The above photograph shows the Fordson Tractor equipped with runners for hauling logs. Not long ago plowing was the only operation associated with the tractor. Today, however, there are hundreds of uses to which the tractor may be adapted, among them some 47 belt uses, thus converting the tractor from a piece of equipment of seasonable use only to one of constant service. In other words, from a machine that originally started simply as a piece of ground-tilling equipment with a yearly period of usefulness covering but a few weeks, the tractor has developed into a year-round machine.

**Tractor Service**

As the Ford Motor Company has always been the recognized leader in Automobile Service, we must maintain that lead in Tractor Service. This can be accomplished only through the close cooperation of our dealers and service stations. The fact that the tractor is a machine of utility makes it obvious that the service pertaining to it must be even more prompt and more sure than on the car. Dealers should appreciate that the loss of a few days' time, or even a day, to the farmer may mean the difference between a good crop and a poor crop, or possibly no crop at all.

Many farmers now are depending almost entirely upon their tractors for the production of their crops, and we hope that the time will come when they will all place such dependence on the Fordson. The proximity of that day will depend in a large measure upon the class
of service rendered. Dealers should carry a stock of repair parts ample at all times to make the needed repairs on the tractors in their territories. Skilled workmen should be employed and complete equipment installed in their shops so that efficient repair work can be turned out in the shortest possible time.

Care of the Air Washer Float

It is safe to say that there is no part of the tractor that is as important as the air washer float, and no part that is as easy to watch and properly take care of as this float.

See that the air washer bowl is full of water at all times. Remove the cap at the bottom of the chamber at least once a day, and thoroughly drain the water and dirt. Then refill the chamber with good clean water and see that the air washer immediately rises to the top and floats freely.

When the float is not on top of the water, the kerosene mixture is not getting the necessary amount of water vapor to properly operate the engine. It is absolutely necessary that kerosene burning motors have a certain amount of water vapor. In this case the clear kerosene goes into the top of the motor, scoring the cylinders, and, not stopping at this point, the kerosene goes down into the crank case and works its way into the bearings. After thinning the lubrication, which results in the bearings wearing down, a knock develops in the motor. A tractor working at its limit in the field with the bearings loose will, in a short time, either break the connecting rods or cut the crank shaft out of round.

It is very essential that every dealer make it a personal matter to inform every tractor owner of the importance of keeping the air washer float in proper condition at all times. You will find that you will be well repaid in the long run by exerting a little effort in the way of proper instruction at this time.

Oil Level in Transmission Housing

Careful attention should be given to oiling the tractor transmission and rear axle, which are lubricated by a single oil bath in the transmission housing. It is advisable to warm the oil to about 100° Fahr. and pour it into the housing when the motor is warm. The oil should reach the level of the filler cap hole. The oil level should be inspected about twice a day and the above level maintained as nearly as possible. In many instances the operator removes the cap on top of the gear shifter and notices that there is oil foam, thus taking it for granted that there is plenty of oil. This, however, may not be the case, as a small amount of oil will foam from the heat and friction of the gears.

Size of Belt Pulleys

The standard Fordson Belt Pulley is 9" in diameter with a 6" face. Special pulleys are not furnished, as the belt pulley attachment was designed to accommodate a 9" pulley. In order to determine the size of pulley to be used on any implement connected up with the Fordson Tractor, first ascertain the speed at which the pulley on the implement is to be driven. The following table shows the size of pulley to use on the implement in order to obtain various speeds from 350 to 2250 R. P. M.

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Speed of Fordson Tractor Pulley 1000 R. P. M.

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Dash Bracket

Our stock of old style dash brackets, Parts No. 3640B and 3641B has been completely exhausted. From now on replacements must be made with the new style bracket 3640C and 3641C as shown in Fig. 214.

Repairs for Starting and Lighting System

Repairs for our starting and lighting system should be purchased from our Branches. The Liberty Starter Company of this City does not supply repair parts.

Brass Connecting Rod

The accompanying cut shows a brass connecting rod which was substituted for a genuine part in a Model "T" Engine. While brass connecting rods are used on low speed marine engines, they are not sufficiently strong to withstand the severe shock received in an automobile engine at high speed. Dealers should warn their trade against the use of such rods.

Replacement of Armatures

Within 3 months' service starting motor and generator armatures may be replaced gratis. Beyond 3 months at $4.00 net each. The armatures can be used to good advantage and dealers and service stations should return them to the branch for credit on above basis.

A File as a Speed Wrench

Fig. 216 shows castle nut being run off with a file. It is first necessary to start the nut with a wrench.

Safety

On Drill Presses

When operating a drill press the following rules should be observed for Safety:

Wear tight-fitting sleeves or roll the sleeves above the elbow, to prevent them from being caught in the revolving drill. Many serious injuries have resulted from failure to do this.

Loose neckties are very dangerous and should be tucked under the shirt. There is a possibility of being choked if the tie is caught in the drill.

Rings should not be worn. They have been known to catch in the drill and pull the flesh off the fingers.

A rag or towel should never be used around a revolving drill. If caught, the hand is liable to be drawn into the drill with it, and severe lacerations will be the result.

Operators should not try to hold material on drill press tables with their hands. It may fly out of the grasp and cause serious injury. All material should be fastened securely.

Wooden sticks should be used instead of wire to remove the steel shavings from around the revolving drill. Fig. 217 shows how a wire can be caught, and a hand severely lacerated.

Lastly, Do Not Wear Gloves.
The above chart shows a convenient method adopted by our dealers, Henderson & Lathrop of Auburn, N.Y., of determining at a glance just how the sale of repair parts, repair labor, and the cost of operating the shop is running. By keeping this graphic record from year to year it can be determined quickly if the gross business or profits for the corresponding months is increasing or decreasing.

This chart may be kept for the Dealer's personal use or it may be placed where it is accessible to any employe. Inasmuch as Henderson & Lathrop allow their workmen a certain percentage of the profits, this chart is displayed on the wall of the office so that it can be inspected by any employe. We believe the idea a good one, and it might be well for dealers to adopt the plan commencing January 1st, 1920.

**Towing Cars**

When cars are to be towed any great distance there is danger of burning out the transmission disc (or thrust plates), clutch shift ring, or clutch shift, due to the fact that they are revolving rapidly on each other without proper lubrication, because the flywheel is not turning over when the control lever or pedal is in a neutral position. To provide against this the transmission should be set in high speed and the spark plugs removed. If it is impossible to have the engine connected to the axle an additional quantity of oil should be placed in the crank case so that the lower edges of the drums are submerged; this allows the brake drum to pick up the oil, thus lubricating the running parts.

**Replacement of Generator Brushes**

Within 3 months' service worn generator brushes may be replaced without charge. After 3 months' service full price should be charged for the new brushes.
Practical Methods of Repairing Ford Cars

Setting the 3rd Brush

(Continued from page 148)

372. When the proper charging rate is attained, the nut on the post should be drawn down. Since this nut draws down on two fibre pieces, a little care is necessary to see that it is not tightened sufficiently to cut through the fibre, causing a ground.

373. Next install the dust cover, making sure that the pigtails and all other wires are in such position that they will not touch the dust cover, bracket or yoke, causing a ground. Also see that the field leads are not touching the armature, as the coils will soon wear through causing a short or ground. It is necessary to use only the top screw in securing the cover. New jobs are coming through with only one screw.

The Armature

374. There is small likelihood of any trouble developing in the armature unless the generator has been subjected to abuse, such as running it without having the necessary ground connection or the complete connection to the storage battery. When the generator is run without the proper connection all the current is drawn off through the third brush passing through the field, thus the voltage and current becomes greater than the wiring is built to withstand, and in a very short time (a matter of a few minutes) the generator will be burned out.

375. If the leads from the field coils and the terminal post are allowed to rub on the armature the insulation will be worn from the coil to commutator leads, thus causing a short or ground. If, by any accident, water gets inside of the housing it also will cause a partial ground. If no testing apparatus is available, trouble in the armature may be determined by substituting a new armature. We do not at this time advise the dealers to make any repairs on the winding.

376. The armature may be removed by running out the screws which hold the front end bracket to the yoke. The bracket, together with the armature, may then be withdrawn by tapping the edge of the bracket with a raw hide mallet at the same time pulling on the end of the armature shaft with the other hand. To remove the armature from the bracket drop the assembly on a block as shown in Fig. 218-B. Striking the bracket as shown in 218-A is poor practice as there is liability of springing the shaft and a greater length of time is required to remove the bracket.

377. The armature should be inspected to see that the mica is undercut. If the brushes ride on the mica excessive heating and arcing will result. The mica is undercut from 1-64" to 1-32" (see Fig. 219). This may be done with a broken hack saw blade.

378. Care should be exercised to remove the mica clear to the edge of the copper. Do not leave it as shown in Fig. 219-A as this is just as bad as having the mica all the way across.

379. If the generator has been water soaked, a leakage of current will occur, causing a partial ground. In some cases this may be detected by the test lamp, placing one terminal on a commutator segment and the other upon the shaft or lamination of the armature (see Fig. 220). A ground will cause the lamp to burn brightly; a slight leak will allow the lamp to glow; if the lamp does not light at all there is probably no leakage between the coils and the shaft, indicating that any trouble in
380. If the armature has become water soaked it should be dried in a warm oven not over 250° Fahr. before replacing it in the yoke. If the commutator has been worn rough it is necessary to clean it up on a lathe. We do not recommend at the present time that this be done by any of the service stations. Such parts should be returned to the Branch. Before replacing the armature see that the ball bearings are tight on the shaft and that they turn freely. Set that the felt washer is in good condition on the commutator end and that the steel washer is tight and in position on the gear end. The first generators had a felt gasket on the gear end. We recommend that this be removed and the steel washer shown in Fig. 196 be installed in place of it. The company will furnish these washers free of cost for replacement on the earlier generators. The bearings are removed on an arbor press. In replacing the bearings they should be forced down to the shoulder of the shaft. Note the difference in the diameter of the two ends of the shaft. The front or the gear end and commutator end bearing are not interchangeable.

381. Before replacing the armature assemble it to the front end bracket, position the bracket on the bearing and drop the assembly on the block as shown in Fig. 218-B, only this time strike the other end of the shaft and drive the bracket on. Next see that all the brushes are raised and held up by the spring as shown in Fig. 203, wipe out the bearing seat in the brush end bearing and insert the armature through the yoke, tapping bracket into position. Insert and tighten two opposite screws, set the brushes on the armature and connect the wire to the terminal, running the generator as a motor. If it runs, indicating that the trouble has been overcome, set the brushes and see that they bear properly as explained in Bulletin No 18. When the proper adjustment has been attained, insert and tighten the rest of the screws which hold the bracket to the yoke. Each of these screws is locked into position by means of a lock washer. When this is done assemble the generator to the engine, make all connections to the battery through the cut-out, start up the engine. Set the third brush and assemble the dust cover as explained in Pars. 367 to 373. If there is too much end play in the armature shaft tighten the bearing in the brush end bracket. This may be done by setting a punch on the bearing housing and the bracket and striking it with a hammer (see Fig. 221); one tap should suffice.

382. It is impracticable to detect short circuits in the armature without the use of a growler or complicated tests with a volt meter. We recommend, therefore, at the present time, that all work on the armature with the exception of that described in this article be done at the Branches.

The Brush Holders

383. The brush holders should be inspected to see that they are not cracked and that they are securely riveted to the support. The brushes should be free in the holder so that there is no danger of their being held off of the commutator. It sometimes happens that a deposit forms on the holder, thus causing the brush to bind. If this occurs, withdraw the brush and file the hole in the holder. Do not file away the brush, simply remove any high deposits which may appear on it. At this time we might remark that due to excessive heating caused by dirty commutator, high mica or improperly set brushes, the solder which holds the pigtails on the brush may flow, causing the brush to stick to the holder. The solder on such a brush should be filed off flush with the surface. A new brush should be inspected to see that the solder at this point is flush with the face before placing it in the holder.

384. If the holder is loose on the support it may be tightened by peening the rivets. When tightening the positive (insulated brush holder), take care not to crack the insulation. The third brush holder is not
secured by rivets but by means of a stud, nut and lock washer. Sometimes the nut may be drawn down too tightly, causing the head of the bolt to cut through the insulation; this causes a ground between the insulated holder and the support. Such a ground may be proved by holding one of the terminals of a test lamp (110 volt circuit) on the holder and the other terminal on the support. If a light shows the holder is grounded.

(To be continued)

Fig. 221

The Carburetor Spray Nozzle

(Continued from page 144)

385. The jet hole is drilled tapered at the top to conform with the taper of the needle. This taper should not extend more than half way through the jet plate and should be perfectly smooth. The spray nozzle is often damaged by the owner or repairman screwing the needle too tightly into it. There is no practical way of repairing such a seat, and the entire nozzle should be replaced by a new one.

386. Before replacing the nozzle it should be inspected to see that none of the holes is closed up even partially with any foreign substance. Replace the gasket in the mortise, drop the spray nozzle into position and draw it down tight with the wrench.

The Strangling Tube

387. The strangling tube is a solid casting, and, if it is properly set with the retainer spring entering the groove at four points, it must necessarily function properly.

Low Speed Tube and Hole

388. One of the most important parts of the carburetor is the low speed tube and hole, as their proper setting determines the functioning of the engine on the lower speeds. If improperly set the engine will be starved, causing hard starting, or the mixture will be too rich, causing the engine to run unevenly, due to the heavy carbon deposit which will soon form in the cylinders and on the spark plugs.

389. The tube is secured by means of a pack nut to a nipple which is screwed into the mixing chamber body. To make room for the head of this screw a chamber is drilled into the side of the mixing chamber body, and, after the nipple has been inserted and tightened, the outer opening of this chamber is plugged with a screw.

390. From this chamber a drilled hole leads to a point near the closed position of the throttle valve plate. The point where this hole breaks into the passage is of the greatest importance as it determines the amount of gas which will be fed to the engine when starting and running at low speed. It should extend from 1/64" to 1/32" beyond the edge of the valve plate when the plate of the valve is squarely
across the passage. To check this distance measure down from the face of the flange to both sides of the butterfly valve plate with a 6" scale reading to 1/64". Turn the stop screw on the throttle lever in or out until the measurements on each side of the shaft are equal. The mechanic may then judge whether or not the hole is located properly. If he believes it is wrong the carburetor should be returned to the Branch for repairs.

391. After the low speed tube has been tightened in its position by means of the pack nut the lower end should rest against the shoulder of the body above the plate and should be .011 to .018 above the surface of the plate. This distance is checked with a 3-Z-2393 gauge as shown in Fig. 222. If the end of the tube is too high above the plate it should be tapped down by placing a piece of rounded wood against the elbow and striking it with a hammer (see Fig. 223). If it is too low the tube should be removed and carefully bent with the fingers. At no time should the orifice (hole) in the lower end of the tube be changed in size or shape. Before replacing, the mechanic should make sure that all foreign substances have been removed from the low speed passage.

392. Before replacing the cap the carburetor should be installed on the test stand shown in Fig. 174, where the level of the gasoline in the pool may be tested. Fig. 224 shows this level being checked with a standard Ford gauge. The gauge is made up with a high and low limit. The low limit, or the end of the gauge having the greater distance between the ends of the points should break the surface of the gasoline in the pool, while the high limit, or that end of the gauge having the shorter distance between the ends of the points, should not touch the surface. In taking the measurements be sure that the gauge stands straight up and down and that the carburetor is level. Incorrect readings may be taken by tilting the gauge at an angle. When this gauge is used in checking the level in the car it is advisable to first drain the carburetor and allow it to refill again, as there is always an excess of gasoline in the carburetor after the engine has stopped running.

393. Any necessary correction in the level of gasoline in the pool is made on the float lever arm. See Par. 368.

The Spray Needle

394. The spray needle is screwed into a boss in the mixing chamber cap and is lined up so as to fit properly into the jet hole of the spray nozzle. The body is made of brass with a monel metal point to prevent corrosion. There is no wear on this needle, and, unless it has been abused nothing can go wrong with it. However, repairmen and owners when making adjustments to carburetors will sometimes force the needle into the seat thereby destroying the taper. It is necessary to replace such a needle with a new one. In replacing the needle the mechanic should make sure that the new needle has not been sprung out of line. To try this, roll it on a smooth plate.
How the Fordson Tractor Helped to Keep the Marmon Plant Running

The above photograph shows one of the 21 Fordson Tractors which, together with Marmon-34 Automobile Engines, supplied power for the Nordyke-Marmon Plant, Indianapolis, Indiana, during the recent coal shortage.

In one instance four tractors were used to displace a 75 H. P. motor which was driving two shafts. The four tractors were placed so that two tractors were driving on each shaft and the two shafts were belted together. The man operating the machinery said they could not see any variation in the speed of their machines greater than they had been accustomed to with the electric motor. The electric motor, according to the millwright's statement, was driving a full load, but the tractors seemed to be running very lightly.

In another instance two tractors were hitched to the same shaft displacing a 40 horse motor which had been operating six Norton grinders. The makers of the grinders claim that it takes 7 H. P. to operate each grinder. The tractors handled this load very satisfactorily and maintained a most uniform speed.

Several tractors were used to displace 20 H. P. motors and in no instance did a Fordson motor fail to hold up the load which had formerly been carried by 20 H. P. electric motors. Production in some instances was increased by the use of the tractors, for the reason that the shafts were run at a somewhat higher speed than under electric power.
One tractor operated six days, 24 hours a day, with only a thirty-minute stop in which to replenish oil and fuel supplies and lubricate a few parts, and then after being idle twenty-four hours, resumed the same grind for six more days, at the end of which time the tractors were taken out of service. This tractor is in apparently as perfect condition as when it went into service. At no time was there any mechanical trouble, not even a spark plug broken and no stops were made on account of the tractor. The average gasoline consumption was 11½ gallons for each nine hours. The average oil consumption was one quart for the same period. The oil was changed every three days and replaced by clean fresh oil. The average water consumption was two gallons per day in the radiator and 2½ gallons per day in the air washer.

**Cleaning Solutions**

Clean parts are essential in making a repair, and the dealer will find it to his interest to return a job to the owner only after all the parts which go into the assembly have been thoroughly cleaned. If the proper solutions are used and the parts have been thoroughly cleaned he will find that the time saved by the mechanic will pay the cost of cleaning.

The most commonly used cleaner is kerosene. As it combines grease cutting with lubricating properties it is invaluable as a cleaner for running parts. It is used extensively to remove road oil and tar from the chassis and body, but should never be used on the tires.

Kerosene is applied in the following different ways:

First, by dipping the parts into a tank full of it.

Second, by applying it with a brush or rag.

Third, by spraying it on under air pressure. A spray tank such as is used for spraying potato plants may be used for this operation.

Running parts which have been cleaned with kerosene should be dried with a clean rag and given a coat of lubricating oil to prevent rusting. Painted parts should be washed with soap and water to prevent the paint becoming spotted.

**Gasoline**

While gasoline has the necessary grease cutting properties combined with quick drying, it should be used sparingly as a cleaner, first, because of the fire hazard which accompanies its use. Second, because it leaves a coating on the part which hinders the oil clinging to them, causing burned-out bearings and pistons sticking to cylinder wall.

Gasoline should be used to clean the grease from rubber, particularly the tires.

**Soap**

Soap and water is used in cleaning body and chassis; a neutral vegetable soap should be used; such a soap may be purchased through the oil jobbers. The soap is dissolved in luke warm water and applied with a sponge. The amount of the soap used depends on the water and the condition of the part to be cleaned. The soap should be rinsed off with water so it will not dry on the painted surfaces.

**Soda Solution**

Where a tank which may be heated is provided the best cleaning solution is made by dissolving one-half to two pounds of soda ash, or sal soda, and three ounces of soft soap chips, to every three gallons of water. The proportions of the ingredients may be varied to meet the conditions of water and dirt. The solution should be kept very hot and parts should be dipped into it. If they are very dirty the operation may be facilitated by scrubbing the parts with a long handled fibre brush.

The washer should be provided with a pair of rubber gloves, boots and apron as the soda will eat the clothing and burn the skin. He should wear goggles to prevent the possible loss of an eye. A bottle of vinegar should be placed convenient to the tank. In case of burns apply the vinegar freely to the injured part, even the eye.

The solution may be used cold but it is only about half as effective as when hot. Further if it is hot the parts dry quickly. If a powder appears on the part when dried the solution has too much soda in it. This solution will spoil the paint making it necessary to retouch any painted parts which may be cleaned in it.

