of assets to liabilities a safe one. For example, an $18,000 mortgage would be reasonable for the eastern Wisconsin grade "A" dairy farm, shown in the accompanying table, with land and buildings worth about $36,000. If $18,000 were borrowed at 5 percent and payments were set up on a standard 20-year amortization plan, the annual payments would be $1,440. Consequently, the farmer with this repayment schedule has $1,440 less for family living than one who is free from debt. This same general qualification applies to the incomes shown for other types of farms.

Livestock Farms and Ranches

A general livestock farm is a good choice for the farmer whose interests and skills are in work associated with livestock and mechanical equipment. General livestock farms—such as the hog-fattening and beef raising farms and hog-beef fattening farms of the Corn Belt—require considerably less daily "chore work" than dairy farms. (See table.) Many farmers consider this an advantage. Although livestock producers often work shorter hours than dairymen, they cannot always make as effective use of the regular labor force during slack seasons. This may not present great problems when a substantial part of the labor force is made up of young people of school age, because the busiest times come mainly when these workers are out of school.

The livestock farmer's income is not as well distributed throughout the year as the dairy-



Courtesy of U.S. Department of Agriculture

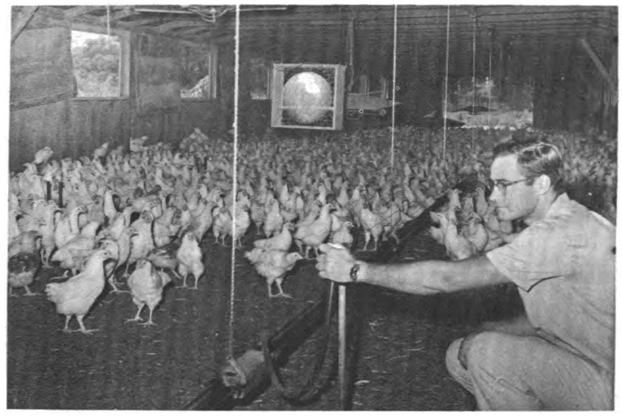
Corralling cattle and "cutting" or separating them for feeding and breeding man's, and it is less likely to be uniform from year to year. To some extent, this complicates financial management problems and increases the risks of operation. Moreover, on farms of rather limited acreages—often found in the 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. With cattle and sheep, however, the situation differs. 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 five types of Western livestock operations: Northern Plains sheep and cattle ranches, Intermountain cattle ranches, and sheep and cattle ranches in the Southwest. In these areas of low rainfall, the main source of feed is range grass, and several acres are required to support one animal. Except where irrigation water is available, few feed crops are harvested. Some ranchers, particularly those in the Intermountain region and the Northern Plains, own only a relatively small part of the land on which they graze their livestock. The bulk of it is public land on which they buy grazing rights. 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 keep some poultry, but in 1959 fewer than 4.3 percent of them were classified as poultry farmers. Many poultry farms concentrate on egg production; most of the larger and more specialized of these are in the Northeastern States 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. There are also specialized turkey producers, and a concentration of specialized producers of ducks in Suffolk County, Long Island, N.Y.

Although a few poultrymen produce some crops, these are usually produced for sale, and



Courtesy of U.S. Department of Agriculture

Poultry operator regulates mechanical equipment for feeding, watering, and ventilating

special poultry feeds and laying mash are purchased. Crops are not grown by most specialized poultry producers, particularly those who produce broilers or large laying flocks. Operators of typical commercial poultry farms in New Jersey, for example, buy all their feed. The typical broiler producer on the Delmarva (Delaware, Maryland, Virginia) peninsula and in Maine devotes practically all of his capital and labor to the production of broilers.

Poultry farming requires some specialized skill in handling birds, chiefly on the part of the operator. Little is required in the way of physical strength, as the tasks are generally not arduous. This is particularly true now that bulk handling of feed and mechanical feeding are widespread. For these reasons, poultry farms can make good use of available family help.

Data on average capital investment and net farm income over the 1960–62 period for representative egg producers in New Jersey and broiler operators in Delmarva and Maine, are given in the table. These averages do not reveal the sharp year-to-year fluctuations in income that these producers experience. Because they have a high proportion of cash costs and a rather 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 somewhat steadier, perhaps because of the high proportion of broiler growers who produce "under contract." Contract production is much 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—virtually everything except the buildings, equipment, and direct production labor. The grower gets a stipulated amount per 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 production of turkeys as for broilers.

Corn and Wheat Farms

For the man who likes working with crops and farm machinery, cash grain or corn or wheat farming has much to offer. Many farmers are reluctant to be tied down the year round with livestock and related farm chores and prefer instead to work long hours with laborsaving equipment during the busy seasons, and then have more freedom when the rush times are over.

The investment required and the recent income experience on some representative cash grain farms are shown in the table. 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. There is also some price risk because of the large surplus of wheat; however, Federal Government's price-support program has stabilized prices to some extent.

Cotton, Tobacco, and Peanut Farms

In terms of numbers of farmers, the production of cotton, tobacco, and peanuts makes up a substantial part of the agriculture in the Southeastern and South Central States. These products 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 cotton farmers in the Southeast out of 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 considerable seasonal labor 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 alert individ-

Courtesy of U.S. Department of Agriculture

Farm operator adjusts flow of irrigation water for his specialty crop ual with reasonable aptitude can usually learn these skills by working a few years as a laborer for a good 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. Since production is often subject to considerable variation because of the vagaries of nature and the changes in prices, operators of these farms must keep abreast of production and marketing conditions. In general, these operators are well rewarded for their ability to manage, produce, and market.

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, know-how, and equipment are required, and risks are high. But even with the high risk, from the standpoint of capital invested and income, the venture is often rewarding to individuals who have the requisite ability and resources. The operator of such a farm must be enterprising and alert, must keep abreast of production and markets, and must have the ambition and desire to accomplish his objective.

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 rapidly. Power machinery, for example, saves many man-hours of labor on the farm, but many highly trained nonfarm workers are required to develop, distribute, and service these machines.

A large number of the vocations that are emerging around agriculture are professional or technical and require college training or its equivalent.

Others can sometimes be learned on the job. For many of these occupations related to agriculture, a farm background is helpful, but not essential. The following sections discuss in detail some of these occupations.

Agricultural Extension Service Workers

(D.O.T. 0–12.20)

Nature of Work

Agricultural extension workers are engaged in educational work in agriculture and home economics. They are employed jointly by State land-grant colleges and the U.S. Department of Agriculture. Extension workers must be proficient in both subject matter and teaching methods.

County agricultural agents are concerned primarily with increasing the efficiency of agricultural production and marketing, including the development of new market outlets. *County home demonstration agents* work closely with women in home management and nutrition.

Agricultural extension workers help people to analyze and solve their farming and homemaking problems. Much of this educational work is with groups, through meetings, tours, and demonstrations. Individual assistance is given to farmers and homemakers on problems that cannot be solved satisfactorily by group methods. Both the county agent and the home agent, along with the 4-H Club agent in counties that have one, work with rural youth in organized groups on projects related to agriculture, homemaking, and community improvement. Extension workers rely heavily on the use of mass communication media, such as newspapers, radio, and television.

Courtesy of U.S. Department of Agriculture

Agricultural extension worker discusses improved farming methods with a family

The work of 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 findings in his particular field and works with agents in applying them to local needs and problems.

Where Employed

Extension agents are located in nearly every agricultural county in the United States. Counties with many farmers producing a variety of crops may have as many as 10 or more agents, 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 newest findings in agricultural research and of new programs and policies that affect agriculture and new teaching techniques. To be successful, extension workers must like to work with people.

In most instances, specialists on the State staff are expected to have the master's degree and special training in their particular lines of work.

Employment Outlook

Employment of Extension Service workers has grown to a total of 15,000 in 1962. The demand for additional workers is expected to continue. 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. A growing number of Extension Service workers will be needed, particularly in depressed rural areas. The work of the Extension Service will also be extended to new segments of the population, as rural nonfarm families and suburban residents recognize the value of assistance from extension workers.

Counterparts of the Agricultural Extension Service are being established in many countries of the world and Extension Service personnel are often recruited to help initiate and organize these programs.

Earnings and Working Conditions

The salaries of extension agents vary from State to State and county to county. In 1962, the average annual starting salary of assistant agricultural agents was about $5,000, and of home agents approximately $4,700. Starting salaries for assistant agricultural agents ranged from $4,600 to $6,300.

Ordinarily, the competent 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 1962, salaries for experienced agricultural agents ranged from $7,800 to $13,000. Salaries of experienced home demonstration agents ranged from $6,400 to $10,400 annually.

Where To Go for More Information

Additional information may be obtained from County Extension Offices, State Directors of Extension located at each State College of Agriculture, or the Federal Extension Service, U.S. Department of Agriculture, Washington, D.C., 20250. (See also statement on Home Economists. Refer to index for page number.)

Soil Scientists

(D.O.T. 0-35.03)

Nature of Work

Soil scientists study the physical, chemical, and biological characteristics and behavior of soils. They investigate soils both in the field and the laboratory and classify them according to a national system of soil classification. From their research, soil scientists can classify soils in terms of response to management practices and capability for producing crops, grasses, and trees, as well as behavior 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.

The field of soil science offers opportunities for those who wish to specialize in soil classification and mapping, soil geography, soil chemistry, soil physics, soil microbiology, and soil management. Training and experience in soil science will also 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 or 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 universary of recognized standing is important in obtaining employment as a soil scientist. The B.S. degree is a minimum requirement for entrance into this occupation. Those with graduate training—especially those with the doctor's degree—can be expected to advance rapidly into responsible positions with good pay. This is particularly true in soil research, including the more responsible positions in soil classification, and in teaching. Soil scientists who are 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 during the remainder of the 1960's. A number of positions were vacant in early 1963 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 others in use of the 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 soil scientists with a B.S. degree was $4,565 a year in early 1963, with advancement to $5,540 after 1 year of satisfactory performance. Further advancement 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 ranged from about $8,500 to $13,000 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.

See also statements on Chemists and Biologists. Refer to index for page numbers.

Soil Conservationists

(D.O.T. 0-35.03)

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: Maps presenting inventories of soil, water, vegetation, and other details essential in conservation planning and application; information on the proper land uses 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 an overall 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.

Courtesy of U.S. Department of Agriculture

Soil conservationist uses soil and contour map in explaining use-capability of soil to farm operator

Training and Advancement

A bachelor's degree is the minimum requirement for professional soil conservationists. Graduates with degrees in forestry, biology, agronomy, engineering, range management, and general agriculture are eligible to become soil conservationists after special field training in farm and ranch conservation and land use planning. A college degree is not required for subprofessional soil conservationists whose primary work is to help farmers or ranchers in applying conservation practices after plans for conservation have been completed.

