

FACTORY FACTS *from Ford*

1920

FORD SERVICE COMPANY
LAWRENCE, MICHIGAN



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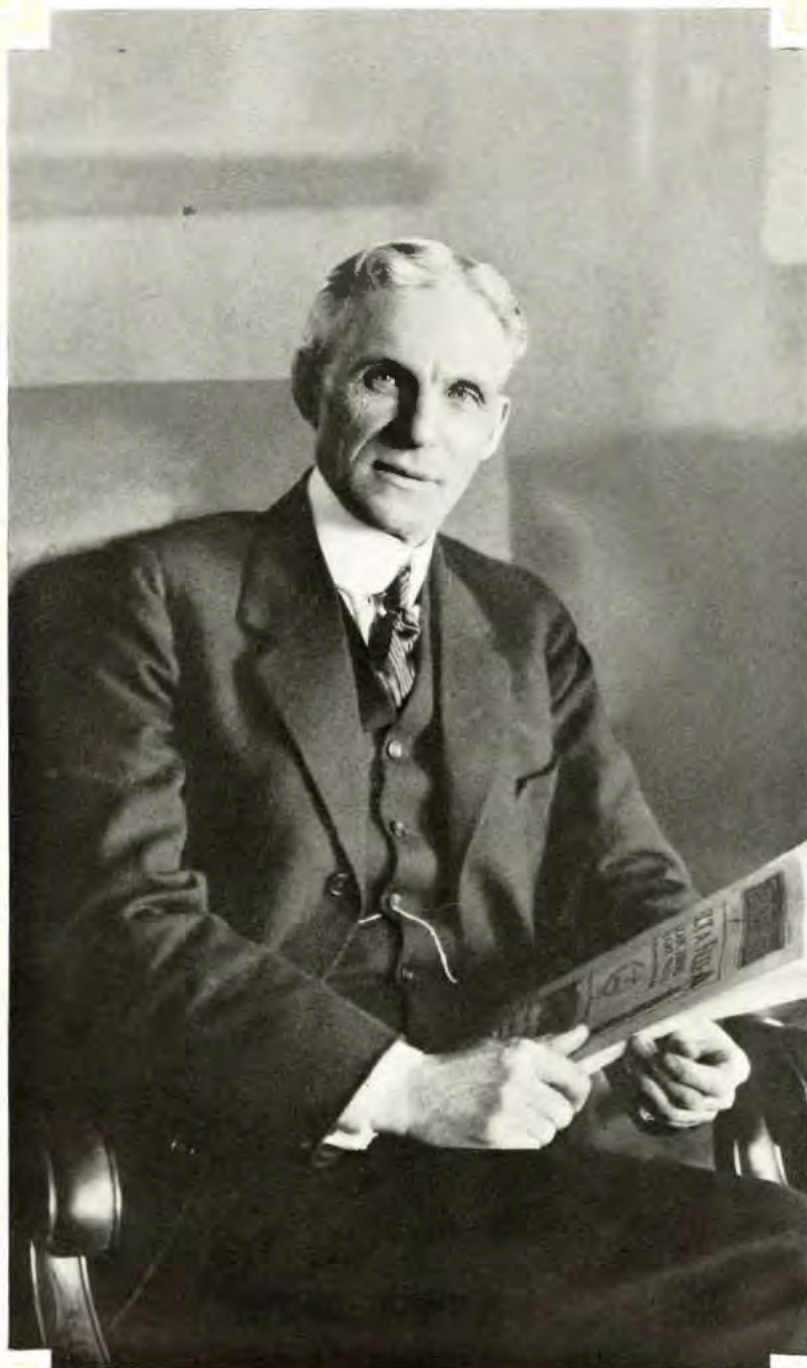


FORD FACTORY FACTS



The Big Power Building is 150 feet wide by 400 feet in length, 300 feet from ground to top of smoke stacks. It required 5,200 tons of structural steel (enough to erect a 20-story "skyscraper"). The huge engines are on the ground floor; boilers on third, and fuel, etc., on upper floors.

*Ford Motor Company
Detroit Michigan*



HENRY FORD

Preface

THE continual march of efficiency throughout the entire Ford factory makes the recital of "factory facts" most difficult. Change is the order of the day because of the unceasing efforts to increase and improve production and reduce the cost. To make Ford cars in larger volume, maintaining the high standards of quality and efficiency. This means that the "factory facts" of today will be different from those of a few months hence. But in this small book are the fundamentals which have brought success and made the Ford factory, in high efficiency and large production, the greatest institution in the automobile world.



The Power House Equipment Includes the Largest Direct Current Control Board in the World

FACTORY FACTS FROM FORD

THE Ford Motor Company is pleased to extend to all visitors the privilege of an inspection of its plant, and for this purpose maintains a staff of experienced guides, who are thoroughly familiar with the activities of the various departments.

Through its product—methods of progressive efficiency in manufacturing, the Ford Profit-Sharing Plan, by which its employes are the best paid workmen in the country—the Ford Motor Company has become a principal point of interest in Detroit and one of national prominence.

A trip to Detroit is not complete without a visit to the Ford factory, and visitors come, not only from all portions of the United States, but from all parts of the world. Many foreign dignitaries, while in this country, have made special trips to Detroit to inspect the Ford factory, and to acquaint themselves with Ford principles of shop practice, with the Ford Profit-Sharing Plan and the Educational Work with employes. As many as 33,128 visitors have been so entertained in a single month. In the summer months from 300 to 1,500 persons are conducted through the plant each day.

It is impossible in the short time which the average visitor can spend in the factory to obtain an adequate idea of the magnitude of the operations or to thoroughly follow the details of the work. Some of the more important processes are set down in this booklet, and from a perusal the reader will gain a reasonable conception of how Ford men, methods and machinery, can produce 750,000, and more, motor cars in a single year. The descriptions are largely those heard from the lips of the guide; the illustrations are glimpses behind the scenes in the Ford shops.

One must first obtain some conception of the magnitude of the plant, taken as a whole. The entire Detroit property comprises a plot of ground containing 305 acres; there are 88.22 acres of floor space actually under roof. The annual business of the Ford Motor Company approximates \$350,000,000 which means that each acre of floor space produces at the rate of \$4,000,000 annually.

The average number of employes is around 36,000 on the factory payroll regularly. Sixty-three nationalities, speaking more than 100 languages and dialects, are to be found in the Ford shops. The wages and share of profits of the factory employes at the present time, average \$4,498.570 per month.

The Administration Building, to which all visitors come first, is a four-story structure and contains the general offices of the Company. It



6,000 H. P. Engine—Showing Starting Devices

is 300 feet long and 65 feet in width. The average number of employees on the salary roll is 950, averaging about \$115,000 a month, exclusive of executives and department managers. At the information desk in the lobby of the Administration Building visitors are welcomed and provided with passes and guides to conduct them through the factory.

* * * * *

Just north of the Administration Building is the big Power House, which supplies the motive element for the entire factory. In the construction of this building, 5,200 tons of structural steel were used, the equivalent necessary to build a modern twenty-story skyscraper.

Nine engines of a combination gas-steam type, housed in this building, develop 54,500 combined horsepower. The engines were designed by Ford engineers, working under the instructions of Mr. Ford, and are the



6,000 H. P. Gas-Steam Engine—Showing Flywheel and Electric Generator

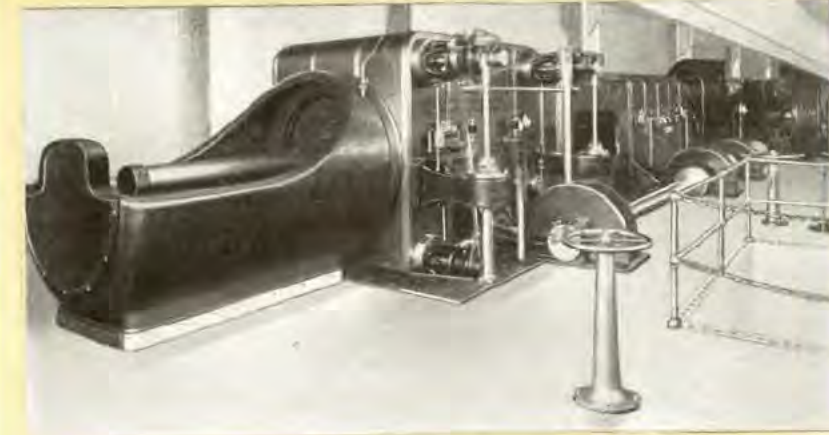
first gas-steam engines to be put to practical use. Another engine, using steam only, develops 2,000 h. p., while several pumping engines increase the total horsepower of the plant to 60,000, probably the largest individual unit of any power-plant in the world, and the only one of its kind in actual operation.

Some idea of the size of the engines is gained from the fact that the stroke is 72 inches, while the gas cylinders are 42 inches in diameter and the steam cylinders are 36 x 68 and 72 inches.

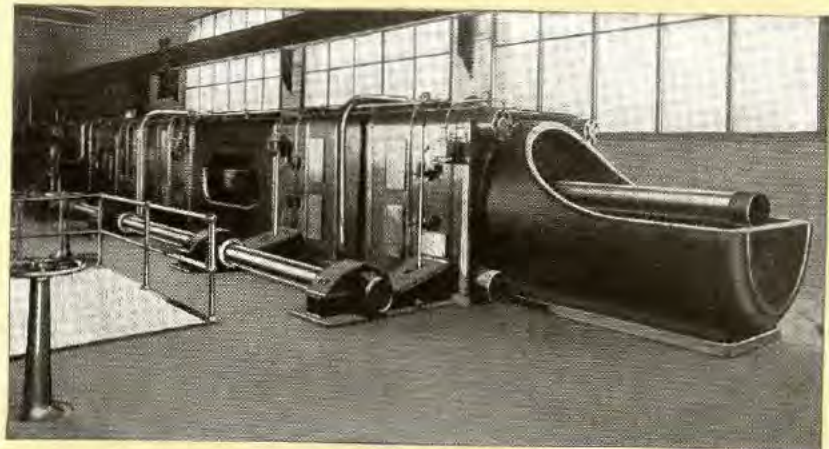
In producing the gas and steam for these engines, only 30 tons of coal per hour are consumed, which speaks well for the efficiency of the engines. In addition to the steam, the daily consumption of producer gas, for power purposes only, is 42,700,000 cubic feet. Added to this figure for power gas, is another item of gas used in the factory for various



Cylinders of 6,000 H. P. Gas-Steam Engine



Steam Cylinders of 6,000 H. P. Engine



Gas Cylinders of 6,000 H. P. Engine

purposes, which averages nearly 2,400,000 cubic feet per day, bringing the per diem consumption of gas by the Company up to 45,100,000 cubic feet.

From the lobby of the Administration Building one enters the garage. Here under a glass roof, supported by steel arches, are 13,400 square feet of floor space, furnishing sufficient parking room for 64 cars belonging to the Company and officials.

The main factory buildings are entered directly from the garage. These buildings are 900 feet long and 800 feet wide, four stories in height and of fireproof construction. They are so designed that every part of the interior receives a full share of daylight.

The heating and ventilating of the factory building is accomplished in a modern, scientific manner. In the winter, warm washed air is forced



The Garage

through long ducts in the floor up into the room. In the summer, cool washed air is handled in the same way, thus providing a clean, healthful atmosphere the year around. By this system the air in the factory is completely changed five times per hour.