**Carburetor Repair Tools**

The carburetor repair tools listed on page 120, Bulletin No. 15, can be purchased from The Fairbanks Company, 416 Broome Street, New York City, or from their Branches or Distributors handling their line of service equipment.

**Handy Stands**

Fig. 226 shows two stands, the construction of each being practically the same. The one at the right is used to support a wheel while a hub is installed, the other stand is for a transmission. The three shafts which
project up about one and one-half inches are to hold the transmission far enough above the flywheel to allow space for the repairman's hands when he wishes to remove it. The radius rods are bent so that they will clear the drums when the transmission is in an inverted position.

The transmission stand is made, as the photograph shows, of three No. 2733 front radius rods, one of the side members being cut off at the ball end on each. These radius rods are bent so that there will be a greater distance from the point of intersection of the rods and the flywheel. A Ford 3269C Flywheel is used after the center is turned out in a lathe. Three No. 3315 triple gear shafts are installed in the flywheel by drilling the flywheel and driving the shafts into the holes. A 2529 thrust plate is used at about the middle point of the radius rods to strengthen the job. A stove bolt of proper size and with a large head is used to expand the radius rods against the thrust plate.

The hub installing stand is similar to the transmission stand except that a large steam flange is used instead of a flywheel. A Flywheel could just as well have been used. Also, in the hub installing stand, the radius rods are not bent.

Contribution by A. A. Knee, Ford Agent, Charlotte, N. C.

Cylinder Reboring Machine

Several improvements have recently been made in the design of the Hinckley-Myers cylinder reboring machine shown on page 67, Bulletin No. 9. For use under a power feed drill press, the cutter head shaft is ground smooth instead of threaded as formerly. The collar through which the shaft passes is provided with an adjustable bronze bushing so that any wear can be taken up. For hand use, the feed is obtained by the threaded shaft running through a threaded bronze bushing in the collar; this bushing is also adjustable. These machines are adaptable to Ford and Fordson blocks by changing the cutter head. These cutters are provided in either solid or adjustable heads with a gauge.

Repair Charges on Starting Motors and Generators

We suggest as a guide for dealers and service stations a labor charge of $2.00 when repairing a starting motor or generator after three months' service. Within three months' service the repairs should be made gratis.

Generators or starting motors which Dealers ship to the Branches will be repaired and returned to the Dealers sending them in. Dealers should, however, make these repairs themselves and replace the units on the customer's car; otherwise a lot of second-hand materials will eventually accumulate. As a matter of service to Ford owners, Dealers should keep two or three repaired starting motors and generators on hand to be loaned to customers while repairs are being made to the original equipment.

Tighten the Yoke

The yoke on the front axle spindle arm connecting rod is provided with a clamping bolt which should be tightened after adjusting the wheels for alignment. A serious accident might result from neglecting this operation, as the yoke might pull off the rod if it is not securely clamped.

The instructions given in Paragraph 354 are hardly complete. The formaldehyde should not be added to the boiling solution. The float should be dipped into the boiling solution and then into a 40% solution of formaldehyde, after which it should be dipped into pure water. Refinished floats, however, are often erratic, causing general unsatisfactory engine operation, and we recommend that floats which are defective be replaced by new ones.

Cars bearing motor numbers from 3,588,001 to 3,659,970 were shipped during the month of Dec.
Practical Methods of Repairing Ford Cars

The Generator Brush Holders

(Continued from page 151)

395. Test the springs to see that they are not riding on the edge of the holder but are exerting their full strength on the brush. To do this raise the brush by means of the pigtail about $\frac{3}{8}"$. It should, when released, drop back onto the commutator with a sharp click. If the spring is riding against the side of the holder it may be bent back to fit properly. If the spring has become weakened it should be replaced. This is done by removing the support and inserting a knife in the slot to spread the post, after which the spring may be withdrawn. The new spring is then positioned and the slot in the post closed. The spring will be weakened by overheating, due to loose pigtail connections, which causes the current to be drawn off by the spring instead of by the pigtail.

The Brush Holder Support

396. The earlier brush holder support had shorter slots in the mortise, thus the movement for adjustment of the external current brushes was much smaller. If it is found that the proper neutral setting cannot be obtained a new brush holder and support assembly should be installed. The position of the rivets which hold the insulating fibre to the support has also been changed. This new position prevents the fibre from rising between the two insulated brushes.

The Cut-Out

397. The cut-out is an electro magnetic switch. It acts in the electric circuit in the same way as a check valve acts in a pipe line, that is, it allows the current to flow in only one direction—from the generator through the battery.

398. Fig. 227 shows a wiring diagram of a cut-out. It consists of two coils and a pair of points. One of the points is set on a spring armature which holds the points apart until acted upon by the magnetism set up in the core. The wire leading from the generator is attached to the armature point. A wire attached to the stationary point makes a few turns around the core and is secured to a terminal, from which a wire leads to the ammeter, and thence to the battery. A fine wire leading from the generator wire is coiled about the core and is grounded to the yoke or frame of the car.

399. A knowledge of the following facts about electro-magnets is essential to an understanding of the operation of the cut-out:

- First, when current is passed through a coil, the coil takes on the properties of a magnet.
- Second, the lines of magnetic force flow in one direction, according to the direction of the electric current in the coil.
- 400. When the engine is not turning over, the cut-out points are open. As the engine picks up speed, the generator voltage builds up until sufficient current passes through the fine wire coil to draw the spring armature down, closing the points. This closes the generator to battery circuit, and, as the resistance through this circuit is less than through the fine wire coil, practically all the current flows through the battery.
- 401. When the engine slows down and the generator voltage drops to below the battery voltage, the current in the coil is reversed, the flow now being from the battery instead of to the battery. Thus, the magnetic lines of force become weaker and weaker until they pass the neutral point and start to act in the opposite direction. But when the neutral point is reached, the spring armature recoils, drawing the contact points apart, thus stopping the flow of current from the battery.
- 402. Once properly adjusted, the cut-out should never need any care unless disarranged by some outside force or disarrangement of the system. If the base or the cover is sprung by striking it, the instrument may be thrown out of adjustment.
Fuel Line Elbow
Mixing Chamber
Packing Nut
Choke Lever
Choke Gate
Fuel Valve
Fuel Valve Seat
Fuel Valve Seat Gasket
Float Lever Pin
Float Lever
Float (to lever) Fastener Screw
Low Speed Tube
Overflow Tube
Mixing Chamber Gasket
Mixing Chamber Nut
Spray Needle
Spray Needle Sleeve
Air Valve Cap
Throttle Lever Lock Screw
Throttle Lever
Throttle Lever Adjusting Screw
Staple
Throttle Gate
Air Valve
Air Valve Shaft
Float
Float Chamber
Drain Cock Body
Drain Cock Needle
Air →
Gas ≈
Mixture ⇆
Fig. 228
403. In working on the cut-out, if the wire from the battery is touched to the wrong terminal, the points will be drawn together and may remain closed. Sometimes the terminals become loose and the wires broken. Continual driving at speeds which cause the points to continually make and break will cause them to become pitted and they may stick.

404. If, when the battery is removed, the generator is grounded through the cut-out, the points will flutter, causing them to pit and stick. However, the above conditions seldom exist, and the repairman will usually find his trouble in some other part of the system.

405. When there is anything wrong with the cut-out it should be exchanged for a new one, as the setting of the points is a very delicate and most important operation. When installing the new cut-out take care not to spring the base, and be sure to make all the connections from generator to battery before starting the engine.

406. If the points stick (indicated by the ammeter registering “Discharge” with the lights off and engine stopped) start the engine and speed it up so that the ammeter registers “Charge.” Stop the engine and see if the ammeter registers zero; if it does not, remove the cut-out to ammeter wire, at the ammeter, leaving the ammeter to terminal block wire attached. If the instrument now registers zero the trouble lies in either the cut-out or in the cut-out to ammeter wire. Inspect the wire for a ground; if not grounded install a new cut-out and return the defective one to the Branch.

Carburetor

Replacing the Mixing Chamber Cap

407. Before replacing the needle and cap the needle should be run out sufficiently far to insure against its touching the seat while the cap is being secured in position. Position the gasket on the body and insert the cap. Insert the screws and run them down. They should be tightened by drawing each one down a little at a time to insure the cap setting squarely on the chamber. When it has been tightened down loosen the jam nut which tightens the needle body in the cap so that the needle turns freely. Run the needle down until it touches the seat, then back it out one turn and the carburetor is ready for assembly on the car. Time and trouble will be saved by first testing all repaired carburetors on the rack shown in Fig. 174 for a period of 20 minutes to insure that they do not leak.

The Valve Plates

408. The valve plates sometimes become bent due to abuse, and it becomes necessary to replace them. They are removed by withdrawing the bridge wire (staple), after which they may be pulled out with a pair of pliers. The new plates must be drilled when in position in the carburetor. The setting of the air inlet butterfly is unimportant—simply insert the new plate and drill the two holes for the wire with a No. 52 drill, insert the wire and bend over the ends. When inserting the plate in the throttle valve a thickness gauge (piece of paper) should be placed on the low speed hole side to force the plate toward the opposite side of the passage. There should be no more than .006 between the edge of the plate and the side of the passage. The holes are then drilled and the wires inserted and secured the same as in the air inlet valve.

Replacing the Intake Throttle Lever Spring

409. First remove the plate as described in Par. 408. The shaft together with the throttle lever may then be withdrawn. Remove the old spring and insert the new one, bending over the end which extends through the hole in the lever. Secure the hook end of the spring around the boss on the mixing chamber body and force the rod into position. Next place the plate as explained in Par. 408.

General

410. Remember that the general trouble with carburetors is that the holes and passages become stopped with dirt or with foreign substances or with water, and the mechanic should bear this in mind when overhauling a carburetor. Besides the holes and passages discussed, the mechanic's attention should be called to the holes B and G. These are both overflow holes which take care of any excess of gasoline which may be drawn into the mixing chamber or inlet manifold. “B” allows the gasoline which condenses in the inlet manifold to return to the pool in the spray nozzle; when an excess of gasoline forms in the pool part of it runs off through the hole through passage “G”.

# Fordson Tractor Section

**Serial Numbers of Tractors Shipped Each Month from Oct. 1st, 1917, to Dec. 31st, 1919**

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<tr>
<th>DATE</th>
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This list will be supplemented each month.

## Special No. 3

**Main Bearing Cap**

![Fig. 229](image)

In Fig. 229 is shown a special main bearing cap designed for taking up end play in crank shaft.

When overhauling tractor motors, always use this cap on the rear main bearing. This avoids any possibility of magnets coming in contact with magneto coil.

Part No. 2565, list price $3.00.

### Grease Not a Proper Lubricant for Fordson Transmission

We recommend only a heavy fluid gear oil for the Fordson transmission and rear axle.

Under no circumstances should greases or compounds be used for this purpose. The
same lubricant used in the transmission must also furnish the necessary filament between the teeth of the worm wheel and worm in order to insure against friction and premature wear. For further information on proper lubrication, see Tractor Lubrication Chart, Page 73, Fordson Manual.

**Kerosene vs. Gasoline**

The Fordson Tractor is equipped with a specially designed vaporizer for using kerosene as a fuel. Recent tests have proven that the Fordson motor will operate, gallon for gallon, just as efficiently on kerosene as on gasoline.

In obtaining this efficiency the Fordson Air Washer plays a prominent part, as it furnishes sufficient moisture to reduce carbon deposit to the minimum. The moistened air mixed in proper proportion with the heated kerosene vapor furnishes a perfect combustion mixture. Approximately one quart of water is consumed per hour when the motor is running at 1000 R. P. M. Were it not for the air washer, 15% more fuel would be consumed in the same length of time.

**Tractor Speeds**

Plowing speed is 2 1/2 miles per hour; low speed 1 1/2 miles per hour; high speed 6 1/4 miles per hour; and reverse speed 2 1/2 miles per hour. This is calculated on engine speed of 1000 R. P. M.

**Retarded Spark**

Many valves, vapor tubes and manifolds burn out through the constant operation of the tractor with a retarded spark. The spark should be retarded only when the motor slows down under a heavy load, or when idling, and great care should be taken not to retard the spark too far.

The greatest economy of fuel consumption is obtained by driving with the spark sufficiently advanced to obtain the maximum power. Driving with the spark retarded is purely the fault of the operator.

**Tractor Hitch**

Fig. 230 furnishes a very good illustration of both the improper and the proper method of making a chain hitch. Never wrap a chain around the rear axle housings; always hitch to drawbar cap.

When it is necessary to use a chain for any heavy pull, fasten chain to drawbar with a clevis and operate tractor in low speed. Avoid unnecessary delays by carrying a clevis in the tool box at all times.
Comparative Size of Ford and Fordson Parts

The above photograph shows an attractive Sales Room Display of Dayton Keith, Ford & Fordson Dealer of Bloomington, Ill. We believe the method adopted of comparing Ford & Fordson parts is a good one.

The Ignition of Gasoline by Static Electricity

There are innumerable instances of fires, due to ignorance on the part of the men handling gasoline. Besides the self-evident hazard of tobacco sparks, open flames and sparks due to opening electric switches and defective wiring, there is the danger of sparks due to the generation of static electricity by the flow of gasoline. Every mechanic knows that electricity is produced by rubbing two substances together, as for example, the sparks which jump from a running machine belt to one's hand in cold weather. In the same way, static electricity is generated by the friction between moving gasoline and its container. If some means is not provided to conduct this electricity away from the container, it will build up until there is a sufficient amount to jump a small gap, causing a spark, which will ignite the gasoline. By following the rules
appearing in "Motor Vehicles and Safety" published by the Travelers Insurance Company, of Hartford, Conn., the danger from this source may be eliminated.

The following advice is given by the National Board of Fire Underwriters, for preventing fires due to the generation of static electricity when pouring gasoline:

1. Never use a hose except of metal or metal lined, making it of the non-static type, which should be in metallic contact with the supply tank. Rest the nozzle at the end of the hose in the filling opening of the tank of can.

2. Never use anything but a metal can or tank. Use approved containers.

3. Never use anything but an unpainted metal funnel.

4. In pouring from an open mouth can, rest the can on the funnel. Be sure the funnel is in metallic contact with the receptacle being filled.

5. Never hold a chamois skin away from the funnel, but allow it to rest against it.

6. Never let a stream of gasoline fall any distance to any kind of receptacle from a valve or nozzle above. Gasoline passing through the air generates static electricity.

7. In filling tank wagons, if the funnel is suspended from the filling pipe allowance must be made for the lowering of the tank because of the compression of the springs.

The Model T Chassis

In Fig. 234 we show an assembly drawing of the Model T chassis with the principal dimensions for commercial body designing. These dimensions apply regardless of the type of body the purchaser intends installing. Dealers should find this diagram of considerable value in explaining to purchasers the dimensions, etc., of bodies that can be used to advantage on the Model T chassis.

Pedal Bending Irons

In Figure 232 we show a Pedal Bending Iron 3-Z-672 and Pedal Adjusting Iron 3-Z-744. We still have some of these tools in stock, and, until our supply is exhausted, will furnish them to dealers and service stations at $1.00 and 75c each net respective. Orders should be placed with the nearest Branch.

Test Set for Starting and Lighting System

In Fig. 233 is shown the F. B. Test Set for locating trouble in the Starting and Lighting System before removed from the car. Full directions for locating and repairing any trouble in the Starting and Lighting System are furnished with each outfit. This test set can be used to advantage in connection with the F. B. Test Stand shown in Fig. 187.

The F. B. Test Set is manufactured by the F. B. Electric & Manufacturing Company, Detroit.

Replacements

Within three months' use, cutouts, ammeters and ignition and lighting switches that do not give satisfactory service may be
replaced without charge. After three months' service, cut-outs may be replaced at 75c net each, ammeters at $1.00 net each, and switches at $1.00 net each.

Neither dealers nor owners should attempt repairs on these parts. If the parts show evidence of repairs having been attempted, credit will be declined. No credit will be allowed on the cut-out if the seal is broken.

Care must be exercised in handling and returning these parts. Credit will be declined if parts show evidence of careless or rough handling.

Coil Unit and Magneto Test Stand

We have disposed of our stock of coil unit and magneto test stands shown in Figure 30, Bulletin No. 3.

We do not intend to stock any more of these stands. Dealers and service stations that were not able to get one of these outfits from the Branch may now obtain one from The Fairbanks Company, 416 Broome Street, New York City, their Branches or Distributors handling their line of service equipment.
Practical Methods of Repairing Ford Cars

The Ammeter

411. The ammeter shown in Fig. 236 indicates the amount of current flowing through the batteries when the generator is running at a charging speed, and the amount of current which the lamps and ignition (if ignition switch is on the battery side) are drawing from the battery when the generator is not cut in.

412. The automobile ammeters are only commercially correct, that is within 10%, so if it reads 13 as the high charging rate it is not necessary to change the adjustment of the third brush.

413. The hand on the dial should register zero when the lights are off and the engine is not running. However the hand may be off one point either way without danger to the system.

414. If it is on the discharge side disconnect the battery to ammeter wire at the meter to make sure that the meter is not registering a leakage of battery current. If the hand returns to zero the wiring should be inspected for a ground.

415. Care should be exercised that none of the wires are allowed to touch any of the metal part of the car as a heavy discharge of current may disarrange the meter. When installing the wires it is advisable to wait until all the other connections are properly made before attaching battery to ammeter wire to the ammeter terminal.

416. If any repairs or adjustments are necessary the ammeter should be returned to the branch. A fair exchange is made on defective or broken ammeters returned.
The Starting Motor

417. The starting motor is attached to the transmission cover on the left side of the engine. The power for starting is transmitted through the bendix drive to a ring gear on the fly wheel. The relation of these gears is such that the motor will make 12 revolutions for each revolution of the engine when starting. For a description of the construction and operation of the bendix drive see Page 25, Bulletin No. 4.

418. The starting motor is of the series wound type, that is, when the switch is in, the current passes from the battery through the field to the positive brushes into the commutator, then through the armature to the ground brushes. To decrease the resistance there are two positive brushes and two ground brushes, half of the current passes through two of the field coils, and one of the positive brushes, the other half of the current flows in a similar path on the opposite side of the motor.

419. The wiring of the motor is much heavier than that of the generator, because it carries a greater flow of current. The motor has a stall torque of between 14 and 16 ft. pounds and draws between 175 and 225 amperes when turning over an engine, depending on temperature and the amount the engine has been run in.

420. There are no ball bearings in the starting motor. The brush end bearing is self lubricating. The mounting bracket arm has a babbitt bearing for the bendix drive and a bronze bushing for the armature shaft. The last two bearings are lubricated by the oil in the transmission. The brush end bracket requires no lubrication as the motor is seldom run for more than a few seconds at a time.

421. Because of the short duration of its operation the motor requires very little attention. However, it should be removed and overhauled once a year to insure efficient operation. A back-fire may spring the armature shaft or disarrange the bendix drive, making repairs necessary.

422. If the motor fails to turn the engine over test the battery, inspect the wiring and try turning the engine over by hand before removing the motor.

The Kingston Carburetor

423. Fig. 228 shows a phantom view of the Kingston Carburetor. The level of the gasoline is maintained by means of the float and inlet valve in the same manner as described in the articles on the Holley Carburetor. When the engine is not running, the gasoline rises until it forms a pool in the mixing chamber, submerging the end of the low speed venturi, through which the needle valve extends. There are four holes drilled in this venturi about 1/8 of an inch above the lower end. These holes allow the passage of air when starting the motor. When starting or when running at low speed the air valve is seated, causing all the gas and air to pass through the low speed venturi. Because of the small cross section of this venturi, sufficient velocity is attained to vaporize the gas. As the speed of the engine is increased, the air valve rises from the seat, allowing the air to pass through the main channel. At first the mixture that passes through this main channel is very lean, but it mixes with the over-rich mixture from the low speed venturi, delivering the proper mixture to the cylinders. As the speed or the load increases, the valve rises higher and higher until practically all of the mixture passes through the main channel.

Removing the Float Chamber Shell

424. The float chamber shell is removed by running off the nut on the bottom in the same way as explained in the Holley Carburetor. There is a gasket between the mixing chamber body and the float chamber where the threaded portion of the body extends through the plate, but there is no gasket at the top of the float chamber.