Professional soil conservationists 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 1962. Opportunities in the profession will expand because government agencies, public utility companies, banks, and other organizations are becoming increasingly 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 1963, the entrance salary for soil conservationists with a B.S. degree employed by the Federal Government was $4,565 a year, with advancement to $5,540 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 $8,500 to $13,000 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 other professional opportunities in agriculture for people trained in various technical fields. Among the more important categories of technically trained persons employed in occupations related to agriculture are the following:

Biochemists deal with the chemical compounds and processes occurring in living plants and animals.

Entomologists study insects, both beneficial and harmful in farming. They are especially concerned with developing measures to control insects that injure growing crops and animals, harm human beings, and damage agricultural commodities in storage, processing, and distribution.

Embryologists study the formation and development of the embryos of plants and animals.

Bacteriologists conduct microbiological and fermentation research to produce vitamins, antibiotics, amino acids, sugars, and polymers, by the action of micro-organisms.

Plant and animal pathologists conduct research on causes and control of plant and animal diseases, including those caused by fungi, bacteria, viruses, and physiological conditions.

Geneticists try to develop strains, varieties, breeds, and hybrids of plants and animals that are better suited to the production of food and fiber than those now available.

Plant and animal husbandry specialists are concerned with methods of caring for and managing plants and animals for the production of food and fiber.

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, 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 with economic affairs.

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

Many of the above specialities are discussed in greater detail elsewhere in this *Handbook*. See index for page references.

Where Employed

Persons trained in these specialities work in various capacities that relate to agriculture. Some are engaged in research for government agencies, colleges, agricultural experiment stations, and private businesses that deal with farmers. Others have technical and administrative responsibilities in public agencies that deal with farmers or whose programs affect farmers. Some are employed by cooperatives, and by private business, commercial, and financial companies that buy from, sell to, or serve farmers. Others serve in vocational agriculture teaching, in agricultural communications work, in farmers' organizations, or in trade associations whose members deal with farmers.

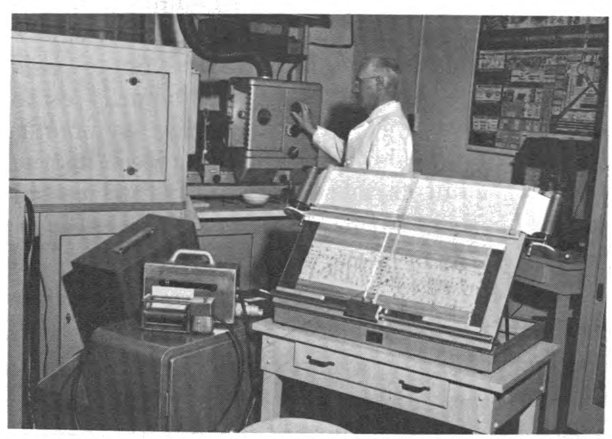
The number of research activities related to agriculture has increased rapidly within the last several decades. The largest agencies in this field are the State experiment stations connected with the land-grant colleges and the various research branches of the U.S. Department of Agriculture. Other research 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., and the nearby Agricultural Research Center at Beltsville, Md.; at land-grant colleges; and at numerous other places. 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 relating 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 state and other farm property. Trained personnel in lending institutions, therefore, are the key to sound credit practices in financing farmers. They 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, and 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 with only two or three helpers.



Courtesy of U.S. Department of Agriculture

Technician sets controls for specified mix in modern feed mill

Another expanding area of specialization is that of agricultural communications. 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 in agriculture 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. In addition, each student is required to conduct a farming project, either at home or on school facilities, with year-round supervision by the teacher. Teachers of vocational agriculture also serve as advisers to the local chapters of the Future Farmers of America. In addition to work with "in-school" students, vocational agriculture 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, with 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 with 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 by the recruitment of professional personnel to staff agricultural missions and 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:

Career Service Opportunities in the U.S. Department of Agriculture, Agricultural Handbook No. 45, U.S. Department of Agriculture, Division of Employment, Office of Personnel, Washington, D.C., 20250.

Choose a Challenging and Rewarding Career in the U.S. Department of Agriculture, Miscellaneous Publication 833, U.S. Department of Agriculture, Washington, D.C., 20250.

I've Found My Future in Agriculture, American Association of Land-Grant Colleges and State Universities, Washington, D.C., 1958. Copies can be obtained from your State Agricultural College.

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, 12 East 36th St., 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 Agricultural Colleges. General information may be obtained from the American Institute of Cooperation or the National Council of Farmer Cooperatives, both located at 744 Jackson Pl. NW., Washington, D.C., 20006, and the Cooperative League of the U.S.A., 343 South Dearborn St., Chicago, Ill., 60604.

Opportunities for Agricultural Economists. For additional information about opportunities in agricultural economics, check with the Department of Agricultural Economics at State land-grant college. 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 can sometimes be combined well with operation of a small farm.

Services that provide year-round employment include: Cow testing, artificial breeding, livestock trucking, whitewashing, well drilling, fencing, and tilling.

In cow testing and artificial breeding, an association of farmers employs one or more workers on a monthly basis to conduct the operations. Supervisors who do cow testing are employed by dairy herd improvement associations. They must have a high school education, and a farm background is almost essential. In 1960, annual salaries were from about $3,000 to $7,000. Artificial breeding associations employ inseminators who must have at least a high school education. In 1962, these workers were paid from about $4,000 to $12,000 a year. 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: 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.

Somewhat more remote from farm operation but still closely tied in with agriculture are such activities as repairing and servicing farm machinery; feed grinding and mixing; maintaining storages and warehouses of agricultural products; operation of nurseries and greenhouses; and packing, grading, and processing of 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.

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Occupations in Government

Government service is one of the Nation's largest fields of employment. In 1962, over 9 million workers, almost 1 out of every 6 in the United States, were employed in some level of government—Federal, State, or local (county, city, town, or village). More than two-thirds of all government workers are employed by State or local governments; the remainder work for the Federal Government. Several hundred thousand individuals are hired each year for government jobs in a wide variety of occupations, ranging from messenger to nuclear physicist. Government service is an important source of job opportunities for women. About 40 percent of all government workers are women, most of whom are employed in clerical or teaching jobs.

Government employees are a significant part of the work force in every State, ranging from 10 percent to more than 25 percent of all nonagricultural workers. 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 spots such as lighthouse installations and forest ranger stations.

Government Activities and Occupations

In 1962, about a third of all government workers were engaged in providing educational services (chart 43); the majority were in schools and colleges supported by State and local governments. In addition to teachers, employees in this field included administrative and clerical workers, maintenance workers, librarians, dietitians, nurses, and counselors. The great majority of workers in educational services were employed in elementary and secondary schools.

The second largest group of government workers was engaged in national defense activities of the Federal Government. This group, with more than a million employees, included civilians working in the Department of Defense and a few other defense-related agencies such as the Atomic Energy Commission. Among this group were administrative and clerical employees, doctors, nurses, teachers, engineers, scientists, and technicians, and craftsmen and other manual workers. They worked in offices, research laboratories, navy yards, arsenals, and missile launching sites, and in hospitals and schools run by the military services.

Other large concentrations of employment were in health services and hospitals, the postal service, and highways. Government workers were also employed in activities such as housing and community development, police and fire protection, social security and public welfare services and assistance, transportation and public utilities, conservation of natural resources, and tax enforcement and legislative activities.

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

The wide variety of government functions requires employees in many 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 1962 distributions of employment, which follow:

Category	Percent of— Government workers in the U.S.	All employed workers in the U.S.
All categories	100. 0	100. 0
Professional and technical	34. 0	11. 9
Managers, officials, and proprietors	5. 9	10. 9
Clerical and kindred workers	22. 6	14. 9
Sales workers	. 2	6. 4
Craftsmen, foremen, and kindred workers	9. 3	12. 8
Operatives and kindred workers	5. 5	17. 7
Service workers	17. 7	13. 0
Laborers	4. 7	5. 2
Farmers and farm workers	. 1	7. 2

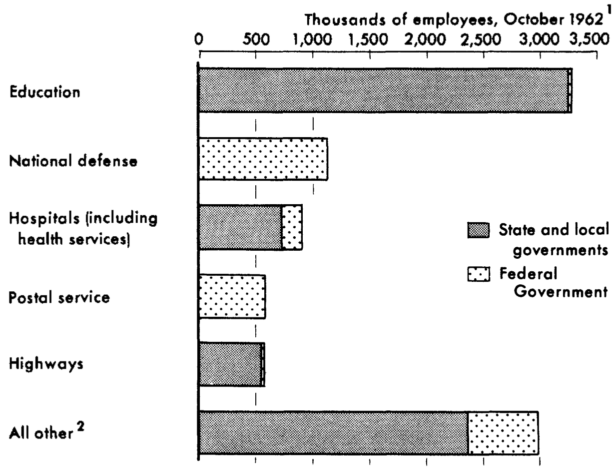
NOTE: Because of rounding, sums of the individual items may not equal 100 percent.

More than 4 million government workers were employed in professional and technical, managerial, clerical, and some sales occupations—the so-called "white-collar" jobs. Among these important occupational groups were teachers, postal clerks, and office workers such as stenographers, typists, and clerks. Among the approximately 3 million service, craft, and other manual workers, some important occupational groups were aircraft and automotive mechanics and repairmen, policemen, firemen, truckdrivers, skilled maintenance workers (including carpenters, painters, plumbers, and electricians), custodial workers, and laborers.

The following chapters discuss opportunities for civilian employment in the major divisions of government and opportunities in the various branches of the Armed Forces. A separate chapter gives detailed information on post office occupations. The postal service, the second largest area of Federal civilian employment, provides many jobs for young people who have no specialized training.

CHART 43

MAJOR AREAS OF GOVERNMENT EMPLOYMENT.....



[1] All Federal civilian employees, including those outside United States and 32,000 employees of the National Guard paid directly from the Federal Treasury.

[2] Includes legislative, judicial, tax, and other financial and general administrative activities; police protection, administration of natural resources, and all other services not elsewhere classified.

Source: Bureau of the Census.

CIVILIAN EMPLOYMENT

Federal Government

The Federal Government is the largest employer in the United States. It engages in manufacturing, research, transportation, lending, insurance, and many other activities. In 1962, it employed about 2.3 million civilian workers in the 50 States and the District of Columbia. These workers were engaged in thousands of 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, and internal revenue agent. Practically all Federal employees (about 99 percent) worked for the departments and agencies that make up the executive branch of the government. The others were employed in the legislative and judicial branches.

The executive branch includes the office of the President, the 10 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 resources; treating and rehabilitating disabled veterans; delivering the mail; maintaining the flow of supplies to the Armed Forces; and administering other programs to promote the health and welfare of the American people.

