EMPLOYMENT OUTLOOK IN

THE AUTOMOBILE INDUSTRY

Job prospects
Duties
Training
Earnings
Working conditions

UNITED STATES DEPARTMENT OF LABOR
Martin P. Durkin, Secretary

BUREAU OF LABOR STATISTICS
Ewan Clague, Commissioner

In cooperation with VETERANS ADMINISTRATION

Occupational Outlook Series

BULLETIN No. 1138

Employment Outlook in the Automobile Industry

Bulletin No. 1138

UNITED STATES DEPARTMENT OF LABOR
Martin P. Durkin, *Secretary*

BUREAU OF LABOR STATISTICS
Ewan Clague, *Commissioner*

In cooperation with
VETERANS ADMINISTRATION

For sale by the Superintendent of Documents, U. S. Government Printing Office,
Washington 25, D. C. — Price 25 cents

Cover picture—Automobiles coming off the final assembly line.

The photographs reproduced in this bulletin are by the courtesy of the Automobile Manufacturers Association.

Letter of Transmittal

UNITED STATES DEPARTMENT OF LABOR,
BUREAU OF LABOR STATISTICS,
Washington, D. C., February 24, 1953.

The SECRETARY OF LABOR:

I have the honor to transmit herewith a report on the employment outlook in the automobile industry. This is one of a series of Occupational Outlook studies for use in the vocational counseling of veterans, young people in schools, and others interested in choosing a field of work. The study was financed largely by the Veterans Administration, and the report was originally published as a Veterans Administration pamphlet for use in vocational rehabilitation and education activities.

The study was conducted in the Bureau's Division of Manpower and Employment Statistics under the supervision of Sol Swerdloff. The report was prepared by E. Eleanor Rings and Arthur D. Rosenberg with the assistance of Evelyn R. Kay. The Bureau wishes to acknowledge the generous assistance received in connection with this study from officials of labor unions, trade associations, automobile companies, and various government agencies.

EWAN CLAGUE, *Commissioner.*

Hon. MARTIN P. DURKIN,
Secretary of Labor.

Contents

Tables

Charts

Employment Outlook in the Automobile Industry

Few inventions have made such an impact on everyday life as has the automobile. The commonplaceness of motor vehicles makes it hard to imagine a world without them, and yet they are a twentieth century product.

About two-thirds of the families in the United States own automobiles. This country manufactured nearly 78 percent of the world's passenger cars and more than 57 percent of all trucks in 1951. At the beginning of 1953, some 53 million passenger cars and trucks traveled along the Nation's streets and highways. With production of at least 5 million motor vehicles a year for the last 4 years, it is easy to understand why the automobile industry has become one of the giants of American enterprise and of major importance in the economy. It provides jobs for more workers than any other industry.

The automobile industry is a pioneer and an excellent example of mass-production technology. Its basic characteristic is the manufacture of great quantities of identical parts which are completely interchangeable and which can be assembled speedily into completed units. The industry is the major consumer of many basic commodities, such as steel, rubber, and glass. As the largest single customer of the steel industry, the automobile industry uses nearly one-fifth of all the steel produced in the United States.

Because of its large size—more than 900,000 workers were employed at the beginning of 1953—and its basic importance in the Nation's economic and social life, the automobile industry will continue to be a major source of new job opportunities. In a typical year the industry will hire many thousands of new employees to replace the large number of workers who die, retire from the work force, or leave the industry to take jobs in other fields. These replacement vacancies will create most of the new job openings that the industry fills. A thorough study of the trends in automobile production, technology, and employment leads to the conclusion that the industry will not substantially increase its employment in the foreseeable future, despite the ever-growing number of cars and trucks on our streets and highways.

The automobile industry provides many job opportunities for men and women in a wide range of occupations. Training requirements vary from college degrees for engineers and other technical personnel to a few days of on-the-job training for some of the less skilled assemblers. About an eighth of the industry's work force are women. Most automobile employees work in modern factory buildings where the working conditions and the safety records are good. On the average, earnings are higher than in most other manufacturing industries.

The automobile industry provides opportunity for persons whose abilities and interests may differ widely. It employs a large force of technical personnel. The largest group are the various types of engineers: automotive, mechanical, electrical, and industrial. Other technical personnel include chemists, metallurgists, and draftsmen. Some automobile employees work in office and administrative occupations. Their jobs range from clerks and business machine operators to accountants and purchasing agents, from stenographers and typists to market analysts and industrial relations personnel. However, by far the largest number of automobile workers are those in factory occupations. These include many skilled craftsmen such as tool and die makers, millwrights, hammermen, and electricians as well as lesser skilled machine operators and assemblers.

This report discusses the employment outlook for the industry. It outlines the trend of employment and production and lists some of the factors that will affect employment prospects in the next few years and over the long run. It presents the duties and training requirements for some of the more important occupations. Information regarding earnings and working conditions is also included.

The Automobile Industry

The automobile industry is composed of plants making the thousands of parts which go into motor vehicles and assembling these parts into completed vehicles. Besides making passenger cars and trucks, the industry produces special types of motor vehicles, such as busses, fire engines, ambulances, hearses, and many kinds of trailers. Automobile companies also manufacture the thousands of replacement parts used each year to service and repair vehicles.[1]

Organization of the Industry

The automobile industry consists of some 1,900 plants organized roughly into two types: (1) those which turn out complete vehicles, and (2) those which make parts to be assembled into these vehicles or to be used as replacement parts.

About 60 percent of the workers in the automobile industry are employed by about 35 companies which produce complete motor vehicles. In 1951, the largest automobile company in the world mass-produced more than 2.5 million motor vehicles. However, a number of small firms turn out only a few custom-built vehicles such as fire engines and racing cars. Although a few of the larger companies manufacture a considerable proportion of the parts that make up the complete vehicle, all of the automobile companies obtain many of their parts from numerous outside suppliers. A manufacturer of a complete motor vehicle may purchase axles from one supplier, bodies from a second, and transmissions and gears from a third, and finally assemble the motor vehicle in his own plant.

The other segment of the automobile industry consists of the automotive parts plants specializing in the production of parts and subassemblies of the motor vehicle and employing about 40 percent of the automobile industry's total work force. These firms supply parts for the new automobile and also produce the replacement parts necessary to keep the millions of automobiles in operation. Included in this segment are plants which specialize in producing such items as passenger-car bodies, engines, brakes, clutches, axles, radiators, and transmissions, as well as those which make accessories such as defrosters, heaters, and windshield wipers. Plants making truck and bus bodies and truck trailers also are included in this group.

Size of the Industry

One of the most significant characteristics of automobile manufacturing is the size of operations. In general, most of the automobile plants are large, with a few capable of both manufacturing and assembling the automobile's more than 16,000 parts. However, plants range in size from huge factories employing 25,000 or more workers down to small plants that employ only a few workers.

According to the 1950 Annual Survey of Manufactures, about two-thirds of all auto-

[1] Not considered part of this industry, however, are plants which make many of the accessories of a motor vehicle, like headlamps, body hardware, tires, ignition systems, and storage batteries. These products are produced in establishments classified in other industries. The definition of the industry used in this report is SIC 371—Motor Vehicles and Motor-Vehicle Equipment. (Standard Industrial Classification, Bureau of the Budget, November 1945.)

mobile workers were employed in 75 establishments, each having 2,500 or more employees. By way of comparison, less than one-fifth of all manufacturing employees in the United States worked in establishments with 2,500 or more employees (table 1). The large plants are generally those which produce complete vehicles. Assembly operations require a large area to accommodate the huge quantities of parts and equipment and the sizable work force needed to turn out hundreds of complete vehicles a day. Parts and accessories plants are generally much smaller.

Because of the vast quantities of materials and large amount of metalworking operations involved in producing parts and assembling them into complete automobiles, capital requirements in the industry are high. The thousands of special tools, dies, and jigs used in the many metalworking operations range in cost from a few hundred dollars to over a million dollars. A set of dies, for example, used in stamping out the body of a car amounts to as much as a million dollars, and the huge press equipped with such dies runs as high as $750,000. However, the large volume production absorbs these tremendous costs so that at the end of the use of the die, the cost per car may be only 4 or 5 dollars.

A few automobile companies produce the bulk of all motor vehicles. The 3 major automobile manufacturers, each producing 3 or more different makes of passenger cars, turned out 87 percent of all passenger cars and 80 percent of all the trucks made in the United States in 1952. The remaining motor vehicles were made by about 30 other firms.

TABLE 1.—*Concentration of employment in large plants contrasted with average for all-manufacturing industries*

Manufacturing establishments with average employment of:	Percentage of workers by plant-size groups	
	Automobile industry	All-manufacturing industries
All plant sizes	100.0	100.0
1–249 employees	5.1	41.0
250–499 employees	3.6	14.0
500–999 employees	7.1	13.0
1000–2499 employees	21.5	14.4
2500 or over employees	62.7	17.6

Source: 1950 Annual Survey of Manufactures, U. S. Department of Commerce, Bureau of the Census

Location of the Industry

Plants making automobiles and parts are scattered throughout 41 States. Automobile manufacturing, however, is concentrated in the Great Lakes region, where more than four-fifths of the workers are employed. Michigan alone accounted for more than half the industry's employment in 1951. Another 18 percent were employed in its 2 neighboring States of Ohio and Indiana. Seven other automobile-producing States each employed 10,000 or more automobile workers: New York, Wisconsin, Pennsylvania, California, Illinois, New Jersey, and Missouri.

Detroit 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 such nearby communities as Dearborn and Pontiac. Several other Michigan cities, especially Flint, Lansing, Saginaw, and Ypsilanti, employ large numbers of automobile workers. The Great Lakes region has many other important centers, particularly Cleveland, Toledo, and Cincinnati, Ohio; South Bend, Indianapolis, and Fort Wayne, Ind.; Chicago, Ill.; and Milwaukee and Kenosha, Wis. In the East, Buffalo, N. Y., has a large cluster of automobile facilities. Much of the automobile manufacturing on the East Coast is centered in the New York-Northeastern New Jersey industrial area in such localities as Newark, Linden, and New Brunswick, N. J.; and New York and Tarrytown, N. Y. Other large facilities in the East are located in the industrial areas of Philadelphia, Pa., Baltimore, Md., and Wilmington, Del. The industry's operations in central United States and the South are concentrated in St. Louis and Kansas City, Mo.; Kansas City, Kans.; and Atlanta, Ga. The Los Angeles industrial area is not only the leading automobile manufacturing center in the Pacific Coast region, but it is second only to Detroit in the number of motor vehicles assembled. Oakland is also an automobile manufacturing center in California.

The growth of automobile centers in various parts of the country reflects the leading automobile manufacturers' policy of building assembly plants in the major market areas of the Nation to avoid the relatively higher freight charges made on completely assembled vehicles. Unassembled parts are packed and shipped more compactly than the whole car. For example, only 4 completely assembled automobiles can be loaded on a freight car; but unassembled, the equivalent of 40 automobiles can be shipped in 1 car. The branch plants receive and assemble these many parts and distribute the automobiles in their respective areas more economically. Based on estimates published in 1950,[2] $46.00 a car was saved by shipping the parts from Detroit and assembling the car in New Jersey.

How Automobiles Are Made

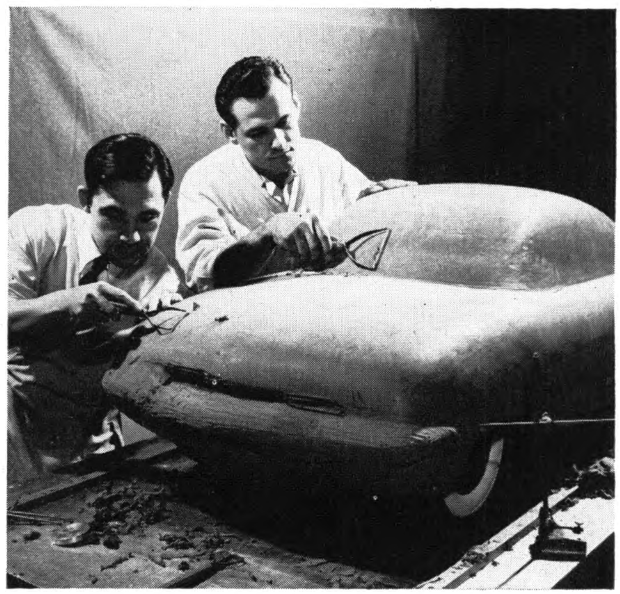
One look at the intricate mechanism inside a modern motor is convincing proof that its engineering represents a triumph for the industrial era in which we live. To visualize the complexity of automotive manufacture, however, the engineering feat of making one car must be multiplied by the production of several million motor vehicles within the course of a year. A single automobile or truck requires the putting together of some 16,000 separate parts, all of which must conform to rigid specifications. The size of a part often must be controlled to limits measured in thousandths of an inch. Despite the number of parts and the accuracy of their size, in many plants throughout the United States automobiles are driven off assembly lines at rates exceeding one per minute.

This amazing record is possible because certain mass-production techniques are used. The making of automobiles is one of the best examples of American manufacturing methods. The mass-production system is characterized by the manufacture of thousands of identical parts which are completely interchangeable. Parts are carried by moving belts or conveyors to work stations nearest the point where they are to be used. The workers then join these parts or assemble them, performing only a limited number of operations on each unit. Extensive preliminary planning and organization of every minute detail of the entire productive process is necessary.

Motor vehicles are produced in three major stages. The first stage is the preliminary planning and engineering before new model production is begun, the second is the production of motor vehicle parts, and the third is the final assembly of these parts into completed vehicles.