The Float

425. The float is removed, repaired and adjusted in the same manner as described for the Holley, excepting that the lower gauge setting is used in setting the float (See Fig. 193).

The Inlet Valve Seat and Spray Needle

426. The inlet valve seat is removed and replaced and any adjustment made on it the same as described in the articles on the Holley.

427. Remember that the Holley needles and seats are not interchangeable and that only Kingston parts should be used in repairing Kingston Carburetors.

428. Before replacing the float chamber see that the air vent hole and the gasoline feed hole are clear. The chamber should be replaced with the drain cock toward the inlet manifold. The mechanic should be sure that the gasket is in place and that the nut is tightened down properly. The carburetor...
should be tested on the test stand shown in Fig. 174 before it is installed on the car.

The Spray Nozzle

429. The spray nozzle of the Kingston is machined in the body of the carburetor and is not removable. It consists of a drilled hole tapered part way to fit the taper on the adjusting needle. If this seating is completely cut out it is necessary to replace the entire mixing chamber body, but because of the design of the carburetor it is seldom necessary to do this.

The Needle Valve

430. The needle valve is removed by loosening the clamp nut, after which the needle may be screwed out. In replacing the needle it is necessary to exercise a little care to be certain that the needle enters the taper of the spray nozzle seat, as there is considerable play in the threads when the clamp nut is loose. In making the adjustment with the needle valve take care not to screw the needle too tight on the seat and back it off about one turn before placing it on the car. The clamp nut should then be tightened so that any adjustments may be made from the dash, but the needle will be tight enough to hold its adjustment against the vibration of the car.

The Air Valve

431. The air valve is a very important part of the carburetor. A great deal depends upon its functioning properly. The valve is exposed by turning off the cap located in the mixing chamber body just above the valve. This exposes the weight and weight sleeve. On top of the weight is a small fibre disc which deadens the sound of the weight striking the cap. Between the shoulder of the weight and the sleeve there is a fibre ring gasket, which also acts to deaden the sound. When the weight and sleeve have been removed the air valve is exposed. To remove the air valve run out the shaft with a screw driver and withdraw it. The valves may then be removed through the opening left by the weight and cap. There is a fibre gasket secured to the valve which acts as a deadener when the valve falls onto the seat. This gasket should be in good condition and the valves should be inspected to see that there are no cracks between the ball and the shaft bearing.

432. To replace the ball insert the shaft bearing through the opening with the seat facing the inlet manifold end of the carburetor (See Fig. 237). When the hole in the shaft bearing is in line with the hole in the body, insert the shaft 238 and screw it down tight. Try the carburetor by tilting it slowly to see that the ball falls freely back and forth. Do not jerk the carburetor to make the ball move. If it is necessary to do this, the ball and shaft should be inspected to see that they fit properly. If the shaft is sprung a new shaft should be used; if the ball is tight on the shaft, or has no end play, it should be replaced by a new one. Replace the weights and sleeve, making sure the gaskets are in place and tighten down the cap.

The Valve Gates

433. The valve gates are subjected to the same abuse as in the Holley; they are removed and replaced in the same way, excepting that the throttle valve plate is located centrally instead of to one side as is done in the Holley.
Extension rims as shown in Fig. 239 may be installed on the rear wheels in order to secure additional traction in sandy or unusually soft soil. When plowing, an extension rim should be applied to the land side (left) wheel only. When discing, harrowing, seeding, drilling, etc., both wheels may be so equipped. The extension rims are 7" wide, and equipped with 10 cleats. The rims are drilled for bolting to the flange of the rear wheel. See Fig. 241. Necessary bolts and nuts are furnished with each rim. Extension rims are not part of the regular equipment of a tractor, but are furnished as an accessory by the Branches and Distributors.

Additional traction may be obtained in exceptionally light and loose soil, such as is found along the Pacific Coast and a few other states by attaching grousers or extension cleats, as shown in Fig. 240. The grousers penetrate the soil sufficiently to obtain a firm grip, thus increasing the traction. Grousers will be supplied within a short time by the Distributors and Branches.

Tractor Don’ts

1. Don’t forget to examine oil level in crank case before starting motor.
2. Don’t forget to clean air washer at least once each day.
3. Don’t run your tractor with loose bearings—adopt the “stitch in time” policy.
4. Don’t forget to release clutch before shifting gears.
5. Don’t forget to watch the fan belt—keep it tight, and the maximum amount of air will be furnished to prevent excessive heating.
6. Don’t fail to drain the radiator and air washer each night in freezing weather; this will reduce your repair bills.
7. Don’t forget to change the oil in crank case once each week.
8. Don’t choke the engine while running on kerosene, as this will foul the spark plugs.

Starting the Motor in Cold Weather

When dry cells or storage battery is used to facilitate starting in cold weather, tractor
operators should be cautioned against connecting the battery wires to the magneto terminal, as this will demagnetize the magnets. The tractor has no switch, hence it is necessary when a battery is used to disconnect the primary contact wire from the magneto terminal shown in Fig. 242. During exceptionally cold weather, the motor should be stopped by shutting off the fuel supply at the sediment bulb. This will eliminate any chance of unvaporized fuel remaining in the combustion chamber and fouling the spark plugs, thus making starting more difficult.

The Fordson Manual

While mechanical knowledge or experience is not required to operate the Fordson Tractor it is very desirable that the operator should understand his tractor.

The tractor dealers should instruct owners and operators to read their Manual. It is a well known fact that the owners who carefully read the Manual seldom bother the dealer with petty and unnecessary service cost.

Every question likely to arise during the operation of the tractor is answered somewhere in the Manual. Go over the index, pick out your question, and you will find the proper answer, written and illustrated in the manner the operator will understand.

One Manual is furnished with each tractor and will be found in the tool box.

Tractor Coil Units

When replacing coil units on the Fordson tractor, always be sure to use the regular tractor units, which are marked on the front of the unit as follows:

"Tractor Unit"

The tractor units are equipped with special vibrator points designed for high speed heavy duty work. The tractor unit is also filled with a composition which will withstand the high temperature developed by continuous service. DO NOT USE MODEL "T" UNITS IN THE TRACTOR.

The Fordson Fan and How to Take Care of It

The Fordson fan, illustrated in Fig. 243, is designed to supply 1700 cubic feet of air per minute with the tractor motor running at 1000 R. P. M. This volume of air is sufficient to properly cool the motor at all times.

The fan should be lubricated at regular intervals by unscrewing the oil plug and filling the fan hub with heavy fluid gear oil. Do not use grease for a lubricant, as the Fordson fan is equipped with ball bearings.

The belt should be inspected frequently and tightened when necessary in the manner shown in the accompanying illustration. If the fan belt is allowed to become loose, the volume of air drawn through the radiator is decreased resulting in overheating.
Another Attractive Sales Room Window Display of Ford Parts

Fig. 24

The proper display of Ford parts is becoming recognized as a good merchandising policy by an increasing percentage of Dealers every day. The volume of parts business handled by the average Ford Dealer certainly warrants a display as attractive as that of any other first class retail store. A well placed sign may direct people to your place of business, but an attractive window display more often invites them inside. A properly dressed window is the silent salesman on the job day and night. We are indebted to the Williamson Motor Co., authorized dealers of Rockford, Ill., for the above photograph.

Lamp Bulbs

The life of lamp bulbs, particularly the tail light and dimmer bulb, is considerably shorter in winter than in summer, because of the inherent properties of the storage battery. The internal resistance of the battery increases with the lower temperatures, therefore the terminal voltage of the battery is higher, necessitating a higher voltage of the generator to overcome the higher resistance of the battery.

If, however, the lamps burn out with too great a frequency, the trouble is probably due to one of the following causes:

Running the lights on the magneto current will cause the bulbs to burn out almost immediately.
A loose connection, poor contact or broken wire in the charging circuit (ammeter to terminal block, terminal block to starter switch, starter switch to battery, battery to ground) will act as an open circuit allowing the generator to build up an exceptionally high voltage, which will burn the lights out in a very short time.

Running the car at speeds that give a full charging rate thru a fully charged battery will shorten the life of the lamps, because of the rise in voltage. If this condition is indicated by the hydrometer test, weaken the battery by starting the engine several times, or by burning the lamps over night.

Grounding the Generator

Fig. 245 shows the proper method of grounding the generator. The wire used is a double strand of shipping tag wire, and the connection is made from the generator terminal to one of the brush end bracket screws. The practice of shorting the generator through the cut-out results in burned out points and may cause other troubles in the generator.

In Fig. 246 are shown the dimensions of the smallest garage in which any Model T car can be conveniently housed. If the space shown in the diagram is not available, the dimensions of the garage may be decreased by reducing the dimensions at sides and ends. If the space is available and more room is desired for working about the car, the dimensions may be increased. With the top down and the touring car in the same position as shown in cut, the clearance at the rear is 16 inches.

Towing Trucks

It is a well known mechanical fact that while a worm may drive a gear with ease, it is very difficult to drive the worm thru the gear, in fact, with a change of a few degrees in a truck axle gear and worm, it would be impossible.

When towing a truck the rotary motion of the rear wheel is transmitted to the drive shaft thru the gear and worm, creating heavy strains on the axle assembly and tires. New trucks should therefore always be moved under their own power.

The Starter Ring Gear

When the engine is stopped, the piston under compression tends to turn the crank shaft back until the compression is relieved, thus the crank shaft stops in one of two positions. When the Bendix gear engages, upon starting the engine again, the wear on the ring gear will therefore be at two points on the circumference. The repairman, when overhauling a motor, should remove the ring gear from the flywheel and replace it after turning it \( \frac{1}{4} \) of the way around. This will bring the wear on a new section of the gear.

Cars bearing Motor Numbers from 3659971 to 3743075 were shipped during the month of January.
Practical Methods of Repairing Ford Cars

Removing Starter Motor

434. To remove the motor it is first necessary to remove the bendix drive. The opening in the transmission cover, through which the armature shaft and bendix drive extends is closed by a cap which is attached to the cover, by means of four screws. When these screws have been removed the cap may be withdrawn. It is necessary to manipulate the clutch pedal in order to obtain clearance between the bendix drive and the slow speed connection.

![Fig. 248]

435. The bendix drive is now exposed and may now be removed as follows: Bend down the ear of the lock washer, which is against the head of the set screw with a pair of pliers, and run the set screw out of the drive head. The drive head is keyed to the shaft with a Woodruff key; it is necessary therefore, to draw it off with a straight pull. Sometimes a burr is thrown up on the shaft by the set screw causing the head to bind. Under such conditions the head should be removed with a 3Z-4712 Extractor (See Fig. 248), which may be purchased from the nearest branch.

436. After the head has been extracted the key is removed by means of a screw driver as shown in Fig. 249, after which the remainder of the bendix may be withdrawn. If the burr thrown up by the set screw is very heavy it may be necessary to dress it down with a fine file before withdrawing the bendix.

![Fig. 249]

437. Fig. 247 shows the relative assembly positions of the bendix and starting motor armature shaft. This will no doubt be of value to the amateur who is about to replace his first bendix. Fig. 250 shows the shaft and gear after the spring has been removed. This is as far as the bendix may be taken down. It will be noted that both the shoulder to which the spring is attached and the drive head are eccentric; this is to allow for the coil in the spring.
438. The sleeve indicated by (A) turns freely in the shaft, its function being simply to guide the spring as it coils. In assembling it is necessary to see that the lugs of the drive head fit into the slots of this sleeve, in order to have the bendix function properly. It sometimes occurs under extraordinary circumstances that the edge of the bendix tooth will register with the edge of the tooth of the ring gear, thus preventing it from meshing. The sudden end thrust may shear the set screw, allowing the head to move back. This will cause the bendix to bind so that it will be impossible to use the motor. It is then necessary to pull off the head, remove the broken set screw from the shaft, run the motor to see that the shaft is not sprung and, after a careful inspection of the other parts of the bendix, re-assemble it to the shaft.

439. After the bendix has been removed as explained above the motor may be removed because of the steering column it is necessary to take off the engine pans to obtain clearance. Run out the four screws which hold the mounting brackets to the transmission cover, disconnect the switch to motor wire from the terminal post, and remove the motor.

Repair Bench for Starting Motor

440. The repair bench for the starting motor is similar to the one for repairing the generator, excepting the battery wiring, which is much heavier, and the meter, which must read to 500 amperes.

441. The cables used on the starting motor circuit should be used to convey the current from the battery to the motor. All connections should be made with the lugs soldered to the ends of the wire.

442. Standard battery lugs should be used in making the battery connections. Before attaching the lugs to the battery terminals it is advisable to clean the surfaces with a piece of sandpaper (particularly the surface of the positive (+) terminal as a dark coating is usually present on this terminal).

443. When the motor has been secured in the vise try turning it over by hand to see that the armature is free, a piece of sandpaper wrapped on the shaft will aid in gripping it. If it turns freely, the dust cover should be removed and the commutator examined. If it is dirty, clean it with sandpaper as explained in the articles on the generator.

444. The repairman will note that the mica between the segments of the commutator extends clear to the surface. While it is unnecessary to undercut the mica on the motor, as the brushes are sufficiently hard to cut it away, the repairman should make sure that the brushes are not being held away from the commutator by riding on it.
445. Try the brush connections to see that they are tight. If everything is in good condition, touch the wire to the terminal and the armature should turn at a rapid rate of speed with a slight hum, the meter registering between 50 and 100 amperes with little or no arcing at the brushes. If it draws approximately 100 amperes or more and a decided hum is heard, it is possible that the armature is striking the yoke or the field leads. It will be necessary to remove the armature and find the high spot.

446. The armature is removed by running out the mounting-bracket-to-yoke screws, after which the bracket, together with the armature, may be withdrawn. It may be necessary to tap the bracket with a rawhide hammer to start it. When they have been removed, the bracket may be slipped off the armature shaft. Examine the armature to see where it is rubbing and examine the corresponding part of the yoke. If the armature is rubbing on the coils they may be bent back closer to the yoke with a hammer and block of soft wood, as shown in Fig. 251.

447. If the field pieces are loose, the yoke should be returned to the Branch for repair, as a special fixture is required to hold them in place while tightening.

448. If a ground is indicated by the ammeter hand moving clear across the ammeter dial when the circuit is closed, trace it into the armature, yoke or brush end bracket as explained in the articles on the generator, Pars. 379, 380 and 384, or in the following article on the yoke.

449. The Generator and Starter yokes should be inspected to see that they are not grounded and that none of the wires are broken. This is done with a test lamp. To see that the circuit is complete on the generator, hold the test points on the field lead terminals as shown in Fig. 253. If the circuit is complete, the lamp will light. It is hardly necessary to test the starter for a complete circuit in this way, because any break in the wires will be exposed to view. Simply inspect the connections carefully to see that they are tightly soldered.

450. To inspect the yokes for a ground, hold one test point on the lead terminal and the other on the yoke, as shown in Fig. 254. In this case there should be no light.

451. The coils should next be inspected to see if they have been damaged sufficiently to cause a short circuit. As tracing and repairing a short circuit involves disconnecting the coils, the repairman should not attempt to do this operation, but if he believes that the trouble is due to shorted field coils, he should try a new yoke.
Fordson Tractor Section

Instructions to New Owners

When delivering a tractor the dealer should call the owner's particular attention to the following points in the operation and care of the machine. A close adherence to these rules on the part of the operator will prolong the life of the tractor, saving both time and money:

1. The importance of correct lubrication cannot be too strongly impressed on Tractor drivers. The proper grades of oil must be used in the motor and transmission—motor oil must never be used in the transmission. The proper oil level must be maintained at all times. Do not forget that lubricating oil wears out and gets dirty and should be replaced frequently. Clean oil will protect the motor bearings and cut down spark plug trouble. (Note: By purchasing high-grade lubricants you insure all working parts against premature wear.)

2. It is very important the air washer be properly filled with water at all times. If due precaution is used in filling and cleaning the air washer at frequent intervals, not only will the life of the motor be lengthened but its power increased.

3. The Drawbar Cap is provided for your convenience in hitching. Always hitch to this Drawbar Cap. Do not hitch a chain or rope around the rear axle housing under any circumstances. When pulling a heavy load—or in case the Tractor becomes mired—be sure to keep your foot on the clutch pedal. Do not race the motor or let the clutch in suddenly, as this might lift the front end of the tractor off the ground. Should this happen, release the clutch immediately—this will bring the front wheels back to the ground at once. If the Tractor should become mired, always pull out in low gear. Do not attempt to pull tree stumps or do any similar work that might bring the Tractor to a sudden stop.

4. One of the worst abuses that can be given the Tractor is by racing the motor. Drivers must avoid this at all times. The proper speed to run the motor is 1000 revolutions per minute. This will give the Tractor the correct working speeds. When the motor is idling cut the speed down as low as possible and retard spark (spark lever down). When starting do not speed the motor to heat up the vaporizer quickly. This is destructive to the Tractor and will not accomplish your purpose.

5. Do not attempt to engage or disengage gears until clutch pedal has been pushed down all the way, nor while the tractor is in motion. When changing the gears, if the clutch is not entirely disengaged the teeth on the gears will not mesh readily, and there is danger of breaking off the edges of the teeth so that in time they will not remain in mesh. Always close the throttle to slow down motor, when shifting gears.

6. Do not run the Tractor down hill with the gears in neutral or with the clutch released. Engage the gears either in low or intermediate speed and use the throttle to govern the speed of the motor. In low gear for every revolution made by the rear wheels, the motor must turn eighty-five times, which acts as an effective brake.

7. If the motor develops a knock it is important the cause be investigated at once and corrected. If not corrected, it becomes more pronounced, thereby causing lack of power and tends to shorten the life of the motor. Never attempt to continue the work with the Tractor when the motor fires only in two or three cylinders. Besides losing power and wasting fuel, it causes raw kerosene to get into the crank case, thinning the lubricating oil.

Road Speed Data

The following table shows a comparative approximate of the engine speed, revolutions of the rear wheels and the distance traveled by the tractor when being driven in high gear:

<table>
<thead>
<tr>
<th>Rev. of Engine</th>
<th>Rev. of Rear Wheel</th>
<th>Tractor Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Per Min.</td>
<td>Per Min.</td>
<td>Ft. Per Miles Per Min. Hr.</td>
</tr>
<tr>
<td>1000</td>
<td>54</td>
<td>594</td>
</tr>
<tr>
<td>1185 1/2</td>
<td>64</td>
<td>704</td>
</tr>
<tr>
<td>1333 1/4</td>
<td>72</td>
<td>792</td>
</tr>
<tr>
<td>1481 1/2</td>
<td>80</td>
<td>880</td>
</tr>
</tbody>
</table>

As the tractor is running 63/4 miles at 1000 R: P. M., which is the rated engine speed, driving at speeds above 63/4 miles per hour is causing an overload of the motor, which, in time will loosen the bearings or pound them out of round.
The Fordson Worm

The Fordson worm is made of the highest grade vanadium steel, which is inspected carefully to see that it is within the proper specification. A final test is made on two out of each 100 worms. The worm is placed on 1/4" centers and 100,000 pounds pressure is applied in the center. (See Fig. 255.) If either one of the worms is depressed in excess of 1/8" (Fig. 256) by this test, the entire 100 from which they were selected is rejected.

Tractor Exchanges

Dealers may exchange parts with Tractor owners as follows:

Connecting Rods, if not damaged, other than babbitt being worn or burned out, may be exchanged at $2.00 net each. Main bearing caps, if not damaged other than babbitt being worn or burned out, may be exchanged at $1.50 net each.

Magnets may be exchanged gratis, within three months' service, if not damaged other than being demagnetized; beyond three months' service, $2.00 net per set.

Magneto Coil Assemblies may be replaced gratis, within three months' service, if not damaged by accident or abuse; after three months, $5.00 net each.

Coil units that require repairs other than the replacement of points within thirty days' service may be exchanged gratis; beyond this period no allowance is in order. Units requiring new points only should be returned to the dealer.

Burning Out of Bearings

When the tractor has buried itself due to the constant pulling on a load, it is advisable to unhitch, run ahead a short distance, and pull with a chain, making the hitch as shown in Fig. 230. The rear end dropping into the hole tends to keep the oil from properly lubricating Number One Bearing, thus causing the Bearing to burn out.

Tractor Power Rating

All tractors are given a double power rating—one for the draft, the other for the belt pulley. The Fordson is a 10-20, that is, at 1000 R. P. M. of the engine the tractor develops a drawbar horse power of 10 at the drawbar cap, and a brake horse power of 20 at the belt pulley.