Imagine now, that you are in the Ford factory, surrounded by the hum and throb of speeding machinery, the industry and systematic labor of 36,000 or more men, every one a specialist in his work.

At the right as the visitor enters the factory, is seen the Tool Construction department. In the factory are employed approximately 3,000 expert tool makers, machinists and die sinkers. These men are engaged in making new machinery (designed in the Company shops), tools, jigs, fixtures and other machine shop accessories, and repairing those in use.

Overhead are traveling cranes which have a capacity of 10 tons each. These cranes facilitate the work of the Tool Construction department by carrying cumbersome parts of machinery to and from it for alterations and repairs.

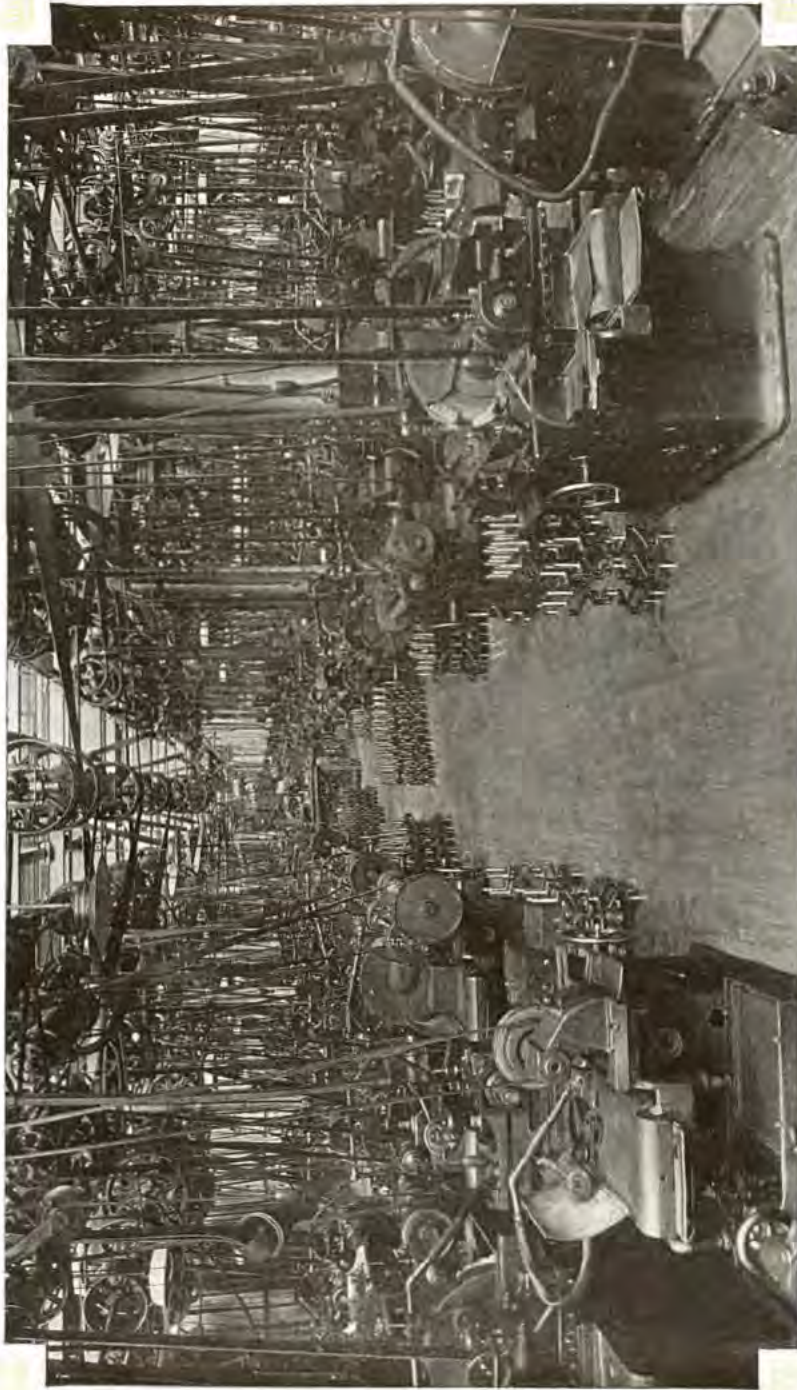
Here the visitor is standing upon the roof of a great tunnel, in which are all the heating, water and steam pipes, and the power cables running from the power house to various parts of the shop. This tunnel is large enough to permit the easy passage of a Ford touring car.

A few steps farther bring one to the Factory Office where the superintendents confer with their foremen, to work out the many various problems that daily confront them. It is here, too, that Mr. Ford meets with the superintendents almost every day, to outline the work of the shops and give his aid to mechanical problems, in which he takes a specially active interest.

Standing in front of the Factory Office, the visitor is doubly impressed with the magnitude of the view before him. In one continuous room, containing approximately 700,000 square feet of floor space, there are, in round numbers, 11,000 machines in actual operation, representing an



Lobby in Main Office—Showing Information Desk on Right



Crankshaft Grinding Department



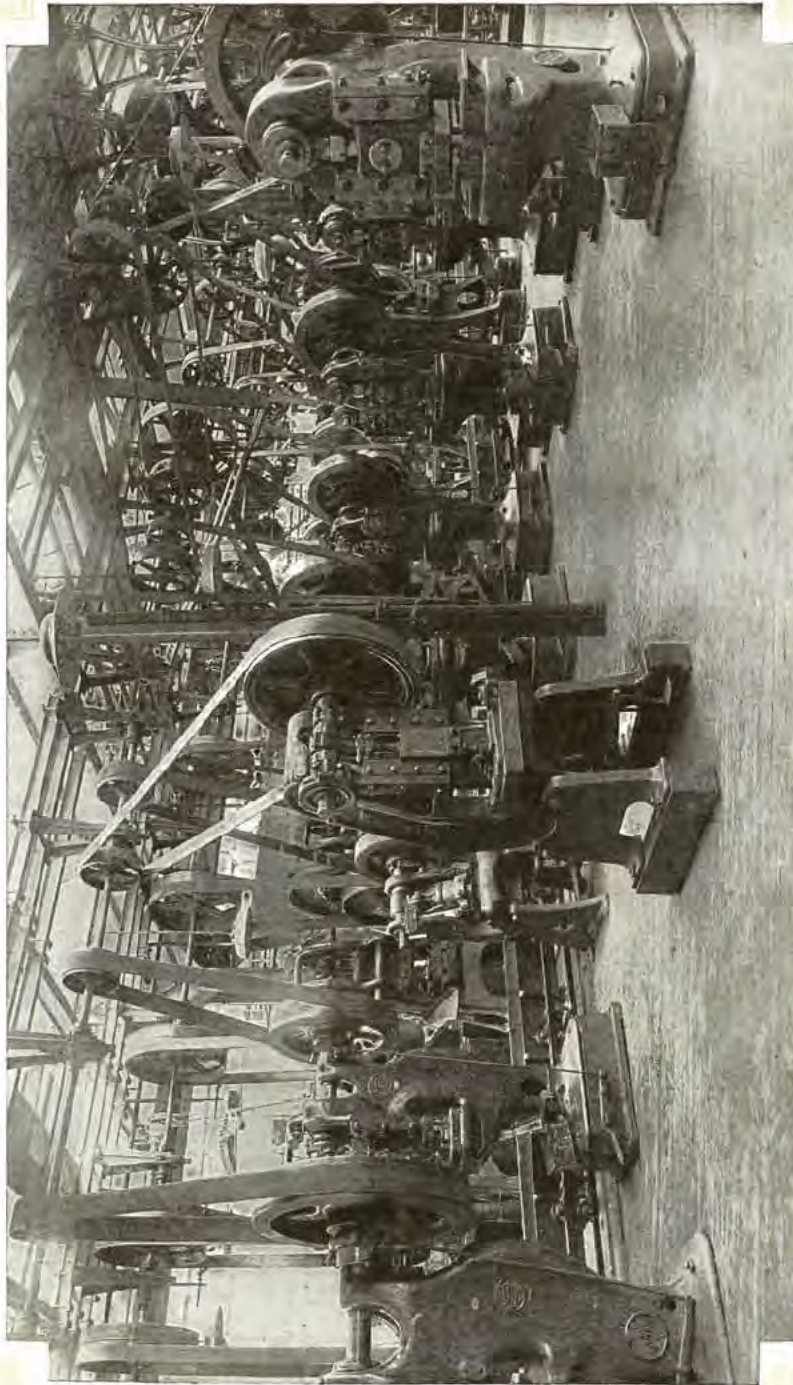
Automatic Screw and Bolt Machines

outlay of about \$7,625,000. These machines use some 3,600 gallons of lubricating oils each day, and 11,000 gallons of cutting fluids are in continuous circulation. For driving the many machines, apart from those equipped with individual electric motors, about fifty miles of leather belting are used, giving the room the appearance of a dense forest.

The visitor who is familiar with machine shop practice will notice at once the peculiar location and setting of machinery in this shop. The machines of a class, or type, are not all located in a single group or unit. Each department contains all of the necessary machinery to complete every operation on each part or piece it produces. To illustrate, a rough forging or casting is started in a department at one point, and after passing through the machines doing the required operations, it leaves this



Factory Yard



Pressed Steel Department—Small Parts



A Section of the Ford Emergency Hospital

department in a finished condition, ready to be assembled into the car. Such a system necessitates the grouping together of many different kinds of machines, as well as including brazing furnaces, cyanide furnaces and other special units (most generally found in separate buildings). Chutes run from one machine to another, so that a workman can transport a part from his operation to the next one by gravity.

The results of this transportation system are remarkable, making a big saving in trucking expense, loss of material and the absence of usual delays.



A Seven-Bed Ward in Ford Emergency Hospital

As the visitor passes down through the machine shop, he particularly notices the sanitary conditions of the plant. There is a department, enrolling about 665 men, whose duties are to keep the floors swept clean, the windows washed, in fact to keep the sanitary conditions surrounding the workmen as nearly perfect as possible. The floors of the entire plant are scrubbed at least once a week, with hot water and a strong solution of alkali, which removes the grease. Another department of about 27 men does nothing but paint the walls and ceilings of the factory, keeping everything fresh and clean.

In this building is the factory laboratory with its equipment of delicate instruments and staff of white-coated chemists, where exhaustive tests are applied to determine the quality of the material which enters into the construction of Ford cars.

Owing to the distinctive transmission of the Ford, the three bands are among the most important parts of the construction. So, there is a machine which determines the wearing qualities of Ford bands and the linings, testing them at all speeds and under varying loads. Only the fit survive.

Springs are tested both at the steel mill and on their arrival at the factory. One machine gives the spring leaf a sort of vibratory massage, to see if it can stand rapid vibrations for the required length of time. In another machine, the leaf is bent around a heavy steel plug, to determine the angle of breaking. Those that break fall by the wayside.

Even the solder used on the radiators is now given a vibratory test to make sure that it will hold firm under the exceptional conditions the Ford car is built to meet.

Steel in the great rolling-mills, still in billet form, must conform to very definite requirements, if it is to become a part of Ford cars. That is why nearly every day a shipment of samples taken from each "heat" at the steel mills arrives at the laboratory in Detroit to be analyzed by the staff of chemists and physicists.