Planning for New Model Production

Preparation for the production of a new model usually requires 1 to 5 years of research and development. The major automobile producers maintain research laboratories and technical staffs who constantly test present models, devise changes, and study theoretical problems which eventually will result in mechanical improvement in some part of the vehicles. Plans for new designs of automobile models are made



Modelmakers prepare small-scale clay models as one step in the design of a new model of an automobile.

by engineers, body stylists, and fabric designers. Public opinion testers are constantly gathering information concerning the demands of the automobile-buying public, and the designers and engineers are always trying to

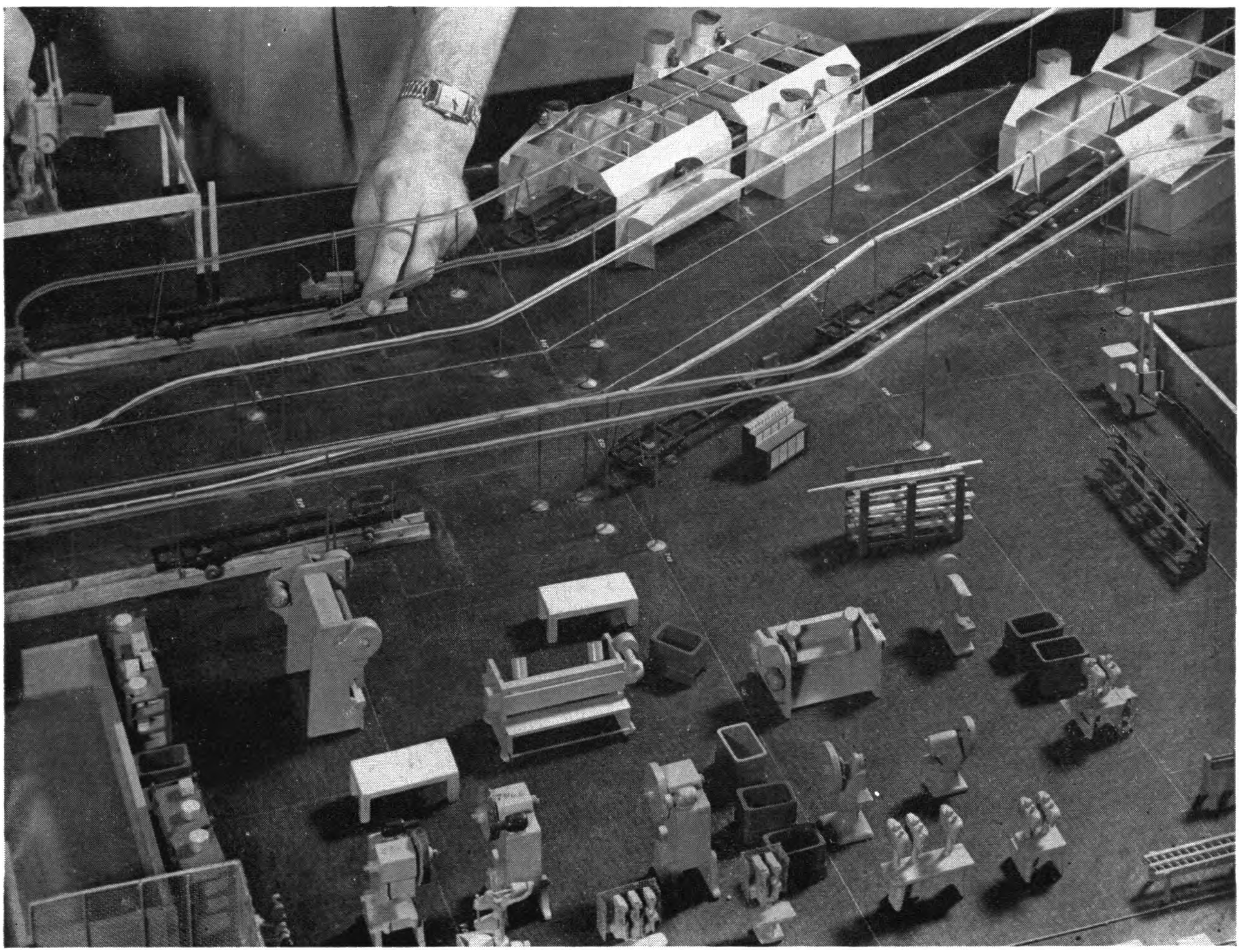
[2] Alderfer, E. B., and Michl, H. E., Economics of American Industry, McGraw-Hill Book Company, Inc., 1950, p. 165.

translate these wants into designs that are acceptable to most of the public. Separate plans are incorporated into several small-scale clay models which are studied by company officials. An initial decision is made on one of these clay models and a new style may be on its way.

The side view of the selected clay model may be transferred, full size, to a blackboard for a discussion of the many small details of styling. After the details have been decided, a full-scale clay model is created. Clay is used because of the ease in altering surface lines until agreement on final styling is reached. From the clay models, full-scale replicas of the major sections of the car are either made in solid mahogany or cast in plaster. From these, the master dies are made. While this exacting process is going on, a full-sized model in wood is being constructed with interior and exterior parts exactly as wanted. Changes in seating capacity, interior styling, and upholstery are made at this time. Plaster casts are also made of many special equipment items such as headlights. These casts, as well as the replicas of the other parts of the car, are used to build parts for the first few handmade running models.

The introduction of a new mechanical improvement in a motor vehicle must be balanced against the estimated cost of producing it. Several alternate methods of manufacturing the new improvement are studied, and costs are compared. The part of subassembly may be produced by the motor vehicle manufacturer, or an outside supplier may be asked to bid on producing the newly designed part or subassembly.

When a new model of an automobile is about to be put into production, engineers use small-scale models of men, machinery, and materials in planning the new plant layout.



Throughout the planning stage, automotive parts companies work closely with the motor vehicle manufacturer on designing, engineering, and tooling problems.

A schedule is drawn up showing the "make-ready" time necessary to prepare the plant for new model production, and also the time required for suppliers to order and install new machine tools and be ready to start deliveries.

Plans for model changeover require a detailed study of the factory layout in order to provide for efficient placement of new machines and for a continuous flow of materials and parts. Scale models of the plant, machines, and work stations are made to show every detail of the factory building in miniature. Any bottlenecks that might possibly develop in the operations of a plant are ironed out at this point. Balanced final assembly line operations depend upon an even flow of parts and subassemblies.

When a changeover is made, specialized machine tools used by the automotive industry must be retooled. Although a large number of the machine tools already in the plant may be utilized for new model production, they will probably have to be reequipped with new cutting tools and dies, and the fixtures and jigs which hold the work to be machined may have to be replaced. New gages to check dimensions of parts for the new model will be required also.

As new machine tools are received, they are tested and installed in accordance with the scale model of the factory layout. As the date for introducing the new model nears, production departments along the assembly line must be closed down for a short period. While the new machinery is being installed and tested, other machines are being retooled and conveyor and power lines are being changed.

Making Automobile Parts

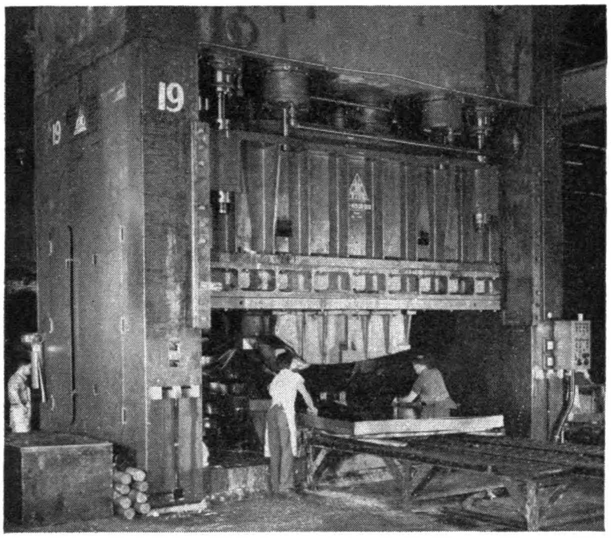
Most automotive plants never manufacture a complete car or truck. They specialize in producing one particular part, such as pistons or bearings, or in making one of the major motor vehicle subassemblies, such as bodies or axles.

In addition to metal, motor vehicle parts are made from a wide variety of other materials, such as glass, rubber, plastic, and fabric. Most parts, however, are made from one of the three basic metals—steel, copper, and aluminum. The automobile industry is one of the Nation's principal consumers of these metals.

Metal parts for motor vehicles are shaped in several ways depending upon the purpose for which the part is to be used, the metal from which it is made, and its size. The principal metal shapes from which parts are made are castings, forgings, sheets, and bars. Castings are made in foundries where molten metal is poured into molds and allowed to cool and harden into the desired shape. Forge shops also shape metal by heating and pounding it into shape. Sheet and bar steel used for the body and frame of the car are obtained from steel rolling mills.

Most of the large automobile companies and many parts companies have their own foundry departments where metal castings are made. These foundries specialize in producing large quantities of identical castings for such parts of the vehicle as the engine block. To make a casting, a wood or metal pattern, shaped to the desired specifications of the casting, is first made. A sand mixture is prepared, then packed and rammed about the pattern. Any hollow space desired in the casting must be carefully shaped by the use of "cores" placed in the sand mold. When the mold is complete, the pattern is removed and molten metal is poured into the mold and allowed to cool. The sand mold is then shaken off, and excess metal and sand are removed from the casting. Machines for making molds for castings are used in many of the foundries operated by motor vehicle companies.

Forge shops make rough metal parts, but by a different process. Forging is similar to the work of the oldtime blacksmith. The metal is heated and then pounded into the desired form. In a modern forge shop the pounding is done by mechanical steam hammers of great pressure. Such shaping produces metal capable of withstanding great stress. Forgings are therefore used to make such parts as the axle and crankshaft of the car.



Many body parts are formed by large presses which stamp them out of sheet steel.

The large sections of the body of the car are formed from sheet steel shaped by huge electronically controlled presses. Smaller parts of the vehicle are also stamped or pressed out of sheet steel or aluminum.

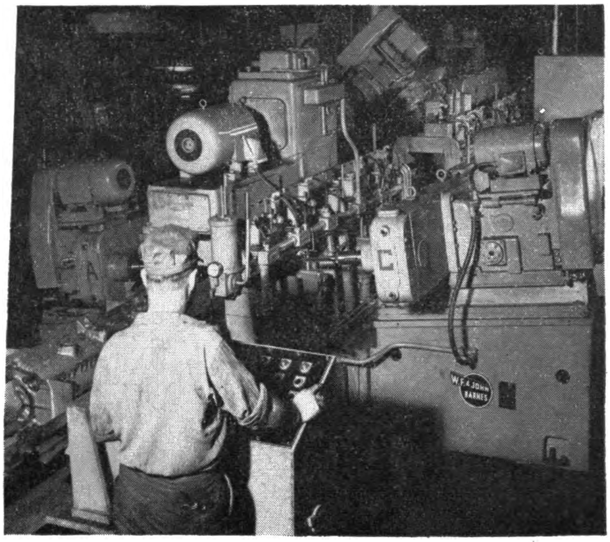
Metal parts usually require some machining before they are assembled. Machining is a process of cutting or chipping away metal from a part by the use of a machine tool. A machine tool shapes metal by holding the part against the tool so that metal is cut or shaved from the part. There are many types of machine tools. Among the more common types are the engine lathe and turret lathe in which the metal part to be cut is rotated against the cutting tool; boring and drilling machines which make holes in metal parts; grinding machines which have abrasive wheels that remove metal from the part; milling machines which shape the part with a saw-toothed tool; and planers and shapers which plane the flat surfaces of the part. These tools are set up to operate with great precision; many are electronically controlled and can perform a series of machining operations automatically. For example, in one large motor vehicle plant, engine blocks are made from rough castings by a machine that automatically performs almost every type of machining operation and makes 157 holes in the engine block before the cycle of operations is complete. No handling of the block is required throughout the entire cycle.

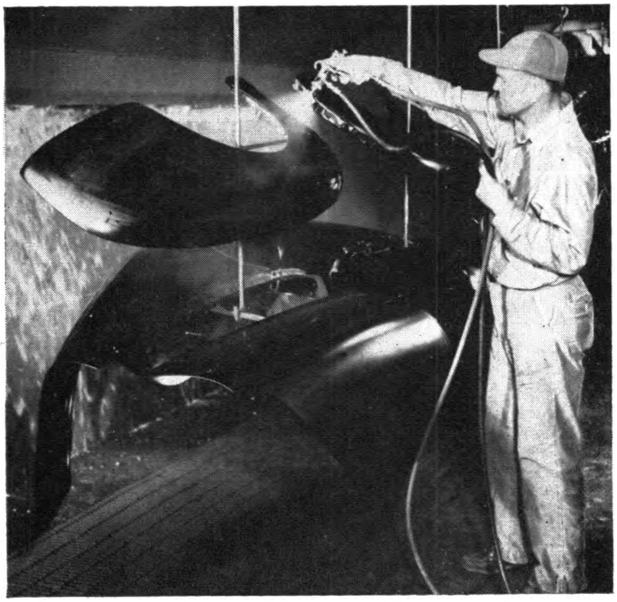
Inspection throughout the manufacturing process insures that the quality of the assembled vehicle will meet the established standards of performance. Such inspection begins with a spot check of incoming raw materials from which parts are to be made. All machining operations require careful inspection to detect tool wear so that the parts produced will not vary gradually from the specified limits. Many of the parts, if they varied by as much as a thousandth of an inch, would not function properly in the finished vehicle or would slow the assembly operation. In mass production, manufactured parts must be identical if they are to be interchangeable. Specially designed gages are used to measure the accuracy of machining operations.