The brake horse power is measured by a dynamometer and figured in the regular way. The drawbar horse power is figured from the pounds pull at the drawbar cap times the distance traveled in feet per minute, divided by 33,000.

(Draft x Ft. Per Min.)

33,000

To obtain the draft (pounds pull at the drawbar cap) a spring scale is attached between the drawbar cap and the load; the distance traveled in feet per minute is measured by a cyclometer and a stop watch or by measuring directly on the ground.

Tractors bearing Motor Numbers from 92114 to 96973 were shipped during the month of January.
In Fig. 257 is shown an inspection card used by C. A. Goodwin, our Authorized Dealer of Chestertown, Maryland. The use of this card insures the dealer that all essential points have been fully inspected before the car is delivered. The card is attached to the steering wheel so that the customer will see that the car is in condition for service when taken out. Mr. Goodwin states that it is pointed out to the customer by the use of this card to just what extent they have gone in delivering the car in perfect condition. Furthermore, this plan has resulted in a decrease in the number of cars returned for minor adjustments and consequently an increase in the number of satisfied customers.

Drive-Aways

There is a heavy drain on the storage battery, when using the starter in turning over a stiff motor. If the starter is used to turn over a new motor the car oftentimes reaches the hands of the customer with the storage battery wholly or partially discharged. Dealers, when driving away cars from the Branches, should not use the starter until the motor is thoroughly limbered up. Taking this precaution will eliminate the chances of the car being delivered to the owner with the battery in a rundown condition.

Connecting Rod Wrench

Dealers and Service Stations may now obtain the 3Z-2304 Connecting Rods Cap Bolt Nut Brace Wrench, with Universal Joint for No. 4 Connecting Rod from our branches. This wrench is shown in Fig. 40, Bulletin No. 5, price $2.50 list.
Winter Deliveries

Live dealers in the Northern States are giving a new kind of "service." It came as a result of the ever-increasing demand for cars which has been, and still is, away in advance of production.

In order to get their share of the production, the Northern dealers not only "sold" cars all winter, but they delivered them. And as a consequence, many of their customers who otherwise would have waited until spring to place their orders, and then waited longer for delivery, now have their Ford cars ready to use with the first signs of spring.

Safety First

Because three out of every seven accidents occur to men's feet, the Safety Department of the Ford Motor Company has adopted the following slogan, which may be of value in the shops of our dealers:

"USE YOUR HEAD AND SAVE YOUR FEET."

Comparison of Genuine and Imitation Springs

It has come to our attention that the manufacturers of imitation springs are representing their product to be just as good or better than genuine Ford springs. We obtained several samples of these springs for testing purposes. The average results are shown in the following table:

<table>
<thead>
<tr>
<th></th>
<th>Genuine Ford Spring</th>
<th>Imitation Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Composition</td>
<td>Chrome Vanadium Steel</td>
<td>Carbon Steel</td>
</tr>
<tr>
<td>Tensile strength per square inch</td>
<td>210,000 pounds</td>
<td>130,000 pounds</td>
</tr>
<tr>
<td>Elastic limit per square inch</td>
<td>200,000 &quot;</td>
<td>115,000 &quot;</td>
</tr>
<tr>
<td>Brinell hardness</td>
<td>415 to 460</td>
<td>241 to 444</td>
</tr>
<tr>
<td>Broke under Olsen testing machines shown in Figs. 66 and 67</td>
<td>60,000 Revolutions</td>
<td>26,000 Revol.</td>
</tr>
</tbody>
</table>

The various limits on the imitation springs do not conform to the specifications on the genuine Ford springs which were designed for the Model T car. Taking all these facts into consideration, it naturally follows that imitation springs will not stand the same amount of wear and tear as genuine Ford springs. Genuine Ford springs are sold as low as the cost of material and manufacture will permit, and Model T owners should not be misled by any representations that imitation springs are just as good.

Practical Methods of Repairing Ford Cars

The Yoke

(Continued from page 174)

452. Care should be taken that the leads on the generator yoke are connected to the proper brush terminals. The earlier fields were wound opposite to the later, and it is therefore necessary to cross the leads on the latter. To determine how they should be connected, test the field with a battery and compass as follows:

453. Attach the leads to wires leading to the battery and try the field poles with a compass as shown in Fig. 259. The north pole (blue) of the needle will point to one pole, the south to the next, etc. If the poles do not indicate with reference to the terminals as shown in the diagram, reverse the leads on the battery wires and test with the compass again. If it indicates properly now, the lead attached to the Positive (+) wire from the
battery is the one to be attached to the third brush.

454. It is impossible to mix the leads on the motor, as both are secured to the positive brushes.

The Brush End Bracket

455. The brush end bracket of the starter motor differs from the generator bracket, in that there is no oil hole in the bearing end, the bearing being of the self-lubricating type, and a press fit in the bracket.

456. As there is little or no wear on the bearing, there is little likelihood of its needing replacing due to wearing over-size. If such a case arises, the bearing will have to be turned out on a lathe, or with a square drift.

457. If the bearing should freeze onto the shaft as would be indicated by the noise and uneven running of the motor, it will of course, come out with the armature, in either case a new bearing is inserted, driving it in on an arbor press, or with a block of wood and a hammer.

458. As no adjustment of the brush setting is required, the brush holder support is riveted to the bracket. Two of the brush holders are riveted directly in contact with the support, and the other two are insulated from it. The former are the negative or ground brush holders; the latter are the positive brush holders, to which the field leads are attached.

459. The brush holders should be inspected, and any necessary adjustment made as described in paragraphs 383, 384 and 395.

The Brushes

460. It is seldom necessary to install new brushes in the motor, as they are comparatively hard and receive very little wear. When it is necessary they may be seated as described in paragraphs 363 to 365 inclusive.

Brush Sanding Tool

461. Where it is necessary to sand in more than one brush the tools shown in Fig. 260 will greatly facilitate the operation. It is made by cutting the commutator of a scrap armature undersize and placing a piece of sand paper on the commutator. The joint where the two ends of the paper come together should be cut at about 10 degrees to insure a smooth surface on the brushes. To use the tool remove the armature replacing it by the tool. A few rotations will bring the brushes to a good seat. Experience has shown that about 75% of the brushes so sanded will be in perfect condition after the generator has been run as a motor for from 20 minutes to a half an hour.

462. While the above cut and description refers to the generator, it applies equally well to the motor.

The Mounting Bracket

463. The mounting bracket should be inspected to see that the armature shaft bushings and bendix bearing are in good condition. The bearing should be a slip fit on the armature shaft while the bendix bearing may have as high as .008 or .010 play.

464. If the bendix bearing is worn oversize it is necessary to return it to the Branch for rebabbitting. If the bushing is worn, or if it has turned in the bracket, it should be driven out and replaced by a new bushing. After the new bushing is installed, an oil relief hole should be drilled into it through the hole in the bracket.

(To be Continued)
Fordson Tractor Section

Breaking in a Tractor

The owner of a new car is always cautioned not to drive above 15 to 25 miles per hour, and to maintain an oil level above normal during the first 500 miles that the car is operated. By doing this the different parts gradually find themselves, and a more satisfactory operating car is the result.

The same general rule applies to the tractor. A great deal of difficulty may be avoided in tractor operation by greater care in breaking in a new machine. This responsibility rests largely with the dealer, and it will pay him to make a thorough study of it in order to reduce the service cost later.

In view of this fact it is advisable for dealers to allow the engine to run idly at from 600 to 800 R. P. M. for possibly three or four hours before delivering the tractor to the purchaser. The extra expense incurred by this operation is more than offset later on by a reduction in the number of service calls.

After delivery, the dealer should call upon the owner once a week during the first month that the tractor is in service, giving such instructions as are necessary regarding its operation and make whatever adjustments are required to keep the tractor in first-class running order.

Keep the Draw Bar Cap Tight

Dealers should not fail to caution owners to keep the draw bar cap tight; the four cap screws should be tried every few days. Failure to do this may result in breakage of both the cap and transmission housing, necessitating expensive repairs.

Plowing Acreage and Speed Data

1 Mile equals 5,280 feet

1 Square Mile equals 27,878,400 square feet, or 640 acres.

1 Acre equals 27,878,400 square feet divided by 640, or 43,560 square feet.

1 Furrow, 28 inches wide and 1 foot long, equals 2 1/2 square feet.

1 Acre of 28 inch furrows equals 43,560 square feet divided by 2 1/2, or 18,695 feet long, or about 3 1/2 miles.

To find the number of feet of furrow plowed per minute, divide 5,280 (the number of feet in one mile) by 60 (the number of minutes in one hour) which gives 88; then multiply 88 x 2 3/4 (the proper plowing speed for Fordson Tractors) and the quotient, 242, is the number of feet plowed per minute.

To find plowing time for one acre, divide 18,695 (the number of feet of 28-inch furrow in one acre) by 242 (the number of feet of progress per minute) and the quotient, 78 9-10 is the number of minutes (1 hour and 19 minutes) required to plow one acre.

To find the number of acres to be plowed in one day of ten hours, divide 600 (the number of minutes in a 10-hour day) by 78 9-10 (the number of minutes required to plow one acre) and the quotient, 7 3-5 is the number of acres plowed in one day of ten hours.

The above data is based on a driving speed of 2 3/4 miles per hour—the proper plowing speed for a Fordson Tractor.

Tractor Gear Ratios

The ratio of engine to rear axle is as follows:

<table>
<thead>
<tr>
<th>Gear</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Speed</td>
<td>84.28-1</td>
</tr>
<tr>
<td>Intermediate (Plowing) Speed</td>
<td>45.77-1</td>
</tr>
<tr>
<td>High Speed</td>
<td>18.26-1</td>
</tr>
<tr>
<td>Reverse</td>
<td>47.76-1</td>
</tr>
</tbody>
</table>

The following table gives the revolutions of the rear wheels and worm gear per minute and the road speed in miles per hour, in low, intermediate, high and reverse gears.

<table>
<thead>
<tr>
<th>Gear</th>
<th>R.P.M. Wheels</th>
<th>R.P.M. Worm</th>
<th>M.P.H. Road</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Inter-</td>
<td>11.86</td>
<td>207.6</td>
<td>1.48</td>
</tr>
<tr>
<td>mediate</td>
<td></td>
<td>382.3</td>
<td>2.73</td>
</tr>
<tr>
<td>High</td>
<td>54.76</td>
<td>958.3</td>
<td>6.84</td>
</tr>
<tr>
<td>Reverse</td>
<td>20.90</td>
<td>366.4</td>
<td>2.61</td>
</tr>
</tbody>
</table>

Paint Your Tractor

Dealers should point out to tractor owners the importance of painting the tractor before starting the spring work. A fresh coat of paint will not only preserve it from rust, but give it a smart appearance.

One quart can of gray, one quart can of red, and one half pint can of black metal paint at a cost not to exceed $3.50, is sufficient to dress up a Fordson in new spring clothes.

The sectional view shown in Fig. 261 will help the dealer and repairman to understand the construction of the Fordson Tractor and the relation of the different units.
Practical Methods of Repairing Fordson Tractors

The principle of the tractor engine is the same as the Ford Model “T,” and, generally speaking, what applies to one in the way of tracing trouble applies to the other. It will not be necessary, therefore, to discuss the subject here—instead we will refer the reader to Bulletin Numbers 1, 2, 3 and 4 of Volume 1, and will enter immediately upon the discussion of the repairing of the several parts.

The Tractor Fuel System

465. The tractor fuel system (Fig. 263) is so designed that the engine will operate equally well on gasoline, distillate or kerosene.

466. To operate efficiently on heavier fuels it is necessary to preheat the vapor to insure a perfect gas before mixing it with the main air supply. This together with the air washer, and the auxiliary starting system, makes the vaporizer appear very complicated, while in reality it is very simple, and is soon mastered by one familiar with the Ford principle of carburation.

467. The system is comprised of: 20 gallon fuel tank, 2-quart gasoline tank (for starting), air washer assembly, float chamber assembly, vapor tube, mixing chamber assembly, manifold assembly, together with the necessary pipes, connections, valves and fittings.

468. Before attempting to repair the fuel system, the mechanic should understand the principle of operation and a little about the functioning of the separate parts.

469. When the engine is started the shifter valve lever (see Fig. 262) is turned so that the letter G is exposed. This turns the valve in such a position that the gasoline feed pipe (from the small tank) is connected with the throat, permitting the gasoline to be drawn through the taper hole which acts as a jet in spraying the fuel into the air.

470. When cranking, and when the engine is running on the small tank, gasoline is drawn into the mixing chamber by the suction created in the cylinders and the venturi action of the air at the jet. The quantity of air passing this jet is so small that an over-rich mixture enters the vapor tube. This tube passes through the exhaust manifold in the path of the hot exhaust. While passing through this coil the fuel is broken up by the heat into a perfect gas. From the vapor tube this gas is drawn through the shifter valve into the throat of the mixing chamber where it mixes with the main air supply and passes through the inlet manifold into the cylinders.

471. Operating on the small tank is poor practice, as this system is not practical as a source of power, and should be used only for starting and warming up a cold engine. After one to two minutes running, the valve (Fig. 262) should be shifted so that the letter K exposed.

472. Running for any length of time on the gasoline starting system will cause the vapor tube to burn out.

473. When the letter K is exposed, the engine is operating on the main system, the fuel being drawn from the main supply tank, marked fuel tank in Fig. 263. The fuel flows by gravity to the float chamber where a constant level is maintained by a float and valve, in much the same manner as in the Ford carburetor.
manner as on the car, excepting that the valve is opened a little more. When starting, the valve is opened 2½ turns and the proper adjustment is obtained by closing it to the proper running of the engine, which is about 1¾ turns on gasoline and 2 for kerosene. The adjustment should be made after the engine has been thoroughly warmed up, with the exhaust shunt valve half open and the choke valve wide open.

477. The air washer serves two purposes: first, it removes the dust and dirt from the air, and second, moistens the air sufficiently to insure a smooth running engine.

478. There are two units in the system which may be classed as wearing parts: The float in the air washer, and the vapor tube. These parts wear out in time and will have to be replaced. With ordinary care the other parts will last indefinitely.

479. Trouble may be traced to the fuel system as discussed in Bulletins 1 through 4. Kerosene is slow burning, and it is therefore possible to have a knock in the motor due to preignition, if the air washer is not functioning properly.

The Air Washer

480. The air washer (Fig. 264) consists of a cast iron tank with a stand pipe in the center through which the air enters from the outside. The air is deflected through the water by means of a sleeve (guide) which fits over the stand pipe and is supported by two floats. This sleeve moves down as the level of the water lowers, until finally the sealed end of the sleeve rests over the opening of the stand pipe, shutting off the air supply, thereby stopping the engine.

481. The air washer should always be kept filled. When driving the tractor hard it is necessary to add water twice a day as the engine consumes approximately 1 quart of water per hour when running at 1000 R. P. M. If the work is particularly dirty, it is necessary to clean the bowl daily. This is done by removing the drain plug and flushing it with water.

482. To prevent an excess of water being drawn into the cylinders, an air deflector is placed above the surface of the water. Part of the moisture of the air deposits on this deflector and runs back again.

483. Trouble in the washer is usually noted by lack of power—a rich mixture showing black smoke at the exhaust, even with the needle valve turned lower than normal; or on the other hand a lean mixture requiring the priming valve to be partly closed to have the engine hit evenly.

484. Trouble in the air washer is often confused with ignition trouble by one who is judging by the sound and running of the engine.

485. The first thing to do if the trouble is indicated in the washer, is to drain the water and flush out the bowl. If this does not overcome the trouble, remove the cover and examine the interior. The cover and float may be removed without taking off the fuel tank. Run out the two (tube flange to cover) cap screws. This frees the flange which may be raised off the primary air supply pipe and drawn off the main air supply pipe. Next drain the water out of the bowl and remove the four cover to bowl bolts, the cover may then be removed, taking care not to damage the float. When the cover has been removed take off the deflector, after which the float may be taken out.

486. If clearance cannot be obtained between the fuel tank and the float, due to the float remaining in a raised position, it is necessary to raise or remove the fuel tank. Take off the fuel tank band on the dash, loosen the nuts on the band on the radiator top tank and disconnect the fuel supply tube. The tank may now be raised up on the dash end sufficiently high to clear the cover. If, however, this does not suffice, disconnect the fuel tube from the sediment bulb and remove the steering wheel; after which the tank may be completely removed.

(To be Continued)
A Stockroom System

The stock system shown in Fig. 265 is worthy of the consideration of every Ford Dealer, large or small, because of its many distinctive features.

It consists of a number of standard size boxes supported on racks. (See insert.) The dimensions of the three sizes of boxes permit them to be placed in any convenient order. It is a neat, compact, flexible system, one that can be expanded or contracted at will. The stock being below the level of the eye, the full value of the light is obtained in all parts of the stockroom.

The boxes containing the stock may be removed from the stands, which reduces the labor in moving the stockroom, taking inventory, and in case of fire considerable more stock could be removed to a safe place than if it were stored in a bin system.

The system may be built locally from the specifications given, or if a sufficient number of dealers are interested, arrangements may be made with the Branch to purchase boxes at an advantageous price from some local box manufacturer. The dimensions of the stand and boxes are given in the insert of Fig. 265. The boxes may be made of 1" cotton wood or any other light strong lumber.

There are three sizes of boxes, the outside dimensions of which are: Large size 13"x26"; Half size 13"x13"; Quarter size 6½"x13". The sides of the small boxes...
have three grooves so that partitions dividing them into halves or thirds may be inserted. These smaller compartments are very desirable for small slow moving parts.

For storing Cylinder Blocks, Transmission Covers, etc., double deck racks 30"x36" are used without boxes. The long parts such as Radius Rods, Pull Rods, Running Boards, etc., are stored in an "umbrella" rack which consists of a platform with skeleton upright compartments 30" high, each compartment approximately one foot square. The fenders are carried in standard fender racks with a filled in platform on top for such articles as Curtains, Hoods, Lamps, etc. Such a rack may be seen at any of the Branches.

The boxes and racks may be painted to suit the surroundings, or the dealer's taste. A very popular finish is obtained with a red creosote shingle stain to which lamp black is added until a dark mahogany red is obtained.

Each box should be fitted with an index plate into which a card bearing the number of the part it contains can be inserted. When a box is subdivided, two or three numbers may be placed on the card, the top number representing the first compartment, the second the middle compartment, and the lower number the rear compartment.

The system is installed in the following manner: Take a Parts Price List beginning at the lowest number and selecting suitable sized boxes for the quantity of stock of the particular item, and place it on the rack. The next part in order is handled in the same way, going through the entire stock in this manner, keeping the parts in numerical order. To increase the holdings on a particular part, it is simply a matter of taking out the box and replacing it with a larger one, moving the other boxes down the line to make room for it. Furthermore this system permits of adding or obsoleting a part by simply adding or removing a box, and moving the other boxes along to maintain the numerical order.

Repair Parts Service

With the enormous growth of the business and the consequent enlargement of the dealer's organization, it is more essential than ever that the service given Ford owners be carefully supervised. It is important that you instil into every man in your organization the same feeling of obligation toward the customer that you hold as a representative of this Company. Do you know how many customers are turned away from your stockroom window every day with a statement something like this: "We have these parts on order, but they have not reached us." Instead of being informed that a telegram would be sent to the Branch immediately calling for an express shipment, the customer departs without any satisfaction as to when the parts may arrive. Some definite action should be taken by the dealer towards securing the parts—rather than force the owner to hunt for them.

A case came under our observation recently where a customer called at a dealer's place of business for a "Rear Spring Main Leaf" and was told: "Sorry, we are out of these parts." No effort was made to send to a neighboring dealer for the part, or to dismantle one of the Rear Springs which the dealer had on hand. Indifference of this kind on the part of the dealer's organization is a serious reflection on our reputation for service. A vast amount of good will may be gained or lost through the service given at your stockroom window.

Hydrometer Readings

In taking hydrometer readings the operator should be careful to see that the stem of the float does not rest against the shoulder of the glass of the syringe. (See Fig. 266.) To provide against this only draw sufficient solution to float the stem in a position which may be easily read.

Return Connecting Rods

Only a small percentage of the connecting rods shipped out are returned for rebabbitting. The material entering into the manufacture of these rods is hard to obtain, and Dealers and Service Stations will assist us in maintaining a sufficient production of connecting rods by returning to the Branches all rods received in exchange.