The results determine the fate of the steel. If it meets the requirements in every degree, the rolling-mills are instructed to proceed, and the rolled



A View in Employment Office

product goes to forging plants, sheet mills and elsewhere. From each of these points in turn samples travel to the home laboratory, and careful checks are made of each bit of material furnished.

There is the machine for testing bearing metals, while paints and varnishes used on Ford cars are subject to the most exacting requirements, and the orders to use are given only after samples submitted have satisfied the most thorough tests for color, covering quality, hardness, elasticity, finish, adhesiveness and durability. The Laboratory department assures Ford owners of an absolutely quality product.



Factory Service Office



Chassis Truck



Main Crane-Way—Where Rough Stock is Handled and Stored

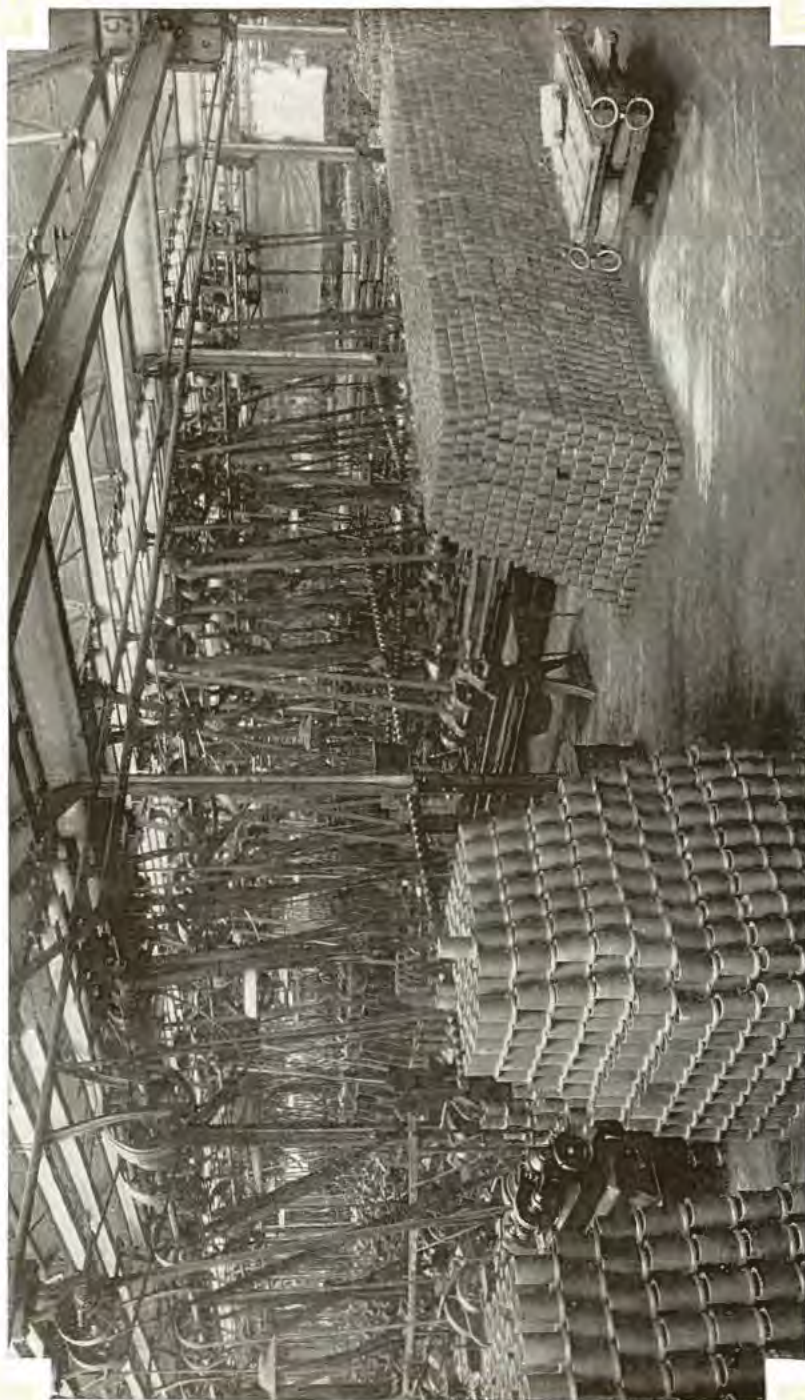


Rear Axle Assembly

The inter-departmental transportation of materials is handled by chassis trucks, tractors and electric trucks; 52 chassis trucks and 19 tractors, each propelled by the regular Ford Model T motor, along with 10 electric trucks make up the present "moving equipment." These vehicles are handling all of the materials transportation formerly done by monorail system and hand trucks at the remarkable saving in man-power of 834 employes as against 1600 under the old system. Furthermore, this saving has been made in the face of a constantly increasing production culminating in 83,706 cars for the month of May, 1917, with the corresponding increase in materials handled which the growing output entails. These chassis, tractor and power trucks supply the utmost in both capacity and mobility of transportation.

After leaving the Superintendent's office, a turn to the right brings one to the Paymaster's office, where each employe of the factory receives his pay every two weeks. In this connection it is interesting to note that in the Ford factory every day is pay-day. The number of employes is so large that it would be quite impossible to pay them all in one day, so each man is classified by letter and number, each group having its own pay-day.

Farther along is the Employment office. Besides hiring men, this office is a clearing house for Ford employes, and all transfers and discharges are handled through it. Some time ago, the Company came to the conclusion that a majority of the discharges were caused by a lack of understanding between the employe and his foreman, or because an employe had been placed at work for which he was mentally or physically unfit. Insofar as possible, the latter trouble is obviated by a strict physical examination, to which all applicants must submit at the time of hiring. A man with weak lungs is not put at dusty or confining work; a man with a weak heart is not placed on a heavy lifting job. And now, when a foreman wishes to discharge an employe, he sends the man, with a written card, to the Employment office. As a rule, the man returns to the same department, often to the same work, but with an ability to see the other fellow's side,



Piston Machining Department



Cylinder Machining Department

and a determination to make good. Sometimes he is transferred to another department, on work for which he is better fitted.

The Medical Examining rooms attached to the Employment office, are a branch of the Ford Emergency Hospital, located within the factory, and which cares for the physical well-being of the more than 36,000 employees in the treatment of injuries received through accidents.

It is a completely equipped twenty-room institution including a seven-bed ward, and with six outlying first aid stations situated throughout the factory. Everything which a modern hospital can use is installed in this



Motor Block Test



Motor Assembly



Transmission Cover Department

department, including an X-ray machine, pulmotor, operating table and electrical appliances, as well as improved surgical instruments, to enable the surgeons to cope with any accident. There are 68 members of the hospital staff, including nine regular doctors and several first aid nurses.

No matter how apparently trivial the accident—a cut finger, a particle in the eye, or mishaps of a like nature—if blood is drawn, the individual is required to present himself immediately at the main hospital or first aid station for proper medical attention. By these measures the possibility of serious complications with the resulting economic loss both to the workman and the Company is forestalled. The wisdom of the plan is evident from the hospital records which show that, during the year 1916, with an average daily working force of more than 30,000 men, and in spite of the number of accidents of all kinds which naturally occurred, only twenty men, after receiving medical attention, failed to return to work the following day.

It is to the hospital that all applications from employees come for transfer, on account of physical reasons, from their present employment to some other department in the factory. Each request is carefully considered on its merit, and where good reasons for the application are evident, effort is made to place the employee at the work most compatible with his physical abilities.

In the hospital an employee may be treated for general debility as well as accident, since the Company considers it better for the employee (and for the Company) to be able to remain at work by receiving medical attention than to have him lay off for lack of it.

Associated with the work of the Medical department is the Safety department, situated next to the Ford Emergency Hospital. About fifteen men have the important task of stepping in between the men on the one hand and the Medical department on the other—that is, of preventing injuries to the employees.

Generally speaking, Safety work with Ford employees is carried on along two different lines, the first being the installation of guards on machines

and other mechanical means, while the second is education along Safety lines. To those familiar with machinery an inspection of the plant will show that Ford workers are well protected against injury wherever a positive safeguard can be devised. So thoroughly has this work been done that many Ford-designed guards are now regular equipment with several standard makes of factory machines.

The educational work consists of Bulletin board displays, warning the men against different hazards, a regular monthly Safety publication devoted to the interests of Ford men from the Safety point of view and motion picture "shows" given daily. These pictures, taken in the Ford shops, show the various methods of guarding machines, point out the sources of many common accidents and indicate the best way to prevent them.

Safety work concerns not only the loss of fingers and injuries of this nature, but undertakes to protect the health of the men as well. Working conditions are made as nearly ideal as possible. The entire factory interior is painted white and kept scrupulously clean. Washed air at just the right temperature for comfort and efficient work is forced into every part of the factory, while drinking water, filtered and properly cooled, is available at sanitary drinking fountains scattered at frequent intervals about the plant. Suction systems remove the dust from grinding wheels and other points where dust arises.

In the past year the number of accidents serious enough to cause loss of time from work has been reduced one-half until a lost-time record of but 2.2 accidents per thousand men per month has been attained. Not a single fatal accident occurred in the Ford factory during 1916.

The Factory Service office houses a department which is responsible for the well-being of factory employees. Of the 200 men in the division, the majority are employed in the capacities of watchmen, to take care of the many entrances and exits of the plant and also to inspect the fire-fighting equipment which is distributed over the entire plant.

This fire-fighting equipment is being continually added to as the plant expands and now embraces more than 2½ miles of large hose, 13,800 feet of smaller hose, and 4,100 feet of hose attached to chemical tanks. There



Inspection of Front Axle after Machining



Installing Motor on Final Assembly Line

are 1,661 three-gallon chemical extinguishers and 82 forty-gallon chemical tanks, mounted on wheels. Surrounding the plant are 33 water hydrants equipped to handle two and three lines of hose, while inside the plant are nine hose-houses fully equipped. Pyrenes to the number of 373 are distributed about the departments for combatting electrical fires.

A new system of fire alarm and factory patrol calls, considered the most complete and elaborate in the country, is installed in the factory.

The system provides connections for 400 specially built call stations, placed about the factory at points 250 feet apart.

The exact minute, hour, day, month and year as well as the box from which the call comes is automatically recorded on the tape. The call is also sent instantly to the pen registers situated in the Superintendent's office, the Factory Service office, the Fire department headquarters and the Chief Engineer's office.

When a general fire alarm comes in, the call bells, located at frequent intervals about the plant, are rung automatically. The number of the box from which the alarm comes, is indicated by the manner in which the bell is rung. The man at the board is a busy individual during the night when the Service men are on their "beats," for he receives a call every twelve seconds, besides locating his men at different points about the plant in case they are needed.

With this system, the work of patrolling the many acres of floor space in the Ford plant is made most efficient, while the fire alarm system is more effective and up-to-date than at any other place in the country, even including the municipal fire and police call systems in New York and Chicago.

Back of all other preparation is the sprinkler system, composed of water pipes hung next to the ceiling in all buildings and so designed that there is a sprinkler head every ten feet. Should the temperature in a room for any reason reach 160 degrees, the sprinkler heads in the immediate vicinity will open automatically, spraying out water which is piped from two tanks having a combined capacity of 600,000 gallons.