Many metal parts must be painted or given some other finish to make them rustproof. They are hung on conveyors, pass through paint spray booths, and move on through drying ovens. These ovens look like tunnels and are lined with infrared lights which bake in the finish or the paint as the part travels through the oven.

Body plants which produce complete bodies for motor vehicles are usually located near the

Highly automatic machine tools are used in making automobiles. Here one man operates a ten-station transfer drilling machine which can bore 134 holes at once.





A painter spraying fenders. Conveyors carry the painted parts through an oven where they are baked with infrared radiation.

final assembly plants. The large parts of the motor vehicle body are formed on huge presses from sheet steel. The assembly operations in body production include the welding together of many separate parts of the body and the installation of the instrument panel and electrical wiring. Body assembly is not entirely a metal-working operation. One department of the body plant is devoted to the preparation of upholstery. The body building process includes cutting and sewing of upholstery for the seats and cushions of the motor vehicle, and preparing and installing the fabric headliners and door panels.

Production on the Final Assembly Line

From the observer's viewpoint, the most dramatic part of the manufacture of the motor vehicle is on the final assembly line, which is the process of putting together a number of subassemblies and individual parts in sequence with the complete vehicle rolling off the line at the end. The assembly line itself resembles the movement of an escalator except that the line moves forward at floor level rather than upward. Meanwhile, overhead conveyors bring the various subassemblies and parts of the motor vehicle to the final assembly line at the point where the part is needed. In conjunction with these conveyors, overhead wires feed electric power to portable motorized tools, such as power screwdrivers and wrenches, which are suspended by spring cables within the worker's reach.

Generally, the assembly of a car starts with the frame which forms the foundation of the car and all other units are attached to it. Automobile frames are made of pressed steel with the deepest and strongest section at the center where the greatest stress occurs. Cross members are next added to the frame so that it looks like an X.

A few feet farther down the line, forward brackets are attached to the frame and then the front suspension assembly which includes front wheel spindles and springs, shock absorbers, wheel hubs, and bearings. Rear springs and rear shock absorbers are next added, and then the rear axle to which gears, bearings, and brakes have already been attached. Each of these subassemblies is fastened to the rapidly emerging chassis of the car.

A complete engine is lowered by crane into position on the chassis as it comes down the line. The steering column (including the gears) and the steering wheel are fastened to the chassis and brake fluid is added. Many of the essentials of the vehicle are in place within approximately half an hour after the first frame units have been placed on the assembly line.

The first indication of the color of the completed vehicle comes with the addition of wheels, complete with tires, which are now added to the chassis of the car. The radiator and battery are next added and a mechanical device measures proper alinement to receive the body of the car. Padded hooks grasp the body of the car, which is lowered by a crane or "dropped" from overhead, meeting the chassis on the assembly line below. The front-end assembly—fenders, hood, and grill—and the headlights, bumpers, hubcaps, and floor mats are now added. At the end of the line the headlights are adjusted, wheels are alined, gasoline is pumped into the fuel tank, and another new motor vehicle is driven off the assembly line under its own power. The finished car is thoroughly inspected before it leaves the factory.

As the many chassis move down the assembly line hour after hour, "banks" of materials located in aisles along the line are continually fed by a careful system of scheduling. This process insures a steady supply of parts to feed the final assembly line and reduces the amount of factory space which otherwise would be used for storage.

Trucks and passenger cars are usually built on separate assembly lines. There are more model variations in trucks than in passenger cars. Exact information for each vehicle is furnished to stations along the assembly line so that the desired specifications of the customer will be built into it. Subassemblies conforming to these specifications are forwarded to the assembly line in the proper sequence. Several methods of synchronizing assembly line and subassembly activities are used. For each truck a record is made and copies then forwarded to each station along the assembly line. The record shows by code the items to be included. On the passenger-car assembly line, the sequence of the models to be built may be transmitted to the various stations along the line by either teletype or telautograph. The information on color and on the special equipment desired in each car is obtained from car orders placed by automobile dealers. By this scheduling program, cars of different colors and types follow each other down the assembly line—a dark blue coupe may be followed by a maroon station wagon.

Jobs in the Industry

Persons interested in working in the automobile industry should inquire about the various types of jobs. Every motor vehicle represents the combined efforts of thousands of workers in a great number of different occupations. Some of these workers are employed in technical and professional jobs, such as engineers, chemists, metallurgists, or draftsmen. They work on problems of research and development of new automobile designs or in testing present models. While these technical personnel are ironing out the kinks of future model cars, purchasing agents are busy buying the steel, rubber, glass, and other materials to be converted into parts for the finished car.

The factory production related workers make up more than 80 percent of the employees in the automobile industry. These workers carry out the ideas of the professional and technical personnel by transforming the raw materials into the completed car. The largest single group are the assemblers who join the thousands of parts of which a motor vehicle is composed (chart 1). A large portion are employed in metalworking occupations like machine tool operators, tool and die makers, welders, or work in some foundry or forge shop job. Another large group of the factory workers are engaged in assembly and inspection jobs. Inspectors are employed at every stage of the assembly operation, both in plants making automobile parts and in those producing complete vehicles.

Chart 1. Assemblers Make Up the Largest Occupational Group in the Automobile Industry

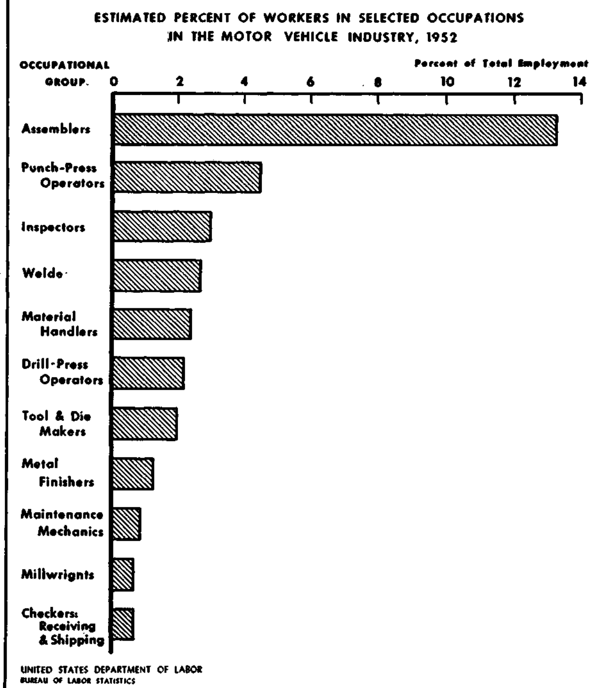


TABLE 2.—*Estimated number of workers in selected plant occupations in the motor vehicle industry, fourth quarter, 1952*

Occupation and department	Number of workers
Assemblers	117,000
Forge department:	
Hammermen and upsetters	1,200
Heaters	1,600
Straightening press operators	1,800
Foundry department:	
Chippers and grinders	1,800
Coremakers	3,500
Molders, machine	2,200
Patternmakers	1,100
Inspectors and testers	26,000
Machine tool operators, production:	
Drill press	19,000
Gear cutter	2,300
Grinder	9,600
Lathe	10,400
Milling machine	5,100
Screw machine, automatic	3,000
Maintenance department:	
Carpenters	1,400
Electricians	6,300
Janitors and sweepers	14,400
Mechanics, maintenance	8,100
Millwrights	6,600
Pipefitters and plumbers	3,300
Materials control:	
Checkers, receiving and shipping	6,300
Stock chasers	5,600
Tool-crib attendants	3,300
Materials movement:	
Crane operators	2,000
Craters, packers, boxers, sawyers	7,500
Material handlers	21,000
Truck drivers	2,800
Truckers, power	9,000
Metal finishers	11,400
Paint shop:	
Polishers, lacquer or enamel	3,600
Sanders, wet	4,500
Sprayers	7,500
Punch press operators	40,000
Tool and die department:	
Cutter grinders	2,800
Die tryout men	2,500
Machine operators	6,000
Tool and die makers	18,000
Tool and gage grinders	2,000
Upholstering department:	
Sewing-machine operators	4,900
Trimmers, cushion and back	6,700
Trimmers, headlining	2,400
Welders:	
Welders, arc and gas	8,500
Welders, gun, machine and spot	15,500

Source: Estimated primarily from data included in Wage Structure: Motor Vehicles and Parts, 1950, Bulletin No. 1015, U. S. Department of Labor, Bureau of Labor Statistics.

Still other factory workers are connected with the movement of materials to the right place at the right time so that there is a steady flow of supplies. These workers check materials in the shipping and receiving rooms, transport materials to other workers, or handle materials from trucks. In addition to these materials control workers, maintenance men keep the many machines and equipment in good working condition. Table 2 gives the number of workers in some of the more important factory occupations in the automobile industry.

Finally, there are many administrative and clerical jobs dealing with the problems of quality control, personnel and payrolls, sales, and advertising. About 11 percent of the industry's working force are women. They are employed largely in the administrative offices of automobile plants and in the less physically demanding plant occupations, such as sewing-machine operations, in light assembly work, and as automobile drivers.

The duties and training requirements of some of the important occupations are briefly described below. A more complete discussion of many of these occupations may be found in the Occupational Outlook Handbook.[3] The handbook contains information about other industries in which these workers are employed, the job prospects in those industries, and the training and other qualifications required for workers in these occupations.

Technical Occupations

Cars begin as ideas. Behind many of these ideas are the engineers and designers. Much thought goes into planning and research—planning the kind of car to make and searching for ways and means of producing it. For these purposes, the automobile industry employs a large force of technical personnel, including engineers, chemists, metallurgists, and physicists. The *engineers,* numbering between 10,000 to 15,000, are the largest group of these technical employees. It is the engineer in the automobile industry who has been primarily responsible for the major improvements in today's automobile. Shatterproof glass, all-steel bodies, high compression motors, automatic gear shifts, rustproof body finishes, and many other new features are products of the engineering team.

Several types of engineers find employment in automobile firms. Heading the list are the automotive, electrical, mechanical, and industrial engineers. The *automotive engineer,* gen-

[3] Occupational Outlook Handbook, U. S. Department of Labor, Bureau of Labor Statistics, Bulletin No. 998, 1951 edition prepared in cooperation with the Veterans Administration. For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Price $3.

erally considered to be in a branch of mechanical engineering, designs, develops, or does research work on the automobile body or engine. He may work at a drawing board, design pilot models of a car to be manufactured several years in the future, or test and analyze a small motor vehicle part such as a starter spring or windshield wiper. The *electrical engineer* is concerned with such activities and problems as instrumentation and control, power generation and distribution, electronics, test equipment, and electrical apparatus and machinery. He is engaged in the design and development of all types of electrical and electronic machinery and equipment as well as the operation, maintenance, and use of these items. The *mechanical engineer* and the *industrial engineer* are primarily engaged in the production stage in such work as the design of new machinery or the layout of plant equipment. Still other types of engineers, including civil, chemical, safety, and sales, are employed in the industry in a wide variety of tasks.

Chemists and *metallurgists* are employed mainly in the research and development units of the individual motor vehicle companies. Metallurgists and metallurgical engineers are also found in the casting and heat treating departments. For example, a metallurgist might be employed to supervise the melting operations in the precision casting and forging departments. A chemist may be employed to head the testing and analytical laboratory. *Physicists* and *mathematicians* are employed mainly in the research departments where they work with other technical personnel, such as engineers and metallurgists. According to a survey of industrial research laboratories made by the Research and Development Board in 1952,[4] nearly 3,000 engineers and scientists work as research personnel in the automobile industry.

The industry employs a considerable number of *draftsmen* who prepare working plans and detailed drawings of automobile parts and assemblies. They work from sketches and specifications furnished by the engineer or designer. There is a wide range of skill in this occupation. Some draftsmen do rough copying or routine tracing work, whereas others at higher levels of skill are often required to make calculations concerning the strength, quality, and cost of materials, and to use engineering handbooks and tables for computations.

Draftsmen prepare working plans and detailed drawings of automobile parts and assemblies.

Persons contemplating an engineering career should rate well above average in mathematics and science courses in high school. Graduation from a recognized college is the minimum educational requirement for engineering or scientific work. Most engineers and scientists have a college education and the proportion with advanced degrees is increasing. It is also important for prospective students to select a properly accredited school because persons trained at such schools generally have the best employment opportunities.

Many automobile companies recruit engineers and other technically trained personnel by sending representatives to colleges and universities each year to interview graduating students. Some companies have formal training programs in which the professional

[4] U. S. Department of Labor's Bureau of Labor Statistics and Department of Defense, Research and Development Board, Industrial Research and Development — A Preliminary Report, January 1953.

trainees are rotated through the various operating and maintenance divisions to give them a broad picture of automobile manufacturing before assigning them to a particular department. In other companies, the newly hired engineer or scientist is assigned directly to a specific research, operating, or maintenance unit. It is important to note that many of the top executives in the industry have an engineering or scientific background.

Usually a person becomes a draftsman by studying at a trade or vocational school and later acquiring practical experience by serving a 3- or 4-year apprenticeship, or by some other type of on-the-job training plus part-time schooling.

Plant Occupations

Metalworking Occupations

After the engineers and draftsmen have planned and designed the new model car, someone must transfer these ideas into the completed car. First, the parts must be made. The parts are principally metal and are shaped by a variety of metalforming processes requiring workers in a number of metalworking occupations. For example, bodies must be stamped out by huge presses, cylinder blocks must be cast in foundries, axles must be forged in the forge shops, and pistons must be ground in the machine shops. To understand exactly what these metal operations entail, a description of the duties of some of the workers performing these operations follows.