Cars bearing Motor Numbers from 3743076 to 3817430 were shipped during the month of February
Practical Methods of Repairing Ford Cars

The Mounting Bracket

(Continued from page 179)

487. The old style motors were equipped with felt washers to keep back the oil. This bushing may be driven out and replaced by the new type. The repairman should then drill both the bracket and the bearing. (See Fig. 267.) It is further necessary to drill a 1/8" hole in the lowest point of the yoke to allow any oil which might accumulate to drain out.

490. After the bracket has been secured to the yoke with the screws and lockwashers, it should be checked for fit with the bendix drive, as shown in Fig. 268.

491. The bearing should be a free fit. If it is tight, loosen the bracket to yoke screws and tap the bracket over with a rawhide hammer, as shown in Fig. 269. If there is only a slight bind, it is unnecessary to loosen the screws. If this does not overcome the difficulty, the mounting bracket should be removed and examined, together with the yoke, for dirt or a burr, which would throw it out of line. If there is nothing to throw the bracket out of line, the bracket is probably out, and should be replaced by a new one.

Testing the Assembly

492. When the motor has been assembled (excepting for the dust cap) it should be finally inspected to see that the brushes are down, the springs set properly, that the leads are not rubbing the armature, that the exposed ends of the wires and the pig tails are in no danger of grounding, and that all connections are tight. Finally run it with the battery current for a short time, noting that it runs smoothly without arcing at the brushes, and draws between 50 and 100 amperes.

Assembling the Motor to Engine

493. Set the gasket on the mounting bracket and position the motor on the cover so that the terminal post is on top; the opening in the mounting bracket arm being toward the fly wheel. Position the gasket so the holes line up properly and start the screws (with
lock washers) in the holes. Draw the screws down evenly until they are tight, after which the wire from the starter switch should be connected.

494. Next install the bendix. Fig. 247 shows the relation of the bendix and motor armature shaft. If the bendix has been disassembled as shown in Fig. 250 it is first necessary to assemble the drive and spring. In making this assembly a new lock washer should be used as the bending of the ear has ruptured the metal, and there is danger of its breaking off, allowing the cap screw to work out and damage the transmission.

495. The washer should be assembled so the ear fits into the space left between the end of the spring and the coil, as shown in Fig. 270. When the cap screw has been tightened down, bend the ears up against the head of the screw with a pair of pliers.

496. This assembly is now put onto the armature shaft and forced well forward to leave room for inserting the Woodruff Key, which is tapped into position with a hammer, the shaft being supported by hand, or on a wooden block. The drive head is next fitted onto the shaft, the bendix being turned so that the loop in the end of the spring positions over the set screw hole. When the hole in the head lines up with the hole in the shaft, insert and run down the set screw, installing a new lock washer as described above.

497. Finally install the bendix cap, making sure the cap to transmission cover is in place and in good condition. Run down and tighten the four screws on the lock washers. Next give the assembly a final test by pressing in the starter switch. If the engine is turned over properly, replace the engine pan and put the car in condition for delivery to the customer.

The Starting Switch

498. The starting switch is used only to start the engine by means of the starting motor. When pressed down it closes the circuit in the starting system, allowing the current to flow through the motor. The switch (see Figs. 271 and 272) consists primarily of the two contact terminals which are secured to and insulated from the lower half of the housing and the bus-bar, which is a floating fit on and insulated from the plunger. The plunger bus-bar is held in the raised position by means of a coil spring acting between the top half of the housing and the cap of the plunger. When the driver presses on the plunger, the spring is compressed, allowing the bus-bar to come in contact with the terminals closing the circuit, the current flowing through the bus-bar between the terminals. When the pressure is released the spring raises the plunger, thus opening the circuit.

(To be Continued)
Fordson Tractor Section

Tractor Motor Stand

Many inquiries have been received from Dealers for a stand for use in repairing tractor motors.

In Figs. 273 and 274 we show two of the positions of the cylinder block on the Carswell-Hammond tractor motor stand. This stand is built of heavy material throughout, and equipped with coil springs to assist the repairman in turning the motor from one position to another.

The stand is manufactured by the Carswell-Hammond Manufacturing Company of Boone, Iowa.

The Belt Pulley

The Fordson Belt Pulley (Figs. 275 and 276) furnished by the Company as an accessory, was designed especially for use with the Fordson Tractor in order that the engine might be used as a source of power for belt driven machinery.

The pulley is 9½" in diameter, 6½" wide and is slightly crowned to insure the belt running in the center at all times. It is constructed of a special paper fibre which prevents slipping, requires no refacing, and is easy on the belt.

The drive is through a spiral bevel gear on the drive shaft, the pulley running at the same speed as the engine. The pulley shaft is supported on ball bearings which reduces the friction to a minimum, so that at 1000 RPM (the rated speed) there is approximately 20 Horse Power available at the pulley.

To Install the Pulley

1. Place a jack under draw bar cap, slightly toward the right hand side. Jack up the tractor sufficiently to remove the right rear wheel, first making sure that the tractor is properly blocked before removing it.

2. Remove foot bracket, part No. 1749 (See Plate No. 1 Fordson Manual) and satisfy yourself that the tractor is equipped with part No. 1549, Transmission Drive Shaft Spiral Bevel Gear. This is the gear that drives the pulley attachment and must be installed before the pulley can be operated. If you find that this gear is not installed you can procure one (gratis) from your distributor.

3. Install pulley attachment assembly so that the hole in the pulley housing is in a downward position, to let the lubricating oil drain back into the transmission.
4. Two paper gaskets, part No. 1900, are provided with each pulley attachment and are to be applied before bolting the pulley housing to the transmission case.

5. After tightening up the six cap screws, hold the pulley between the two hands and make sure that there is a slight play or backlash between the two gears, otherwise a grinding noise will be noticed while running which indicates that the gears are too tightly meshed. Operating in this condition will cause the premature wearing of gears and ball bearings in addition to consuming more power than is required. After installing pulley attachment, if the gears are meshed too tightly, a third gasket should be applied. This can be made from ordinary wrapping paper.

6. In cranking the engine after the belt has been applied, see that the clutch pedal is held down or difficulty will be experienced in turning over the motor.

The pulley bearings are lubricated by the oil in the crank case. When running the motor for a belt operation, it is necessary to maintain the oil level close to the top pet cock to insure the proper amount of lubrication reaching the outer bearing. If an excess of oil works out of the pulley end, reduce the oil level in the crank case to below the top pet cock.

**Lighting Tractors**

For night work the tractor may be lighted by oil, acetylene, Prest-o-lite, or electric lamps. If the latter are used, current may be supplied either by a storage battery or by the magneto. If a 6 volt battery is used the lights should be connected in parallel as shown in Fig. 277, using 6 to 8 volt single or double contact lamps. The diagram shows a single wire system, the metal work of the tractor acting as the second wire. The battery should never be connected in any way with the same system as the magneto, as this practice invariably results in discharging the magneto.

![Fig. 277](image)

When the magneto is used as a source of current for lighting, it is advisable to connect the lamps in series as shown in Fig. 278. The sum of the voltage of the bulbs should be 18-24 and the total candle power should not exceed 45. It is necessary to use double point contact bulbs when wiring in series.

![Fig. 278](image)

Probably the best results will be obtained by having two 15 candle power 9-12 volt lamps in series. The lamps in series should both be of the same candle power, as the lower candle power lamp controls the flow of current, causing the higher candle power lamp to burn dim.
Practical Methods of Repairing Fordson Tractors

The Air Washer
(Continued from page 184)

499. The float should be examined to see that it does not leak. Usually this may be determined by shaking it and listening for the sound of water inside. See that the guide is not damaged so it will stick on the deflector and that the floats are securely connected to it. Finally see that the floats are not badly collapsed, as collapsed floats allow the float assembly to settle too deep in the water.

500. Small leaks in the floats may be repaired by soldering. A final test on a soldered float should be made on the repaired float by submerging it in four to five inches of water, holding it down by a weight for a period of five hours or more. Before replacing the float, the bowl and air passage in the stand pipe should be thoroughly cleaned.

501. A very important point in the assembly of a fuel system is to have air tight joints. Good gaskets are essential, and the repairman will save time and expense by making sure they are in perfect condition. If there is the least bit of doubt, use new ones. The gaskets should be shellaced to the bowl and the cover, making sure that the bolt holes are not covered.

502. Fig. 279 shows the relative assembling positions of the air washer. Put float in the bowl, and place a gasket on the bowl. Next position the deflector on the bowl with the convex side down. This is very important as the deflector will not function properly in the inverted position. Furthermore the deflector acts as a guide for the float assembly, and if it is inverted, the guide of the float does not extend through the opening; thus the float may turn and be held down preventing the engine from starting.

503. When the deflector has been positioned as shown in Figs. 264 and 279, put on the cover and secure it with the bolts. The tube flange is next fitted over the main air supply pipe and down over the primary air pipe. Here again the repairman should take care to inspect the gaskets between the flange and the air supply pipes. A gasket is then placed between the flange and the cover, and they are drawn together with the two cap screws.

504. If the fuel tank has been removed it should be inserted into the front end (radiator top tank) and rested on the dash. The dash strap should next be put on and tightened.

505. After installing the steering wheel, connect the fuel supply tube to the sediment bulb, drawing it down with the nut, and the tractor is ready to test.
The Float Chamber

506. The float chamber (Fig. 280) consists of the float chamber, together with the necessary passages, nozzle and valves to vaporize the proper amount of fuel.

507. The fuel flows from the supply tank into the bowl of the float chamber where a constant level is maintained in the bowl by means of a float and valve. This level is just below the opening of the spray nozzle.

508. The float chamber floods in two typical ways: First, when the fuel runs out of the overflow hole. Second, when the fuel runs over the top of the bowl. The first obtains when the float is set too high, allowing the fuel to flow out of the jet; when the nozzle is not tightened in place, or when there is a poor gasket between it and the body; when there is a slight leak at the float valve, and at times just after the engine has been stopped. This latter is caused by the vapor condensing in the vapor tube and is of no consequence if it stops after a minute or two.

509. If the bowl floods as mentioned in the second case, it is caused by the float valve not seating properly.

510. To overcome flooding, it is necessary to use the trial and elimination process. Expose the float chamber by turning off the cap retainer spring and swinging the cap to one side. Raise up on the valve stem permitting any foreign substance which may be on the valve seat to be washed out.

511. If this does not overcome the trouble, try reseating the valve by placing a screw driver in the slot of the valve shaft and tap it lightly with a small hammer, turning the valve a quarter turn between taps. If it still leaks hold the stem down with the finger. Should this overcome the flooding, it indicates that the float leaks, or is set too high. Withdraw the cotter pin from the float lever shaft and remove the shaft; the float together with the lever may then be lifted out of the bowl.

(To be Continued)
WHEN A. Pohl & Son, our authorized dealers of Georgetown, Ohio, first signed a Ford contract they were located in the building shown in the top picture. They have just recently moved into the building shown below, which is one of the most up-to-date and completely equipped Ford Service Stations in the country; a real credit, not only to themselves and the Ford Motor Company, but also to their city. Ford dealers are the
recognized leaders in the automobile business in their respective localities. As such leaders they should improve their places of business, thus setting an example for dealers in other lines of cars. Retail merchants as a rule are quick to improve their business places when trade prospers. Clean attractive quarters, coupled with prompt and efficient service, have long been recognized by merchandising experts as essential to making and retaining customers. The same rule applies to automobile dealers, particularly Ford representatives, as their business is usually as profitable as any in their locality.

A. Pohl & Son as well as many other Ford dealers have improved their surroundings as their business developed, and by so doing have shown faith in their city, as well as confidence in themselves and the Ford Motor Company.

It is to be hoped that any Ford dealers still doing business in old dilapidated buildings will see the advantage of establishing themselves in up-to-date attractive quarters.

Useful Tools

We offer subject to prior sale the tools shown below at very attractive prices:

The Valve Port Tool (Fig. 2) consisting of reamer and holder will be supplied at $3.00 net. This tool is particularly valuable in cases where the valve seats are too wide through excessive grinding, as it will slightly increase the valve ports but not sufficiently to necessitate oversize valves.

The price of the Spark Plug Brace Wrench (Fig. 3) is 50 cts. net.

The use of this tool will not only facilitate removal of the spark plugs, but also reduce the possibility of breaking the porcelains.

Orders for either of these tools may be placed with our Branches.

Bulletin Enters Upon Its Second Year

With this issue, the Bulletin enters upon its second year. We hope to make it even more helpful to our Service organization during the coming year than in the year just closed. In order to do this we must have the co-operation of our dealers and service stations. Many of them have assisted us in the past year by furnishing service suggestions, such as quick methods of repair, time studies on the different labor operations, window displays, methods adopted for increasing the profits from the service branch of the business, etc. Most of these suggestions have been published so that our entire organization have benefited.

To the dealers and service stations who have assisted us in the past we wish to express our appreciation, and trust that during the coming year more of them will submit for publication any ideas of service that they have found beneficial, so that the entire organization may profit by their experience.

A portion of the Bulletin will be devoted to the Fordson tractor, and present dealers are especially requested to furnish any service suggestions that will be of benefit to dealers just entering the tractor field.

Truck Drive Shaft and Worm Couplings

A change was made in the splines of the drive shaft and worm coupling. The splines are deeper on the new style; therefore the new shaft and worm may be used with the old coupling, but an old shaft and worm cannot be used with the new coupling. The stock clerk should bear this in mind when filling orders on these parts.
**Leave This Tag On Your Car for 500 Miles!**

The care you take of this new car will set the future value of it. Do not drive over 15 to 20 miles per hour for the first 500 miles. Keep the radiator full of water and the oil up to the proper level at all times. Also fill up and screw down all grease cups. See that your ammeter shows a charge at all times. Call at a battery service station and have your battery tested and flushed. See that all nuts and bolts are kept tight. If you experience any trouble call at our garage for consultation. We desire to give you the best of service and you should cooperate with us.

**THE BRYANT AUTOMOBILE COMPANY**

*Authorized Ford Sales and Service Station*

CENTRAL 2514 W 3191 WEST 25th St. HARVARD 3040

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In Fig. 4 we show facsimile of a sticker which the Bryant Automobile Company, our authorized dealers at Cleveland, Ohio, are pasting on the dash of all the cars they sell. They report that splendid results are obtained from the use of this label.

**Safety First**

**First Aid Cabinets**

"The immediate treatment of all injuries, no matter how slight, is one of the first principles of Safety practice."

No garage is complete unless it has a First Aid Cabinet, with at least one competent person who is familiar with the methods of administering first aid. A book of instructions is included with every cabinet purchased.

Infections from slight injuries comprise approximately 18½% of lost time accidents. This shows the importance of immediate treatment of all injuries no matter how slight.

It is also very important to keep the cabinet filled with a complete line of articles at all times. To let the supply become depleted is to invite serious consequences.

Reports have reached us from different sections of the country indicating that the representatives of certain equipment companies are claiming the sole indorsement of the Ford Motor Company, and are endeavoring to make sales on this basis rather than the merit of their goods. In order to clear up any doubt on this point, it may be understood that our dealers are free to select any equipment that they may consider most advantageous for the needs of their repair shop. We are only interested in seeing that every Ford Dealer has complete and up-to-date repair shop equipment in order that prompt and efficient service can be given to our customers.

It is a good plan to consult with the Branch and receive the benefit of their experience on matters of this kind.
Practical Methods of Repairing Ford Cars

The Starter Switch
(Continued from Page 188, Vol. 1)

1. The extension cap shown in Fig. 271, Vol. 1, sets over the plunger cap to give the necessary length when the switch is used on the touring car, runabout and coupe.

2. The switch is of very substantial construction, and will cause little or no trouble.

3. If when the switch is pressed down the motor does not turn over, connect the two terminals with a wire as shown in Fig. 6. If the starting motor now turns over properly, the trouble lies in the switch which should be replaced. If water is permitted to enter the switch it will cause a short circuit, resulting in a discharged battery. Such a switch may be removed and dried. Before replacing, it should be tested for leakage with a test lamp of 110 volt capacity. First try one end of the test cord on each terminal with the plunger out. The lamp should not light. Next hold one wire on one of the terminals and the other on some metal part as the cap. Try both of the terminals in this way. Neither of them should show a light. Finally try holding one wire on a terminal and the other on the cap with the plunger pressed in; there should be no light. If the light shows after the switch has been properly dried the insulation has been broken down and the switch should be replaced by a new one.

4. Up to the present time we have had no call for switch parts, and therefore have not listed them.

The Starting and Lighting Switch

5. The current for the lighting and ignition is controlled by a combination switch (Fig. 7), which is located in a panel on the instrument board. It is so constructed and wired, that the lights, both bright and dim, draw from the battery, while for ignition, current from either the magneto or the battery may be selected.

6. Lights are controlled by swinging the lever so that the pointer registers with the indication of the condition as desired: "Off," meaning no lights; "Dim," meaning dim light; and "On," meaning bright lights. The tail light burns when the lever is in either the "On" or "Dim" positions.

7. The ignition is controlled by inserting a key into the barrel in the center of the lever and turning it so that the key registers with the indication of the current desired. Fig. 7 shows the key on the magneto side.

8. The terminals (Fig. 9) on the back of the switch, are named to indicate which wires should be attached to them. By referring to the diagram shown in Fig. 39, Vol. 1, the repairman should have no trouble in checking the wiring.

9. If trouble is indicated in the switch it may be checked with a 6 volt test lamp for open circuits, and 110 volt test lamp for grounds. Do not use the test lamp until all wires have been disconnected from the switch as the indications with wires in place are not reliable, and furthermore, the magneto may be discharged. While it is only necessary to check that circuit which is causing the trouble, we will give here the indications of the entire system.
Removing the Switch

10. Before removing the switch the battery to terminal block wire should be disconnected from the terminal block on the dash. (See Fig. 8.) This will provide against grounding when working on the switch wires.

11. As stated above, the switch is made integral with the panel, and when removing, it is necessary to remove the entire assembly by taking out the four panel to instrument board screws; the panel may then be drawn forward as far as possible, thus leaving sufficient space between the dash and instrument board to permit the removal of the wires from the back of the instruments.

Fig. 8

Ignition

12. Hold one wire of the 6 volt test lamp on the terminal marked “Mag.” and turn the switch key so that it indexes with Mag., try the other wire on the terminal marked “Coil” and the light should show. Next try the 110 volt lamp, holding one wire on the “Mag.” terminal, while the other wire is touched to each of the other terminals and the metal of the case. There should be no light excepting when the “Coil” terminal is touched. In the same way test the battery circuit, turning the switch key to the “Bat.” side, using the “Bat.” terminal instead of the one marked “Mag.”

13. Hold one wire of the 110 volt test lamp on the “Grd.” terminal and try the other terminals in each of the three positions of the ignition. The only one which should show a light is the “Coil” when the switch is in the “Off” position. The “Coil” to “Grd.” terminal should also show a light on the 6 volt test lamp with the key in “Off” position.

Lights

14. Next try the lights. turn the lever to “Dim.” and with one wire of six volt test lamp on “Bat.” terminal, touch the REAR and the dim terminals. In each case a light should show. Now with a 110 volt lamp, try the “Bat.” terminal with the other terminals as explained above. No light will show if the switch is in the proper condition. In the same way test the bright light system, turning the lever to the “On” position, the test now being made on the REAR and HEAD instead of the DIM and REAR terminals. If trouble is indicated in the switch, the entire panel should be replaced, as repaired switches are generally unsatisfactory.

Fig. 9

Replacing the Switch

15. If it is necessary to install a new switch, the ammeter should be removed from the old panel and inserted in the new one. Connect the wires to the back of the assembly and the battery wire on the terminal block. Try the switch in its several positions to prove that the wires have been properly connected. When the wires check up properly, install the panel in the instrument board.
Fordson Tractor Section

Laying Out Fields for Tractor Plowing

Many factors are to be considered in making plans for tractor plowing in order to reduce to a minimum the time spent in turning and in running with the plows out of the ground. Reducing this waste time increases the number of acres which can be plowed in a day, making the tractor that much more efficient.

"A" headland all around the field; the lands to be plowed around back furrows. "B" indicates the first back furrow. Another back furrow laid out at "D" after the first land is finished.