Final Assembly



Mechanical Starter—End of Final Assembly

In addition to its other duties, the Factory Service department has charge of the Lost and Found articles. Since this work was included, almost every sort of personal property, from key-rings to motor-cycles have been found and restored to the rightful owners.

Extending lengthwise of the main building is the crane-way, devoted exclusively to the storage of parts in the rough, or semi-finished condition. This crane-way contains over 67,000 square feet of floor space. Overhead are two 5-ton electric cranes, so arranged that they can unload material from railway cars at one end of the crane-way and deposit it in a position to be picked up by the chassis trucks, or placed in bins or barrels for storage. An interesting item in regard to these cranes is that the load can be moved in three directions at one time, this being accomplished by means of the small car hoist. While the crane proper is moving through the crane-way, this car travels across the crane, and at the same time raises or lowers whatever may be suspended from it.

In the crane-way will be noticed a number of inspectors, who are gauging and testing various parts and materials.

Passing by the crane-way one comes to the rear axle unit assembly. The manufacturing policy of the Company is to make unit assemblies in different departments and deliver them to the loading docks from where they are shipped to the several assembly plants. This is one of the methods which has enabled the main factory, and its various branch assembly plants, to assemble and ship 3,196 finished cars in a day of eight hours.

In the unit assembly departments are received the finished parts from the machine shop. These parts are assembled on progressive traveling tracks. By this system each assembler, or operator, performs one operation only, and repeats this operation on every unit passing through the department. As a result, every operator soon becomes a specialist, and specialization is the fundamental principle of the entire Ford organization.

The economic results from this system have been wonderful, as will be shown in some of the departments yet to be described. It saves

floor space, and eliminates congestion due to trucking, as large quantities of material are piled along each side of the conveyor, and the unit in process of assembling is moved to the stock, rather than each individual piece of the assembly being distributed at different places.

The conveyor system as applied to the transportation of material, unfinished and finished, between departments, is well exemplified in the rear axle assembly.

This assembly is completed on the third floor of a six-story factory building. On the fourth floor all of the separate operations on the drive shaft are handled and the completed part delivered to the third floor by chain conveyor. On the second floor the differential is completely built, and is transported by an endless chain elevator to the third floor to combine with the drive shaft assembly and other parts to form the complete rear axle system.

This final assembly is handled on four parallel conveyor assembly lines. After a careful inspection at the end of the lines, the rear axles are placed on an elevator which delivers them to the waiting freight cars on the ground floor. By these methods the maximum of production is achieved with the least expenditure of time and labor.

All material and unit assemblies move in one direction—that is, toward the loading docks.

To the left is the department that makes the magnets for the special Ford magneto, and also that in which the transmission is assembled on a conveyor track, ending in an automatic elevator which transports the completed transmission to the Motor Assembly line.

In the rear of the Transmission department is the Motor Assembly. This assembly begins at the point where the cylinder machine shop ends, so that the movement of the cylinder from the time it arrives in the machine shop until it goes into the finished motor, is continuous. In the machining of the cylinder castings, and the operation of assembling the motor, close inspection of the work is noticeable. By the use of the



Laboratory



View in Grinding Department, Showing the Suction Pipes Which Remove Emery Dust

assembling line, better inspection is possible, than where one or two men assemble the entire motor. In addition to the inspection in the assembly, there are three points of trial, or working or testing, which show up any defects in the motor.

The final operation in the motor assembly line is the block test, where the motor is inspected and tested before being assembled into the chassis. On the block test, the motor is driven by an electric motor for the final O.K. and tryout.

At the end of this testing period, if no defect has developed, the motor is approved and is ready for shipment.

The Motor department just described furnishes an interesting illustration of the economy of the moving assembling system. Before the present system was installed about 1,100 employees were required in this department, working a 9-hour day to build 1,000 motors. Today, as a direct result of the new methods of assembling, and the efficiency gained through the Profit-Sharing with employees, about 1,400 men are assembling more than 3,000 motors daily.

The assembling of the front axle, dash and radiator are fully as interesting as the unit just described, but space will not permit a detailed explanation of them.

Perhaps the most interesting department in the whole factory, to the visitor, is the Final Assembly.

The trend of the Company's policy is that the main factory shall manufacture the parts for Ford cars, which parts are shipped to the assembling plants located throughout the country at strategic points of distribution, where the parts are assembled into the completed cars to supply the surrounding territories. Accordingly, while the factory produces parts to build more than 3,000 cars a day, only a small number of cars are completely assembled in the home plant.

This factory final assembly, while comparatively small in volume of output, accomplishes several valuable objects. In the first place, the



Crane-Way in New Six-Story Building—Showing Walked-in Loading Platforms



Roof Heating System

parts which enter into the factory assembled cars, from the smallest screw to the cylinder casting, are selected indiscriminately from the output of the particular departments, thus establishing a constant check in addition to the regular departmental inspection, on the accuracy of the parts coming through.

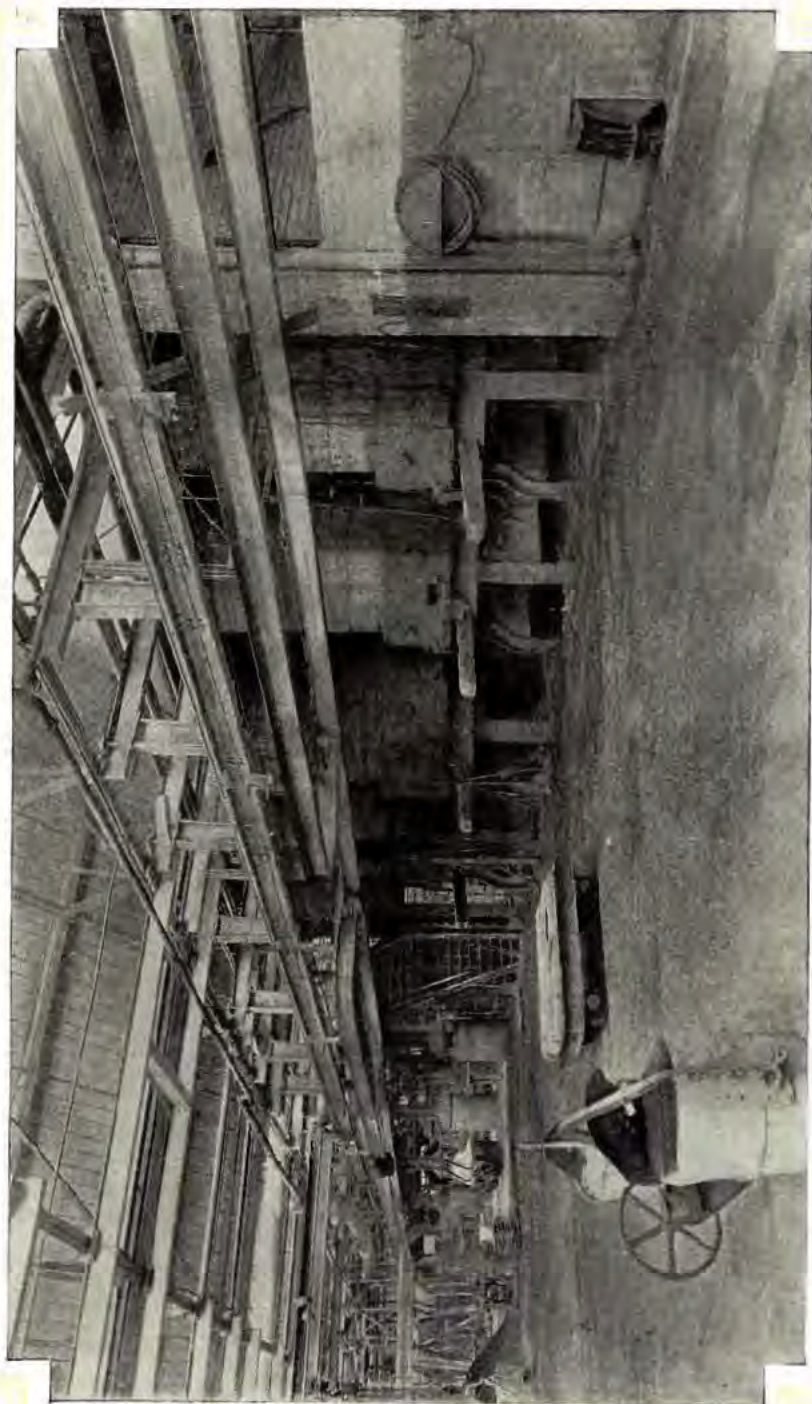
Furthermore, the machinery and labor operations of the factory assembly line are duplicated in each of the assembly plants, so that any labor-saving devices or methods in assembly, which may be originated, can be tried out at the factory and their merit decided upon.

In this division, all the assembled units meet the assembly conveyor at the point where they are needed. At the start of the track a front axle unit, assembled in the department, a rear axle unit and a frame unit are combined. This assembly is then started in motion by means of a chain conveyor, and as it moves down the room at a constant speed, each man adds one part to the growing car or does one operation, which is assigned to him, so that when the car reaches the end of the line, it is ready to run on its own power. Each parts assembly meets the final assembly line at the point where it is combined with the growing car.

In following the Final Assembly line from the point where the chain conveyor engages the frame and axles, the visitor is impressed with the dispatch with which every movement is executed. Next in order the gasoline tank is installed, each tank having received one gallon of gasoline.

After the gasoline tank is assembled, a number of small units are added, such as the hand brake control lever, gasoline feed pipe, and fender irons, until the point is reached at which the motor is placed in the frame. The ease with which this is performed furnishes one of the best illustrations of the interchangeability of Ford parts.

Ordinarily the setting of a motor in the frame is a long operation, but in the Ford assembly the motor is elevated by a hoist, and lowered into place while the chassis is moving along the conveyor track. From this point, other small parts are added, and bolts tightened, until the growing chassis reaches the point where the dash unit is assembled and added to the car. The dash unit includes the dash, complete steering gear, coil, horn, and all wiring ready to be attached to the motor, so that its installation is rapid.



Foundry Cupolas



Making Cylinder Moulds

Further along, such parts as the exhaust pipe, muffler, and side pans for the motor are quickly fastened in place, and the wheels are brought into the assembly. There will be noticed the horizontal chutes, extending at right angles to the assembly line. Along these come the wheels, with the tires mounted and inflated to the proper pressure. Then the chassis moves to the point where the radiator is installed.

At the end of the assembly line, the rear wheels on the finished car drop into a set of revolving grooved wheels, sunk into the concrete floor, and driven by an overhead motor. Two ends are accomplished by this operation. First, when the wheels of the car revolve with the grooved wheels, this motion is transmitted to the differential, through the drive shaft to the motor, limbering up all these parts. The second is that while the parts are being limbered up, the switch is turned on and the motor started.

The tops and bodies installed on the factory-assembled cars are built up on a moving conveyor in the final assembly department. As the completed chassis reaches the end of the assembly line, the body is swung into position by a chain hoist moving on an overhead track, the top installed and a complete new Ford car has been built.

From the Final Assembly department the complete cars are driven under their own power to the Detroit assembly plant of the Company, and combined with the output of that branch.

The factory production is considerably augmented by the output of the Ford Branch Factories throughout the country. These will be described more fully later on. With the aid of these plants it was possible for the Company to produce and actually sell 88,706 Ford cars during the month of May, 1917.