The largest agency, the Department of Defense, which includes the Departments of the Army, Navy, and Air Force, employed more than 960,000 civilian workers in 1962; the Post Office Department employed about 590,000. The Veterans Administration and the Department of Agriculture were the only other Federal agencies with more than 100,000 workers. The remaining employees of the executive branch were distributed among 68 departments, agencies, commissions, offices, and boards, where employment ranged from 4 or 5 paid employees of small commissions, to large departments with 50,000 or more (Treasury; Health, Education, and Welfare; and the Interior).

The legislative and judicial branches have relatively few employees. In 1962, their total employment was less than 30,000. Most of these employees were in the legislative branch, which includes the Congress, the Government Printing Office, the General Accounting Office, the Library of Congress, the Office of the Architect of the Capitol, and the U.S. Botanic Gardens. The remaining workers were employed by the judicial branch, which includes the Supreme Court and the other United States courts.

More than 70 percent of all Federal employees were full-time white-collar workers. The great majority of white-collar workers (86 percent) were in nonprofessional occupations. Over a third were office workers such as secretaries, stenographers, typists, clerks, office machine operators, and receptionists. Postal clerks, carriers, and postmasters make up another third. The remainder were employed in a variety of occupations such as fiscal clerk, inspector, investigator, hospital worker, and nonprofessional scientific or technical worker.

The other 14 percent of the white-collar workers were in professional occupations. These occupations usually require the worker to have more education, specialization, and training than most nonprofessional jobs. Among the occupations in this group were those of engineer, doctor, lawyer, librarian, chemist, physicist, auditor, budget examiner, economist, historian, and psychologist, to mention only a few. Nearly a third of all Federal professional employees were engineers. The next largest group, about 20 percent, were doctors, dentists, or nurses.

An increasing number of physical scientists are needed by the Federal Government for its expanding research programs in space and other activities.

In addition to the many white-collar occupations in the Federal Government, more than 640,000 workers were employed in many different service, craft, and manual labor jobs in 1961, as shown in table 1.

TABLE 1. DISTRIBUTION OF FULL-TIME, BLUE-COLLAR WORKERS IN THE FEDERAL GOVERNMENT, BY JOB FAMILY, UNITED STATES, OCT. 31, 1961

Job family groups	Number of workers	Percent of total
All groups	640,922	100.0
Manual labor	92,031	14.4
Mobile industrial equipment operation and maintenance	70,942	11.1
Fixed industrial equipment operation and maintenance	51,355	8.0
Warehousing	49,940	7.8
Services	41,342	6.5
Metal work	41,356	6.5
Electrical installation and maintenance	32,934	5.1
Aircraft repair, propeller work, and engine overhaul	33,262	5.2
Machine shop work	32,387	5.1
Electronic equipment installation, maintenance, and operation	25,541	4.0
Marine work	24,516	3.8
Woodworking	23,863	3.7
Pipefitting	18,387	2.9
Ammunition and armament work	15,323	2.4
General maintenance and operations	14,189	2.2
Painting and paperhanging	14,142	2.2
Printing and reproduction	13,273	2.1
Packing and processing	9,853	1.5
Instrument maintenance and operation	6,781	1.1
Fabric and leather work	6,167	1.0
Manufacture and repair shop operation	5,163	.8
Other	18,175	2.8

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

SOURCE: U.S. Civil Service Commission.

Most of these workers were in establishments such as naval shipyards; arsenals; air bases; quartermaster depots; construction projects and harbor, flood-control, irrigation, or reclamation projects. More than 73 percent of these workers were employed by the Department of Defense. Most of the remaining employees were engaged in activities of the Post Office Department, Veterans Administration, General Services Administration, Department of the Interior, Tennessee Valley Authority, and Department of Agriculture.

Among individual craft, service, and manual labor occupations, laborers comprised the largest single group. Other occupations with large numbers of workers were automobile and aircraft mechanic, carpenter, cook, construction machinery and equipment operator, electrician, electronic technician, machinist, painter, plumber, printing pressman, sheetmetal worker, stationary engineer, steamfitter, truckdriver, and waiter.

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

Federal employees are stationed in all parts of the United States and its territories and in many foreign countries. Most Government departments and agencies have their headquarters offices in the Washington, D.C., metropolitan area, and about 1 out of 10 Federal workers was employed in that area in 1962. California, with about 250,000 Federal employees, had almost as many as the metropolitan area of Washington, D.C. Other States with more than 100,000 Federal workers included New York, Pennsylvania, Texas, and Illinois.

The Merit System

Approximately 9 out of every 10 jobs in the Federal Government in the United States were covered by the Civil Service Act in 1962. This act was passed by the Congress to ensure that 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 who are 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, a large percentage of the excepted positions are under separate merit systems of other agencies, such as the Foreign Service of the Department of State, the Department of Medicine and Surgery of the Veterans Administration, the Federal Bureau of Investigation of the Department of Justice, the Atomic Energy Commission, and the Tennessee Valley Authority. These agencies established 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. To be eligible for appointment, an applicant must meet minimum age, training, and experience requirements for the particular position, and be physically able to perform the duties of the position. Examinations vary according to the types of positions for which they are held. Some examinations include written tests; others do not. In non-written examinations, applicants are rated on their training, experience, and skills as shown by their applications and any corroborating evidence required by the Commission.

Examinations are given for a great variety of jobs either at the entrance grades or at higher levels, depending upon the needs of the Government. In a given period, for example, examinations may be open for clerk-typists, accountants and auditors, agricultural marketing specialists, offset pressmen, and research chemists.

A written examination for persons with college training or the equivalent—the Federal Service Entrance Examination—is given to fill entrance or trainee positions in a wide range of occupations. It is used to fill positions in which an employee's potential capacity is considered more important than special training for the work. Thus, a person who passes the examination may be considered for entrance-level professional, administrative, or technical positions in a variety of fields—not just positions in the applicant's special field of study or training. The Federal Service Entrance Examination is given periodically during the school year. It is open to college graduates, college seniors and juniors, and to persons who can qualify through experience or a combination of education and experience.

Other entrance examinations for college graduates are given under specific job titles such as engineer; physicist; chemist; accountant; and librarian. Persons who have primary interest in and training for a specialized field should refer to the announcements of examinations appropriate to that field.

The Civil Service Commission will not open an examination to the general public and accept applications until there are job vacancies or expected job vacancies. When vacancies exist or are expected, the Commission issues an examination "announcement" which lists experience or training requirements, location of jobs, duties, pay, and forms that must be filed, and when and where examinations will be held. (See p. 754 for sources of information concerning examination announcements.)

After the examination is announced, applications are accepted as long as the examination is open. Even after an examination is closed, some persons are permitted to file applications. These include, for example, persons in military service, those working overseas for the Government or for an international organization, and those who have been granted "10-point veteran preference" by the Civil Service Commission.

A person who has been granted veteran preference receives extra points which are added to the passing grade (70 percent) in an examination. An honorably discharged war veteran gets 5 extra points; a person who is eligible for disabled veteran preference gets 10 extra points.

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 applicants for a job vacancy, the Commission sends the agency the names at the top of the appropriate list. The appointing officer in the requesting agency can select any one of the available eligibles. Names of those not selected by this agency are restored to the list for consideration in connection with other job openings.

Appointments to civil service jobs are made without regard to an applicant's race, color, religion, national origin, politics, or sex. Civil service employees can vote as they choose, but they are prohibited, under the Hatch Act, from certain political activities and may not be forced to contribute to any political fund.

After a person is appointed to a Federal job through a civil service competitive examination, he must complete a 3-year period of conditional service to acquire full career status. During the first year, appointments are probationary and an employee can be dismissed, if his work is not satisfactory, upon written notice giving the reason for the dismissal and the effective date. After he has completed the 1-year probationary period, he has the same protections against dismissal as career employees (within limitations mentioned below). A career or career-conditional employee may be promoted, reassigned to another job in his agency, or transferred to another agency. Except for removals resulting from reductions in force, he can be removed from the career service only for cause—such as inefficiency, misconduct, or insubordination—after adequate review to protect him against dismissal for arbitrary or capricious reasons. A career employee can be reinstated without time limit after leaving the Federal service, without competing in examinations with the general public.

Federal employees who demonstrate outstanding ability are encouraged to prepare for more responsible assignments. Although agencies tend to promote from within, they also seek workers elsewhere in the Federal service or outside the Federal service to obtain the best qualified person for each position.

Layoffs, or "reductions in force," are sometimes necessary in the Federal Government for such reasons as cuts in appropriations made by the Congress and decreases in work in certain fields. When a reduction in force occurs, an employee may be either retained or separated by the agency affected depending on whether he has career status, whether he is a veteran or nonveteran, how many years he has been employed by the Government, and whether he performs his duties satisfactorily. A career employee receives retention preference over career-conditional and temporary employees of the same grade, and a veteran receives retention preference over nonveterans with the same type of appointment. A Federal employee who is laid off is entitled to unemployment compensation similar to that provided for employees in private industry. He is covered by the unemployment insurance system in the State or area in which he worked.

Employment Trends and Outlook in Federal Government

Each year, the Federal Government hires several hundred thousand employees. The majority of these workers replace employees who resign, retire, or die.

In recent years, Federal employment has remained at about the same level, averaging about 2.3 million workers. Over the long run, the trend in Federal employment has been upward, stimulated by national emergencies such as World War II and the Korean crisis. (See chart 44.)

Employment in the Federal Government has increased not only because of the need for a stronger defense establishment, but also because of the United States' important role in world affairs, and the greater activity of the Federal Government in such fields as agriculture, social security, conservation and flood control, veterans' services, the regulation of interstate commerce, and missile and space research and development. The need to provide a growing population with services such as those of the Post Office has also contributed to an expansion in Federal employment.

The outlook for Federal Government employment is difficult to forecast, because the number of Federal workers is determined by the needs of domestic government programs and international responsibilities, as defined by the Congress.

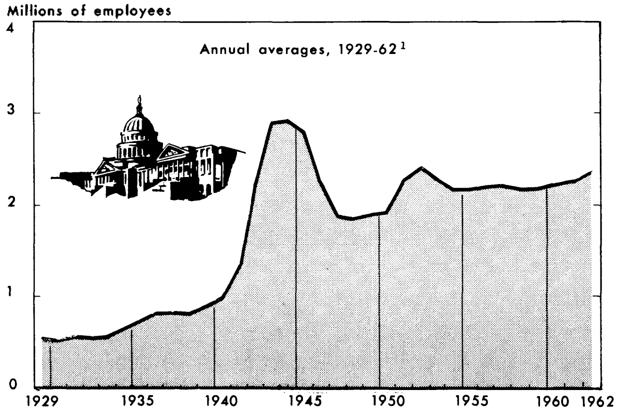
The most important factor determining employment opportunities in the Federal Government is the need for replacements. During 1961, for example, about 450,000 workers left Federal employment. At the same time, almost 525,000 persons were hired. Of these, nearly 100,000 were individuals who transferred from one agency to another, were reappointed to Government service, or returned to active employment.