Methods to be followed in laying out fields for tractor plowing are fully discussed in United States Department of Agriculture Farmer's Bulletin 1045 which contains diagrams similar to Fig. 10, showing the most efficient ways to lay out the fields.

It would be a good idea for dealers and customers to obtain a copy of the above Bulletin by writing to the Department of Agriculture at Washington, D. C.

Thrust Bearings

A number of ball bearings in the Fordson are of the combined radial and end thrust type. The proper installation of these bearings is most important, as a misplaced bearing may result in a cracked trans. housing.

Fig. 11 shows the proper method of installing the average thrust bearing with the radius in the outside ring toward the housing or that part of the assembly which receives the thrust.

There are three different bearings used on the worm thrust. The Hess Bright is a single race ball bearing which is built to take the bearing and the draw bar cap. This bearing is so constructed that it may be installed on the worm either way.

The Standard is a unit assembled double race two-way thrust bearing and may be assembled either way.

When the Gurney bearing is used at this point it is necessary to place two of them together with the radii in opposite directions as shown in Fig. 12.
Practical Methods of Repairing Fordson Tractors

The Float Chamber

(Continued from Page 192, Vol. 1)

16. Shake the float, listening for the sound of fuel inside; if it leaks or has any dents in it, it should be replaced by a new one, as soldering a float is a very delicate operation and we do not recommend that repairs be attempted excepting in extreme cases.

17. Try the float to see that the stem binds in the lever arm. If it cannot be made to bind by tightening the binder screw, a new lever should be installed; unless the threads are damaged on the float stem, in which case it is necessary to install a new float.

18. If nothing is found wrong with the float or lever, replace it in the bowl, setting the lever under the head of the valve stem, insert the lever shaft, and secure it with the (brass) cotter pin. Loosen the clamp screw and turn the float down two or three threads, turn on the fuel at the tank and watch to see that the flooding has stopped.

19. If holding the float valve down with the finger did not stop the flooding, or tapping it with a screw driver does not overcome it, the valve and seat should be removed, and after inspection the faulty part should be replaced. The valve is removed by detaching the float as described in paragraph 511, Vol. 1, after which the valve may be lifted out of the well (guides).

20. The seat is in the brass (nipple) Float Valve Seat, into which the feed pipe elbow is screwed. To remove it, first disconnect the feed pipe, next turn out the elbow, after which the nipple may be turned out.

21. Both the valve and seat should show a smooth taper. If either one is rough or has a score in it, it should be replaced by a new part. There is a carefully machined ring on the shoulder which does away with the necessity of a gasket at this point. This is necessary in order to locate the seat squarely with the valve. The elbow is provided with a pipe thread, so it is also unnecessary to have a gasket at this point.

22. The connection between the elbow is made by inserting the tube into the elbow and tightening the gasket against it by means of a pack nut. If when the fuel is turned on, a leak appears at this point, try tightening the pack nut still further. If this does not overcome the leak the pack nut should be removed and the old gasket should be replaced by a new one. If no gasket is available, wrap the end of the tube with lamp wicking or loosely wound cotton string.

The Needle Valve

23. The needle valve determines the relative amount of fuel which may flow through the jet, and is the only adjustment in the entire system.

24. The needle valve may be operated from the driver's seat by means of the rod which extends from the head of the shaft to the dash. To prevent this jarring out of adjustment, the needle valve is held in position by means of a coil spring. It sometimes occurs that dirt will collect at this point, preventing the proper functioning of the entire system. This condition is noted by lack of power (the engine running on a lean mixture) and may be overcome by surging the engine. See paragraph 40, Vol. 1.

25. If this fails to remove the dirt, turn out the needle valve and raise the float valve, permitting an excess of fuel to flow through it. If the condition still prevails it is advisable to remove the assembly from the vaporizer, dismantling it, and blow out all the passages.

Removing the Float Chamber

26. The float chamber is screwed to the manifold by means of two studs. Before removing the nuts it is necessary to disconnect the adjusting rod which leads from the needle valve to the dash. This is done by removing the cotter pin and drawing the rod up out of the way.

27. Next shut off the fuel supply at the sediment bulb and drain the bowl by opening the drain plug in the float chamber bowl shown in Fig. 280, Vol. 1. Disconnect the fuel line from the float chamber by backing off the pack nut, after which the line may be drawn out of the elbow. Next run the two nuts off the studs. This loosens the assembly which may be drawn down off the studs and primary air tube.

28. It may be upon inspection, the repairman will find that the seat of the needle has been scored. This will prevent the proper adjustment of the valve, and the needle should be replaced by a new one. At the same time the repairman should remove and examine the valve seat to see that it has not been scored. It is usually advisable to remove this seat in order to clean out the fuel passages.

29. The seat is removed by inserting a wide screw driver through the opening left by
the needle valve. This screw driver engages the slots in the seat which may then be turned out. The size of the opening in this seat should not be changed under any circumstances. This hole is drilled in a piece of Monel metal which is pressed into the brass body of the valve.

30. In replacing the seat body, it is important that it be turned down tight so that the Monel metal rests against the shoulder in the chamber body to insure a tight seal between the float chamber and the fuel passage, and also to prevent the Monel metal from being pushed out when the needle valve is screwed against it.

31. The needle should be rolled on a flat surface to prove that it is not sprung out of line; if it is, it should be replaced by a new one.

32. In replacing the needle valve, it is important that it be turned out of the bushing far enough to prevent it being forced into the seat when the bushing is being tightened into the housing.

33. From the needle valve the fuel flows thru a passage to the spray nozzle. The opening in this nozzle is at the venturi point in the primary air system, into which the fuel is introduced in the form of a heavy spray.

34. The only thing that can go wrong with the nozzle is stoppage of the tube, unless it has been tampered with. This is a condition which the repairman should always take into consideration in repairing any piece of mechanism. For instance, at times the repairman will find that some one has placed two gaskets between the nozzle and the shoulder of the passage. This lowers the opening in the venturi and changes the suction on it.

35. The nozzle is exposed by turning out the plug at the bottom of the passage. (See Fig. 280, Vol. 1.) This is best accomplished by securing the head of the plug in a vise and twisting the body of the chamber. If it is very tight it may be necessary to start it by tapping the passage part of the casting with a rawhide hammer as shown in Fig. 13.

36. The nozzle is removed by inserting a large screw driver in the slot and turning it out. If necessary the screw driver may be turned with a wrench as shown in Fig. 14. When it has been turned out the full length of the thread, turn the chamber the other way up and the nozzle will drop out.

37. Inspect it to see that the passage is clear. If it is stopped blow it out with air from the top (small end) or run a wire through it. The size of the opening is correct when it leaves the manufacturer and should not be changed under any circumstances.

38. In replacing the nozzle be sure there is only one gasket under the shoulder and that both the nozzle and passage are free from dirt or a burr which would cause a leaky joint. After the nozzle has been tightened into place, replace the plug, holding it in the vise to tighten it.

(To be Continued)
Sales Room Display of Ford Parts

WHEN Max O'Leary, our authorized dealer of this city, was unable to get cars for display purposes, he made use of his entire sales room floor for displaying Ford parts. The benefits to be derived from an attractive display of parts was never better demonstrated than in this case. Hardly a person passed Mr. O'Leary's store who did not stop to look at the display, and many were attracted inside.

An attractive display of goods has long been considered good merchandising, and it applies to the automobile business just as well as to any retail store. The day of the progressive automobile dealer is at hand, and Ford dealers should be the first to adopt up-to-date merchandising policies.

Safety
The Handling of Sharp Tools

SCREW DRIVERS—The picture shows the right and wrong way to use a screw driver. The work should not be taken into the hands, but should be set firmly upon a table or other flat surface. Many bad lacerations have been caused by screw driver slipping from work held in the hand.
The edge of the screw driver should also be kept filed sharp, to prevent slipping from the slot of screw.

**FILE TANGS**—All users of files should see that only suitable and well-fitted handles are used, as some bad hand and wrist punctures have been caused by badly fitted handles coming off of file tangs.

**SAFE**

**KNIVES**—When cutting insulation or other material, the knife should not be drawn toward the person—it may slip and cut a deep gash in the flesh.

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**A Business Getter**

The Palace Garage Company, authorized dealers of Portland, Oregon, distribute among Ford Owners cards $3\frac{1}{2}'' \times 6\frac{3}{4}''$, reading as follows:

**PALACE INSPECTION SERVICE FOR FORD CARS $2.50**

SO many of our friends have asked us to inspect their cars and they seem to appreciate our doing so so much that we want you to know about this service, too.

This service is calculated to relieve you of a lot of worry and uncertainty as to the true condition of your car. IT INCLUDES—

1. A thorough oiling and greasing, including grease and oil, except grease used in transmission and differential and oil in motor.
2. General examination of car and minor adjustments.
3. Road test.
4. Jacking up and testing wheels.
5. Adjusting brakes.
7. Tire test and proper inflation, including spare.
8. Examination of condition of motor.
9. Written report and inspection certificate.

If you wish to know the exact condition of your car, and have it looked over, greased and oiled by Ford experts, and a written itemized report made to you, bring it in.

Hoping to have the pleasure of a call from you, we are, Sincerely,

**PALACE GARAGE CO.**

Telephones: Broadway 1572 A 2442 AUTHORIZED DEALERS FORD SALES AND SERVICE

We believe that the service, as well as the method of getting it before Ford Owners is a good one. In addition to performing the services mentioned, an Inspector's Report covering the condition of the car is furnished the customer. This report is on a sheet $3\frac{1}{4}'' \times 8''$.

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Cars bearing motor numbers from 3,817,431 to 3,910,000 were shipped during the month of March.
Due to extending our sources of supply on connecting rod forgings, the number of genuine connecting rod forging trade marks is increased. Connecting rods bearing one of the trade marks shown above, may be accepted in exchange. Rods bearing any other trade marks are to be considered as imitation parts.

**Practical Methods of Repairing Ford Cars**

**Lamps**

39. Because of the large number of lamps required, it was found necessary on cars equipped with starting and lighting systems to use three different installations, namely, the double bulb head-lamps, the single bulb double coil lamps, and the single bulb with dimmer resistance.

40. The first two are generally found on closed jobs originally equipped with starting and lighting systems, while the third method is used on the open cars on which the starting system has been installed.

41. There are only two styles of head-lamps necessary for the three installations. The first is the double bulb shown in Fig.19-A.
Both sockets on this lamp are single point contact. The second lamp is the single bulb type containing in both cases a double contact socket. (See Fig. 19-B.) Fig. 20 shows the lamps and sockets of both double and single point contact, the double contact is to the left and the single contact is to the right.

42. The wiring for the double bulb lamps and the single bulb double coil lamps is the same as shown in the standard wiring diagram Fig. 39, Vol. 1.

43. To install a single bulb with dimmer resistance, it is necessary to make a change at the terminal block of the dash as shown in Fig. 161, Vol. 1. The circuits formed by this change are shown in the diagram Fig. 21. It will be noticed that the current for both of the lights is brought back to the terminal block and ground to the dash bracket. This is done so that the equipment as far as possible may be maintained standard without any loose end wires.

44. About the only thing that can go wrong with the lamps, unless subjected to an accident, is to have the bulbs burn out. (See article on Page 169, Vol. 1, entitled Lamp Bulbs.)

45. To replace the bulb it is necessary to first remove the lamp door. This is done by forcing in on the door and turning it counterclockwise; the bulbs are removed in much the same manner, forcing them in and turning them counterclockwise.

46. The new bulb is replaced by forcing it in and turning it clockwise as far as it will go. When released it is then forced into and locked in position.

47. In replacing the double coil bulbs it is necessary to have them in the correct position to index the proper contacts. If when tested by turning the switch to “bright” the lamp burns dim turn it, remove and replace after turning it half way around.

48. Care should be exercised that the fingers do not touch the reflector, as even a slight touch will fog the highly polished surface. If the polish has been destroyed touch it up with a chamois or some soft cloth. On the first page of Bulletin No. 10, Vol. 1, there is an article on setting and focusing the lamps.

49. The double bulb lamps are focused by drawing the socket forward or pushing it backward in the reflector. This necessitates removing the door as explained above, the operator grasping the large bulb. No focus is necessary on the smaller bulb.

50. The single bulb lamps are focused by means of a screw in the rear of the lamp as shown in Fig. 22.

(To be Continued)
Fig. 23 shows an oiling chart of the FORDSON Tractor with instructions as to the kind and quantity of oil and the frequency with which it should be replenished.

Too much stress cannot be laid on the subject of lubrication, as the life of the Tractor depends to a great extent upon the attention given to this subject by the operator. The tractor is a heavy duty machine working at maximum capacity the greater part of the time, and consequently the motor develops high temperature when at work.

Only the best quality of oil obtainable should be used in the FORDSON motor, and it should be sufficiently heavy to maintain its "body" at high temperature. Many inquiries come to us from owners and dealers as to whether or not oil marketed under certain trade names are dependable for use in the FORDSON Tractor. To answer such a question by a direct statement that one certain brand of oil is suitable would be discriminating on our part, and such a practice is contrary to the policy of the company. Some mineral oils have a paraffine base while others have an asphaltum base; an oil with a paraffine base is to be preferred to one with an asphaltum base, because of the congealing properties of the latter. Inferior oils tend to carbonize quickly and to congeal on the piston rings, valve stems and bushings.

The motor is oiled by the splash from the oil reservoir in the crank case. The oil supply should be replenished at least twice during an eight-hour day, and the oil level should not be allowed to drop below the lower pet cock under any circumstances.

A thin oil is practically useless in the tractor motor as it does not furnish the necessary lubricating filament between the working parts; it follows, therefore, that a heavy cylinder oil which will furnish this filament and also maintain its body at high temperature should be used in the FORDSON motor.
The transmission requires heavy fluid gear oil. It is occasionally asked, "Should a quantity of cup grease be added to increase the consistency of the transmission oil?" And the answer is "No." Cup greases are largely composed of animal fats which, when heated, disintegrate and entirely defeat the purpose (thickening) for which intended.

It must be borne in mind that oil becomes "worn out" and dirty through continued use, and must be replaced by fresh oil from time to time. Then, too, the oil in the crank case becomes diluted by the leakage of fuel (either gasoline or kerosene) past the piston rings and down into the crank case. (Regardless of how closely the pistons are fitted or of the kind of fuel used, this leakage occurs in all internal combustion engines.) This worn out and diluted lubricating oil should be drained from the crank case thru the oil sump drain plug about every fifty working hours, and before the crank case is refilled it should be thoroughly flushed out with kerosene. Pour in sufficient kerosene to reach the upper pet cock; then run the motor under its own power for about 1 minute, after which the kerosene should be thoroughly drained out through the oil sump drain plug and the crank case refilled with fresh lubricating oil.

The heavy pressure under which the worm and gear operate breaks down the oil in the transmission housing, making it necessary to renew this oil about every 200 working hours. Because of the thickness of this oil it cannot be properly drained out when cold; it is advisable, therefore, to do this operation after having worked the tractor under load, when the oil is in a more fluid state. When the oil is thoroughly drained out, the transmission housing should be filled with kerosene in a manner similar to that of the crank case and...the tractor driven about for from 1 to 2 minutes. Under no condition, however, should the tractor pull a load when the transmission housing is filled with kerosene.

This changing of oil is not to be considered a waste, but rather a practice of economy for it will greatly prolong the life of the tractor, and the oil which has been drained off may be used for other purposes about the farm.

NOTE: When operating with Belt Pulley attachment, oil level should be maintained near top pet cock, so as to insure thorough lubrication of the ball bearings in the belt pulley.

Piston Rings

The Fordson piston ring like the Model T is cut tapered, and should be assembled with the larger diameter down. To aid the repairman in determining the proper position, a punch mark (see Fig. 24) is placed in the side which should be assembled toward the top.

Fig. 24

Estimating Distance and Speed by Pacing

Distances and speeds may be estimated by pacing and timing with the minute hand of a watch.

Most people make the mistake of trying to adjust their stride to three feet instead of using their normal stride and figuring the number of feet covered per stride.

The average man will find he takes 40 paces to a hundred feet. To approximate the speed of a slow moving tractor, walk beside it counting the paces per minute.

The table below gives the corresponding speed in miles per hour for three feet to a step, and 2½ feet per step (40 to 100).

<table>
<thead>
<tr>
<th>Paces Per Minute</th>
<th>2½ feet per step</th>
<th>3 feet per step</th>
<th>Miles per hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>53</td>
<td>44</td>
<td>1½</td>
<td></td>
</tr>
<tr>
<td>61</td>
<td>51</td>
<td>1¾</td>
<td></td>
</tr>
<tr>
<td>70</td>
<td>58</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>79</td>
<td>66</td>
<td>2½</td>
<td></td>
</tr>
<tr>
<td>87</td>
<td>73</td>
<td>2¾</td>
<td></td>
</tr>
<tr>
<td>96</td>
<td>80</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>106</td>
<td>88</td>
<td>3½</td>
<td></td>
</tr>
</tbody>
</table>

The following speeds should not be exceeded:

Plowing, 2½ miles per hour.

Harrowing and cultivating, 3 miles per hour.
Practical Methods of Repairing Fordson Tractors

The Float Chamber
(Continued from Page 8, Vol. 2)

51. The float chamber should be inspected to see that the plugs in the end of the passage are all tight and leak proof. The two in the fuel passage may be tightened with a screw driver while the plugs in the end of the air passage are peened into position with a hammer and torch. As it is never necessary to remove this plug it is unlikely that it will need attention.

52. One trouble the repairman will experience is caused by the owner stopping the overflow in the hole in the air pipe. (See Fig. 280, Vol. 1.) The average owner who sees the fuel running out of this hole believes it to be a fault in the casting. He therefore plugs it up. If the flooding is caused by a high float level repairman may experience difficulty in locating the real trouble. Therefore, the first thing he should do is to see that the overflow passage is clear.

Replacing the Float Chamber

54. Before replacing the float chamber, inspect the flange top manifold gasket to see that it is in good condition. This gasket is made of a special composition to withstand the heat, and it is essential that only genuine Fordson parts be used.

55. Place the gasket on the flange and positioning the flange on the studs, force it up until it rests against the manifold. While forcing it up, it is necessary to insert the primary air tube. The nuts backed up by lock washers are then started on to the studs and run down. In tightening them it is essential that they be drawn down evenly taking a few quarter turns on each nut until both are tight. The adjusting rod is then installed and the cotter pin put in place. Connect the fuel tube as explained in Paragraph 22. The float chamber should then be given a final test by running the engine, before returning the tractor to the owner.

The Vapor Tube

57. The vapor tube (see Fig. 263, Vol. 1) is a coil of thin metal tubing which conveys the rich mixture of fuel and air from the float chamber to the mixing chamber. As the tube
is subjected to high temperatures, it sometimes burns out. However this will not happen if the driver uses the proper precaution in regulating the exhaust shunt valve.

58. If the engine is run on the gasoline tank with the exhaust shunt valve open (in the raised position) the tube will be subjected to the heat of the exhaust gases without the cooling effect of the fuel and air on the inside, thus the tube will be burned out.

59. If the tractor is run on a very rich mixture the lighter fuel in the kerosene will distill off, leaving a carbon deposit on the inside of the tube which will in time close the passages and thus reduce the power of the engine. There is no way to remove this deposit and it is necessary to replace the tube.

Removing the Tube

60. Disconnect the float chamber as explained in Par. 26. Next loosen the cap screw which holds the exhaust pipe clamp to the transmission housing and disconnect the exhaust pipe flange. By running the two nuts off on the studs and drawing down the flange, the exhaust pipe may be swung down on the floor.

61. Next remove the two nuts from the manifold outlet to manifold studs, the outlet may then be withdrawn. As the float chamber end of the vapor tube usually sticks in the outlet, it is necessary to drive it off with a screwdriver as shown in Fig. 27.

62. After the outlet has been removed the tube should be disconnected from the mixture chamber where it is held to the shifter valve housing by means of a screw bushing and a brass compression ring. When the bushing has been run out the tube may be withdrawn, the compression ring and bushing coming off as the tube is drawn through the manifold.

63. Care should be exercised in drawing out the tube to prevent its becoming distorted or cracked. It may be started by inserting a screwdriver under the coil and prying on it lightly. Usually, however, it is necessary to remove the paint from the tube at the point where it leaves the manifold. If the tube will not start, wrap it with a piece of paper or cloth, and gripping it with a pair of pliers drive it off by striking the pliers with a hammer as shown in Fig. 28.