In the rear of the main plant are four six-story buildings officially designated W, X, Y and Z buildings, each 60 feet wide by 845 feet long, built parallel to each other and connected by a crane-way 40 feet wide, the full length and height of the buildings.



Moulding Machines and Overhead Sand Hoppers



Pouring Molten Iron into Cylinder Moulds

These buildings are of reinforced concrete, steel doors and sash being used throughout. Their erection increased the factory floor space by 1,376,560 square feet, and involved an expenditure of about \$2,500,000.

Paralleling these four six-story buildings, and connected by covered courts, are four single story structures. Building No. 5, which adjoins Z building, is 60 feet wide and 1,140 feet long; Nos. 3 and 4 each measure 64 feet in width by 1,200 feet in depth; while Nos. 1 and 2 are each 72 feet by 363 feet. These five buildings with the connecting courts add 465,000 square feet to the factory floor space.



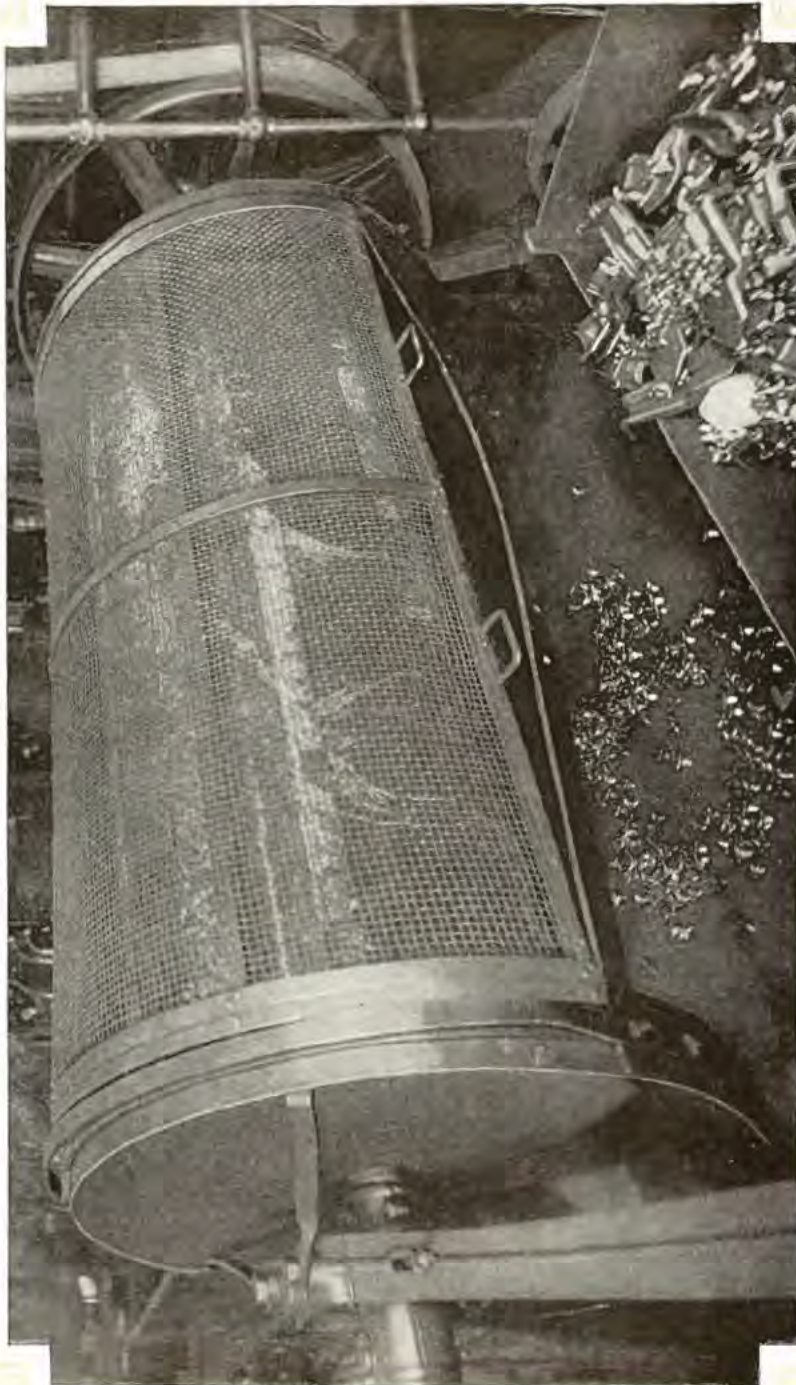
Continuous Core Oven



LOOKING FROM THE BALCONY DOWN THE 400 FEET OF THE FRONT GROUND FLOOR OF THE BIG POWER HOUSE

Note beautiful tiled floors. Walls and columns faced with white enamel brick, and all other surfaces painted white. Three 50-ton cranes, with parallel runways extending full length of building. The huge engines are composite gas-steam type (the only ones of the kind in use), and are rated 6,000 h.p. each. (A brief description of one will answer for all): the gas side has tandem cylinders, 42x72 in., and the steam side tandem compound cylinders, 36x68 and 72 in. Between the two engines are mounted a 100-ton flywheel and a 4,000 k.w. 250-volt direct current generator, the latter being of unusual size owing to a speed of 80 r.p.m. The approximate weight of this dual gas-steam engine is 1,700,000 pounds,—the steam engine weighing 700,000 and the gas one 600,000, and the generator and flywheel 200,000 pounds each. The bed

on the steam side weighs 150,000 and on the gas side 140,000 pounds. The crankshaft is 25 ft. 2 in. long and 31 in. in diameter at the bearings and 34 in. for the flywheel, weighing 72,000 pounds; the crank disk weighs 23,000 pounds and the connecting rod, with boxes, 10,000 pounds. The gas engine piston rods weigh 14,000 and each piston 8,500 pounds, while the steam engine piston rods weigh 10,300 pounds and the main crosshead, on either engine, complete with shoes, pin and box, 6,000 pounds. Over all the engine measures 32 ft. in width with length of 72 ft., occupying a floor space of 2,304 square ft. The generator extends 14 ft. 5 in. above the floor and 11 ft. underneath. There are nine of these gas-steam engines—and, in addition, one smaller steam engine and four great pumps.



Tumbling Cylinder

North of the main factory buildings is the new Tool Construction building which further increases the total floor space by 96,000 square feet.

The average visitor has no conception of the problem involved in distributing to the various assembling plants all of the necessary parts to build more than 700,000 Ford cars in a single year, and to keep the quantity and variety of parts shipments so balanced that an assembly plant shall not be handicapped in the steady flow of output by a shortage in the supply of any particular part.

As stated previously, all parts assemblies move steadily towards the loading platforms, where they are placed in waiting freight cars. In this connection, it required 127,600 freight cars to carry Ford business in 1916.

Seven railroad tracks enter to the full length of the factory buildings, and are each paralleled by loading platforms. To these platforms the assembly parts are delivered, assembled in units or knock-down as the case may be, and crated or uncrated, depending upon the manner in which they are to be packed for shipment.

Assembled motors are packed in units designated as "100's," miscellaneous parts are packed in "1,000's," that is, the parts required to build 1,000 Ford cars. It requires over 200 different boxes to handle a single "1,000" and there is an interesting study of efficient handling and economy of space in the distance these boxes travel from the raw lumber to the finished crate, sealed and packed in a freight car. The entire evolution takes place within a distance of about 30 feet.

The boiler house, which furnishes the steam for heating the entire plant, is located in the rear of these buildings. The method of heating is worthy of particular interest, as the air is forced over coils of steam pipes located in pent houses on the roofs, and from this point is driven down into the various rooms through the hollow columns which support the floors. In the summer, cool washed air is forced down through these same columns, maintaining a normal, even temperature, compatible with the state of the weather.

Just beyond the loading docks is the Foundry.

The Foundry is one of the most interesting divisions of the entire Ford Plant, and ranks, perhaps, as one of the most unique in the country, as far as practice and equipment are concerned. As a general rule foundry



Breaking the Cylinder Moulds



Quenching Steel Forgings in Heat-Treatment Operation



Carbonizing Furnaces

practice has not shown the changes in an increase of production that machine departments have, but in the Ford foundry, due to standardization of parts and specialization on the one car, it has been possible to devise and install the unique equipment now used, which brings this department down the plane of expense and up in the labor-saving efficiency prevailing throughout the entire plant.

This department works 24 hours a day, in three shifts of 8 hours each; iron is being melted and poured continuously during the day and first night shifts. An average of over 550 tons of iron is poured daily, and 623 tons of gray iron have been poured in a single day.

All this iron is poured on over-head power driven mould carriers, which travel about 12 feet per minute. These mould carriers have suspended from them pendulum-like arms, on the lower end of which is a shelf. The moulders who make the moulds for the castings are stationed alongside of these conveyors; the moulding sand with which they fill the flasks is stored overhead in a hopper, the gate of which discharges directly onto the moulding machine. There are two moulders for each part, one making the "drag," or lower part of the mould, the other making the "cope," or the upper half. When these two halves of the mould are finished they are put together, or "closed," on the shelf of the conveyor, which carries the finished mould to the man who pours the molten metal. The molten metal is brought to this man's station by means of large ladles, suspended on a trolley on an I-beam track, running from the cupola through the entire length of the foundry. This does away with the necessity of carrying the ladle of iron a long distance, thus saving much time and lessening the liability to accidents.

While the mould is being poured it is in constant motion, and continues so from the pouring station to the end of the conveyor, where the casting is shaken out of the sand. The casting is thrown to one side to cool, the flasks are hung upon hooks on the arm of the conveyor, to be returned to the moulder, and the sand drops through a grating in the



Restriking or Straightening Crankshafts on Steam Hammers



Cyanide Pots and Quenching Tanks



Pyrometers from which the Temperatures of the Furnaces are Regulated

floor onto a belt conveyor; on this conveyor it is dropped on an elevator, raised overhead and "cut," or mixed with new sand, and passed on to another conveyor, which deposits it in the hoppers above referred to, ready for the moulder's use. In all this journey the sand is never shoveled.

In casting cylinders, on account of their size and the care needed in setting the cores, a different style conveyor is used. The moulder, instead of putting the mould on a pendulum conveyor, places it upon a track, where it is moved by means of a chain. During this travel the various cores are set, and the moulds closed, moving to the point where the men



Snagging Wheels



This Belt Carries the Finished Steel Parts and Scrap from the Punch Presses

with large ladles pour the mould. From this point it is transferred to another track. As it travels down this track, the casting is given an opportunity to "set," or cool. At the end of this line it is shaken out over a grating, and the sand handled in the same manner as on the smaller conveyors.

As soon as the castings have cooled sufficiently they are put into great horizontal cylinders, called tumblers. Small metal stars are placed in these tumblers with the castings, and when the tumbler is full it is started revolving. This shakes all the sand from the castings and they come out clean and bright. This process continues for some time, depending on the size of the castings. Near the tumblers are the grinding wheels, upon which are ground off the rough edges and the castings put into shape for the machine shop. They are sorted, inspected and counted before removing from the foundry.

Another interesting feature is the handling of sand in the core room. The sand is handled entirely in a gallery built above the room, equipped with storage bins and sand mixers. Over each core-maker's bench is a hopper, connected with the floor of the gallery. When the sand is mixed it is dropped through holes in the floor into the hoppers, which deposit the sand on the bench convenient for the core-maker.