The kinds of jobs in the Federal Government at any time are a direct reflection of changes in programs, technology, and methods of operation. The impact of the space age, for example, has stimulated the growth in engineering employment. The number of engineering jobs has about doubled in the last 15 years. The greatest demands are for electronic, mechanical, and internal combustion and powerplant engineers. Employment in the physical sciences has also increased rapidly. Here, the largest increases are in occupations in physical science administration, physics, chemistry, and meteorology, and in nautical sciences.

The introduction of quick-copy equipment in many Government offices is expected to continue to reduce the need for people whose office skill is

CHART 44

TREND IN FEDERAL GOVERNMENT EMPLOYMENT



1 Data include Alaska and Hawaii beginning with 1959, and are therefore not strictly comparable with previous years.

Note: Data relate to civilian employment only and exclude Central Intelligence Agency and National Security Agency.

limited to typing. By contrast, there is an increasing need for stenographer-secretaries. The increasing use of automatic data processing equipment is providing new jobs such as systems analyst, computer programer, and computer operator.

Occupations related to transportation have become increasingly important in the last 10 years. One of the rapidly growing occupations in this group is that of air traffic controller, in which employment increased by 140 percent between 1947 and 1962. This growth resulted from the increase in the number of scheduled commercial airline flights and the consequent expansion in the Government's responsibility for air safety standards.

Earnings, Advancement, and Working Conditions

Federal civilian employees are paid under several pay systems. In June 1962, the distribution was approximately as follows: 47 percent of all full-time employees under the Classification Act; 23 percent, under the Postal Pay Act; 27 percent, under the wage board pay system; and the remainder under other systems.

Pay rates for employees under the Classification Act are set by the Congress and are nationwide. This Act provides a pay scale called the General Schedule for employees in professional, administrative, technical, and clerical jobs, and for employees such as guards and messengers. The jobs under the General Schedule are classified and arranged in 18 pay grades according to difficulty of the duties, the responsibilities, knowledge, experience, or skill required. The distribution of Federal white-collar employees by grades and the entrance and maximum salary, as well as the amount of periodic increases for each grade, are listed in table 2.

Table 2. Distribution of Full-Time Federal Employees in the United States Under the Classification Act, June 30, 1962, by Grade Level and Salary Scale, Effective Oct. 11, 1962

General schedule grade	Employees		Salaries		
	Number	Percent	Entrance	Periodic increases	Maximum
Total	1,039,224	100.0			
1	1,851	0.2	$3,245	$105	$4,190
2	35,778	3.4	3,560	105	4,505
3	156,654	15.1	3,820	105–125	4,830
4	172,954	16.6	4,110	140	5,370
5	124,716	12.0	4,565	160	6,005
6	52,239	5.0	5,035	170	6,565
7	93,605	9.0	5,540	185	7,205
8	22,055	2.1	6,090	205	7,935
9	110,918	10.7	6,675	225	8,700
10	14,536	1.4	7,290	245	9,495
11	94,909	9.1	8,045	265	10,165
12	72,099	6.9	9,475	315	11,995
13	50,231	4.8	11,150	365	14,070
14	23,225	2.2	12,845	425	16,245
15	11,281	1.1	14,565	480	17,925
16	1,362	.1	16,000	500	18,000
17	548	.1	18,000	500	20,000
18	263	(1)	20,000		

1 Less than 0.05 percent.

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

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. Additional within-grade increases may be given in recognition of high-quality service.

The number of employees in each pay grade differs, of course, from one occupation to another. For example, in 1962, almost all of the clerk-typists were in grades GS–2, GS–3, and GS–4. About 88 percent of the secretaries were concentrated in grades GS–4, GS–5, and GS–6, and about 11 percent were employed at higher grades. About 68 percent of all electronics engineers were in grades GS–11, GS–12, and GS–13; 17 percent were in grades GS–5 through GS–9; and 15 percent in grades above GS–13.

New appointments to professional positions such as those filled through the Federal Service Entrance Examination, described earlier in this chapter, are usually made at the entrance salary in grade GS-5 with some appointments at GS-7 of especially well-qualified individuals. An eligible individual who holds a master's degree, or the equivalent in education or experience, usually enters at grade GS-7, and those who are especially well qualified may enter at grade GS-9. 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 auditor, electronic and nuclear engineer, and physicist. Appointments to entrance-level positions requiring less than professional-level training are usually made in the grades below GS-5, the exact grade and salary depending on the difficulty and responsibilities of the position.

Although new appointments must usually be made at the minimum rate of the salary range for the appropriate grade, employees may be hired at higher rates when the Government's ability to recruit and retain well-qualified personnel is handicapped by substantially higher salaries in private enterprise. For example, in 1962, employees were being recruited at above-minimum rates for engineering and certain physical science jobs.

Promotions depend upon openings in higher grades and upon the ability and work performance of the individual employee. Sometimes, however, it is not necessary for an employee to move to a new job to get a promotion. If his work assignments become more difficult and his responsibilities increase, his job may be reclassified to a higher grade with an increase in pay.

More than 500,000 workers, not including postmasters of 4th class post offices and rural carriers, were employed in early 1963 under the Postal Field Service Compensation Act. Of these, about 380,000, or 75 percent, were in pay level 4, which includes all city carriers and most postal clerks. The average (median) salary of these workers was $5,685 a year. (A detailed discussion of earnings of postal workers is found in the next chapter of this *Handbook*.)

More than 590,000 full-time craft, service, and manual workers employed by the Federal Government in the United States in 1962 were 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, rather than by legislation. The median annual pay of employees under this system was $5,574 in 1961. The following tabulation of Army-Air Force Wage Board pay rates for selected occupations in specific labor market areas, in June 1962, illustrates hourly wage rates for workers paid under the wage board system.

City	*Common laborer*	*Electrician*	*Machinist, general*
Atlanta, Ga	$1.87	$2.84	$2.98
Boston, Mass	2.14	2.93	3.03
Charleston, S.C	1.74	2.91	3.05
Chicago, Ill	2.29	3.15	3.28
Denver, Colo	2.21	2.84	2.94
Fort Worth–Dallas, Tex	1.94	2.78	2.91
Hampton Roads, Va	1.89	2.88	3.00
Houston–Galveston, Tex	2.01	2.83	2.95
Los Angeles, Calif	2.37	3.05	3.15
New Orleans, La	1.96	2.92	3.04
New York, N.Y.–Newark, N.J	2.29	3.04	3.14
Pensacola, Fla	1.84	3.01	3.14
Philadelphia, Pa	2.26	2.95	3.05
Portsmouth, N.H	2.05	2.80	2.88
Puget Sound, Wash	2.25	2.96	3.06
San Diego, Calif	2.22	3.02	3.12
San Francisco, Calif	2.50	3.12	3.21
St. Louis, Mo	2.25	3.08	3.19
Washington, D.C	2.05	2.84	2.95

SOURCE: Army-Air Force Wage Board, U.S. Department of Defense. Rates are for the second rate of a three-step pay range, in effect June 30, 1962.

More than 66,000 Federal Government employees in the United States in 1961 were paid under acts or orders other than those already discussed. Among the employees paid under the miscellaneous pay acts or orders were those working for the Tennessee Valley Authority, the Foreign Service of the Department of State, and physicians, dentists, and nurses in the Department of Medicine and Surgery of the Veterans Administration.

The standard workweek for Federal Government employees is 40 hours, and the pay schedules are based on this workweek. If an employee is required to work more than 40 hours a week, he is either paid overtime rates for the additional time worked or given compensatory time off at a later date. Most employees usually work 8 hours a day, 5 days a week, Monday through Friday. However, the head of an agency may decide on a different schedule for his agency. Annual earnings, for most full-time Federal workers, are not affected by seasonal factors.

Federal employees receive paid vacations and sick leave. They earn 13 days of annual (vacation) leave during each of their first 3 years of service, then 20 days each year until they have completed 15 years; 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 are also granted up to 15 days of paid military leave a year for training purposes. Court leave with pay may be granted to employees to attend court as a Government witness or for jury duty.

Other benefits available to most Federal employees include: A contributory retirement system providing annuities based on salary, length of service, and either age or disability, along with survivorship annuities; optional participation in low-cost group life and health insurance programs supported in part by the Government; compensation to employees injured in performance of duty; and employee training programs to develop maximum proficiency in the performance of official duties. These training programs may take place 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 vocational guidance counselors. Additional information about Federal job opportunities and Civil Service competitive examinations may be obtained from the central and regional offices of the Civil Service Commission, State employment service offices, and many post offices. The offices of the U.S. Civil Service Commission are listed below along with the States included in each region.

Central Office—U.S. Civil Service Commission, Washington, D.C., 20415. (Includes Washington, D.C., Metropolitan Area; Montgomery and Prince Georges Counties, Md.; Alexandria and Falls Church cities, and Arlington and Fairfax Counties, Va.; and overseas areas except the Pacific.)

Atlanta Region—Atlanta Merchandise Mart, Peachtree St., NE., Atlanta, Ga., 30303. (Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina, Tennessee, Puerto Rico, and Virgin Islands.)

Boston Region—Post Office and Courthouse Building, Boston, Mass., 02109. (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont.)

Chicago Region—Main Post Office Building, 433 West Van Buren St., Chicago, Ill., 60607. (Illinois, Indiana, Kentucky, Michigan, Ohio, and Wisconsin.)

Dallas Region—1114 Commerce St., Dallas, Tex., 75202. (Arkansas, Louisiana, Oklahoma, and Texas.)

Denver Region—Building 41, Denver Federal Center, Denver, Colo., 80225. (Arizona, Colorado, New Mexico, Utah, and Wyoming.)

New York Region—News Building, 220 East 42d St., New York, N.Y., 10017. (New Jersey and New York.)

Philadelphia Region—Customhouse, Second and Chestnut Sts., Philadelphia, Pa., 19106. (Delaware, Maryland, Pennsylvania, Virginia, and West Virginia.)

St. Louis Region—1256 Federal Building, 1520 Market St., St. Louis, Mo., 63103. (Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota.)

San Francisco Region—128 Appraisers Building, 630 Sansome St., San Francisco, Calif., 94111. (California, Hawaii, Nevada, and the Pacific Overseas Area.)

Seattle Region—Federal Office Building, First Ave. and Madison St., Seattle, Wash., 98104. (Alaska, Idaho, Montana, Oregon, and Washington.)

Information on career and competitive examination opportunities in Federal agencies which have separate career systems such as the Foreign Service, the Federal Bureau of Investigation, and the Atomic Energy Commission may be obtained by writing to their respective personnel offices in Washington, D.C.

General information on administrative careers in government may be obtained from: The American Society for Public Administration, 6042 South Kimbark Ave., Chicago, Ill., 60637.