Machining Occupations.—One of the largest metalworking occupations in the automobile industry is that of *machine tool operator.* A machine tool is a power-driven machine which firmly holds both the piece of metal to be cut and a cutting instrument, or "tool," and brings them together so that the metal is cut, shaved, ground, or drilled. Machine tool operators may be divided into two main classes according to their degree of skill. The skilled operator does widely varying kinds of machining on all types of machine tools. Working from blueprints or layouts, he sets up his machine for each machining operation, selects the proper tools and materials, adjusts the feed and speed controls, and measures the finished work to see that it meets specifications. He knows how to sharpen cutting tools when they become dull and he understands the machining qualities of various metals.

However, the majority of machine tool operators in the automobile industry are much less skilled than the machine tool specialist described above and their work is repetitive rather than varied. A typical job consists mainly of placing rough metal stock into an automatic machine tool, watching the machining operation for signs of trouble, and measuring the finished work with specially prepared gages which simplify measurement. The operator may make minor adjustments to keep the machine tool in operation, but usually he must depend upon skilled workers, such as setup men or machine tool specialists, for major adjustments.

Machine tool operators, skilled and semiskilled alike, are designated according to the kinds of tools they operate, such as engine-lathe operator, turret-lathe operator, drilling-machine operator, grinding-machine operator, and milling-machine operator.

A skilled machine tool operator requires from 1 to 3 years of on-the-job training. The less skilled machine tool operators are generally trained on the job in not more than 6 months.

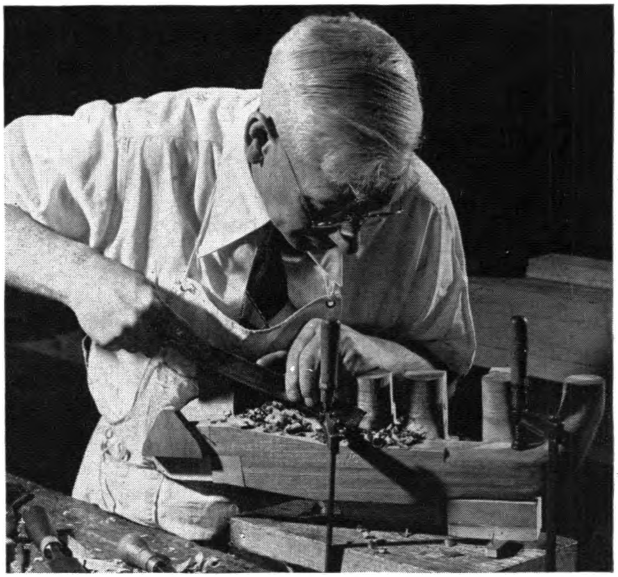
An important person in automobile production is the *tool and die maker* who is one of the most skilled plant workers found in this industry. The toolmaker makes the jigs, fixtures, and other accessories that hold the work while it is being machined. He also makes the gages and other measuring devices needed for precision work. Diemakers construct the dies which are used in such metalforming operations as forging, stamping, and pressing. The tool and die maker must know how to read blueprints, set up and operate machine tools, use precision measuring instruments, understand the working properties of common metals and alloys, and make shop computations. In addition, he must work to very close tolerances and do precision handwork. This work requires rounded and varied machine shop experience usually obtained through formal apprenticeship or its equivalent in other types of on-the-job training. A tool and die apprenticeship ordinarily covers 4 or 5 years, including shop training in the various parts of the job. In addition, during the appenticeship, courses such as shop arithmetic and blueprint reading are usually given in vocational schools. After apprenticeship it is often necessary to work for a number of years as a journeyman in order to qualify for the more difficult tool and die work. Since tool and die making is the most exacting type of machine shop work, persons planning to enter the trade should have a great deal of mechanical ability and a liking for painstaking work.

Foundry Occupations.—Some parts of the automobile must be made in the foundry departments which make castings for such units as engine blocks by pouring molten metal into a mold and then allowing the metal to harden and take the shape of the mold.

The first step in casting is for the *patternmaker* to make a wood or metal pattern in the shape of the final casting desired. *Sandmixers* prepare sand for use in molding and coremaking. *Hand molders* make the sand mold into which metal is poured. The molds are made by packing and ramming sand around the patterns. *Machine molders* operate one of several types of machines which simplify and speed the making of large quantities of identical sand molds. *Coremakers* shape the bodies of sand, or "cores," which are placed inside molds in order to form any hollow spaces needed in castings.

When the mold is made and the cores (if any) are put inside, the molten metal is poured into the mold. A *melter* operates a furnace used to melt metal for castings. The actual pouring is customarily done by a *pourer*. When the casting cools off, it is taken out of the mold by *shakeout men* and sent to the cleaning and finishing department. *Sandblasters* and *tumbler operators* run the various kinds of cleaning equipment. *Chippers* and *grinders* remove excess metal and finish castings.

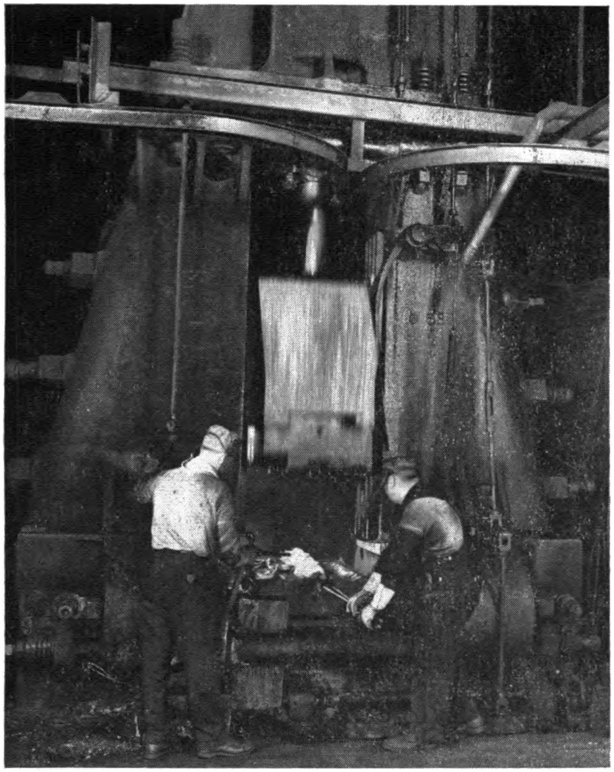
Patternmakers, hand molders, hand coremakers, and the more difficult types of machine-molding jobs are generally learned through an apprenticeship, usually lasting 4 years. The less skilled machine-molding jobs and many of the other foundry jobs may be learned in a few months of on-the-job training.



Patternmaking is the first step in the sand casting process. Here a highly skilled patternmaker is constructing a wood pattern in the shape of the part desired.

Forging Occupations.—The forging process shapes metal objects which are required to withstand great stress, such as automobile crankshafts and axles. These objects are formed by machines which pound and squeeze heated metal into the desired shapes just as the oldtime blacksmith used to do, but now machine power is substituted for the blacksmith's arm, and dies take the place of the anvil and hammer. Jobs in forge shops vary. Many have to do with operating the forging hammers and presses which are usually run by crews of 2 or more and sometimes by as many as 10 or 15 men.

For example, a *hammerman* operates a drop-hammer which pounds metal into various shapes between closed dies. He places a steel bar between the dies and forges to the required shape by striking the steel with a steam hammer. The hammerman is assisted by a *heater* who heats the stock in a furnace to prepare it for forging and then passes the stock to the hammerman. Forge shop workers include many men engaged in cleaning, finishing, heat treating, or inspecting forgings, as well as laborers employed mainly in moving materials.



Forging is used to shape metal objects which are required to withstand great stresses, such as automobile crankshafts.

For these jobs workers need the strength and endurance required for heavy lifting and for withstanding the noise, heat, and vibration typical of forge shops. The job of hammerman, one of the highest paid plant jobs, is filled by promotion from men already on the crew. A man generally starts as a helper on a hammer crew and by advancement over a period of several years, he may become first a heater and later a hammerman.

Other Metalworking Occupations.—The automobile industry employs large numbers of workers in other metalworking occupations. Included among these are the *punch press operators* who numbered 40,000 in late 1952. These workers operate and maintain the power-driven presses varying in size from small presses which blank out door handles to the massive presses which form, trim, and press holes in the doors and body panels. Depending on the size of the machine and the material to be processed, an operator may work at his machine alone or with the assistance of other workers.

Automobile plants also employed about 24,000 of the various types of *welders,* who may be divided into 2 groups according to the type of equipment used. The more skilled welders, numbering 8,500, operate electric arc and gas welding equipment. In this type of welding, metal parts are joined through the application of heat intense enough to melt the edges to be joined. The skilled welder controls the melting by properly directing the heat and adding filler metal where necessary to complete the joint. A course in welding methods, usually in public or private vocational schools followed by extensive job experience, has been the common way for skilled arc and gas welders to receive their training. Welders doing the simplest repetitive types of arc and gas welding are trained on the job without special instructions in about 6 months.

About 15,500 welders are in the less skilled jobs of operating gun and spot welding equipment. These electrically controlled machines fuse metal parts by bringing them together under heat and pressure. The metal pieces to be joined are pressed between two electrodes through which electric current is passing. The parts being welded offer sufficient resistance to the flow of current to create intense heat which, with the pressure, fuses them together. Usually, the supervisor sets the controls of the machine for the desired electric current and pressure whereas the operator merely feeds and alines the work, starts the machine, and then removes the work when it is finished. Most gun and spot welders learn their work on the job in a relatively short time.

Assembling Occupations

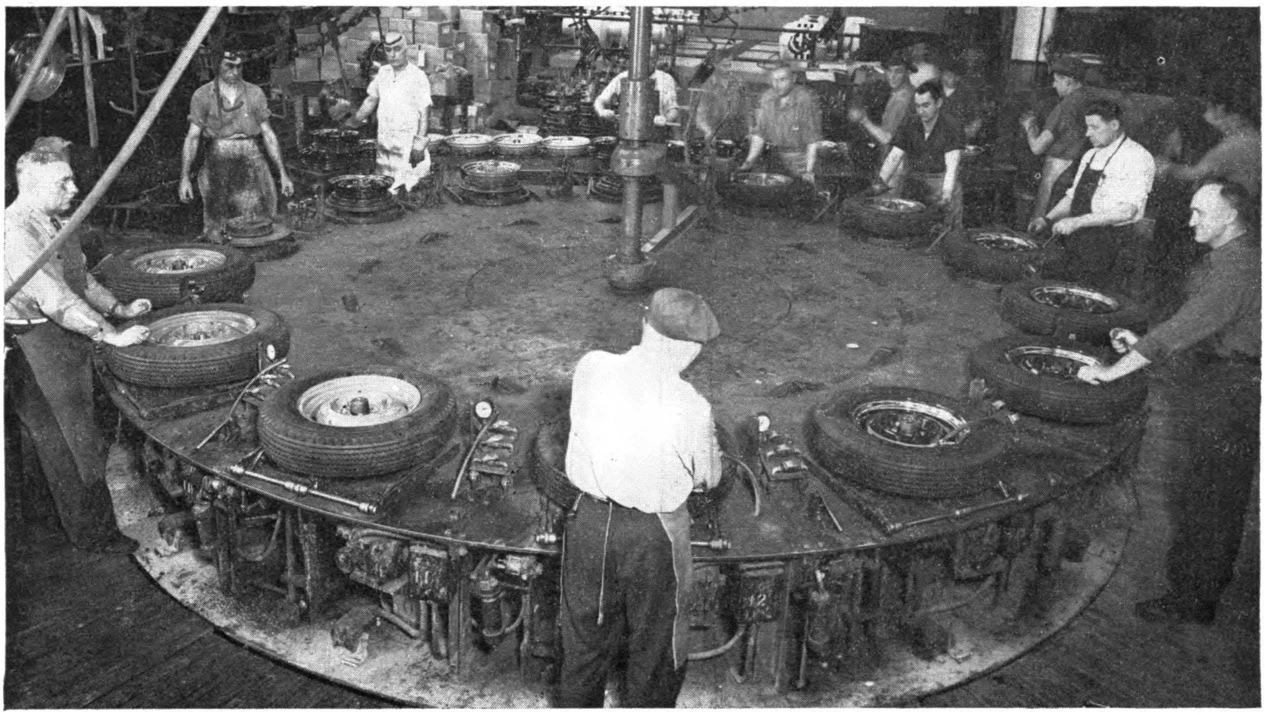
The final stage of the mass-production technique of automobile manufacturing is putting together parts into units. As these parts are finished or brought in from other plants, they are transported by belts, trucks, or overhead conveyors to different subassembly lines within the factory. Each subassembly line is a unit within itself. For instance, all the parts for the engine go to the line that assembles only engines. This is true for such units as the body, front and rear axles, wheels, and frame. As these units are completed, they are transported to the final assembly line at designated points where they are assembled in their proper sequence into the final car.

Assemblers make up the largest occupational group in the automobile industry; they comprise more than 13 percent of the production workers. About 117,000 assemblers were employed in the automobile industry in late 1952. *Bench assemblers* put together small units or subassemblies while working at a bench. They usually work in parts plants or on subassembly lines of the larger automobile manufacturers. Other assemblers may rivet and screw together parts of the chassis as it moves down the final assembly line or they may join the body and chassis together.

"Repetitive" is the word that most aptly describes assembly jobs. It is here that division of labor is carried to its extreme degree. Each worker has one or a few operations to perform on a part of the car. He may stand as he joins a fender to the hood of the car, or he may walk beside the car as he places bolts on the frame. But no matter what particular task he performs, he must do each operation as many as 60 times an hour to keep up with the assembly conveyor which is geared to that speed.