This core room contains perhaps the only endless chain core oven in this country in which are two endless chain conveyors. These have hanging upon them large sets of shelves, upon which the cores are placed for baking. It is impossible to overbake or underbake a core, as the rate of travel of the conveyor is fixed at a speed which leaves the core in the oven the correct length of time.

All the aluminum parts of the Ford car, as well as a large proportion of the brass, are also cast in this foundry.

The Ford process of heat-treating steel forgings before they are machined is one of the most scientific and accurate features in the manufacture of the Ford car. The famous Ford Vanadium steel is used throughout the construction of the car. It has been found from long and deep experimental work by the Ford Engineers that the structural condition of steel may be changed by the application of heat, and with certain conditions ascertained, by bringing a piece of steel to a certain temperature, and then setting the molecular condition in the steel by sudden cooling, or quenching, that the steel of a crankshaft can be made to stand impact, that the steel of a front axle can be made a most efficient agent to withstand vibration. Practically every forging in the Ford car is made of a special steel, for which a special formula of heat-treating has been worked out, in accordance with the work or strain the part must stand in the finished car.

It is by the use of this high grade, scientifically heat-treated Ford Vanadium steel that it is possible for the Company to manufacture a light weight car, which has the ability to stand up under severe usage, and to sell at the low price at which it is sold today.

The Heat-Treating department contains about 200 large furnaces, which consume 35,000 gallons of fuel oil per day. It is into these furnaces that the various forgings are placed for heat-treating. In each one is introduced a pyrometer, connected electrically with a switchboard located in a separate building. This switchboard is very similar to those used in telephone exchanges. The operator takes the temperature reading of every furnace on his board about every minute. The furnace foreman is

notified by the operator as to the temperature by means of small colored electric lights, located above the furnace. The lighting of all the colors at the same time is the signal to pull the heat, or in other words, extinguish the fires and empty the furnace. After the required heat has been reached, the forgings are allowed to either cool in the air, be covered with pulverized mica, or quenched in a special solution, as the case may require.

In this department are also located many grinding wheels and tumbling barrels, similar to those used in the foundry, so that the various forgings may be put in first-class condition before they are laid down in the machine shop.

The operations in the manufacture of the crank case, or engine pan, of the Ford motor is of interest for several reasons, and the visitor has the opportunity of viewing these processes.

The crank case in itself is interesting because it is made from drawn sheet steel, instead of cast aluminum, as was once thought necessary.

The presses on which these crank cases are drawn are especially worthy of note, for they weigh about 50 tons each, and exert a downward pressure of about 900 tons. It is necessary that this drawing be made in four operations; the first and second are particularly interesting, on account of their depths, which are $5\frac{1}{2}$ and $9\frac{1}{8}$ inches, respectively. After each drawing operation it has been found necessary that the case be annealed, to restore the strained or calloused surface produced at certain points by contact with the dies, to a soft ductile condition, to conform to the balance of the case, or in other words, to produce a homogeneous condition of the surface.

This annealing is accomplished by a furnace through which the cases are moved by a chain conveyor onto an elevator which raises them up through the roof, and down again, depositing them near the press which is to perform the next drawing operation. While moving on this elevator the cases are cooled so that they can be handled as soon as they are lowered.

After the drawing operations have been completed, the case is trimmed; the side arms, front end supports, radius rod support, are riveted and brazed to it, making a case as strong and solid, and yet as light, as it is possible to make.

Near these crank case presses are located several hundred punch and drawing presses of various sizes. These presses blank out and draw from sheet steel of special analysis, a large number of parts (which in ordinary practice are made from castings or forgings), carrying the same strength, but also very much lighter in weight.

The interesting feature of this department is the arrangement of the presses, which enables all finished parts, as well as the scrap steel, to be deposited upon a traveling belt conveyor, at the end of which are stationed men who sort the various parts, and place them in proper receptacles. By this arrangement it is possible to place the presses closer together than could be done if it were necessary to leave aisles large enough for trucking the material to and from the presses, effecting a great saving in floor space.

The visitor has now had the opportunity of viewing all the more important operations in the manufacture of Ford Motor Cars.

While the Company has specialized in methods, material and machinery, and a single model of car, it is also, through its Educational department and the Ford Profit-Sharing Plan, specializing in MEN.



A Russian Family—Just as They Stepped from the Train in Detroit

EDUCATIONAL AND PROFIT-SHARING

IT is not alone the treatment of material and machinery that has brought the Ford Motor Company to its present position. It is in a large part the treatment of men. The Company is not building its cars at the expense of its workmen. The crowning glory of its achievement is that success has been built upon constructive, not destructive methods. Hand in hand with the building up of its business has gone the building up of men. Today Ford men constitute not only the largest body of workmen in the world employed in one place, but because of their relations to the Company and the conditions under which they work, they are the most interesting body of workmen in the world.

Neither the usual way of making automobiles nor the usual way of dealing with men was good enough for the Ford Motor Company. It was usual once to light a candle to go to bed by with a twisted paper lighter. It was usual to travel in ox-carts. It was usual once to build automobiles with two cylinders and a door in the middle of the back seat. Those are by-gone days.

It was usual to hire 40,000 men a year in order to maintain a working force of 10,000. That was in 1913, the year before profit-sharing started. In that year, with an average working force of 13,632, the number of employes who left the Ford Motor Company was 50,418. When profit-sharing was three years old, there was a working force of 40,903, and the number of men leaving the employ of the Company for all reasons during the year was 7,512. At the old usual rate, the number would have been over 150,000.



Typical Case of Poverty, Relieved by the Hiring of an Unemployed Man by the Company

Once it was usual for manufacturers to pay their men as little as possible and then to forget them. Now it is becoming usual to consider what is right for men. The Ford Plan is one of the big landmarks on the way of progress. The outstanding features of this plan may be named as follows:

1. An eight-hour working day.
2. A share in the profits added regularly to the wages in the pay envelope.
3. Working conditions that promote the health, safety and comfort of workers.



Advisor Suggesting to the Housewife by Photographs Changes in Home Conditions



Education Will Do More Lasting Good Than Store Polish for This Kitchen

4. Steady employment through the removal of the power of arbitrary discharge from foremen.
5. Department of Education, together with legal and medical bureaus, devoted to the care and protection of the men in all their interests, and the maintenance of the personal relationship.

The work of the Ford Plan is being carried on by the Department of Education. This used to be called the Sociological department. It was too human for such a name. The men who visit the homes are Advisors, not investigators as at first.



Improvement in Home Conditions of the Above Family Shown by Second Survey



Undesirable Home Surroundings Found on First Survey

On January 12, 1917, the Third Anniversary of profit-sharing, there were 247 men doing the work of this department. Of this number 144 were Advisors, 69 at the home plant and 75 at the various branches. An office force of 80 men, including the department executives and 19 interpreters is required besides four men who spend all their time looking up absentees.

In addition to this force, there are nine men from the staff of the Legal department who devote a large share of their time to protecting the interests of the employes. Legal counsel, as well as advice regarding real estate and investments, is given gratis to between 150 and 200 employes daily. Contracts are inspected, property values appraised, titles to property examined, and the interests of the men protected.

There is also the Medical department where 9 physicians, with 26 assistants and other attendants to the number of 33, give treatment to about 1,500 cases, surgical and medical, daily in the Factory Hospital and the five first aid stations. The Factory Hospital is considered one of the most perfectly equipped hospitals in the country.

It was on January 12, 1914, that the Ford Motor Company put its plan of profit-sharing and its new methods of dealing with its men into operation. A few days before, it had made the announcement which had startled the world with its magnitude and originality. The scheme was as simple as it was sensational. Ten Million Dollars was to be set aside for the first year, and the minimum income, wages and profits, was to be Five Dollars a day.

Three years of successful operation of the plan have brought attention anew to Ford Methods. The many dire prophecies and criticisms have fallen before the proof of practical experience. What men criticised was not what the Ford Motor Company was doing, but what critics thought it was doing. Thousands of manufacturers and business men



This was the Home of a Profit-Sharer Until He Had His Lot Paid for

have come from all over the world to see for themselves, and have gone home to do something more for their own men.

The Ford Profit-Sharing grew out of the discovery that most men could not live properly on the wages they were receiving. Other men have made the same discovery, but said they couldn't help it. The Ford Motor Company made the discovery and tried to help it: first, by giving to men a share of profits; second, by teaching them to use these profits to build homes and to become self-reliant and independent. This was the firm purpose and it has been the great result of the Ford Plan—to change life from



This is the House that Profits Build



A Ford Man Made This Garden on a Sand Lot Where Nothing Grew Before

a barren struggle for existence to a life of progress and happiness. The best proof of this purpose is that the men receiving the smallest wages are given the largest share of the profits. Their labor is just as necessary as the higher paid labor and usually more difficult and disagreeable, and the welfare of industry as well as the welfare of the individual and of the state is served in this way.

This Ford profit-sharing sprang from a genuine concern for men. It is Mr. Ford's idea that what men need most is an opportunity to provide for their present and future needs through work.



One of the Forty Million Dollars Worth of Homes Ford Men are Buying

The second part of the Ford idea is that an employer has not performed his whole duty to his men simply in putting money into their hands. Money, according to Mr. Ford, must be followed by the willing gift of self in a personal interest and concern in the lives of men.

The aim of the Ford Plan is to put every cent it has for its men into their hands, to enable them to provide for themselves whatever things are necessary to their happiness and progress, and when necessary, to teach them how to do it—to build the man of and through himself.

Just a word about methods and results.

Contrary to usual expectations, the absence of rules and arbitrary requirements is noticeable. The one binding rule is that every man shall receive individual consideration and be judged by his merits. There is no single thing that the Ford man must have or must do to get profits. The Advisors make careful examinations, report the facts and make recommendations. A committee passes on the report for the purpose of approving or disapproving, conferring with the man personally in every case of doubt or disapproval.

The only rules governing profit-sharing are these standards for qualification. "The following become eligible for a share in the profits after six months in the employ of the company:

"1. Every employe 21 years of age who leads a clean and constructive life, and is of proven thrifty habits. A married man must be living with and taking good care of his family.

"2. Any employe under 21 years of age who lives with and is the sole surviving support of a mother, or next of kin, and leads a clean and constructive life."

When the profit-sharing was started in 1914, two hundred men were taken from the factory and set to work, to determine what men met the qualifications and could be expected to make good use of the profits. They were not sociologists. They were Ford men. When their work was completed it was found that about seventy out of every hundred had been approved. These began to receive the profits at once.

Then began the real work of educating the others so that they too could qualify for their share of profits. The aim of Mr. Ford has been from the first to make every man in the factory qualify for profits. At first, only 70 per cent qualified. Now, after three years, 99½ per cent of every hundred men eligible are receiving profits. This is what Advisors are for.

The share of profits given to employes is distinct from the wages. It is paid regularly with the wages in the bi-monthly pay envelope. But the payment is at all times optional with the company. The latest figures show that an average of only one in two hundred is deliberately disqualified for falling short of the standards, and of this number, nearly all correct the faults and begin receiving profits again before they reach the limit of six months which men are allowed to remain as non-profit-sharers. All profits withheld from men go into a Charity Fund and are distributed by a committee. The company does not profit by withholding profits from its men.