State and Local Governments

State and local governments provide an important source of job opportunities in many different occupational fields. In 1962, nearly 7 million (full- and part-time) workers were employed in State and local government agencies. More than 75 percent (5.2 million) of these workers were with units of local governments, such as counties, municipalities, towns, school districts, or special districts. The remainder were employed in State government agencies.

More than 3 million employees, or nearly half of all State and local government workers, were employed in public schools, colleges, or other educational services in October 1962. The less densely populated States had the highest proportions of employees in educational services.

In addition to approximately 1.7 million classroom teachers (the largest single occupation in the field of education), school systems also employ administrative personnel, librarians, guidance counselors, nurses, dietitians, clerks, and maintenance workers. More than 85 percent of employment in the field of education is in elementary and secondary schools, which are largely administered by local governments. State employment in education is concentrated chiefly in institutions of higher learning.

The next two largest areas of full- and part-time State and local government employment in 1962 were in health and hospital and highway work. The 722,000 persons employed in health and hospital work included physicians, nurses, medical laboratory technicians, and hospital attendants. About 550,000 workers were employed in many occupations in highway activities. State and local government workers construct and maintain roads, highways, city streets, toll turnpikes, bridges, and tunnels. Among these employees were civil engineers, surveyors, operators of construction machinery and equipment, truckdrivers, concrete finishers, carpenters, and construction laborers.

Protective services such as those provided by police and fire departments were other large areas of employment in State and local governments. There were 360,000 full- and part-time people employed in police work in 1962, principally by local governments. Police work includes administrative, clerical, and custodial personnel, as well as uniformed and plainclothes policemen. All of the 216,000 firemen were employed by local governments, and about a third of these were part-time employees.

Another large group, about 440,000 full- and part-time workers in 1962, were employed in general 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. Lawyers, judges, and court officials, tax agents, accountants, and recording clerks are examples of persons in this field.

Other State and local government employees are engaged in a wide variety of fields—social security administration; public welfare; and operation of prisons, government-owned liquor stores, and local utilities such as water, electricity, gas, and transportation supply systems. These functions require workers in many types of occupations such as welfare workers, prison guards, electrical engineers, electricians, pipefitters, clerks, and busdrivers.

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 professional, technical, mechanical, and other occupations in State and local governments are given elsewhere in this *Handbook*, in the sections covering the individual occupations. See index for page numbers.)

State and local government employment opportunities are distributed among the States, roughly in proportion to their population. For example, New York, California, Pennsylvania, Illinois, Ohio, and Texas, which have more than 40 percent of the Nation's population, also employ more than 40 percent of the State and local government work force.

Employment Trends and Outlook

The long-range trend of employment in State and local governments has been steadily upward. (See chart 45.) Over the past 30 years, the number of employees (full- and part-time) more than doubled, reaching nearly 7 million in 1962. Since the end of World War II, the rate of employment growth has been rapid, primarily because of rapid population growth, expansion of school systems, and growth of cities. City development has required more highway facilities, police protection, health and sanitation, and other services.

A continued steady increase in State and local government employment seems likely during the remainder of the 1960's and in the longer run. A substantial growth in educational employment is anticipated as a result of the rising school-age population. In addition to employment opportunities from the expected overall growth in State and local governments, thousands of employees will be needed to replace workers who transfer to other fields of work, retire, or die. Retirements and deaths alone will probably result in the need for more than 100,000 new workers annually during the years ahead.

Most positions in State and local governments will be 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, for specialized personnel or if shortages of particular skills exist in their areas.

Earnings and Working Conditions

Earnings of State and local government workers depend primarily on the employee's occupation. Information on salary rates for any specific occupation can be obtained from the appropriate agencies in each State or locality.

The average earnings of State and local government employees also vary from one government function to another. Average monthly earnings in October 1962 for full-time employees engaged in various functions were as follows:

Function [1]	*Average monthly earnings of full-time employees*
All functions	$443
Education	494
Local schools	488
Instructional personnel	542
Other	321
Institutions of higher education	537
Instructional personnel	746
Other	397
Other education	460
Functions other than education	401
Highways	393
Public welfare	371
Hospitals	317
Health	431
Police protection	465
Local fire protection	486
Sewerage	420
Sanitation other than sewerage	369
Local parks and recreation	377
Natural resources	416
Housing and urban renewal	420
Airports	477
Water transport and terminals	510
Correction	427
Local libraries	332
Financial administration	395
General control	431
Local utilities:	
Water supply	407
Electric power	500
Transit	528
Gas supply	420
Other and unallocable	422

[1] Because a considerable number of educational employees are paid on a 9- or 10-month school term basis, average earnings for this group for a single month, such as October, cannot be used directly to estimate comparative annual earnings of educational personnel in relation to those of other employees. The lower average earnings for hospitals reflect cash compensation only and do not include the value of meals, lodgings, or other payments-in-kind.

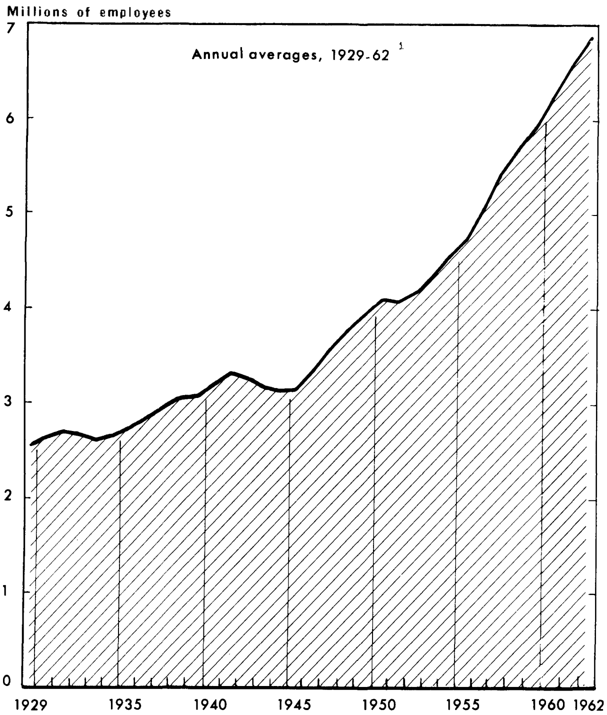
SOURCE: State Distribution of Public Employment in 1962, U.S. Bureau of the Census.

Average monthly earnings of full-time State and local government workers in the United States in October 1962 ranged from $297 in Mississippi to $725 in Alaska.

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 serv-

CHART 45

TREND IN STATE AND LOCAL GOVERNMENT EMPLOYMENT.....



[1] Data include Alaska and Hawaii beginning with 1959, and are therefore not strictly comparable with previous years.

ice coverage which applies only to their specific groups.

More than half of all State and local government employees are covered by State-administered retirement systems; most of the remainder are covered either by locally administered systems or by the Federal old-age and survivors insurance program. Nearly all teachers and full-time local policemen and firemen are covered by some kind of retirement provisions. In addition, approximately two-thirds of the public school teachers and about a third of the policemen and firemen are also under the Federal old-age and survivors insurance program.

Most State and local government employees work a 40-hour week; overtime pay or compensatory time benefits are often granted for hours of work in excess of the standard workweek.

Where To Go for More Information

People interested in working for State or local government agencies should seek information about job openings, salary rates, and how to apply for employment at 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 will also have, or can tell applicants where to get, information.

General information on administrative careers in government may be obtained from:

American Society for Public Administration,
6042 South Kimbark Ave., Chicago, Ill., 60637.

Post Office Occupations

The mailman, with the familiar leather pouch over his shoulder, and the clerk 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.

Nearly 600,000 postal service workers were employed in about 45,000 separate installations throughout the United States in early 1963. These workers, employed in the second largest agency in the Federal Government, collected and distributed more than 67 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). Nonmail services performed by postal workers include filling out and selling money orders and accepting deposits in postal savings accounts.

Postal employment is concentrated in the larger centers of population. The metropolitan area of New York City, in its various post offices and other installations, has about 50,000 postal workers, or almost 10 percent of all post office employment. Other large centers of postal employment include the Chicago, Los Angeles, Boston, and Philadelphia metropolitan areas. Postal jobs are also found in very small communities and in rural areas. Young people in these places may find postal employment particularly attractive in view of the limited opportunities which may exist for other employment. Approximately 10 percent of all postal employees are women, most of whom are employed in the smaller post offices.

Young men may try postal work before making a career choice, by getting a temporary job during vacation periods. From mid-December until Christmas Day, temporary workers are employed in many post offices to handle extra mail. In the summer months also, when regular employees usually take their vacations, some post offices hire temporary workers.

Occupations in the Postal Service

Unseen by the general public, the giant workrooms behind the lobbies of the big city post offices are busy centers of activity. 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 it is sorted according to type of mail and destination. The people who do this sorting are called distribution clerks and make up the largest single group of employees in the postal service. (Another group of employ-

Courtesy of U.S. Post Office Department

Mail carrier delivers letters

ees also distributes mail but they do not work in the post office. These are the postal transportation clerks who work on a train or bus, sorting mail while moving.) Behind counters in the lobby of the post office building are the window clerks who sell stamps and money orders, register and insure mail, and accept parcel post. In all, there were about 240,000 postal clerks throughout the country in early 1963.

The city carriers are the second largest group of postal workers (almost 170,000 in early 1963). These workers collect the mail which flows into the city post office and deliver the mail 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. 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 1963. 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 the smaller post offices, this work is performed by the clerks. In the larger post offices, mail handlers are employed to do most of this work. In addition to handling sacked mail, the mail handlers make rough separations of 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 1963, there were approximately 30,000 mail handlers.

About 28,500 postal supervisors and 11,000 postmasters directed the work of approximately 440,000 clerks, carriers, and mail handlers in the larger post offices. (About 23,000 additional postmasters were employed in the smaller post offices.)

Approximately 19,400 maintenance service employees were concerned with the operation, maintenance, and protection of post office buildings and equipment. About 12,000 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 5,000 motor vehicle operators who drove trucks transporting bulk mail. About 3,500 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 30,000 parcel post delivery 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, and 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 limit 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.

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

As in the case of 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, sex, 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 by a Federal medical officer. 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 memorize the streets and numbers which make up a district so that they can sort mail rapidly. Carriers have to keep record of changes of address. Both clerks and carriers must also remember many postal regulations.

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 tight deadlines and work in large groups at close quarters, they should be able to get along well with their coworkers.