Do Your Bit

All Ford Dealers throughout the country should affiliate themselves, as much as possible, with the great movement of Safety, which is being inaugurated by most of the cities throughout the United States and Canada.

The average citizen is starting to realize that at least seventy-five percent of the useless slaughter of over 250 persons, every day in the United States, is preventable.

Walk right and drive right.
T. SMITH, Ford Dealer at St. Johns, Michigan, began business in 1909 in the blacksmith shop shown in the upper picture. During that year he sold a total of nine (9) Ford cars and $450.00 worth of repair parts.

In 1916, to meet his growing business, he erected the brick service station shown in the center picture. During that year he sold 160 cars and $11,612.00 worth of repair parts.

He has since outgrown these quarters and has just completed the addition shown in the lower picture, giving him 19,060 square feet of floor space. In addition Mr. Smith has a warehouse 42x125 feet with a private railroad siding which he uses to store carload shipments and set up cars. During the year 1919 Mr. Smith sold 216 cars and $26,000.00 worth of repair parts. This business has been accomplished in a city of less than 4,000 population, with a territory covering only four townships.

Mr. Smith attributes his splendid success to satisfied customers. Service has always been paramount with him, and his shop is equipped with the latest and most approved machinery for rendering prompt and efficient service to Ford owners.
Transmission Bands

Dealers should make a point to educate the owners in the care and operation of the bands in order to increase the useful life of the lining.

Bands with new linings should not be set too tightly, as the heat caused by the constant rubbing of the drums will cause the surface to char (burn) causing a chatter in a very short time. The bands should be set loose enough to require tightening after a week or ten days' run.

The owner should use only good oil, and change it every 500 to 1000 miles. The crankcase should be washed occasionally with kerosene as described on Page 44, Vol. 1.

The owner should be instructed as to the proper method of applying the band. Riding continually with the foot on the pedal causes the bands to drag which will give the same effect as having them set too tight. This not only consumes more power but also chars the band. In applying the bands very good results can be obtained, even with fairly well worn and charred bands, by easing up slightly on the pedals before the bands seize or chatter and then applying them again. This suggestion applies equally well to brake, reverse and low speed, and can soon become automatic with the driver.

Motor and Generator Yoke Replacements

Within three months' use the Generator Yoke Assembly, part T-1887 and the Starting Motor Yoke Assembly, part T-1852 may be replaced without charge. After three months' service these parts may be replaced at $4.00 net each.

For the present at least, dealers should not attempt repairs on these parts by installing new field coils or pole pieces. Parts received in exchange should be returned to the Branches for credit on the above basis.

Delivery and Inspection Card

In Fig. 30 we show a sample of a Check, Test, Delivery and Inspection Tag used by the Van Syckle Garage Co., our authorized dealers of Perth Amboy, N. J.

This dealer states that all the items on the card are tested and checked in the customer's presence before the car is delivered. After this inspection the card is OK'd by the foreman and signed by the customer as being OK on delivery. The owner is then requested to return the car to the Service Station within ten days for final inspection. This period allows ample time for the car to limber up so that final adjustments can be made.

The Van Syckle Garage Co. states that this method reduces free service to a minimum and makes satisfied customers.

The New Style Pistons

The new style piston for the Model T engine has no reinforcement on the bushing bosses nor around the skirt, which makes the
piston about nine ounces lighter than the old type. This new type piston reduces the vibration and gives a better balanced engine.

An engine should not be assembled with both style pistons in it, as the difference in their weight will throw it out of balance. It is, however, permissible to replace all four old style with new style pistons.

Because of their exceptionally light construction we recommend that the dealers do not attempt to renew the bushings in these pistons until some means to support the bosses when removing and replacing the bushings is provided.

We are designing a fixture for this purpose, but until it is on the market it is advisable to install a new piston with bushings complete.

A notice will appear later as to where this fixture may be obtained.

Transmission Band Yoke

Fig. 31 shows a yoke to be used for holding the transmission bands in position while replacing the cover. It may be made from a piece of bar stock according to the dimensions given. When replacing the cover hold the ears of the bands together and slip the yoke over them. After the cover is in place the yoke may be withdrawn. This method is much quicker than the method of tying them together with a piece of wire.

Screw Drivers

The screw driver is probably one of the most abused tools in the repairman's kit. When properly ground the tool is very efficient and will remove a screw without marring it, and with no danger of injuring the repair man. Screw drivers which are in constant use become worn, as shown in Fig. 32A.

When in this condition the screw driver will often slip out of the slot, damaging the screw and in some cases injuring the operator. The screw driver should be hollow ground with square sharp edges as shown in B, or with a square shoulder as shown in C. A screw driver should not be used as a punch as the sharp edges will be turned over or broken.

Tap as Bushing Remover

A quick and effective way of removing the bushing from the Brush End Bracket of the starting motor is to turn a 9-16 inch tap into it. When the tap bottoms on the bracket the bushing will be forced out.

Suggested by H. R. Hiatt
Oklahoma City Branch

“Z” No. Tools

We have received numerous orders for "Z" number tools which we do not list. We believe students obtain these "Z" numbers when taking the Service Course at the home plant. As it is impossible for us to furnish dealers with all tools used in our production, we request students to refer any matter regarding tools to the instructor in charge of the Service School. If there is a sufficient demand for any such tools we will make arrangements to have them placed on the market.

The attention of dealers and Service Stations is called to the May 1st issue of Parts Price catalogue. Several increases in prices were made necessary on account of the higher cost of materials. The new price lists are available at all Branches.
Practical Methods of Repairing Ford Cars

The Head Lamps
(Continued from Page 12)

64. Replacing a broken lens is accomplished by removing the door and bending back two adjacent lugs, which will allow room enough to replace the lens.

65. Should the head lamp door lens gasket become worn or lost a new one should be installed. It is held in place by shellacing the groove on the reflector.

66. If the reflector becomes damaged or loses its polish it may be removed in much the same manner as the door was, pressing in on it and turning it counterclockwise until the slots in the flange register with the lugs on the housing. If the reflector is in a single bulb lamp, it is first necessary to remove the bulb.

67. As the reflector is a tight fit on the lugs and shifts easily, it is usually necessary to assist it past some of the tight places with a screwdriver. The reflector is held against the lugs by means of a wire spring, but as there is nothing that can happen to this it is very seldom necessary to remove it. If, however, it has been removed, it should be replaced with the points standing forward in the body. Fig. 34 shows the relative assembly of a double bulb lamp. The single bulb is practically the same excepting for the wiring, and socket which is located in the body instead of the reflector.

68. In removing a double bulb lamp reflector it is necessary to disconnect the wires from the housing. This is usually done by disconnecting the plug which is secured by a spring ring shown in Fig. 35.

69. Fig. 33 shows the method of locating the double bulb reflector. It consists of two slots in the reflector and a locating lug on the top of the lamp. The reflector is inserted with the lug coming through the lower slot; it is then turned until the lug drops into the upper slot. Figure shows the lug just before it drops into position.

70. To remove this ring, insert a screwdriver in the loose end and force it off, then turn the socket until the flat of the ring rests on the tip of the reflector forcing the ring back into position. This causes the end to be raised out of the plug. Next turn the plug back so that the ring will not slip into the slot, after which it may be removed with a screwdriver as previously described.
FORDSON TRACTOR SECTION

Interchangeable Parts

Commencing at once the tractor plant will discontinue shipping to domestic dealers, the following parts which are interchangeable on both the Model T and Fordson tractor. Orders for these parts should be placed with the Branches.

<table>
<thead>
<tr>
<th>Tractor Catalogue No.</th>
<th>Model &quot;T&quot; Catalogue No.</th>
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<tbody>
<tr>
<td>179</td>
<td>Comm. contact point nut 3210</td>
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<tr>
<td>460</td>
<td>Starting crank handle pin 3902</td>
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<td>461</td>
<td>Starting crank handle pin 3901</td>
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<td>520</td>
<td>Fly wheel magnet support 3257</td>
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<td>576</td>
<td>Magnet bolt 3254</td>
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<td>805</td>
<td>Fly wheel magnet washer 3255-B</td>
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<td>1572</td>
<td>Fuel tank cap 2901</td>
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<td>1622</td>
<td>Sediment bulb assy. 2902-B</td>
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<tr>
<td>1843</td>
<td>Stg. crk. handle spring 3909</td>
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<tr>
<td>1907</td>
<td>Cam shaft timer gear rivet 3207</td>
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<tr>
<td>1964</td>
<td>Pack nut 2910</td>
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<td>2102</td>
<td>Sediment bulb outlet flange 2086-X</td>
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<td>Fly wheel magnet 3276-B</td>
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<td>Fly wheel magnet clamp 3277</td>
</tr>
<tr>
<td>2230</td>
<td>Pack nut packing 2913</td>
</tr>
</tbody>
</table>

These parts are to be sold at Model T prices.

Cotter Pins

When repairing the tractor, particularly those parts which are enclosed, the repairman should make sure that the nuts are secured with the proper size cotter pin. It is not enough that the holes be plugged with wires or bent nails. Full size cotter pins should be used and the ends split two ways. If there is sufficient play between the nut and the cotter pin, the nut is likely to work loose, causing the smaller cotter pin to be sheared off.

Knocking

Ability to tell one knock from another forms an important part in the education of the owner or operator. All knocks result from one of the four following causes:

1—Spark too far advanced.
2—Carbon in cylinder head.
3—Over-heating.
4—Loose or worn parts.

A spark knock occurs only when the spark is too far advanced and the engine is pulling a heavy load.

For light work such as harrowing, the spark is set at \( \frac{3}{4} \) advance, while for heavy work such as plowing in varying soils, the spark is set from \( \frac{3}{4} \) to \( \frac{3}{4} \) advance according to the pull.

If under normal spark setting a knock occurs but disappears when the spark is retarded beyond its usual position, the operator has an indication of a carbon knock.

A knock due to overheating will be noticed when pulling against a load, but it also occurs when the tractor is running light. It is further indicated by accompanying steam from the radiator.

Most knocks occur when there is a change in the load or in the speed of the motor. If there is no knock while the engine is cool but one develops when the engine is warmed up, it is probably a carbon knock.

If the knock occurs with a retarded spark in either a hot or cool motor, it is a loose part knock.

If the motor produces a dull thud with an accompanying jarring in the steering gear when the motor is under a heavy load, but the thud is not noticeable while accelerating the engine with the clutch out, the noise probably results from an ill-fitting rear main bearing.

If the knocking is not noticed on an increasing load but on varying the speed, a single slight blow is heard and felt, either the flywheel is loose or there is too much end play in the main bearings. When the knock is not accompanied by a jarring in the steering column, it is in No. 1 or No. 2 line bearings, connecting rod bearings, wrist pin, piston, camshaft or time gears.

With the engine running at a fair rate of speed, cut out one cylinder at a time by holding down the vibrator armature of its coil unit, accelerating and retarding the engine to produce the knock. If the knock disappears it is in the system of that unit which has been cut out. If, however, it is in No. 1 cylinder, No. 1 main bearing may be a loose fit. If in No. 4 it may be in the rear main bearing. If both No. 2 and 3 cylinders have to be cut out to stop the knock, the trouble probably lies in the center line bearing.

The wrist pin knock is a sharp click. It usually is most noticeable when running at about 800 RPM.

A connecting rod bearing knock is a rapid hollow pounding which becomes worse if not remedied.
A piston slap is a rapid tinny sound. Sounds are deceiving and hard to describe, so when the trouble is located as being in a certain cylinder it is good policy to take out the piston and connecting rod assembly and inspect it carefully.

Practical Methods of Repairing Fordson Tractors

71. The tube should be inspected for cracks, holes or carbon deposit. The carbon deposit is noted particularly at the mixing chamber end of the tube.

Replacing the Tube

72. The long end of the tube is first inserted through the manifold, when it appears above the manifold the screw bushing and brass ring are slipped onto it.

73. Some of the first tractors were assembled with an asbestos packing at this point. We recommend that such gaskets be replaced by a compression ring which will fit into the old assembly.

74. Force the tube up until it enters the mixture chamber, and is all inside the manifold excepting the last coil. Next assemble the exhaust outlet inserting the end of the tube through the opening in the float chamber flange; start the nut on the large stud to hold it in position and replace the float chamber. The four nuts should then be drawn down evenly until the outlet is tight against the manifold. The float chamber assembly is then complete, as explained in Par. 54. Finally swing the exhaust pipe into position and tighten the flange to the manifold outlet by means of the nuts on the studs, also tightening the cap screw on the exhaust pipe to transmission case clamp.

75. Another method of removing the vapor tube is to disconnect the exhaust pipe clamp from the foot rest plate and remove the outlet attached to the exhaust pipe as shown in Fig. 36. This method has an advantage over the other method in that there is one less bolt to remove, and as the exhaust pipe clamp to outlet nuts become very tight after continued running. This method is particularly desirable on tractors that have been in service for any length of time.

The Shifter Valve

76. If it is found that the vapor tube has carbonized badly it is usually necessary to clean the shifter valve as it is a continuation of the passage. This is done by disconnecting the gasoline line from the small tank and removing the reducing nipple as shown in Fig. 42.

77. The shifter valve handle shown in Fig. 263 is secured to the valve shaft by means of a pin, the ends of which have been peened over. This pin must next be driven out with a small taper punch which may be purchased at any hardware store, or the punch may be made from a piece of $\frac{1}{8}$ inch drill rod.

78. The home made punch should be hardened by quenching it at a cherry red heat and then "drawn" to a dark blue by moving it in a flame until the desired color is obtained.
It is best to harden only the taper end of the punch, thus leaving soft steel to strike on.

Replacing the Valve

82. When replacing the valve insert it with the hole in the shaft in a vertical position and the hole for the gasoline extending toward the cylinder. Next place the valve shifter handle over the stem, making sure that the spring and plunger are in place and toward the engine.

Fig. 30
Force it onto the shaft until the pin holes register with the hole in the shaft. Insert the pin and support it on the under side while peening it over with a light hammer. (See Fig. 41.)

83. If it is necessary for any reason to replace the valve, the hole in the shaft must be drilled when in position. In this case insert the valve so that the kerosene passage is in a horizontal position and the gasoline passage is up as indicated by the match stick in Fig. 39. Remove the plunger spring from the handle and force it onto the shaft with the lever down (covering the letter G) until about \( \frac{1}{8} \) of an inch remains between the casting and the handle. With the handle in this vertical position drill a 1-16" hole through the shaft using the hole in the shifter to locate from. When the hole has been drilled remove the shifter, and after inserting the spring and plunger replace it and secure it with the pin as described in Par. 82.
84. Extreme care should be exercised in performing this operation; if the hole is drilled in the wrong place, the valve will not be fully opened, thus cutting down the supply of fuel and causing a loss of power. If the gasoline hole is assembled the wrong way it will be impossible to shift to the smaller tank.

85. When the handle has been secured, replace and tighten the reducing nipple connecting the fuel supply line, completing the assembly. As the valve is only used to make a rapid shift from one fuel supply to the other it is not lapped into the housing, but is a loose fit. When the engine is running on the main fuel tank the gasoline shutoff cock should be closed, the lever extending forward as shown in Fig. 263, Vol. 1.
An Attractive Parts Store

The above photograph shows the parts store of the William L. Hughson Co., Ford dealers of Oakland, California. This store is connected with the salesroom but has a separate entrance directly from the street, and is devoted exclusively to the sale of Ford parts and accessories.

Conservation of Material

Due to the shortage of steel, and also the abnormal traffic conditions which are seriously handicapping us in the movement of both raw material and finished product, we must ask all dealers and service stations to assist us in conserving material. Economy should be practiced when overhauling any part of the Ford car, and all usable parts put back into the job rather than scrap the parts that are only slightly worn and yet perfectly good for the proper upkeep of the car. The customer will appreciate the interest taken in his welfare, and your co-operation will help solve the serious problem of serving our customers under existing conditions.
Demountable Rims

We are using as standard equipment both Kelsey and Hayes wheels with demountable rims. These parts are not interchangeable.

The Hayes rims have the lugs attached and are mounted on wheels which have a slight depression in the felloe at each lug bolt.

The Kelsey rims have a clip which straddles the lug bolt nearest the valve hole in the felloe and there are no lugs attached to it. This rim is assembled with the beading toward the outside of the wheel which has a shoulder on the inside of the felloe at each lug bolt. The Kelsey lugs are installed with the long leg inside the felloe, firmly bearing against the lug seat on the rim as shown in Fig. 44.

Mr. Harvey states that from the use of these cards his repair business has increased about 75% and his parts business over 100%.

Fig. 44

When installing a rim it is very important that the nuts be drawn down evenly by turning each nut a little at a time, crossing back and forth across the wheel until all are tight.

Front Radius Rod

When cars are brought in for repairs of any kind, dealers and service stations should call the owner’s attention to the advisability of installing the present style front radius rod.

The superior merits of the present rod may be mentioned, such as a more rigid front end construction, also ease of control.

Motor and Generator Brushes

The use of inferior brushes frequently results in serious trouble.

We are using as standard equipment, the following makes of brushes:

**Manufacturer** | **Mfr’s Symbol**
--- | ---
Motor Brush | National Carbon Co. No. 543
| Stackpole Carbon Co. “S-106”
| Corliss Carbon Co. “D-10”
| Speer Carbon Co. “Metal B”
| Morgan Crucible “C M”
Gen. Brush (small) | Stackpole Carbon Co.

Battery Service

Numerous inquiries are being made by dealers and owners as to whether new batteries can be purchased of this Company.

We do not sell batteries for the reason that we are not in a position to give service on them. The following batteries are now being supplied as regular equipment on Ford cars:

- Exide
- Willard
- Prest-O-Lite
- U.S.L.

All of these concerns have a national service organization and the different makes of batteries should be returned to their respec-
the straight bushing part No. 3320-C on new cars.

In place of the flange, three steel washers part No. 3320-D fill the space between the Driven Gear Sleeve and the Clutch Disc Drum.

Fig. 47

It is not possible to install washers on the transmissions originally assembled with No. 3320 bushing, as the washers are .015" thicker than the flange of the bushing.

Tool for Removing Headlamp Doors

Headlamp doors are very easily removed with the tool shown in Fig. 48. This tool is made from a strip of flat iron 36¾" long, ¾ wide and ½" thick bent into the shape illustrated. At the four points indicated by the arrows (4" apart) are holes each ½" in diameter. The door is removed by clamping the device snugly around the rim with the four rivets on the rim of the door engaged in the four holes of the tool, forcing inward on the two handles and turning to the left.

Contributed by Glenn A. Metcalf, F. E. Sticklen Agency, Blandinville, Il.

Cars bearing motor numbers from 3,910,001 to 3,969,150 were shipped during the month of April.
Fordson Tractor Section

Clutch

Dealers should not return clutch assemblies to the Branches, but should repair them in their own shop. We are starting a clutch repair article on page 29 of this Bulletin so that all the dealers and mechanics may become familiar with this operation.

We are now in production on the new 150 pound compression springs. When it is necessary to overhaul the clutch to overcome slipping, first see that the plates are thoroughly cleaned with gasoline to remove any asphaltum, or carbon deposits. When this is done a complete set of new style heavy springs should be installed and the clutch reassembled.

Under no circumstances should extra plates be installed where the new style heavy springs are used as this will make it impossible to properly release the clutch and cause premature wearing of the plates.

Fordson Front Wheel Bearings

The first Fordson tractors were assembled with ball bearings in the front wheels, the later tractors are being delivered with Timken roller bearings. While the roller bearings are interchangeable in the wheels, it is necessary to use a new style spindle body with a groove in the thread end to take the tongue of a special washer similar to the one used on the Model T. If no means were provided for holding this washer there would be a tendency for the nut to turn with the wheel; this action would eventually cut the cotter pin allowing the nut and outer bearing to tighten or work loose destroying the bearings.

To install a wheel with ball bearings the nut on the spindle body is drawn down as tightly as possible. When installing a wheel with roller bearings the outer bearing assembly is first drawn down snug and is then backed off 1/8 to 1/4 turns until the wheel turns freely with no play on the spindle body. Then install the washer, tighten down the nut and insert cotter pin.

Lubrication

A little more attention paid to the lubrication of the steering gear, will make steering much easier and reduce the wear. All parts where there is any friction should be well oiled, such as spindles, spring bushings, drag links, and steering rods.