Results:—

What the Ford plan means to the average worker in the shops is best told in the words of one of them. The following is a translation of a letter written in a foreign language:



The Children Enjoy the Benefits of Ford Profit-Sharing

"I have been working for Mr. Ford for the last five years, and I wish I could work there all my life, because you will not find another factory like this in the whole world.

"When I was in the Old Country I worked in a bridge works for such little wages that I could hardly pay my board. Since I have been working for Mr. Ford I have had a chance to know how to live happily. I have bought a house on the installment plan, and if I continue to work I will pay that debt very soon.

"I want to tell you this from my heart, that it is true what I have heard some of the men say, that Mr. Ford takes care of his own employees just as if we were his own children—working only eight hours a day, and sharing in the profits. Also, looking after our home conditions so that we would not live too crowded, and have a clean house, for this is the only way to be happy.

"I want to assure you that this is very deeply appreciated by myself and my friends. Now, on top of it all, Mr. Ford gives us this free English school where we can study three hours each week. I have been going to the school regularly, and am very much satisfied with the results.

"I wish the Lord would give one hundred years of life, health and happiness to Mr. Ford and all his family. Greetings from your friend."

The stories of what the Ford plan has accomplished in individual cases would fill volumes. Men for whom life had been a hopeless struggle against poverty; families submerged by misfortune, welcomed their first real chance for independence and began life anew.

Two great results were immediate. The first was industrial. There was a voluntary increase of from 15 to 20 per cent in efficiency. Men showed a voluntary response because the eight-hour day and the profits were given voluntarily. There was more strength in the worker and more interest in the work; less worry and fear at home, and more work and cheer in the shop.

The second great improvement was in living conditions. There was a veritable exodus from some districts. Thousands of families moved into better quarters. Homes have been largely cleared of the crowded conditions due to roomers and boarders. Such conditions as existed when the Advisors first began their work can scarcely be found today. The depart-

ment works in hearty co-operation with the Boards of Health in Highland Park and Detroit, and in some sections the Advisors have been made special officers of the Board.

The best answer to what the Ford plan and the teaching of thrift for the last three years has accomplished is found in a study of the following figures which have been compiled from accurate records:

Comparative Financial Statement of Employees Showing the Results of Three Years of Profit-Sharing, from January 12, 1914, to January 12, 1917

	Jan. 12, 1914	Jan. 12, 1915	Jan. 12, 1916	Jan. 12, 1917
Number of Employees.....	13,251	14,255	29,314	40,903
Amount in Banks.....\$	996,418	\$3,046,301	\$5,968,936	\$9,137,619
Amount of Life Insurance..	2,471,663	6,193,709	11,822,962	23,408,186
Value of Homes Owned.....	468,230	933,524	2,892,667	4,157,659
Value of Lots Owned.....	67,160	94,136	614,790	1,022,081
Value of Homes on Contract	3,232,331	8,867,159	21,787,493	40,861,318
Value of Lots on Contract..	413,854	999,327	2,800,940	6,038,586
Amount Paid on Homes on Contract	1,111,253	3,237,864	7,844,614	13,990,343
Amount Paid on Lots on Contract	100,757	276,722	775,453	1,640,666
Amount of Rent Paid Monthly	58,576	114,464	217,881	376,865

Out of these rows of eloquent figures may be gleaned some vision of what the Ford Plan is making possible for this and the next generation in the upbuilding of better workmen, better home-makers, and better citizens.

The family shown in the illustration below is one of the thousands who are daily reaping the benefit of Ford profit-sharing. The smiling countenance, the health and happiness expressed in this picture is all due to the fact that this family shares in the profits. Previous to the time of sharing in the profits, they lived in a neighborhood of cheap tenement houses, very poorly furnished. Ford profits and persuasion took them from these things to a home of their own in the open country.





Reading Room—Ford English School

ENGLISH AS TAUGHT AT THE FORD PLANT

WHEN the work of the Advisors was started, a serious problem presented itself. It was found that a large percentage of the employes in the factory could not speak the English language, which necessitated the employment of a large number of interpreters to work with the advisors.

It had been ascertained that it is almost essential that a workman have a knowledge of English, from a "Safety-First" standpoint, so that he be able to understand the explanations of safety devices in the factory, as well as to thoroughly understand the requirements of his work. This knowledge also helps to make better citizens, and protects them against the many pitfalls which lurk in the path of the unwary foreigner.

To remedy these conditions the Ford English School was organized in May, 1914, with one teacher and twenty pupils. The latter part of the same month five experienced teachers took up the work and in September following a call was made in the plant for volunteer teachers. The response was so generous and the interest so splendidly maintained that the enrollment of the school was soon increased to 2,200 pupils, at which number it remained until the school was moved into new quarters giving a capacity for 1000 more students. This now gives us an enrollment of 3,200 pupils ranging from the ages of 18 to 72 years.

A problem which had to be met early was that of providing suitable lessons for the men. With valuable suggestions from foremen and others throughout the plant as a starting point, suitable data, based upon the daily living needs of the men was collected and arranged, preparing thus a series of seventy-two lessons. The lesson exercises take up such matters as the proper care of the body, bathing, clean teeth, etc., daily helps in and about the factory, including safety first and first aid; matters of civil government of the state and the nation; how to obtain citizenship papers, etc. In a word, the lessons are based on environmental conditions and their improvement.



Class Room—Ford English School

The seventy-two lessons are taught in thirty-six weeks, two lessons a week, each covering a period of an hour and a half. When the course is complete, the pupils, whatever the land of their birth, are able to read, write, and speak simple American language.

The Cumulative Method of teaching is used. This system may be explained as an adaptation of the Francis Gouin Method which originated in Germany about the year 1710. Francis Gouin, a Frenchman, had a great desire to learn the German language, but after spending much time in studying German grammars, he found himself still unable to speak the language. Accordingly he visited Germany and made his home in a German family. The next step was to observe and record the actions by which familiar spoken phrases were executed. Through book studies and the aid supplied by this course of observation he was soon able to speak German. His system has become an accepted method of instructing pupils in acquiring a foreign language. The Ford system, however, differs from this and all other existing systems in that it furnishes instruction sheets and classroom programs for the guidance of the teacher.

As previously stated, all teachers in the Ford English School are volunteers, employes of the Company from all parts of the plant, who are willing in the spirit of "Help the Other Fellow" to give their own time, without pay, to the work of instructing the foreigners in the American language. These teachers are put into a teachers' training class which meets every week. After approximately three months' instruction they become substitute teachers and may then teach two school periods a week. If satisfactory results are obtained, these teachers are given regular classes.

To return to the school-itself; thus far there have been four graduating classes. July 25, 1915, 115 men were graduated from the first class; the second class, consisting of 519 men, was graduated February 27, 1916; the third, with 230 men, received diplomas October 1, 1916; and the fourth consisting of 400 was graduated July 1, 1917.



Ford Employees' English Class

Of the thirty-two hundred men in the school it is not possible to give diplomas to those who have merely a sufficiently satisfactory knowledge of the American language, because some men may lack familiarity with the principles of the government of the state or the nation.

Every graduate must be thoroughly familiar with the basic principles of civil government.

Each class graduating has had a representative who made an address in the American language as part of the program of the graduating exercises. Each class represented over fifty languages. A graduate receives a diploma signed by officers of the Company and those of the Educational department certifying that he can read, write and speak the American language sufficiently well for the usages of common life, and also that he possesses a knowledge of the fundamental principles of American government.

His diploma is accepted in lieu of an examination when he applies for his second citizenship papers.

In addition to the basic principles of civil government the simple fundamentals of table manners are taught; how to sit down at the table, how to place the napkin, how to put sugar and cream into coffee and how to drink from a cup and not from a saucer. The men are taught how to use a knife and a fork; that the knife is made to cut with and the fork to convey food to the mouth.

Several Canadian and American concerns have sent men to the Ford plant to be trained as teachers of the Ford method.

So thoroughly has the spirit of the school permeated the factory at large, that a foreman holding a prominent position in the plant recently remarked that it was now easier for him to handle 300 men than it was to control twenty-five men before the school was started.



Teaching Safety-First by Motion Pictures to Ford Employees

THE PHOTOGRAPHIC DEPARTMENT

INDIRECT advertising, by means of which an already well known product of an equally well known concern is kept before the public, finds a full development in the Ford Historical and Educational films now witnessed by approximately five million people each week.

While conveying to these millions of people information of potent educational and historical value, the company is enabled at the same time to keep constantly before them facts concerning the company and its activities with which they have previously become familiar. In carrying on this work of preparing and issuing 110,000 feet of film every week for use in 3500 theaters, a very completely equipped plant is needed. This includes everything necessary to convert the raw film into the finished product.

A staff of 33 men, all experts in their line, is maintained in this department, which is situated on the fourth floor of the "A" building, directly back of the main office, while three operators are kept busy on the road, securing new material for the Ford Historical and Educational films.

The growth of this department has kept pace with the growth of the company in every respect. But a few years ago it was an incident only. The quarters were small, the staff composed of two men and the entire work was confined to making photographs of the cars and parts for advertising literature. Now, however, the volume of work done here compares favorably with some of the largest film-producing studios of the country.

While hundreds of photographs for use in the factory are made yearly, still the greater part of the work of the Photographic department has to do with the procuring, preparation and distribution of these Historical-Educational films. The historical subjects include comprehensive views of the larger cities of the country in which the principal points of interest,



Studio and Miscellaneous Work. Title Making, Cartoons, Portrait Work, Lantern Slides, etc.

as well as glimpses of local dignitaries, are brought out. Mountain scenes form subjects that are a never-ending source of attraction to the camera man, while the theater patrons, especially those living in regions remote from the mountains, never tire of seeing them.

Trips through the principal industrial plants of the country with the Ford camera man, presented in "story" form, have already attained great popularity, while a particularly interesting and instructive travel film is one taken in the Hawaiian Islands, portraying life and customs in the Hawaiian group.



The Perforating Room—Where the Raw Stock is Perforated



The Tank Room—Where Pictures are Developed



The Printing Room—Where the Positive Copies are Made

All of the Ford films are of more than current value while some can claim a place as permanent historical records. One film of especial patriotic value is that which portrays the presidents of the United States in order, the likenesses of each being shown in animated form.

Because of the peculiar prominence of the Ford Motor Company in its particular field, many of its activities have been filmed and are now greatly in demand all over the world. One of these is the film on "How Ford Cars Are Made." This film shows the Ford car in the process of its manufacture from the beginning until the finished product is ready for the user.



The Assembly Room—Where the Positive Copies are Cleaned and Assembled



The Drying Room. Here the Film is Wound on Drums, the Air in the Room is Scientifically Washed and Tempered

The film is of value not only to the casual observer who is merely curious to know how the Ford car is made, but to the expert along mechanical lines who wishes to study the methods that are employed to make possible the production of more than three thousand cars each day—an accomplishment that has no parallel in the mechanical world.

Another film that is always in demand is that which shows the methods the Ford Company is employing to safeguard its 36,000 workmen. In this field of activity, as well as many others, the Ford Company is leading the way and for this reason its methods are watched with keen interest. The work of instructing foreign-born employes in the fundamentals of the English language, mathematics, history, geography, etc., as carried on by the Ford English School, has also been filmed and a very keen demand for the film has resulted. The work of this school is unique in every particular and its filming is of particular value.