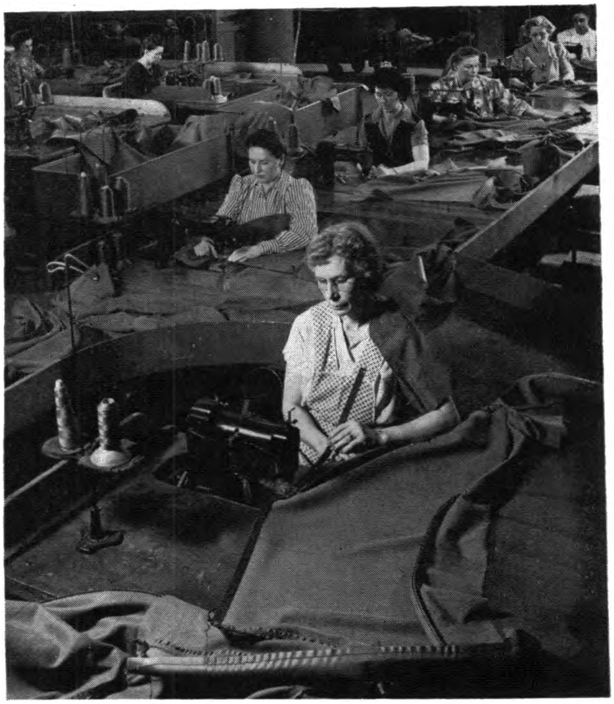
Manual dexterity and patience with repetitive tasks are the two necessary requirements for assembly operations because the worker must be fast on his job and must do the same operation repeatedly. New workers are usually trained for the less skilled jobs in a few days of on-the-job training experience. Workers with machine shop experience are often chosen for the more skilled assembling jobs.

Many of the assembly operations are split into specialized jobs. Here a wheel and tire merry-go-round rotates slowly as each worker performs a single task.



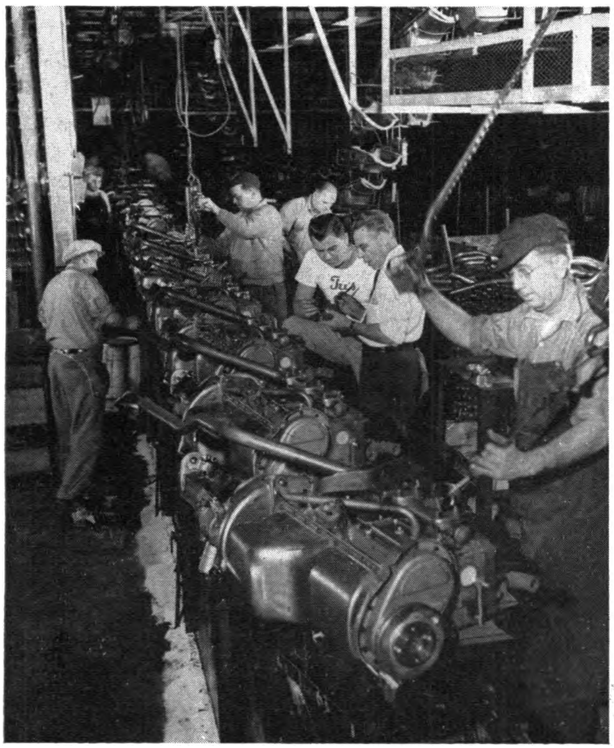
Inspection Occupations

Another large and important group of automobile workers are the inspectors whose chief duties are to examine completed units and subassemblies or to measure the accuracy of machined parts. Nearly 26,000 *inspectors* and *testers* were employed in automobile plants in late 1952. In parts plants, inspectors check dimensions of parts by using specially designed gages and other measuring instruments which speed and simplify the inspection process. Other inspectors check the correctness of the many assembly operations throughout various subassembly stages and on the final assembly line. A few more specialized inspection jobs are held by skilled inspectors who test raw materials or the operation of parts of completed vehicles under experimental conditions. Most of this testing, however, is done by professional workers such as engineers, chemists, or metallurgists; but less skilled workers often assist them in the laboratories and on experimental testing grounds.



Several thousand women are employed as sewing machine operators in the upholstery departments of automobile plants.

Engine assembly and inspection line.



Frequently, assemblers who show special aptitude are promoted to inspectors. However, inexperienced workers may be hired for some of the less skilled inspectors' jobs and given a brief period of on-the-job training.

Finishing Occupations

Before a car goes off the assembly line, many finishing operations must be performed. 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, cutters, sewing-machine operators, and upholsterers. *Metal finishers* remove surface irregularities of metal parts in preparation for painting. They file and polish rough surface areas to a smooth finish. *Platers* electroplate automobile bumpers and "hardware" for ornamentation and protection against corrosion. *Sprayers* operate spray guns to apply paint or other finishes to the metal parts.

Polishers polish the finished surfaces by hand or by a portable motor-driven buffing wheel.

Cutters, sewing-machine operators, and upholsterers combine their skills to provide comfortable and attractive interiors. The *cutter* cuts material to the proper length and width according to a pattern. The *sewing-machine operator,* using a power-driven machine, sews together the upholstery sections after they have been cut to size. *Upholsterers* arrange and fasten springs and padding for the seats and backs, and tack the covering material in place.

Material Movement and Maintenance Occupations

A large number of workers is required in automobile plants to maintain and to repair the great amounts of machinery and equipment, to move materials and supplies, and to perform a variety of other maintenance and service operations.

Production of motor vehicles by the assembly line process requires an elaborate system of material movement to feed the assembly lines adequately and to remove finished products. In 1952, about 42,000 workers were employed in moving materials in automobile and automobile parts plants. Some workers drive tractors or trucks, delivering parts or subassemblies to the various stations on the assembly line or moving materials between plants or to and from shipping stations. *Material handlers* load and unload material from trucks or in and out of containers. Other workers, such as *checkers, tool-crib attendants,* and *stock chasers,* coordinate the delivery of parts to the proper location on the assembly line; check, receive, and distribute materials; and keep records of incoming and outgoing shipments. Some 15,000 workers were employed in materials control jobs in late 1952.

Among the important maintenance workers in automobile plants are *millwrights* who install and maintain mechanical equipment. They dismantle machinery and replace defective parts. One of their important functions is to set up new machinery and equipment. Several thousand *electricians* keep the wiring, motors, switches, and other electrical equipment in good operating condition, and make repairs when equipment breaks down. With a definite trend towards more automatic machinery, increasing numbers of workers are being used to maintain electronic and hydraulic equipment. *Plumbers* and *pipefitters* lay out, install, and repair piping, valves, pumps, and compressors. *Machinery repairmen* diagnose trouble in various types of machinery. They adjust, repair, and assemble machinery. Other maintenance and service workers found in automobile plants include *carpenters, sheet-metal workers, crane operators,* and *janitors.*

Experienced craftsmen, such as millwrights, plumbers, pipefitters, sheet-metal workers, and electricians, who have acquired their skills elsewhere, are sometimes hired directly by automobile companies. Most automobile plants conduct some type of apprentice training program to meet the needs of their maintenance shops. The apprenticeship programs usually cover 3 or 4 years, and include, mainly, shop training in various parts of the particular jobs. In addition, classroom instruction in related technical subjects is generally given either in the plant or in local vocational schools.

Administrative and Office Occupations

The plant workers' contribution to the making of the automobile has already been noted. But what goes on behind the scenes? Who keeps the records of parts, shipments, personnel, and sales? Who determines what and how much to buy? Who keeps production running smoothly? More than 150,000 of the industry's workers have administrative, sales, professional, technical, supervisory, and clerical jobs. The vital role played by engineers, metallurgists, tool designers, draftsmen, and other professional and technical personnel has already been described. The administrative field, also, provides opportunity for many men and women in interesting and important jobs.

For the most part, persons now employed

in the administrative positions in the automobile industry have not been trained specifically for any particular industry. Automobile companies recruit persons for administrative jobs by sending representatives to colleges and universities to interview graduating students. Many of the higher rated jobs are filled by promotions from within. Engineers and other specialized personnel are often used for top managerial positions. More and more college-trained persons, especially those with degrees in business administration, are being trained for administrative jobs in automobile companies. Many of these people have specialized in a particular administrative field, such as marketing, labor relations or personnel, or accounting and finance work. Now let's take a look at some of the administrative positions.

At the top of the administrative field are many persons in executive positions who are called upon to make policy decisions for their firms. These executives are continually required to decide how many vehicles to produce, what styles to make, which parts the company should produce and which to buy, how best to locate plants and equipment, and how best to coordinate production processes. To properly make such decisions, a large body of specialized personnel is needed.

The comptroller is the source for some important policy decisions such as those noted above. Because he is the company's chief accounting officer, he directs the entire accounting program. The services of many accountants, bookkeepers, and clerks are required to maintain the essential and complicated recordkeeping system needed by automobile firms. *Accountants* establish and direct accounting procedures and recordkeeping systems. They audit the records kept by bookkeepers and clerks, analyze costs, and do tax accounting. *Bookkeepers* keep complete and systematic sets of records of business transactions. Much of the work is performed on bookkeeping machines, calculators, and adding machines. *Clerks* file records, attend to the mail, and make relatively simple calculations on business machines.

Market analysts, economists, and *statisticians* collect, analyze, and interpret information for use in production planning and for guiding sales operations. They provide forecasts of market conditions and sales potentials. They study consumer buying habits and forecast consumer acceptance of new styles.

The sales department, working under a *sales executive* and in conjunction with *advertising personnel,* stimulates demand for products of the company. It is the responsibility of the sales department to make all arrangements with the company's automobile dealers throughout the country. The sales department usually has a service section which performs such functions as the training of dealers' mechanics. Many of the large automobile companies have sales offices located in all regions of the country.

The *purchasing* department must line up sources from which raw materials, finished parts, and equipment needed in the production process can be obtained regularly. Specialists in the purchasing department are needed to buy different kinds of materials, machines, and tools. They must be acquainted with the best available sources and trade conditions. They also must be good judges of value and quality and know the capacity of suppliers to meet their firm's demands. It takes well-trained personnel to buy wisely and thus protect the quality of the finished product.

A *legal staff* advises management as to legal rights and obligations under existing laws. Lawyers represent their companies in court or before semijudicial or administrative agencies of the Government. They also draw up legal documents and do other legal work as required. A few *doctors* and *nurses* also are needed to care for the health of the industry's workers while on the job.

Because manpower is a vital factor in the production process, a well-trained and organized *industrial relations staff* is required. Labor policies are analyzed and recommendations are made to top management. This staff also handles the many problems which arise in the day-to-day administration of union-management agreements. Trained *personnel workers* are needed to plan and assist in the recruiting, training, and rating of employees. They maintain personnel records, classify jobs, engage in employee counseling, and participate in the operation of established health, safety, and retirement systems.

The industry employs thousands of other "white collar" workers to help the specialized workers described above. Included among these are *secretaries, stenographers, clerks and typists,* and *business-machine operators.* A large proportion of the office workers are women.

Earnings and Working Conditions

Anyone interested in working in the automobile industry would like to know the pay he would earn and what kind of working conditions he might expect. Of course, the amount of earnings a person would get depends on what type of job he held. Earnings, in general, in the automobile industry are higher than in other manufacturing industries. Current data on earnings for the professional, technical, and administrative jobs are unavailable. Much more information is available for plant workers, however.

Earnings

In January 1953, the average hourly earnings for production workers in the automobile industry were $2.08, 35 cents more than the all-manufacturing average of $1.73. At that time, production workers in automobile plants earned an average of $85.90 for a workweek of 41.3 hours. This compares with the average earnings in all-manufacturing industries of $70.93 for a workweek of 41 hours.

However, pay rates vary considerably in the industry because of the great range in occupations and levels of skill.[5] This is reflected in a comprehensive survey of wages and related benefits in the automobile manufacturing industry undertaken early in 1950 by the Bureau of Labor Statistics. Table 3 summarizes some of the information collected in this study. The average straight-time hourly earnings for a number of the important plant occupations are given for several types of motor vehicle and parts plants. From the time this survey was undertaken in February of 1950 until the end of 1952, workers in the automobile plants have received general increases in wages totaling 32 or 33 cents per hour,[6] under the terms of the contracts between the major automobile manufacturers and the International Union, United Automobile, Aircraft, and Agricultural Implement Workers of America (CIO), to which union a very large proportion of automobile workers belong.

Generally, automobile contracts provide overtime pay for work in excess of 8 hours per day, or 40 hours per week, and premium pay for work on the night shift, in addition to double time for work on Sundays and holidays, and time and a half for the sixth day of the employee's workweek. Workers in plants of the major motor vehicle companies now have 6 paid holidays throughout the year, and periods of annual vacation which vary according to length of service, generally ranging from 1 to 3 weeks.

Other Employee Benefits

In addition to these provisions which affect the pay envelope directly, other benefits for the worker are provided for in most contracts. Many workers are covered by group insurance plans which usually include life insurance, accidental death and dismemberment benefits, weekly accident and sickness payments in case of temporary disability, hospitalization, and surgical and medical benefits. Often workers'

[5] Passenger car companies generally pay on a straight-time hourly basis. Only 2 such companies were using an incentive pay system in early 1950. In the parts and truck branches, on the other hand, almost half of the workers were in plants using incentive pay systems.

[6] These hourly increases were the result of two separate contract provisions. Twelve cents of the total increase was based on the provision for an annual improvement factor. The remainder was the result of several cost-of-living adjustments made at the end of each quarter. They were based upon changes in the cost of living during the previous period as measured by the Consumers' Price Index of the Bureau of Labor Statistics.