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

The amount of training given to a new employee varies considerably, depending on 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. Te become proficient in all of his work, however, takes much longer The new clerk or carrier must spend many hours of his own time in memorizing postal regulations and schemes and routes and additional hours of practice in sorting to get the necessary speed and accuracy. (A scheme is a group of places consisting of States, cities, zones, or streets and numbers arranged for 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 absent regular employees and also supplement the regular work force. There may not be more than one career substitute for every five regular employees. As vacancies occur in the regular work force, they are filled by converting substitutes to regulars in order of seniority. The length of time served as a substitute depends on the size of the installation, economic conditions in the area, and other factors.

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 with 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 fairly limited. Most employees start as postal clerks and carriers and continue in those categories. Some employees may become supervisors or advance to higher level, nonsupervisory jobs. Most employees, however, can expect only to receive preferred assignments or routes as their seniority increases.

One higher level position which offers an interesting career and excellent opportunities for further advancement is that of postal inspector. The openings are few, however, and the requirements are very exacting.

Employment Outlook

The Post Office Department will hire many thousands of young workers each year during the remainder of the 1960's and in the longer run. Based on the experience of recent years, there should be many thousands of job opportunities in the postal service each year as a result of the need to replace employees who retire, die, or transfer to other employment. Deaths and retirements alone should provide about 15,000 job opportunities annually.

A modest increase in total post office employment will result in some additional job opportunities during the years ahead. Most of this employment increase will occur in carrier jobs. As in the past, the volume of mail is expected to continue to grow rapidly, largely as a result of expanding population, and increasing personal income and business activity. Employment, however, will grow at a much slower rate than in the past because of continuing modernization and mechanization of postal facilities and equipment which should greatly increase the volume of mail an individual employee can handle.

In advanced stages of development and in actual use in 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. Nevertheless, 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 maxi-

Postal field service level	Employees		Scheduled salaries [1]		
	Number	Percent	Entrance	Periodic increases	Maximum
Total employees under PFS schedule [2]	530,895	100.0			
1	4,504	0.8	$3,595	$130	$5,025
2	23,934	4.5	3,905	135	5,390
3	40,690	7.7	4,230	145	5,825
4	379,915	71.6	4,565	160	6,325
5	25,555	4.8	4,965	165	6,780
6	11,401	2.1	5,365	180	7,345
7	17,437	3.3	5,805	195	7,560
8	10,704	2.0	6,285	210	8,175
9	7,542	1.4	6,805	225	8,830
10	3,663	.7	7,395	245	9,600
11	1,890	.4	8,045	265	10,165
12	1,352	.3	8,840	295	11,200
13	1,030	.2	9,725	325	12,325
14	729	.1	10,705	355	13,545
15	294	.1	11,780	390	14,900
16	169	(3)	12,955	430	15,965
17	49	(3)	14,260	470	17,550
18	15	(3)	15,500	500	18,500
19	8	(3)	16,750	500	19,250
20	14	(3)	18,000	500	19,500

[1] Effective Oct. 13, 1962.
[2] Does not include postmasters of fourth-class offices and rural carriers.
[3] Less than 0.05 percent.

SOURCE: U.S. Post Office Department.

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mum, 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.

The average (median) annual salary of the more than 500,000 PFS employees in early 1963 was $5,685. Most of the city carriers and postal clerks are in PFS level 4.

Most regular postal employees work an 8-hour day, 5 days per week. If a regular employee subject to an 8-hour day works more than 8 hours, he is paid at 1½ times the regular rate for the extra hours worked. If he works an extra day he does not receive overtime, but is entitled to take a day off (called compensatory time) at a later date.

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.

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 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 most 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 about 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. 1-28.01)

Nature of Work

The carrier—or "mailman" as he is known to most people—is responsible for delivering and collecting mail in a specific area. Most of his time is spent outdoors where he has frequent contact with the people on his route. Some city carriers (usually new men) may be assigned only to collect mail from street letter boxes and from office building mail chutes. Most of the work of this group of carriers is done in the evening after the close of the business day. The great majority of carriers, however, work during the day, delivering as well as collecting mail.

The carrier begins his work very early in the morning. He spends a couple of hours at the post office, where he arranges the mail in the order in which it will be delivered. To do this sorting, he uses a "case," which is an upright box with compartments labeled with names of streets, house numbers, or buildings. (Rural carriers sort ["case"] the mail by name of patrons and rural box number rather than by street and number.) 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 and places in his route case reminders for special mail, such as insured mail which requires a signature by the person receiving the mail. He signs receipts for postage due and c.o.d. mail.

When the mail has been arranged, it is assembled into bundles numbered in the order of delivery. The residential foot carrier's mail is generally too heavy to be carried by him all 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 by other carriers in trucks and placed in storage (relay) boxes at intervals along the route.

The carrier starts out on his route with the mail in a large leather bag which is carried over his shoulder or in a mail cart. The bag or cart will contain mail to be delivered on the first section of his route. When he reaches the first relay box, his bag is empty, or nearly so, and he refills it with the bundles in the relay box containing the mail for the next section of his route.

In some cities, a carrier on an outlying residential route may use a light, three-wheeled motor vehicle called a "mailster" to deliver mail. Such a carrier does not make up relays, but rather loads the vehicle with the mail for his entire route. He also takes the parcel post mail for his route and delivers it together with the letter and paper mail.

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

Courtesy of U.S. Post Office Department

Carrier drives a "mailster" on delivery route

When a required signature cannot be obtained for mail such as an insured parcel, the carrier leaves a notice that tells where the parcel is being held. The carrier brings back to the post office letters left in the mail box for mailing. He also collects mail from street letter boxes.

When the carrier returns to the post office after completing his route, he "faces" the mail he has brought back for cancellation (i.e., arranges letters so that the stamps are all in the same direction). He also turns in the money and receipts which he collected.

The residential city carrier covers his route once during the day. The carrier in the downtown business district, covering a more highly concentrated area, makes a number of trips over his route during the course of the day.

Where letter and paper mail is delivered by foot carriers, parcel post is delivered separately by other carriers who drive trucks. Parcel post is sorted by postal clerks and put into sacks. Each sack has a parcel post carrier's route number and another number indicating the order of delivery within the route. The parcel post carrier loads his truck, arranging the sacks in the order of delivery, and proceeds along his route which covers about the same area as 8 to 10 foot carrier routes combined. He also collects mail of all types from street letter boxes.

A substitute carrier may have a combination of duties. For example, he may deliver mail on foot during part of the day and then drive a truck in the evening, making collections from street letter boxes.

The rural carrier delivers mail by motor vehicle along routes primarily outside city limits. He places the mail in mail boxes set up on posts by the roadside and collects the letters left in the boxes for mailing. In addition, he sells stamps and money orders and accepts parcel post, letters, and packages to be registered or insured.

All carriers must be able to answer questions about postal regulations and service and provide change of address cards and other postal forms when requested.

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, they 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 requirement 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, becoming 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 very 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 opportunities each year during the remainder of the 1960's and in the longer run for young men to become carriers. Based on the experience of recent years, many thousands will be hired each year as replacements for carriers who leave the service as a result of transfer to other work, retirement, or death. Deaths and retirements alone should provide about 5,000 job opportunities annually. The total number of carrier jobs is also expected to increase substantially.

As in the past, the number of city carriers will increase steadily as population continues to grow and to spread out into suburban areas. Such innovations as "mailsters" probably will slow down the rate of employment growth.

Rural carrier employment is expected to remain relatively unchanged in future years, as it has for many years in the past. Rural routes near large cities are converted to city routes as the suburbs continue to spread. On the other hand, new rural routes are established to provide service in areas where fourth-class post offices are discontinued. In recent years, vacancies have averaged about 1,700 annually.

Earnings and Working Conditions

Almost all city carriers begin as substitutes and receive $2.26 an hour. If their work is satisfactory, they receive an increase of 8 cents an hour each year for the first 6 years, and an increase of 8 cents an hour every 3 years thereafter, up to a maximum of $3.14 an hour. Regular city carriers are paid on an annual basis, beginning at $4,565 and increasing each year by $160 for the first 6 years, and by $160 every 3 years thereafter, up to a maximum of $6,325 after 21 years of service.

When a substitute city carrier receives a regular appointment, he gets credit for his service as a substitute. For example, a substitute with 2 years of career service who is appointed to a regular position would be paid at the annual rate of $4,885. 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 58-mile route (the average route length in 1961) would receive $4,949 a year in his first year and $5,909 in his seventh year. The allowance for the use of his automobile would give him an additional $2,115.84.

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 per week. If he works more than 8 hours a day, he is paid at 1½ times his regular rate for the extra hours worked. If he works more than 5 days a week he receives compensatory time off. Substitute city carriers receive straight-time rates for all hours worked. Both regular and substitute city carriers receive 10 percent additional pay for work between the hours of 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. The working conditions of carriers vary considerably depending upon the time of year and the part of the country in which they work. 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 out 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.

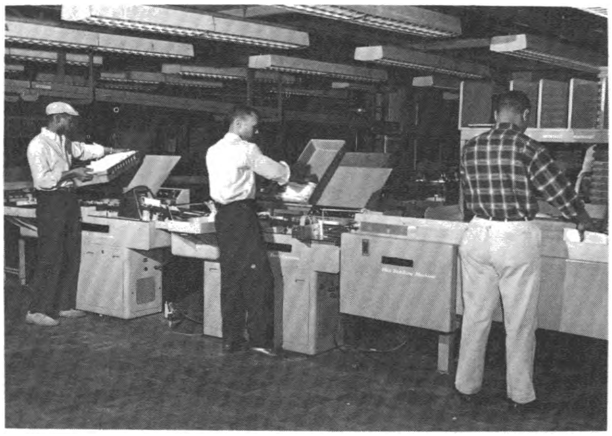
Postal Clerks

(D.O.T. 1-27.20)

Nature of Work

The great majority of post office clerks work behind the scenes and are never seen by the public. They are the distribution clerks in the large city post offices who sort incoming and outgoing mail and prepare it for dispatching. Other clerks deal directly with the public at windows in the lobbies of post office buildings, selling stamps and money orders and providing other services. (In smaller post offices, the same clerk does both types of work.) Every postal clerk, whether a distribution clerk or a window clerk, must be able to sort mail. New substitute clerks may be assigned to carrier duties.

The mail that has been collected by the carriers is brought into the post office workroom and dumped on long tables. Here the first rough separation of the mail into parcel post, paper mail, and letter mail takes place, usually performed by new distribution clerks (and sometimes by mail handlers). Parcel post and paper mail are separated into separate containers. The letter mail which remains on the table is "faced" (stamps down and facing the same direction) and fed into canceling machines which print over the stamps the date and time, and the city and State in which the post office is located. (Many of the larger post offices have installed new canceling machines which make it unnecessary to face the letters because the machines can "find" and cancel the stamp, wherever it is.) Parcel post and paper mail are canceled by hand. After the mail has been canceled, it is taken to



Courtesy of U.S. Post Office Department

Postal clerks feed letters into high-speed canceling machines

different sections where other clerks begin a series of sortings according to destination.