The department is equipped with all the latest appliances to protect it against fire hazard. The manufacturing and operating rooms are of fire-proof construction throughout, while every possible precaution is taken by those working with the films.

Theaters are not the only places in which the Ford Educational and Historical films are shown. Because of their peculiar interest and value to students, they are finding a greater field each day in the schools and colleges of the country, while many penal institutions have found in the Ford films a solution of their problem of entertaining and instructing the men by means of motion pictures, without fear of degrading them by showing phases of life with which the prison inmates have been only too familiar in the past. Testimonials from large numbers of school superintendents and prison heads show that the efforts of the Ford Company in this field are being highly appreciated.

INTERESTING FIGURES

THE Ford Motor Company was organized June 16, 1903. The history of the greatest automobile production is given below, recording one of the most phenomenal industrial developments in the world's history.

In 1903-4, to Sept. 30, there were made and sold	1,708 Ford cars;
In 1905, the Company built and sold	1,695 Ford cars;
In 1906, there were made and sold a total of	1,599 Ford cars;
In 1907, the total of cars made and sold was	8,423 Ford cars;
In 1908, the production and sales reached	6,398 Ford cars;
In 1909, the phenomenal growth began with	10,607 Ford cars;
In 1910, the production jumped to a total of	18,664 Ford cars;
In 1911, there were made and sold a total of	34,528 Ford cars;
In 1912, production more than doubled, with	78,440 Ford cars;
In 1913, a new high water mark was reached with	168,220 Ford cars;
1914 saw an even greater triumph achieved by	248,307 Ford cars;
While 1915 crowned all efforts with a total of	308,213 Ford cars;
In 1916, the volume of production reached	533,921 Ford cars;
In 1917, the production will exceed	700,000 Ford cars.

As a more practical illustration of what it means to produce 700,000 Ford cars in one year, and also as an evidence of the buying power of the Ford Motor Company with its "spot cash" payments, the following items speak for economy in manufacturing:—

- 325,000 tons of steel were needed in the cars.
- 98,000,000 square feet of rubber cloth material in the tops.
- 2,800,000 each of wheels and tires.
- 3,500,000 lamps.
- 12,775,000 feet of Vanadium steel shafting and axles.
- 3,970,000 square feet of plate glass in windshields.
- 88,016,880 feet of copper tubing in these radiators.
- 9,800,000 pounds of steel in Ford magnetos.
- 24,791 miles of wiring used in magnetos.
- 6,300,000 square feet galvanized metal in gasoline tanks.
- 45,000 horsepower developed by new engines and generators.
- 59,458,000 square feet of sheet metal for guards and fenders.
- 22,471,680 feet of tubular radius rods.
- 125,851 freight cars were needed to handle material and product, in addition to 63,939,494 pounds of material received at the home factory in less than carload shipments.
- And, approximately \$10,000,000 profits are shared annually with employees.
- During 1916, more than 200,000 persons visited the Ford factory at Detroit, and were conducted through the big plant by the staff of experienced guides.
- In the one month of August, 1916, 33,128 visitors saw the manufacture of "The Universal Car."
- Average number of persons engaged in making and selling Ford cars in 1917 totaled about 100,000—supporting a city of half a million people counting five to the family.



1,000 Assembled Chassis—an ordinary day's work



A Glimpse Into the Big Top-Making Department, Showing Men at Sewing Machines and Traveling Conveyor



Ford Motor Band

FORD MOTOR BAND

THE Company maintains a band of 55 pieces. All the members of the band, including the director, are employees of the Company. The members of this organization are from 15 different nationalities, part of whom have come from some of the most prominent musical organizations of this country and Europe.

The Company each year arranges a series of concerts and provides an auditorium, so that the entire Ford organization may have the privilege and pleasure of hearing high class and light music at no cost to themselves, as all expense of maintaining the band is borne by the Company. The program for these concerts is so arranged by the director as to please lovers of high class, as well as those of the lighter and more popular music.

FORD BRANCHES AND BRANCH FACTORIES

THE production of more than 700,000 Ford cars from August 1, 1916, to August 1, 1917, will mark a record, and in point of numbers is more than the output of all other companies combined, for the same period. This great output would be impossible were it not for the Ford assembly plants, located in the principal cities of the United States. To these assembly plants are shipped parts for Ford cars in carload lots, and the cars are assembled at the different plants and supplied direct to agents in the surrounding territory. The assistance of the assembly plants makes possible the attainment of a daily average of approximately 3,000 cars.

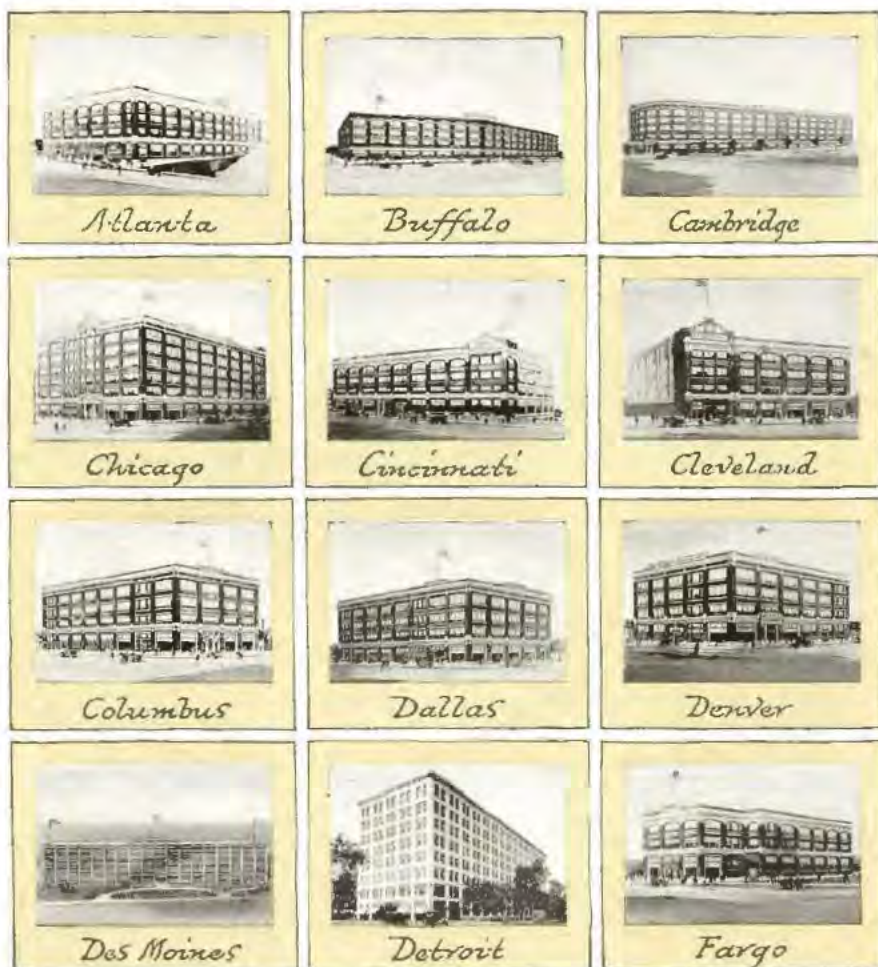
Where the Ford assembly plants are located, they are a distinct addition to the red blood of the industrial life of the community, for they employ from 200 to 700 workmen each, at the best wages. A large portion of the employees in the outside plants are profit-sharers. The Ford branches, too, occupy an important place in the commercial life of the cities, for through them millions of dollars' worth of business is transacted yearly.

It is estimated that the value of buildings alone, for branches and assembling plants, is in excess of \$15,000,000.

All this intricate organization and investment of funds is designed to accomplish two objects. First, the system makes it possible to ship parts from the main factory to definite points for assembly, obtaining a more rapid and more economic distribution. Second, the locations of the assembling plants aid Ford agents in giving prompt, reliable and economical service to Ford owners, through the handy distribution of parts and supplies, and there are no vexatious delays for the owner of a Ford car while a part is forwarded from the home factory.

Furthering this organization, the Company is represented by more than ten thousand agents in the United States alone. In any emergency, there is a Ford agent not far away—and where the Ford agent is, you will find a goodly stock of Ford supplies, which his contract requires him to maintain, so Ford service for Ford owners is as universal as the car.

We illustrate with photographic reproductions the thirty assembly plants.



Ford Factories and Branches

Ford Factory, Detroit—*Parent Plant*—
Capacity 750,000 cars annually

Ford Factory, Ford, Ontario, Canada—
Capacity 50,000 cars annually

Ford Factory, Manchester, England—
Capacity 25,000 cars annually

American Wholesale Branches

Albany—346 Broadway	Louisville—2400 South Third St.
Atlanta—465 Ponce de Leon Ave.	Memphis—495 Union Ave.
Buffalo—2495 Main St.	Milwaukee—411 Prospect Ave.
Cambridge—400 Brookline St.	Minneapolis—420 North 5th St.
Charlotte—212 East Sixth St.	New Orleans—2120 Canal St.
Chicago—3915 Wabash Ave.	New York—1723 Broadway
Cincinnati—660 Lincoln Ave.	Oklahoma City—900 W. Main St.
Cleveland—11610 Euclid Ave.	Omaha—1502 Cuming St.
Columbus—427 Cleveland Ave.	Philadelphia—2700 N. Broad St.
Dallas—2800 Williams St.	Pittsburgh—5000 Baum Blvd.
Denver—920 S. Broadway	Portland—481 East 11th St.
Des Moines—101 S. E. 5th St.	St. Louis—4100 Forest Park Blvd.
Detroit—1550 Woodward Ave.	Salt Lake City—230 West Temple St.
Fargo—509 Broadway	San Antonio—221 W. Commerce St.
Houston—4006 Harrisburg Road	San Francisco—2905 21st St.
Indianapolis—1315 E. Washington St.	Scranton—601 Wyoming Ave.
Jacksonville—16 East Ashley St.	Seattle—724 Fairview Ave.
Kansas City, Mo.—1025 Winchester Ave.	Spokane—1801 W. Third Ave.
Long Island City—564 Jackson Ave.	Washington—451 Pennsylvania Ave. N. W.
Los Angeles—2060 East Seventh St.	Wichita—218 W. Douglas Ave.

Foreign Branches and Service Stations

Bordeaux, France—Place Sainte Croix	Montreal, Que.—119 Laurier Ave. E.
Buenos Aires, Argentine—752 Peru	Paris, France—61 Rue de Cormeilles
Calgary, Alta.—127 E. 11th Ave.	Saskatoon, Sask.—1st and 25th Sts.
Hamilton, Ont.—74 John St.	St. John, N. B.—Rothessay Ave.
London, Eng.—55 Shaftesbury Ave.	Toronto, Ont.—572 Dupont St.
London, Ont.—680 Waterloo St.	Vancouver, B. C.—1531 W. 15th Ave.
Manchester, Eng.—Trafford Park	Winnipeg, Manitoba—Portage Ave. at Wall St.
Melbourne, Aus.—153 Williams St.	

Foreign Department

1135 Whitehall Building, 17 Battery Place, New York

There are Ford Agents in all principal cities and towns throughout the entire country

FACTORY FACTS *from Ford*