TABLE 3.—*Average straight-time hourly earnings*[1] *for selected occupations in the automobile industry, by type of plant, United States, February-April 1950*

Occupation	Type of plant: Passenger-car	Truck	Body and body parts	Automotive chassis-parts	Automotive engine-parts
Metalworking occupations					
Machining occupations:					
Diemakers (excluding leaders)	$1.98	$1.95	$1.91	$2.02	$2.00
Die tryout men	2.00	---	1.90	1.78	1.83
Die sinkers	2.69	---	---	2.24	---
Drill-press, special and heavy	1.61	1.73	---	---	---
Drill-press operators, class A	---	---	---	1.98	---
Drill-press operators, class B	---	---	---	1.69	1.66
Drill-press operators, class C	---	---	---	1.59	1.27
Grinders, external and internal	1.60	1.91	---	---	---
Grinding-machine operators, class A	---	---	---	1.86	1.84
Grinding-machine operators, class B	---	---	---	1.74	1.67
Grinding-machine operators, class C	---	---	---	1.74	1.69
Lathe operators, crankshaft	1.63	---	---	---	---
Milling-machine operators, heavy or special	1.61	1.64	---	---	---
Milling-machine operators, class A	---	---	---	1.92	---
Milling-machine operators, class B	---	---	---	1.75	1.72
Milling-machine operators, class C	---	---	---	1.61	1.48
Punch-press operators, heavy double-crank or toggle	1.62	1.70	1.63	1.69	1.57
Punch-press operators, light and medium	1.65	1.80	---	1.61	1.47
Punch-press operators, small crank	1.58	1.54	1.55	---	---
Screw-machine operators, automatic	1.67	1.83	---	---	---
Screw-machine operators, automatic, class A	---	---	---	1.84	1.75
Screw-machine operators, automatic, class B	---	---	---	1.84	1.78
Screw-machine operators, automatic, class C	---	---	---	1.72	1.39
Toolmakers (excluding leaders)	1.97	1.92	1.91	1.94	1.89
Foundry occupations:					
Coremakers, light, blow machine and hand	1.72		---	---	---
Machine molders	1.73	---	1.78	1.82	1.80
Patternmakers, bench, wood	2.15	1.85	2.00	---	---
Forging occupations:					
Hammermen, steam, medium	2.57	---	---	---	---
Heaters for hammermen, steam	1.94	---	---	---	---
Upsetters	2.08	---	---	1.98	1.70
Other metalworking occupations:					
Welders, arc and gas	1.70	1.81	1.76	1.85	---
Welders, gun	1.64	---	1.59	---	---
Welders, spot	1.62	1.75	1.56	1.63	---
Assembly and inspection occupations					
Assemblers, bench	1.55	1.77	1.48	---	---
Assemblers, conveyor	1.60	1.77	1.70	---	---
Assemblers, class A	---	---	---	2.00	---
Assemblers, class B	---	---	---	1.69	1.67
Assemblers, class C	---	---	---	1.44	1.32
Inspectors, final car	1.64	1.67	---	---	---
Inspectors, machine parts	1.59	1.67	---	---	---
Inspectors, class A	---	---	1.74	1.67	1.69
Inspectors, class B	---	---	1.63	1.57	1.46
Inspectors, class C	---	---	1.48	1.40	1.33
Finishing occupations					
Metal finishers, body	1.72	2.09	1.75	---	---
Polishers, lacquer or enamel	1.66	1.71	1.97	---	---
Sprayers, lacquer or enamel	1.75	1.68	1.73	1.46	---
Sewing-machine operators	1.50	1.46	1.50	---	---
Material movement and maintenance occupations					
Checkers, receiving and shipping	1.53	1.51	1.48	1.46	1.46
Crane operators, traveling bridge	1.60	1.55	1.55	1.53	1.47
Material handlers	1.48	1.35	1.42	1.38	1.31
Truck drivers, inside power	1.52	1.46	1.44	1.45	1.43
Truck drivers, outside	1.59	1.45	1.53	1.46	1.45
Carpenters, maintenance	1.80	1.64	1.76	1.68	1.69
Electricians, maintenance	1.85	1.75	1.84	1.77	1.76
Machine repairmen, maintenance	1.89	1.82	---	---	---
Mechanics, maintenance	---	---	1.83	1.74	1.80
Millwrights, maintenance	1.80	1.72	---	---	---
Millwrights	---	---	1.76	1.72	1.70
Laborers, maintenance, janitors, and sweepers	1.37	1.29	1.34	1.29	1.25

[1] Excludes premium pay for overtime and night work.

Source: Wage Structure; Motor Vehicles and Parts, 1950, U. S. Department of Labor, Bureau of Labor Statistics, Bulletin 1015, tables 5, 6, 16, 17, and 18.

dependents are covered by hospitalization and surgical benefits with the company paying part of the cost.

A large proportion of the automobile workers are covered by pension programs, almost all of which are paid for entirely by the employer. A typical contract provides that, upon reaching the age of 65, employees with 10 years of credited service become eligible to retire on a pension. The amounts of the pensions vary among the individual company contracts. One widely used plan grants a monthly benefit of $1.50 for each year of service up to 30 years, in addition to any payments under the Federal social security program to which the worker may be entitled. Most of the programs in the industry also provide benefits for permanently disabled workers who have fulfilled certain requirements, often 15 years of service and the attainment of 50 or 55 years of age.

Working Conditions

The working environment of an automobile employee cannot be described in terms of a typical workplace, in view of the many differences in the size, condition, and age of the 1,900 plants in the industry; the nature of operation; the type of equipment; the kind of product; and the stage of fabrication. Working conditions among the various types of occupations in the industry also differ.

In general, the work surroundings are more favorable than those in most types of metalworking facilities. Most of the places in which automobile workers are employed are relatively clean and free from dust, smoke, or fumes. However, some work surroundings, particularly in the foundry and forge departments, may be hot and the worker may be exposed to dust and fumes. Such working conditions have been greatly improved with adequate ventilation systems.

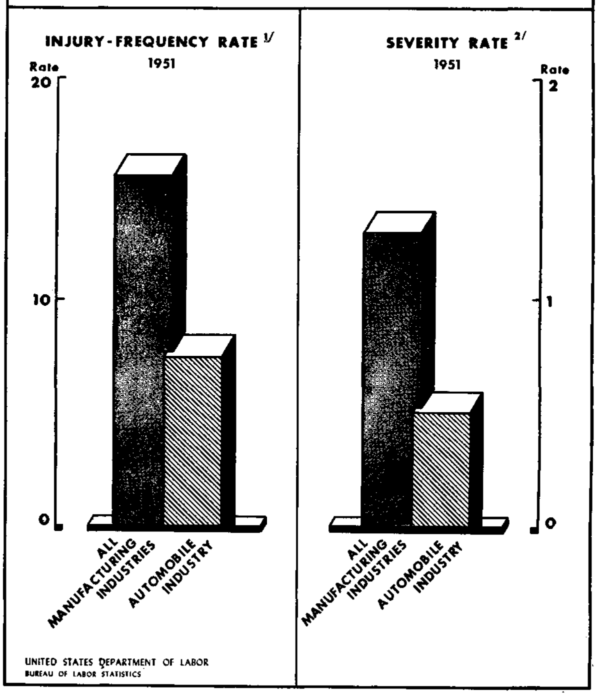
Assembly plants are large and also fairly clean, although conditions may vary somewhat along the assembly line itself. One work station may be considerably noisy, especially where parts of the chassis are riveted, bolted, or welded together with portable power tools. At the end of the line, where finished cars receive final inspection, workplaces are more or less removed from the clatter of motorized tools.

Although safety conditions vary somewhat among the individual departments or facilities, automobile plants on the whole are comparatively safe places to work. The work injury rate is only about half as high as the average in all-manufacturing industries. In 1951 the average number of disabling injuries was 7.4 for each million employee hours worked in motor vehicle and motor vehicle parts establishments. This compares with an average of 15.5 for all-manufacturing industries in that year (chart 2).

Labor Organizations

New employees in the automobile industry will find that nearly all plant workers and some office workers belong to labor unions. They will discover also that wage rates, hours of

Chart 2. Automobile Industry Has Better Than Average Safety Record



[1] Injury-frequency rate is the average number of disabling work injuries for each million employee hours worked.

[2] Severity rate is the average number of days lost as a result of disabling work injuries for each thousand employee hours.

work, pensions, vacations, and other matters affecting their jobs, which have been previously mentioned, are, for the most part, established through collective bargaining between the unions and the automobile companies. These collective bargaining contracts also contain such provisions as seniority rules and grievance procedures.

The great bulk of the workers in the industry belong to the International Union, United Automobile, Aircraft, and Agricultural Implement Workers of America (CIO). The United Automobile Workers of America (AFL), International Association of Machinists (AFL), and a few other unions are the bargaining agents with a number of automobile parts plants. Other unions with membership in automobile plants include such craft unions as the Pattern Makers' League of North America (AFL), the International Molders and Foundry Workers Union of North America (AFL), the Metal Polishers, Buffers, Platers, and Helpers International Union (AFL), and Mechanics Educational Society of America (Ind).

Trends in Production and Employment

By the end of 1952, more than 128 million motor vehicles had rolled off the assembly lines of American automobile companies. In the little more than 50 years of the automobile industry's existence, the Nation has witnessed its extraordinary rise from the manufacture of 4 "horseless carriages" in 1895 to more than 8 million cars and trucks in 1950.

Early Growth of the Industry

Although the automobile is essentially a product of the 20th century, its development goes back many years. As far back as the 15th century, Leonardo da Vinci, one of the greatest geniuses of his time, foresaw the possibility of a power-driven vehicle. Several hundred years later, in the 18th century, both French and English inventors experimented with steam-propelled carriages. The greatest stimulus to the development of the motor vehicle was the appearance of the internal combustion engine around 1880. A period of intensive experimentation followed, and by 1895 a number of pioneers in this country, including Duryea, Ford, Haynes, and Olds, were developing and perfecting working models.

The production of automobiles on a commercial basis began with the turn of the century. The next 2 decades was a period of remarkably rapid growth. From an employment of about 2,500 workers and a production of about 3,700 passenger cars in 1899, the industry expanded so that by 1919, 394,000 workers were employed in the industry and 1.9 million cars were produced. The application of mass-production methods to the building of cars was responsible for this tremendous increase in output.

After 1920, the automobile industry entered a new phase. The industry had become an important factor in the Nation's economy, and the car had become an accepted form of transportation. A continuing succession of technical improvements made the automobile a more reliable and comfortable vehicle for travel, aided by the improved highway system that was spreading throughout the country. The number of motor vehicles in use nearly tripled in the 10-year period from 1920 to 1930. Total automobile registration jumped from 9.2 to over 26.5 million over the decade.

As this industry became an important part of our economy, it became sensitive to changes in general business conditions. The sharp fluctuations in output between prosperous and depression periods are shown in chart 3. Motor vehicle production fell from 5.4 million units in 1929 to a low of 1.4 million at the bottom of the depression in 1932. Over the same period, employment showed a drop of about 50 percent, and the average workweek registered a decline of 33 percent. As the country recovered from the depression, automobile production and employment swung upward. By 1937, automobile manufacturers produced 4.8 million vehicles, or more than triple the number produced in 1932. Employment doubled over the same period.

Business cycles are not the only causes of sharp fluctuations in the output of the automobile industry. Wartime also brings great changes in the industry's activities. Our entry into World War II created a tremendous demand for the production of war materiel. Because of the automobile industry's vast amount of metalworking facilities and experience, it was given the task of producing great quantities of military items. Automobile production for civilian use was virtually discontinued during World War II and most of the industry's facilities were converted to the production of such military items as aircraft and parts, combat vehicles, tanks, guns, and ammunition.

Employment increased substantially during World War II, reaching a peak of 827,000 wage and salary workers in the beginning of 1944, but decreased steadily thereafter until the end of the war (chart 4).

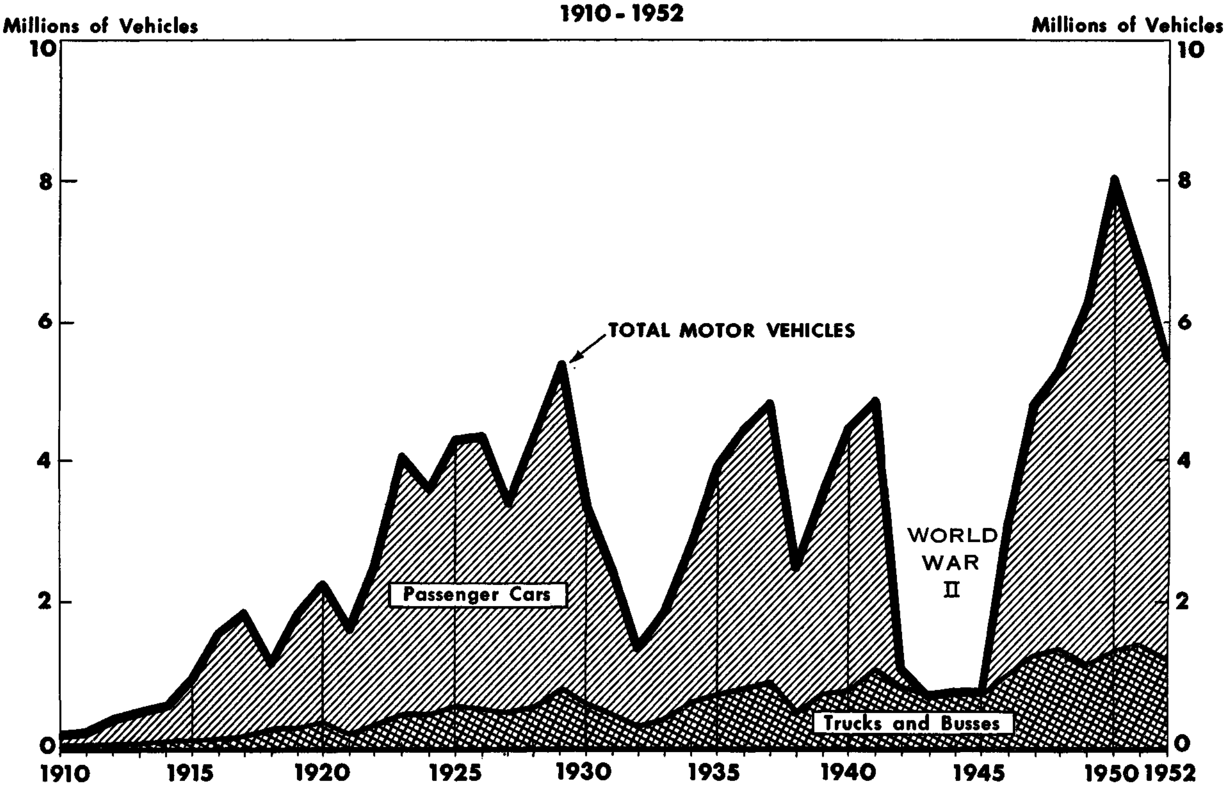
Employment Since World War II

Automobile and truck production for civilian use was virtually discontinued during World War II, and was not resumed until the latter half of 1945. Wage and salary worker employment in both 1945 and 1946 averaged 660,000,[7] about 17 percent less than in 1944. Motor vehicle output in 1946 totaled only 3 mil-

[7] A work stoppage in one of the largest automobile companies in late 1945 and the beginning of 1946 resulted in smaller average employment and production in those 2 years.