Clerks who work on letter mail throw the letters into a case (an upright box with labeled compartments). For a "primary distribution" (first sorting by destination) the case 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 will 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 this mail have to be familiar with every street in the city and 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, by separating it into ever finer groupings. However, to sort parcels, clerks use chutes, conveyors, slides, tables, and bags or other containers instead of letter cases.

Some distribution clerks separate mail while traveling in trains or buses. Other clerks, known as transfer clerks, arrange for mail to be moved to and from trains promptly and at the lowest possible cost.

New equipment is being used to make distribution work faster and easier. Mechanical conveyor systems are in use in a number of post offices to reduce the manual movement of mail between work areas. With new electronic sorting machines, a clerk can push a button on a keyboard and a letter is automatically sent to the proper compartment. This clerk 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.

The clerks who work at public windows in the lobby of the post office building, in addition to selling stamps, provide a variety of other services. In accepting material for mailing, window clerks weigh letters and 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 office, accept deposits in postal savings accounts, 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 the larger 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 on page 759. The written civil service examination and the physical requirements are the same as for carrier applicants and are discussed on page 763. A new type of examination, including a machine aptitude test, is given to applicants for the recently established 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 to have 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.

Promotional opportunities for postal clerks are somewhat better than for carriers, but still limited. In the larger 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

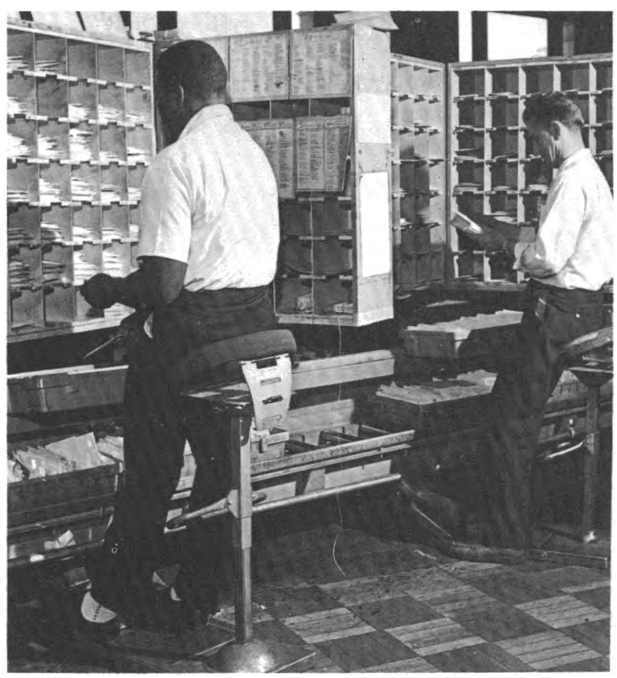
There will be many thousands of job openings for postal clerks during the remainder of the 1960's and in the longer run. Most of these openings will result from the need to replace clerks who leave the service because of transfers to other work, retirements, or death. Deaths and retirements alone should provide about 6,000 job opportunities annually. Some additional job opportunities will result from an expected moderate increase in total postal clerk employment.

With the anticipated increase in population, business activity, and personal income, mail volume will grow substantially. Post offices will be needed in the new communities. The increased volume of mail and the new post offices established will require more postal clerks.

However, because of technological developments already introduced and others on the horizon, employment is expected to grow at a much slower rate than the volume of mail. As a result of these developments, the amount of mail a clerk can handle will increase and postal clerk employment will rise at a slower rate than it has in the past.

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 764. Clerks working on the nightshift receive 10 percent additional pay. Postal clerks in the post-office-on-wheels receive higher salaries than clerks in large post offices, and the clerks in



Courtesy of U.S. Post Office Department

Postal clerks sort mail

large post offices receive higher salaries than those in the small 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.

ARMED FORCES

When planning their future 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.

For the young man who is a conscientious objector to combatant and noncombatant military service, there are several areas in which he can employ his service time. State and local Selective Service Boards have a list of acceptable areas of work, and of groups sponsoring such projects. Among the sponsoring groups are the Friends Service Committee, the Church of the Brethren, and the Mennonites.

At the present time, 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.

These enlistment choices and the draft are subject to change at any time by Congressional action. The alternative choices described here in a general way serve only to illustrate a few possibilities. Detailed up-to-date information can be obtained from local Armed Forces Recruiting Stations or from such publications as *It's Your Choice*, and *Your Life Plans and the Armed Forces*. The former is available by writing to the following address:

It's Your Choice,
Washington, D.C., 20301.

Your Life Plans and the Armed Forces is available at high schools, colleges, and State Employment Service offices.

The Reserve Forces Act of 1955 provided additional choices for fulfilling military obligations. One of these important new choices allows a young man to fulfill his military obligation by enlisting in the reserves for 8 years, 6 months of which is spent in active duty training. This enables him to complete his active military service in a 6-month period just after high school, before he enters college or starts to work.

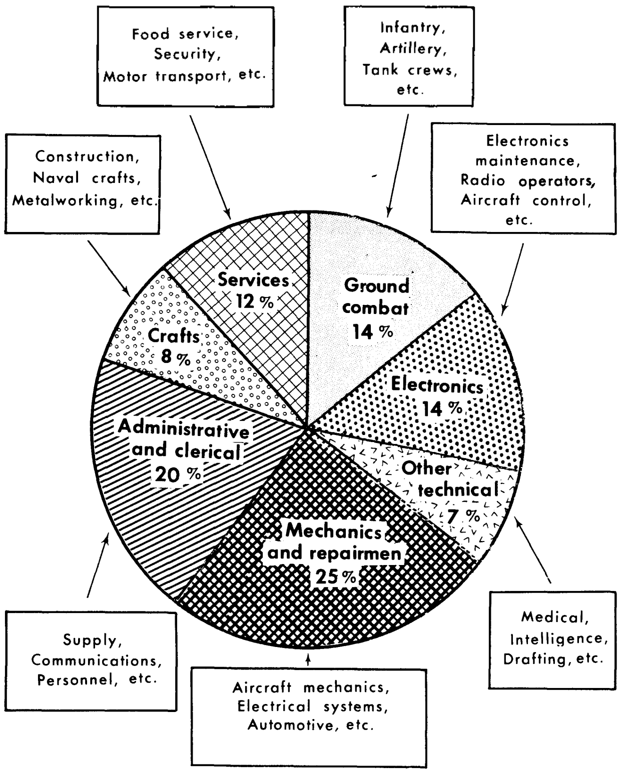
If a young man wants to go directly to college, he can remain in a deferred status by qualifying for student deferment or, upon entering college, by enrolling in ROTC or certain other officer training programs. A young man who wants to enter an industry training program directly from high school may qualify for apprentice deferment and complete apprentice training before entering military service.

About half of all enlisted jobs in the Armed Forces require training in a skilled trade or a technical specialty. It is possible for a young man, during his military service, to receive training in electronics, aircraft maintenance, metalworking, or other skilled work. (See chart 46.) Such work can often be utilized later in civilian employment. To receive this kind of training, it is usually necessary to enlist for more than 2 years.

In addition to specific on-the-job 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, (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 2 years of college level. In addition, approximately

CHART 46

TYPES OF WORK PERFORMED BY ENLISTED MEN IN THE ARMED FORCES, JUNE 30, 1962[1].....



[1] Includes over 2,000,000 enlisted men.

Source: U.S. Department of Defense.

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 which 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. In 1962, more than 1,250,000 enrollments were recorded by military personnel in these 4 programs.

General information on the occupations in the Army, Navy, Air Force, Marine Corps, and Coast Guard may be obtained from their respective recruiting stations. Career fields in the Army, Air Force, and Navy are listed in this chapter together with further sources of information. In January 1963, the military personnel in the Armed Forces was distributed among the various services as follows: Air Force, 868,000; Army, 957,000; Navy, 663,000; Marine Corps, 189,000; and Coast Guard, 30,604.

Army

The Army has divided its occupations into approximately 55 occupational career fields classified into 10 occupational areas, which are explained in the U.S. Army Handbook, *Army Occupations And You*, Office of the Adjutant General, Department of the Army, Washington, D.C., 20310, revised edition, 1962. Briefs on the career fields describe job organization, duties and responsibilities, work environment, qualifications, training given, advancement, and related civilian jobs. Each brief contains a job progression chart showing normal lines of advancement and indicating areas of work in the particular career field. The handbook contains additional sections on requirements for enlistment, pay scale and allowances, educational opportunities in the Army, opportunities for commissioned and warrant officers, opportunities for women in the Army, aptitude areas, and an index to related civilian jobs. The handbook is available in high schools, State Employment Service offices, and Army recruiting stations. Information on jobs in each career field is given in greater detail in the Manual of Enlisted Military Occupational Specialties, AR 611–201, June 1960. Although intended for military use, this book is useful to civilians as well, because of its thorough examination of each job specialty. The manual is available at all Army recruiting stations, posts, and installations.

Air Force

The Air Force has published a manual for vocational guidance counselors and Air Force personnel officers called the *Occupational Handbook of the United States Air Force* (Headquarters, U.S. Air Force, The Pentagon, Washington, D.C., 20330, 1962). This handbook contains descriptions of each of the 45 airmen career fields. Each brief includes a statement of the scope of the particular career field and an organizational chart which shows the relationship between the various jobs and indicates the paths of advancement. For the various jobs in a career field, the brief gives a description of duties and responsibilities, qualifications and preparation, training given, and related civilian jobs. The handbook also has special sections on pay rates, opportunities for a commission, women in the Air Force, and reserve components. In addition, there is a valuable school subject index to airmen career fields. This publication is available in high schools, colleges, public libraries, State Employment Service offices, and Air Force recruiting stations.

Navy

The many different kinds of occupations found in the Navy are described in the *U.S. Navy Occupational Handbook* (Bureau of Naval Personnel, Washington, D.C., 20350, 1963). This handbook contains 65 vocational information statements on Navy occupations, classified into 9 major groups. Each brief explains the purpose of the job, duties and responsibilities, work assignments, qualifications and preparation, training given, lines of advancement, and related naval or civilian jobs. Promotions, pay rates, retirement provisions, and other aspects of careers in the Navy are explained in the introduction. Included in the handbook are sections on women in the Navy, commissioned officers, the Naval Reserve, and the Submarine Service. This publication is available in all high schools, colleges, public libraries, State Employment Service offices, and the Navy recruiting stations.

Technical Appendix

This appendix is designed for readers who wish more information on the courses and procedures followed in developing the conclusions on employment outlook than is presented in the nontechnical 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*) 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, because of differences in the factors influencing the labor market, the same general pattern of research was followed in all of the outlook studies.

The starting point in most studies was an analysis of past and prospective population trends, including the changes expected in population of school and college age, in numbers of older people, in employment of women, and in the concentration of population in and around cities. In fields such as teaching, the health professions, and many personal services, population factors have a direct and obvious influence on employment opportunities. They are also of great importance in many industries—for example, residential construction, 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 they also influence the size of the required work force and the kinds of occupations and skills needed.

In studying the outlook in each industry, the factors having the greatest influence were analyzed and projections were made of demand for the industry's products or services. These projections were then translated into estimates of the numbers and kinds of workers required to produce the indicated amounts of products or services—in view of the relative numbers currently employed in different occupations, productivity trends, possible further reductions in the workweek, and other factors. Past trends in employment were also given much weight in arriving at the conclusions as to probable future trends.

To assist in carrying through this analysis and ensure that the assumptions made in the different studies were consistent, overall projections of the economy to 1975 were developed. This general analytical framework included projections of the population, labor force, gross national product, average hours of work, employment in major industries, and related economic measures, by 5-year intervals from 1960 to 1975. In all studies of separate occupations and industries, the employment projections were tied in with those derived from the projections of the entire economy.[1]

The basic data on population and labor force trends, used for the overall employment projections and for the studies of individual occupations and industries, are from the decennial Censuses of Population, and from the monthly labor force surveys conducted by the Bureau of the Census for the Bureau of Labor Statistics.[2] Data were also drawn from the Censuses of Manufactures and Business conducted by the Census Bureau. It should be noted that Census of Population data were used for most of the charts on occupations in this *Handbook* since decennial censuses provide the only long-term trend data available on employment in detailed occupations. The 1960 Census of Population data were also used in charts designed to show the comparative size of occupations.[3] However, in the text and in a limited number of charts, employment for individual occupations was estimated for 1962 or early 1963. These more recent estimates were made possible by utilizing information from a variety of sources such as licensing agencies, trade unions, professional associations, and special surveys.

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[1] Some of the economic projections derived in these studies by the Bureau of Labor Statistics have been published in the *Manpower Report of the President* and a *Report on Manpower Requirements, Resources, Utilization, and Training,* prepared by the U.S. Department of Labor, March 1963; for sale by Superintendent of Documents, Washington, D.C., 20402, at $1.25 a copy; 204 pp.

[2] Special Labor Force Report No. 24, Interim Revised Projections of U.S. Labor Force, 1965–75; available on request from the U.S. Department of Labor, Bureau of Labor Statistics, Washington, D.C., 20210.

[3] U.S. Department of Commerce, Bureau of the Census, *U.S. Summary—Detailed Characteristics,* table 201, U.S. Census of Population 1960. PC (1) ID, Superintendent of Documents, Washington, D.C., 20402, price $2.50.

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 25 million workers. They are available for a great number of different industries, for the past quarter-century or more.[4]

Another Bureau program which contributed to the analysis of future employment trends was its series of studies of productivity and technological developments. Anticipated productivity trends and technological changes were allowed for in converting the projections of demand for the products of a given industry into estimates of the number of workers who will be needed in that industry. 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, has also been extensively utilized.[5]

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 159 industry sectors which represent the entire economy of the United States. For each industry sector, the tables show a percentage distribution of employment among about 150 of the most important occupations and also among the major occupational groups. The matrix was valuable in appraising the effects of changing employment levels in different industries on employment in specified occupations. It was also useful in estimating the numbers of workers currently employed in each occupation. This was an important function, since for many occupations the 1960 Census of Population was the most recent source of basic data on employment, and for many others only fragmentary data were available, which had to be integrated by means of the matrix in order to derive overall estimates of employment.

Conclusions based on the analysis of information from these many sources generally indicate increases in employment and, hence, openings for new workers. Expected gains in employment, however, are by no means an adequate indication of the total numbers of job openings which will need to be filled. In most occupations, more workers are needed yearly to fill positions left vacant by those who leave the occupation (to enter other occupations or because of retirement or death) than are needed to staff new positions created by growth of the field. Rarely do occupations grow fast enough so that the reverse is true. Even occupations which are declining in size may offer employment opportunities to many young people.

In estimating the number of openings likely to arise in an occupation, use has been made of Bureau of Labor Statistics studies of occupational mobility among selected groups of workers, and of tables of working life, also developed by the Bureau.[6] The tables, which are similiar 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, in turn affected by differences in sex and average age of the workers in various occupations. In many occupations, for example, where men comprise 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; 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 only within comparatively recent years. The reader should bear in mind that economic forecasting is still in an early stage of development and that it is, at best, difficult and uncertain. It is necessary to keep in mind also the basic assumptions underlying the forecasts (enumerated on page 10). The Bureau believes that, within this general framework of assumption, the basic trends affecting employment can be discerned with sufficient accuracy to meet the needs of young people preparing for careers.

D.O.T. Classification Numbers

The reports in this *Handbook* have been grouped in the manner which seemed most appropriate in view of the needs of the users and the realities of the industrial world. The arrangement followed does not conform to any one established system of classifying occupations.

[4] See *Employment and Earnings,* described on page 791.

[5] National Science Foundation, *Scientific and Technical Personnel in Industry, 1960* (NSF 61-75); for sale by Superintendent of Documents, Washington, D.C., 40402, at 45 cents a copy.

[6] A paper, "The Length of Working Life," which contains the latest published data on the work life expectancy for men is available on request from the U.S. Department of Labor, Bureau of Labor Statistics, Washington, D.C., 20210. Data on women are published in *Tables of Working Life for Women* (BLS Bulletin 1204, 1950); for sale by Superintendent of Documents, Washington, D.C., 20402, at 30 cents a copy.

Provision has been made, nevertheless, to meet the needs of those persons who wish to relate the occupations discussed to an established classification system. To indicate where each occupation fits into the classification system of the *Dictionary of Occupational Titles*, D.O.T. numbers are given wherever possible following the title of the occupation. The first digit of each of these numbers indicates the major occupational group in which a given occupation is classified, and the second digit the subgroup, as follows:[7]

0 Professional and managerial occupations:

0–0 through 0–3	Professional occupations
0–4 through 0–6	Semiprofessional occupations
0–7 through 0–9	Managerial and official occupations

[7] The classification system used here is from the most recently published (second) edition of the D.O.T. In 1964, a completely revised third edition of the *Dictionary* will be published in two volumes. Volume I will contain job definitions arranged alphabetically, as at present; Volume II will provide two arrangements of titles, one primarily for placement and one primarily for counseling. All jobs will be classified by a new code structure using six-digit numbers; the system can be used as a filing system for occupational information. A table converting codes used in the second edition to those appearing in the third edition will be published simultaneously with the new *Dictionary*.

1 Clerical and sales occupations:

1–0 through 1–4	Clerical and kindred occupations
1–5 through 1–9	Sales and kindred occupations

2 Service occupations:

2–0	Domestic service occupations
2–2 through 2–5	Personal service occupations
2–6	Protective service occupations
2–8 and 2–9	Building service workers and porters

3 Agricultural, fishery, forestry, and kindred occupations:

3–0 through 3–4	Agricultural, horticultural, and kindred occupations
3–8	Fishery occupations
3–9	Forestry (except logging), and hunting and trapping occupations

4, 5 Skilled occupations.

6, 7 Semiskilled occupations.

8, 9 Unskilled occupations.

Index to Occupations and Industries

692-408 O—63——51

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. Annual subscriptions for the *Occupational Outlook Quarterly* are $1.25 domestic, $1.75 foreign; single copies are 35 cents each. Order from Superintendent of Documents, Washington, D.C., 20402.

OCCUPATIONAL OUTLOOK REPORT 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 reports 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 or a full set of 108 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., 20210.

FREE OCCUPATIONAL OUTLOOK PUBLICATIONS: These include briefs, wall charts, and reprints of articles from the *Quarterly*. Occupational outlook briefs describe the employment outlook in each of the broad occupational groups. 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., 20210, to request the List of Free Occupational Outlook Publications and to have your name placed on the mailing list.

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: Monthly report featuring statistics on employment, earnings, hours of work, and labor turnover by industry for the Nation, and by industry division for each State and 146 metropolitan areas. Also contains statistical tables for the country as a whole developed from the Current Population Survey appearing in the Monthly Report on the Labor Force (see following paragraph), as well as additional detail on the characteristics of the current labor force. Statistics for earlier years are contained in *Employment and Earnings Statistics for the United States* (BLS Bulletin 1312–1), price $3.50 and *Employment and Earnings Statistics for States and Areas* (BLS Bulletin 1370), price $3.50.

MONTHLY REPORT ON THE LABOR FORCE: Monthly release analyzing the current employment and unemployment situation. Contains summary of national data on size and characteristics of the labor force and unemployment; national data on employment, hours, and earnings of employees on payrolls of nonfarm establishments; and State and area data for insured unemployment. This publication is available without charge upon written request to the Bureau of Labor Statistics, U.S. Department of Labor, Washington, D.C., 20210.

SPECIAL LABOR FORCE REPORTS: Reports based on special surveys of the labor force are issued several times a year. They include statistics and analysis of selected characteristics of the labor force, such as educational attainment, employment of school dropouts and recent high school graduates, work experience during the year, and marital and family status. Published in the *Monthly Labor Review*, which may be available in your school library, these reports are also available (as long as the supply lasts) without charge, upon written request to the Bureau of Labor Statistics, U.S. Department of Labor, Washington, D.C., 20210.

OCCUPATIONAL WAGE SURVEYS: These reports include figures on average earnings and employment in selected occupations and in major industries and labor market areas. Weekly working hours for some groups of workers and customary practices regarding pensions, vacations, holidays, and sick leave are also reported. Occupational Wage Surveys are listed in the Directory of Community Wage Surveys which may be obtained from the Bureau of Labor Statistics, U.S. Department of Labor, Washington, D.C., 20210. You can write BLS regional offices for free releases on individual city surveys.

UNION WAGE SCALES: Annual releases on union scales of wages and hours of work in 52 major cities cover the following industries: Construction, printing, local transit, and local trucking. Quarterly releases on surveys of seven major building trades in 100 cities cover averages and increases in wage scales by trade, and wage trends for the industry as a whole. These releases are available from the Bureau of Labor Statistics, U.S. Department of Labor, Washington, D.C., 20210, or any of the regional offices.

Priced publications mentioned above can be ordered from the Superintendent of Documents, Washington, D.C., 20402. Both priced and free publications are available (as long as the supply lasts) from the Regional Offices of the Bureau of Labor Statistics, U.S. Department of Labor, at the following addresses:

630 Sansome St., San Francisco, Calif., 94111.
1371 Peachtree St. NE, Suite 540, Atlanta, Ga., 30309.
105 West Adams St., Chicago, Ill., 60603.
18 Oliver St., Boston, Mass., 02110.
341 Ninth Ave., New York, N.Y., 10001.
1365 Ontario St., Room 740, Cleveland, Ohio, 44114.

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