Chart 3. Trend in Production of Motor Vehicles

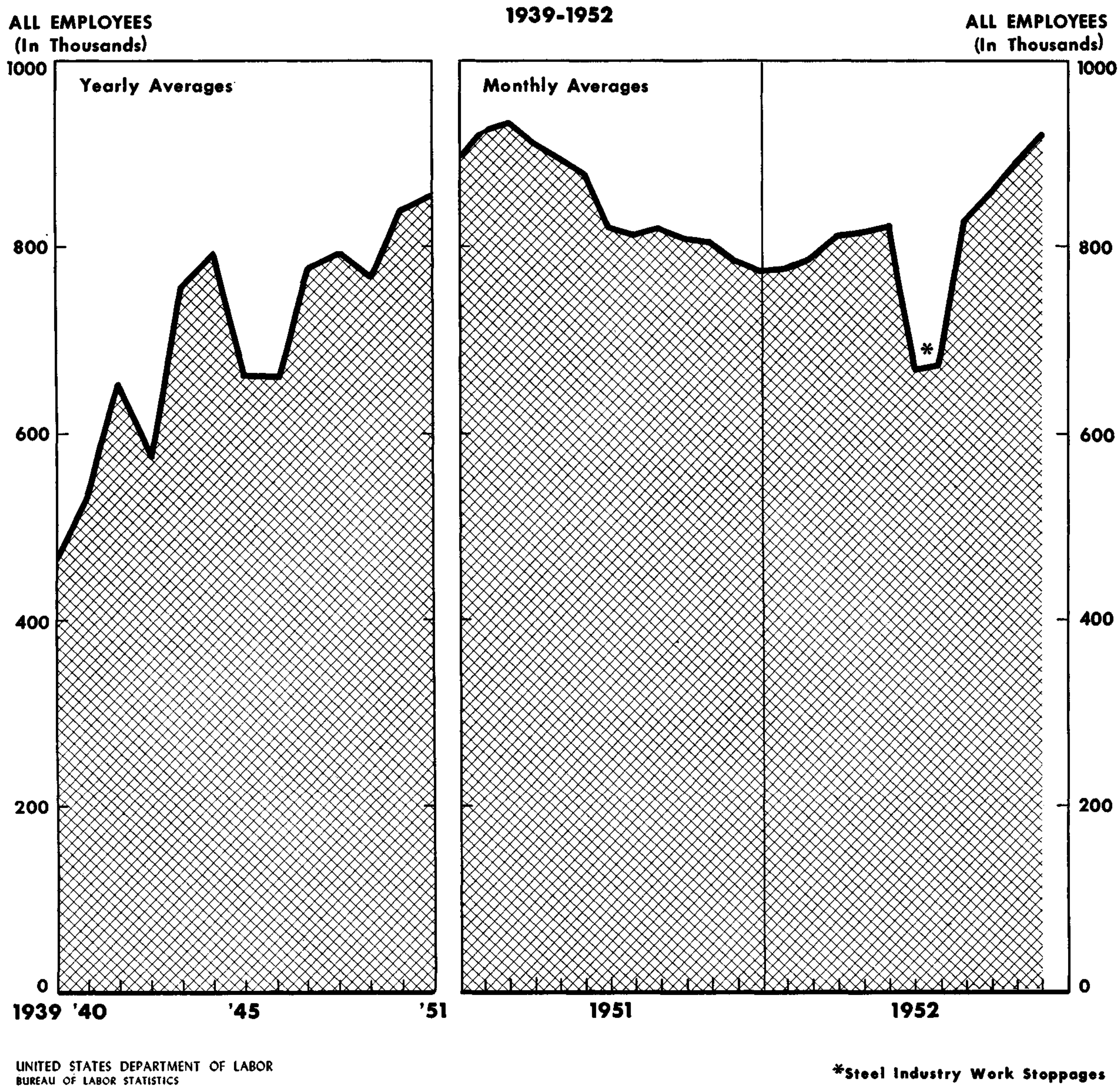
1910 - 1952



UNITED STATES DEPARTMENT OF LABOR
BUREAU OF LABOR STATISTICS

Source: Automobile Manufacturer's Association, "Automobile Facts and Figures, 1952"

Chart 4. Trend of Employment in the Automobile Industry



lion units. Although consumer demand for both passenger cars and trucks was very great because no new vehicles had been available since 1942, it was not until 1947 that production reached prewar levels. The years 1947-50 saw a steadily rising rate of motor vehicle output, culminating in a record production of 8 million cars and trucks in 1950. The trend of employment was also upward during this period, but was characterized by considerable fluctuation.

The outbreak of Korean hostilities in June 1950 had a great impact on the economy of the automobile industry. Initially, a considerable demand resulted from scare buying in anticipation of future shortages such as had occurred during World War II. Employment was therefore at very high levels during the last half of 1950 and the first quarter of 1951. In March 1951, employment reached a new high of 935,600 wage and salary workers. Motor vehicle production of nearly 2 million units in the first quarter of 1951 was at an annual rate about equal to the 1950 peak level.

The second major effect of the Korean hostilities on the industry's activities was a cutback in civilian automobile output. Limitations on output were necessary to insure the supply of critical materials for defense and essential civilian needs. In July 1951, the National Production Authority began to allocate the basic metals, particularly steel, copper, and aluminum, for both military and civilian use under the controlled materials plan. Production ceilings on cars and trucks were established for each quarter by limiting the consumption of basic materials to be used in automobile manufacture and by fixing quotas on the actual number to be assembled. As a result of these curbs, automobile production fell from nearly 2 million units in the second quarter of 1951 to 1.5 million in the third, and to less than 1.4 million in the final quarter of the year. Despite these declines, the total output of 6.8 million vehicles for the year 1951 was above any previous year except 1950.

Employment levels reflected the drop in production. From a total of 935,600 wage and salary workers in March 1951, employment fell rapidly and by the end of that year the industry had dropped about 150,000 workers from its rolls. In Michigan, where automobile manufacturing is most heavily concentrated, thousands of workers became unemployed.

During 1952 the downward employment trend changed. The number of workers increased steadily again except in July and August when employment dropped heavily because of the work stoppage in the steel industry. With increases in the amount of material allotted for the manufacture of automobiles, motor vehicle output rose from about 1.3 million units in the first quarter of 1952 to more than 1.6 million units in the last quarter of the year. At the end of 1952 the industry was operating at an annual production rate of about 6.5 million cars and trucks.

As the year ended, wage and salary worker employment totaled about 920,000, nearly 150,000 more than the number employed at the beginning of 1952, and only about 2 percent less than the peak reached in March 1951. A large part of this increase was a result of the growing number of workers employed in the production of military equipment in automobile companies' plants.

Defense Activities of Automobile Companies

At present, the beginning of 1953, the automobile industry accounts for a considerable proportion of the Nation's total defense production, as it did in World War II. The present mobilization period, however, is in sharp contrast to the industry's experience in World War II, when civilian motor vehicle production was completely stopped and existing facilities were converted to the manufacture of military equipment. Under the present defense program, military production has been added to a relatively high level of civilian output.

At the end of 1952, it was estimated that some 110,000[8] of the 920,000 employees in the automobile industry were working on defense production. This was an increase of about 750,000 over the number employed at the beginning of 1952.

Some of the automobile workers employed on defense production have jobs in new plants or in Government-owned World War II plants. Among the new plants are a number which had been constructed as part of the industry's postwar expansion program but which had not been tooled-up to produce motor vehicles and parts at the time of the outbreak of Korean hostilities. As part of the current defense mobilization program, other new plants have been built, some of which are adjacent to plants producing automobiles. In addition to new plants, some of those producing automobiles and parts have been partially converted to the manufacture of military equipment, particularly aircraft.

[8] In addition to these 110,000, about 90,000 other defense workers were employed in plants owned or managed by automobile companies. These plants, however, did not have as their principal products motor vehicles or motor vehicle parts, and thus were not considered to be a part of the automobile industry.

In the present mobilization period, as in World War II, the automobile industry accounts for a considerable proportion of the Nation's defense production. Here, medium tanks are being readied for shipment in an automobile company plant.

Employment Outlook

What are the job prospects in the industry? What are my chances for getting a job? And what opportunities for advancement can I expect? These are the questions most important in the mind of anyone considering a career in the automobile industry.

The answer to these questions can be summarized in two conclusions: (1) Because of the large size of the industry and its basic importance, the industry will continue to offer thousands of job opportunities for new workers each year to replace those among its workers who die, retire, or who leave the industry to go into other fields of work. These vacancies also provide promotional opportunities. (2) Despite the ever-growing number of automobiles on our streets and highways, no large increases in employment are expected either in the near future or in the long run. These conclusions have been based on a thorough consideration of the major factors which affect the number of jobs for automobile workers.

Some of the factors affecting the number of jobs are reasonably predictable, such as a rising population and the need to replace the motor vehicles that are scrapped each year. Other factors are less predictable. What will the level of general business conditions be 10 or 20 years from now? Will other means of transportation significantly affect the demand for automobiles? These and other factors, together with an appraisal of the employment prospects for the next few years and over the long run, are discussed below.

Prospects for 1953 and 1954

The employment outlook in the automobile industry in the short run depends upon the size of the demand for new automobiles and replacement parts, the availability of critical materials, and any change in the number of automobile workers employed on defense production.

In February 1953, limitations on the use of most critical materials were discontinued and restrictions were lifted on the number of motor vehicles to be manufactured. With supplies of materials generally increasing and materials requirements for most defense-connected programs leveling off, it appears likely that 1953 motor vehicle production will not be seriously hindered by material shortages.

In general, the demand prospects for new cars and trucks appear favorable for 1953. Inventories of new automobiles at the end of 1952 were not excessive, and industry experts expect the automobile companies to produce and sell some 5.5 million passenger cars and 1.3 million trucks in 1953. This would be near the levels reached during the fourth quarter of 1952 when automobiles were turned out at the annual rate of 5.2 million passenger cars and 1.4 million trucks.

The level of production of replacement parts is another factor in determining the employment outlook for the automobile industry. Sales of parts are expected to rise somewhat during 1953 and should be at about the record 1951 sales figure. Demand for replacement parts is strongly affected by the growing volume of automobiles and trucks in use. At the end of 1952, 50 percent more passenger cars and 90 percent more trucks were on the Nation's roads than in 1941. Moreover, many of the vehicles on our roads are relatively old; more than one-quarter of the 53 million vehicles had been in use 10 or more years at the end of 1952.

The employment outlook also is affected by the defense activities of automobile firms. Production of military equipment by automobile companies is expected to rise moderately in 1953, reach a peak at the end of the year, and level off in 1954. It is estimated that the number of employees working on defense activity in the automobile industry will increase by about 25,000 during 1953.

On the whole, therefore, the automobile industry is expected to operate in the next 2 years at levels not much different from those at the end of 1952. During 1953, employment is expected to fluctuate around the number employed at the end of 1952, somewhere near 900,000 wage and salary workers.

The outlook for the years just beyond 1953 is uncertain. It seems probable, however, that, barring any major downturn in general business conditions, the level of automobile production during the next several years should not vary greatly from the rate of output attained at the end of 1952. A recent report of the United States Department of Commerce, "Markets After Defense Expansion," concludes that if general economic conditions remain favorable over the next few years, average domestic demand for new passenger cars will be around 5 million a year.

The level of employment also will be affected by the volume of defense material being produced in the industry. Present mobilization plans indicate that defense production will reach its peak at the beginning of 1954 and may ease off thereafter. Defense activity beyond mid-1954 depends directly on the size of congressional appropriations and indirectly upon the state of international affairs.

Long-Range Prospects

Persons interested in a career in the automobile industry should take into consideration the long-run outlook for employment, because this influences not only their chances for getting and holding a job, but their promotional opportunities. The following appraisal of future employment trends presents a general picture of the outlook for the industry, based on what are believed to be reasonable assumptions about some of the more important factors which will influence its growth. Although approximate future production and employment levels are presented for 1975, they should not be considered as applying to that particular year, but as a general indication of what employment levels might be in that period. Automobile production and employment tend to fluctuate from year to year, in relation to general business conditions. The estimates for 1975, therefore, represent an average of what might be expected during the mid-1970's based on past trends in automobile usage and other factors affecting employment in the industry.

In 1950, employment in the automobile industry averaged about 840,000 and exceeded 920,000 in October. Total volume of production of motor vehicles in the 1970's is expected to be as great as or greater than the very high level of 1950. Over the next 25 years, technological changes and the general steady improvement in production efficiency are likely to result in a fairly substantial gain in output per man-hour. This increase will be offset, at least partly, by a probable drop in the length of the average workweek in the industry. Thus, it seems reasonable to expect that employment in 1975 may not differ much from the level of 1950. However, even under these conditions, the automobile industry is likely to remain the largest employer in the manufacturing field. Consequently, this industry would be one of the major sources of job openings because of the large number of workers who will be needed each year to replace those who are leaving the industry because of death, retirement, or taking jobs in other industries. It is estimated that death and retirement alone will create between 12,000 to 15,000 openings a year for new workers. These estimates are based upon the following analysis.

TABLE 4.—*Increase in use of passenger cars, 1920-75*

Year	Number of passenger cars in use[1] (thousands)	Population 14 years and over[2] (millions)	Number of persons (over 14) per car
1920	8,132	74.0	9.1
1930	22,973	89.0	3.9
1940	27,372	101.1	3.7
1950	40,185	112.3	2.8
1975[3]	60,000	149.6	2.5

[1] Automobile Manufacturer's Association, Facts and Figures 1952, p. 21.
[2] Employment and Economic Status of Older Men and Women, May 1952, U. S. Department of Labor, Bureau of Labor Statistics, Bulletin No. 1092.
[3] Estimates for 1975 by Bureau of Labor Statistics.

With the automobile accepted as the basic form of passenger transportation, and with trucks carrying an increasing proportion of the freight traffic, demand for motor vehicles will continue to be strong, both to replace cars as they wear out and to increase the number of automobiles and trucks in use. The Nation's population is expected to show a substantial increase during the next 25 years. This increase, together with a generally rising level of consumer income, should result in a steady increase in the total number of automobiles in use. Registration data show that in 1950 approximately 40 million passenger cars were in use. This means that there were less than 3 persons, 14 years of age or over, for every car in use. By 1960, the total population 14 years of age and over is expected to increase about 10 percent. Estimates of the Bureau of Labor Statistics indicate that by 1975, the total population will be more than a third higher than it was in 1950.[9] If the ratio of cars to the population over 14 years of age continues at the 1950 rate, a total passenger car registration of a little over 53 million cars will result. In recent years, however, the ratio of cars to population has been steadily rising because of higher average incomes, the movement of population to the suburbs, the more equal distribution of consumer incomes, better highways, and high farm incomes. By 1975, the number of persons 14 years of age and over per automobile may be 2.5 compared with 2.8 in 1950 (table 4). This assumption appears to be consistent with the past trends in the ownership of automobiles. (In 1940 there were 3.7 persons per registered automobile and 3.9 in 1930.) The moderate increase in the ratio of cars to population could mean a total passenger car registration of about 60,000,000 in 1975. To increase the number of cars in use to 60,000,000, the industry will have to produce, over the 25-year period, an average of about 800,000 more cars a year than are scrapped.

The biggest element in demand will be the number of cars needed to replace those being scrapped. Between 1935 and 1941, an average of nearly 8 percent of the total cars in use were scrapped each year. With the recent trend toward longer life expectancy for cars, it might

[9] Employment and Economic Status of Older Men and Women, May 1952, U. S. Department of Labor, Bureau of Labor Statistics, Bulletin No. 1092.

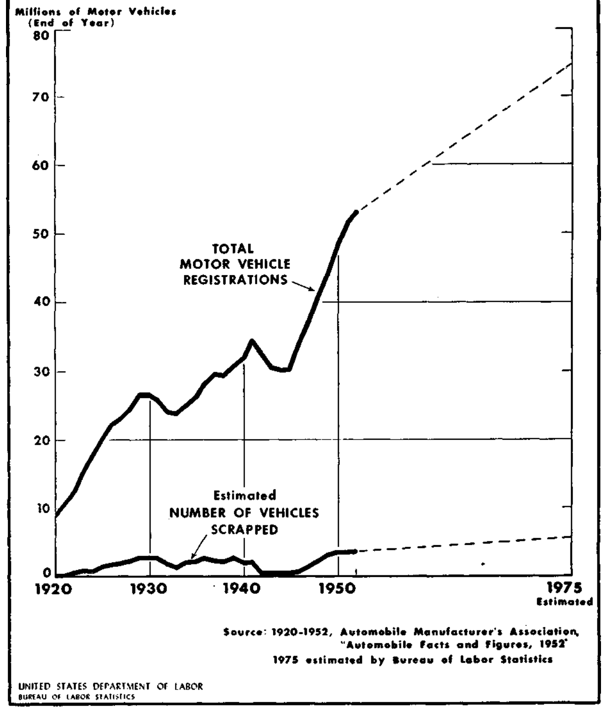
not be unreasonable to assume that for 1975 between 7.5 and 8 percent of cars in use would be scrapped each year. This would mean that in 1975 between 4.5 and 5 million passenger cars would be required to replace those discarded (chart 5). If to this total is added the number needed for expansion of the automobile population and allowance is made for 200,000 cars for export (about the average in the postwar years), the total annual production would amount to less than 6 million passenger cars a year.

This rate of production is considerably higher than the highest pre-World War II production of automobiles. In only one prewar year, 1929, did passenger car production exceed 5 million. In the post-World War II years, passenger car production was over 5 million in every year from 1949 through 1951, dropping to 4.3 million in 1952, principally because of restrictions on the use of critical materials. The peak production, however, was reached in 1950 when the combination of high postwar demand, plus the scare buying in anticipation of curtailment of automobile production after the Korean hostilities broke out, boosted total production to about 6.6 million cars. Thus, the estimated 1975 car production, which is based upon a continued expansion of automobile usage and reasonably generous assumptions as to replacement rates, would be under the 1950 peak.

The total truck population may increase somewhat more rapidly than that for passenger cars. The total number of trucks in use increased about 80 percent between 1940 and 1950. Although this rate of increase probably will not be maintained, the expected population growth and the trend toward more extensive use of trucking probably will boost total truck registration between 50 and 75 percent by 1975. This increase, together with replacement requirements and exports, should result in an annual truck and bus output of between 1,750,000 and 2,000,000 in 1975. On the basis of these passenger car and truck estimates, total motor vehicle production in 1975 would be slightly below the record 1950 output.

Replacement parts for cars and trucks also account for a substantial part of the industry's

Chart 5. Trend in Motor Vehicle Registration and Number Scrapped



total production—about a sixth of the value of products in 1950. In 1975, with a 50-percent increase in the number of motor vehicles since 1950, the volume of replacement parts should show a roughly proportionate increase.

To sum up, the large increase in replacement parts, together with the fact the trucks would make up a higher proportion of total vehicle output in 1975 than they did in 1950, should result in a total volume of production at least equal to the 1950 level, despite the smaller number of passenger cars.

This discussion of the long-run outlook for employment in automobile manufacturing has been presented to give a general picture of the future trends for use as a guide to those who are planning careers. These projections of employment have been based upon a careful consideration of the past trends in the industry and what are believed to be reasonable assumptions as to some of the more important factors which will affect the industry's future employment. However, all such forecasts have basic limitations, and the longer the forecast period the more serious these limitations are. Much can happen in the next 25 years to change substantially the course of the industry's development; yet some of the more important changes cannot be discerned with sufficient precision to be applied in making the forecast. Possible technological changes may affect both the type of the cars being produced and the labor requirements in the industry. For example, the widespread introduction of the gas turbine engine, now in an early stage of development, could substantially affect the industry's production. Also, there have been recent trends toward adding more equipment and stepping up the power output of the cars and trucks.

On the other hand, the demand for cars could be noticeably modified by such developments as increased use of aircraft for personal transportation, including the potential development of the helicopter for use in and about urban areas. A higher standard of living in many of the foreign countries, in which automobiles and trucks are as yet a comparatively unimportant means of transportation, could have a substantial effect on the volume of American exports of motor vehicles. Because of these uncertainties of future events, the projections of employment should be considered as illustrations of the general levels of employment likely to prevail in the automobile industry in the mid-1970's on the basis of present information on the industry's production and employment trends.

Occupational Outlook Publications of the Bureau of Labor Statistics

Studies of employment trends and opportunities in the various occupations and professions are made available by the Occupational Outlook Service of the Bureau of Labor Statistics.

These reports are for use in the vocational guidance of veterans, in assisting defense planners, in counseling young people in schools, and in guiding others considering the choice of an occupation. Schools concerned with vocational training and employers and trade unions interested in on-the-job training have also found the reports helpful in planning programs in line with prospective employment opportunities.

Two types of reports are issued, in addition to the Occupational Outlook Handbook: *Occupational outlook bulletins* describing the long-run outlook for employment in each occupation and giving information on earnings, working conditions, and the training required.

Special reports issued from time to time on such subjects as the general employment outlook, trends in the various States, and occupational mobility.

These reports are issued as bulletins of the Bureau of Labor Statistics. Most of them may be purchased from the Superintendent of Documents, Washington 25, D. C., at the prices listed with a 25-percent discount on 100 copies or more. Those reports which are listed as free may be obtained directly from the United States Department of Labor, Bureau of Labor Statistics, Washington 25, D. C., as long as the supply lasts.

Occupational Outlook Handbook

Employment Information on Major Occupations for Use in Guidance. Bulletin 998 (1951 Revised Edition). $3. Illus.

Includes brief reports on more than 400 occupations of interest in vocational guidance, including professions; skilled trades; clerical, sales, and service occupations; and the major types of farming. Each report describes the employment trends and outlook, the training qualifications required, earnings, and working conditions. Introductory sections summarize the major trends in population and employment and in the broad industrial and occupational groups, as background for an understanding of the individual occupations.

The Handbook is designed for use in counseling, in classes or units on occupations, in the training of counselors, and as a general reference. Its 600 pages are illustrated with 103 photographs and 85 charts.

Occupational Outlook Bulletins

	Price
Plastics Products Industry, Employment Outlook in the Bulletin 929 (1948). Illus.	20 cents
Electric Light and Power Occupations, Employment Outlook in Bulletin 944 (1949). Illus.	30 cents
Railroad Occupations, Employment Outlook in Bulletin 961 (1949). Illus.	30 cents
Engineers, Employment Outlook for Bulletin 968 (1949). Illus.	55 cents
Elementary and Secondary School Teachers, Employment Outlook for Bulletin 972 (1949). Illus.	40 cents
Petroleum Production and Refining, Employment Outlook in Bulletin 994 (1950). Illus.	30 cents
Men's Tailored Clothing Industry, Employment Outlook in Bulletin 1010 (1951). Illus.	25 cents
Department Stores, Employment Outlook in Bulletin 1020 (1951). Illus.	20 cents
Accounting, Employment Outlook in Bulletin 1048 (1952). Illus.	20 cents
Earth Scientists, Employment Outlook for Bulletin 1050 (1952). Illus.	30 cents
Merchant Marine, Employment Outlook in the Bulletin 1054 (1952). Illus.	30 cents
Electronics Manufacturing, Employment Outlook in Bulletin 1072 (1952). Illus.	25 cents
Federal White Collar Workers—Occupations and Salaries, June 1951 Bulletin 1117 (1952)	15 cents
Technicians, Employment Outlook for Bulletin 1131 (1953). Illus.	25 cents
Printing Occupations, Employment Outlook in Bulletin 1126 (1953). Illus. Reprinted from the 1951 Occupational Outlook Handbook	25 cents
Air Transportation, Employment Outlook in Bulletin 1128 (1953). Illus. Reprinted from the 1951 Occupational Outlook Handbook	20 cents
Mechanics and Repairmen, Employment Outlook for Bulletin 1129 (1953). Illus. Reprinted from the 1951 Occupational Outlook Handbook	20 cents
Metalworking Occupations, Employment Outlook in Bulletin 1130 (1953). Illus. Reprinted from the 1951 Occupational Outlook Handbook	30 cents

Occupational Outlook Supplements

	Price
Effect of Defense Program on Employment Outlook in Engineering (Supplement to Bulletin 968, Employment Outlook for Engineers) (1951)	15 cents
Effect of Defense Program on Employment Situation in Elementary and Secondary School Teaching (Supplement to Bulletin 972, Employment Outlook for Elementary and Secondary School Teachers) (1951)	15 cents

Special Reports

Factors Affecting Earnings in Chemistry and Chemical Engineering Bulletin 881 (1946)	10 cents
Occupational Outlook Information Series (by States) VA Pamphlet 7-2 (1947). (When ordering, specify State or States desired) (each)	10 cents
Employment, Education, and Earnings of American Men of Science Bulletin 1027 (1951)	45 cents
Employment and Economic Status of Older Men and Women Bulletin 1092 (May 1952)	30 cents
Negroes in the United States: Their Employment and Economic Status Bulletin 1119 (December 1952)	30 cents
Mobility of Tool and Die Makers, 1940–1951 Bulletin 1120 (1952)	35 cents
Occupational Mobility of Scientists Bulletin 1121 (1953)	35 cents
Manpower Resources in Chemistry and Chemical Engineering, 1951 Bulletin No. 1132 (1953)	50 cents
Employment Opportunities for Student Personnel Workers in Colleges and Universities for Public School Teachers (1951)	Free
Elementary and Secondary School Principalships—Chief Advancement Opportunity for Public School Teachers (1951)	Free
Employment Opportunities for Counselors in Secondary and Elementary Schools (1951)	Free
Employment, Education, and Income of Engineers, 1940–1950: A Survey of Engineering Society Members of Full Professional Grade (1953)	Free
Industrial Research and Development: A Preliminary Report (1953)	Free

☆ U. S. GOVERNMENT PRINTING OFFICE: 1953—256052