Tractor operators should be especially instructed to look at the oil in the crankcase and transmission before starting the engine. After the engine has been run for a few minutes a foam forms on the oil in the transmission. Upon removing the cap and looking into the shifter plate the operator may think that this foam indicates the level of the oil, while in reality there is an insufficient quantity.

If the pet cocks on the crankcase are opened while the engine is running, oil will run out of them when there is an insufficient supply.

Caution

Unless the engine is supported by a chain hoist, it is not advisable to remove the front axle unless the engine is connected to the rear end which is assembled with the wheels complete. This eliminates any possibility of the engine toppling over.

Tractors with Motor Numbers have been shipped as follows:

**FEBRUARY**

Dearborn, 96,974 to 100,000  
St. Louis, 100,001 to 101,501

Dearborn, 110,001 to 111,500

**MARCH**

Dearborn, 111,501 to 117,133  
St. Louis, 101,502 to 103,876

**APRIL**

Dearborn, 117,134 to 125,036  
St. Louis, 103,877 to 104,924
Practical Methods of Repairing Fordson Tractors

Clutch

86. The Tractor Clutch is located on the Drive Shaft immediately behind the Flywheel. It is of the type known as the Multiple Disc Clutch running in oil. It consists of eight small discs which are keyed to the Flywheel studs; and nine large discs which are keyed to Clutch Drum. The Clutch Drum in turn is keyed to the Drive Shaft by means of splines and is locked onto the Shaft by means of a nut and cotter pin. When in the disengaged position (when the Clutch Pedal is pressed down), these discs, which are assembled alternately, may turn independently of each other. When they are in the engaged position (when the pedal is up), the discs are forced together by means of six springs. Fig. 49 shows the relative assembly of the clutch parts. The spring acts between the Clutch Drum and the rear half of the Housing. The pressure of the spring on the Rear Housing is transmitted through its flange to the front half of the Housing which draws the disc tightly against the disc drum. The shifting of the Clutch is effected through a Shifter Ring which straddles the Drive Shaft and by means of a lever connected to the Pedal it is forced against the ground surface of the Rear Housing.

87. The Clutch needs little or no attention other than the annual overhaul of the Tractor, unless it develops a tendency to slip when pulling under a heavy load. In a number of cases this is caused by the operator riding continually with his foot on the pedal, the weight of his foot being sufficient to relieve a little of the tension on the spring. If the Clutch slips it is necessary to remove it from the Tractor and make the necessary replacement of parts.

Splitting the Tractor

88. Splitting the Tractor consists in disconnecting the engine from the transmission housing. The first thing to do is to remove the Steering Wheel from the Steering Post; this is done by running off the nut after which the wheel may be withdrawn from the shaft to which it is splined. If it sticks on the shaft drive it off with a lead hammer striking the spider on opposite side as close to the hub as possible. Next remove the Gas Tank; this is done by loosening the straps which secure it to the radiator top tank and the dash. If the tank is filled with fuel at the time of this operation, it is advisable to syphon the fuel out of the tank by means of a piece of hose or to drain it out of the sediment bulb; the latter is much slower than the first method.

89. Disconnect the fuel supply tube at the sediment bulb and when the straps have been removed the tank may be lifted out and set to one side. Next disconnect the fuel supply tube from the gasoline tank and attach the commutator pull rod and the needle valve adjusting rod.

90. Next remove the two cap screws from the cylinder head which holds the two clips which guide the spark controller rod. Remove the two cap screws which hold the air washer to the dash and the two cap screws which hold the dash to the transmission cover. When it
is necessary to remove the air washer without removing the control rods it is found advisable to remove the small gasoline tank to prevent the rods from becoming bent. The air washer may then be removed without bending the control rods. While it is unnecessary to remove the dash it is always convenient to do so, inasmuch as it requires the removing of only two remaining cap screws after which the body of the tractor is clear and easy to work on. Next disconnect the drag link steering arm; the link is held to the arm ball by means of two bolts which pass through the cap and are threaded into the link; they are then backed up by castle nuts and cotter pins. The tractor is now in condition to divide it. However, it is first necessary to provide some means of supporting the two assemblies. The front assembly including the engine block, radiator and the front axle, is supported on an 8x8 timber as shown in Fig. 50. This timber is cut to the average height of the tractor above the ground and any discrepancy in the distance is made up by inserting a shingle between them. The rear end is supported on a jack. Immediately behind the jack, say one foot, build up the blocking which is shown in the figure. The jack is used to move the rear end up and down while extracting any bolts which might bind. After removing the three cap screws at the top of the flange screw in two pins made by cutting the heads off of two cylinder head cap screws. This will prevent the transmission housing damaging the oil pipe as it is being drawn back. Probably the most important part of the blocking is the wedges shown in Figs. 51 and 52. These are inserted between the axle and the cylinder front end cover as shown in Fig. 51. If these are not put in place the engine will fall over, resulting in injury of the castings and probably hurting the operator. When the last bolt has been removed see that the shifter lever is in neutral and draw the rear end back out of the way into the position shown in the figure. We recommend moving the rear end because it is considerably lighter than the engine and easier to handle than the front end, the wheels of which are not fixed when disconnected from the steering arm, and an opportunity is afforded of blocking these wheels.

Fig. 50

Fig. 51
and running off the large nut on the end of the drive shaft with a wrench as shown in Fig. 53. After the nut has been removed the clutch may be withdrawn from the shaft and taken to the repair bench for disassembling.

92. The clutch is held together by means of eight nuts and bolts located in the flanges of the housing. When these have been removed it is a simple matter to take the parts out. However, as the springs are exerting their full force between the rear housing and the clutch drum it is necessary to provide some means of holding the two together while the bolts are being taken out. Otherwise the clutch is likely to fly apart, injuring the operator.

 Probably the best method of doing this is to hold the clutch in an arbor press. If no arbor press is available remove two opposite bolts and hold the housing together by means of two C clamps as shown in Fig. 54.

93. Another method is to hold the housings together by means of a bolt and washers as shown in Fig. 55. This is probably the safest method when the arbor press is not available. The fixture for assembling the Timken bearings in the front wheels of the Model "T" car may be used for this purpose. When all these bolts have been removed, the pressure on the bolt or the C clamps may be released and the clutch taken apart as shown in Fig. 49. Remove the plates, inspecting same to see that they have a bright surface where they bear together. This surface should be smooth and bright, if it shows blue or bumpy it is an indication that the plate has been burned or scorched by slipping and such a plate should be replaced by a new one. Inspect the springs to see that they are all of about the same length and even tension. If one of the springs is shorter than the average, it should be replaced by a new one. The slipping is corrected in a number of cases by installing an extra large plate to replace the thickness of the other plate which has been lost due to wear. However, we recommend the use of the new 150-lb. pressure springs which are now available. Never install an extra plate with the new style springs as the clutch will drag, causing premature wear.

(To be Continued)
Mixing Chamber

94. The mixing chamber is that unit of the vaporizing system in which the fuel and air are finally metered and brought together in the proper proportion for a combustible mixture. It comprises a ring valve for metering the air, a venturi to facilitate the flow of fuel, a priming or choke valve, throttle valve and fuel shifter valve, together with the necessary passages, levers and housing.

95. Fig. 42 shows a section and phantom view of the mixing chamber, the arrows show the travel of the air and fuel through the chamber.

96. The main air supply is drawn in through the passage at the top and down through the center of the guide. The portion of air to fuel is governed by the rising and falling of the ring valve, which is supported by the column of air; the higher it rises the more air is permitted to pass through.

97. Just below the guide is the choke or venturi at which point the fuel from either tank is introduced according to the setting of the shifter valve.

98. The flow of mixture into the cylinders is controlled by the throttle valve which is located in the fuel passage below the choke tube.

99. The mixing chamber is of rigid construction and is not subjected to heat stoppage and wear as are the vapor tube and float chamber; it is therefore seldom the cause of any trouble. Continued running with the air washer functioning improperly permits dust and dirt to collect in the chamber causing the valve to stick. Again, through rough handling, the casting may be broken which will necessitate removing the parts, assembling them in a new casting.

100. One of the most prevalent troubles in the mixing chamber is caused by the novice trying to correct the ring valve. (See Fig. 42.) In replacing it he often inserts it with the flange down; in this position the valve will not function at all. Again he tries to correct the weight by drilling out or filing off part of the metal.

101. As stated above very little can happen to this assembly other than the stoppage of the passage in the shifter valve and the sticking of the ring valve. We will therefore immediately enter into the method of removing the parts for assembly in the new casting, discussing the different parts in their turn.

Removing the Mixing Chamber

102. If the large fuel tank is off, the mixing chamber may be removed from the manifold leaving the assembly in place. This is accomplished by disconnecting the fuel tube from the front end of the shifter valve housing, and the priming rod from the priming valve lever. Back out the vapor tube pack nut and remove the air washer tube flange by running out the two cap screws which hold it to the air washer cover, at the same time drawing the large air washer tube out of the mixing chamber. Finally run the nuts off the two mixing chamber to manifold studs and draw the mixing chamber off.

103. When the large fuel tank is in position it is necessary to remove the entire vapor system from the engine, as there is not sufficient clearance between the end of the long stud and the tank to permit the mixing chamber to be removed.

104. Remove the air washer tube flange and tube, disconnecting the priming rod and gasoline tube as described above. After shutting off the fuel at the sediment bulb disconnect the supply tube and needle valve adjusting rod from the float chamber. Next run out the cap screws which hold the exhaust tube bracket to the foot rest bracket. The assembly may now be removed by running out the four cap screws which hold it to the cylinder block.

105. As an aid in this operation some repair men replace the two outer cap screws with cylinder head bolts from which the heads have been removed. These "pins" support the weight of the assembly while running out the center cap screws and aid materially in replacing it.

106. The assembly is then placed on a bench where the mixing chamber is removed by backing out the vapor tube pack nut, and running off the two mixing chamber to manifold stud nuts.

The Air Valve and Guide

107. The air valve is exposed by removing the cover which is held to the mixing chamber body by means of four cap screws. The ring valve will then drop out when the chamber is inverted.

108. The ring valve may be removed when the chamber is assembled to the engine by removing the cover and using two wires bent into hooks to draw out the valve.

(To be Continued)
ARRIVED!

Saturday at 6:30 P.M. the two Ford truck loads of parts arrived from Detroit.

Five Hundred and Eighty-three miles in three and one-half days.

Splendid record in performance for Ford Ton Trucks. Splendid example of the extent to which we go to uphold our reputation for high grade Service to Ford Owners.

Modern Automobile & Garage Co.,
500 East Main St., Belleville, Ill.

583 Miles by Truck

When the railroads fail to function we go to this extent to maintain the quality of our Ford Service.

Two Ford Ton Trucks will leave Detroit Wednesday morning, May 8th, each loaded with 3000 pounds of necessary Ford Parts.

What a wonderful assurance that as a Ford owner you are at all times protected with Genuine Ford Parts against a possible necessity for repairs.

Modern Automobile & Garage Co.,
500 East Main St., Belleville, Ill.
One of Our Wide-awake Dealers

The pictures on the first page show how the Modern Automobile & Garage Co., out enterprising dealers of Belleville, Ill., met a business contingency. When it was impossible to move shipments due to the recent freight and express embargoes, this dealer transported sufficient parts overland to replenish his stock, thus maintaining the high standard of Ford service.

Not only were Ford owners supplied with genuine parts, but this enterprising dealer took advantage of the opportunity to advertise the Ford one-ton truck, also the extent to which he would go to render service to his customers.

Save the Transmission Bands

Only a small percentage of the transmission bands shipped out are returned for relining. An accumulation of bands with worn linings is to be found in almost any Ford repair shop. The shortage of steel makes it imperative that every usable band be relined for further service.

If the bands cannot be conveniently exchanged, dealers should consult the Branch as to the best method of doing the work in their own shop.

Rim Clamps

It has come to our attention that imitation demountable wheel clamp nut assemblies are on the market. These clamps do not check up to the required dimensions in order to secure the proper bearing to hold the rim on the wheel, and consequently are very dangerous to the user, as a serious accident is liable to happen.

Dealers and service stations should warn their customers to use only our genuine clamp assemblies.

Our clamp for either straight side or clincher type, bears the patent date of 7-6-09.

Follow Up Repairs

We show below facsimile of postal card sent out by one of our Detroit Dealers to every owner who leaves his car for repairs. The owner is impressed by the fact that his work is receiving the personal attention of the manager, and by this means it is often secured as a regular customer.

As Manager of this Company I wish to thank you for your business. I note from our yesterday's report we completed some repair work on your Ford Car, and if this is not satisfactory kindly report to me personally.

Yours very truly,

Ford Motor Sales Co.

Pres. and Gen. Mgr.
Practical Methods of Repairing Ford Cars

The Wiring

109. The Ford car is wired with what is known as a single wire system, i.e., the metal work of the car acts as the second wire and is usually called the ground. The frame is always connected to the negative (−) terminal of the battery.

110. Fig. 39 Vol. 1 shows the wiring diagram with relation to the chassis. All the wires may be easily traced by means of their relative size as in the case of the starting circuit and high tension wires, or by the color as is the case with the remaining wires.

111. To facilitate assembly and repair the wires are wherever possible combined in a cable. (See Fig. 39 Vol. 1.)

112. Wherever possible connections are made through clips or lugs soldered to the end of the wires, connections are made in the lamp socket by tightening a screw against the end of the wire which has been tightly twisted and dipped into solder.

113. Care should be taken to see that all wires are so installed as to prevent chafing. The head lamp wires are led through fibre bushing in the hood block and are clamped to the frame at several points so as to reduce chafing to a minimum. The repairman should take special care to see that all wires are properly installed to guard against this chafing effect, particularly at the hood block, battery, tail light, and around the commutator.

114. There are three characteristic currents in the Ford car. (1) The normal current used in charging the battery, lighting the lamp, sounding the horn, and the primary circuit of the ignition. This current is of low voltage and low amperes, which requires a wire of only small cross section, and insulation of ordinary thickness. The generator and battery current in these wires is 6 to 8 volts direct current with a maximum of 12 amperes. The magneto circuit carries an alternating current of from 5 to 26 volts, with a maximum of 9 amperes.

115. (2) The secondary current in the ignition system requires a wire with an extra heavy insulation to prevent the high tension current breaking it down. This circuit carries a current of extremely low amperage at 15,000 to 25,000 volts.

116. (3) The starting circuit is just the opposite of the secondary circuit of the ignition, in that it transmits a current of high amperes, 225 amperes at about 4 volts. The insulation therefore need not be very heavy, but the cross section of the wire should be large to cut down the resistance as much as possible.

117. There are eight distinct circuits, each of which may be isolated from the other in tracing trouble. These circuits are as follows:

1—Charging circuit.
2—Starting or cranking circuit.
3—Tail lamp.
4—Head lamp (bright).
5—Head lamp (dim).
6—Ignition on battery.
7—Ignition on magneto.
8—Horn.

These circuits may be broken into smaller sections by means of several connections, at such points as terminal block on the dash and the terminal posts.

Tracing Trouble in the Electrical Equipment

118. Trouble in the electrical system may be either electrical or mechanical. Mechanical troubles very seldom occur, and when they do, they are located either by the resulting noise or during inspection for electrical trouble. There are only four kinds of electrical trouble:

1—Weak source of current.
2—Open circuit.
3—Short circuit.
4—Crossed circuit.

119. The weak source may be the battery, the magneto or the generator, and the trouble may be due to mechanical or any of the other electrical troubles in that part.

120. An open circuit occurs where there is a gap in the wires of a circuit. This gap may be caused by a switch not functioning properly, a poor electrical contact between the wires and terminals, misplaced fibre insulators, dirty contact points or a broken wire.

121. The importance of clean, tight contacts particularly in the low voltage circuits, cannot be too firmly impressed on the repairman’s mind, as it is one of the most prevalent sources of trouble in an electrical system often causing unnecessary drain on the battery when the system is apparently functioning properly.

122. A short circuit obtains when the current returns to its source without traveling.
through all the wires it is supposed to. This is caused by a bared wire coming in contact with some other uninsulated part of the circuit. The above conditions may occur in the wiring or inside the separate devices.

123. Crossed circuits occur where the current from one circuit runs into another circuit through bared wires touching or wires misplaced in assembly.

(To be Continued)
Crank Case Pet Cocks
If trouble is experienced with the pet cocks opening when driving the tractor through stubble or low brush cut off the wings of the valve as shown in Fig. 60 B. A shows the standard pet cocks.

The Breather Strainers
There are two strainers in the breather pipe, one in the cap and one pressed into the pipe. It is important that both of these strainers be in place and in good condition.

We note that some owners not having the patience to filter the oil through the permanent strainer remove it entirely, or punch a hole in it, thus permitting dust and dirt to be drawn into the crankcase where it cuts out the crankshaft and camshaft bearings and wears the pistons and cylinder walls.

In cold weather the pouring may be facilitated by heating the oil before putting it into the engine.

Tightening Spark Plugs
Never draw a spark plug down tight into a hot cylinder head. When the cylinder head is hot the diameter of the spark plug hole is slightly enlarged, while the spark plug which is comparatively cooler is nearer its normal diameter. When the engine becomes cool the cylinder head shrinks onto this plug making it almost impossible to remove it. Correspondingly if the repairman finds a tight spark plug he may be able to remove it by running the engine until it becomes thoroughly warm.

If considerable trouble is experienced with plugs sticking, it is advisable to wipe the threads with some flake graphite which has been mixed with a little oil, before screwing them into the cylinder head.

Shearing Pins
When plowing the operator should always carry extra shearing pins in his tool box. These wooden pins are designed to shear before the strain on the plow is sufficient to bend the beams. Connecting the plow by means of a bolt or other metal pins inevitably results in a sprung beam. A plow with a sprung beam will not only require considerably more power but will cut a ragged furrow.

The above table will be found useful in estimating the work accomplished at any particular time.
Practical Methods of Repairing Fordson Tractors

The Clutch

(Continued from Page 31)

124. To assemble the clutch place the rear housing and clutch drum on a vise or on a table as shown in Fig. 61. Assemble the plates in the drum alternately, starting and ending with a large plate. Insert all the bolts and start the nuts. Pull the assembly together and tighten all of the bolts.

125. Before drawing the bolts down all the way it is advisable to line up the small plates so that they will fit over the fly wheel studs readily; they may be placed into position with a screw driver and hammer as shown in Fig. 62. When the bolts have all been tightened, secure them with a lock wire which runs through all eight of the bolts. Before assembling the clutch to the drive shaft try it over the flywheel studs to make sure the plates are all in line.

126. On the early tractors the clutch was located by means of split rings which fitted into the grooves in the shaft. (See Figs. 63 and 64.) This groove was a little less than a quarter of an inch in width. The new tractors are provided with a shoulder to replace these split rings. The groove is considerably wider on this type of drive shaft and it would be impossible for the operator to position the rings. After the rings have been put in position, put the clutch onto the drive shaft and secure it by means of the nut and cotter pin.

127. The repairman should always take the opportunity of cleaning the oil tube whenever the tractor has been split. The tube may be cleaned by blowing it out with compressed air from the funnel shaped end which is located on the magneto end of the engine.

128. When the clutch is secured to the drive shaft the rear end is assembled to the engine. Set the shifter lever in the neutral position and turn the clutch into such a position that the slots in the small discs line up with the lugs on the fly wheel. To facilitate locating the flanges and to guard against damaging the oil pipe gasket insert two cylinder head cap screws, from which the heads
have been removed into the cap screw holes at the top of the cylinder flange as shown in Fig. 50. The gasket may then be installed over the locating pins. Bring the transmission housing forward and enter these pins into the bolt holes; then push the rear end forward until the flanges meet. If the lugs do not fit into the slots of the small discs the lugs may be brought into position by turning the engine over slowly at the same time pushing the rear end gently forward. Next insert the two bolts through the holes in the engine flange just above the crank case; these holes are reamed accurately and after they have been lined up it is a simple matter to enter all the other bolts.

129. Draw down all the bolts including the two cap screws in the top of the flanges to an easy seat and then tighten them by crossing from one side to the other. Finally try all the bolts in rotation to insure their being tight.

130. Connect the exhaust tube to the foot bracket.

131. Before positioning the dash, screw the locating pin (main bearing bolts) into the front holes as shown in Fig. 65 and position the paper gaskets. To replace the assembly it should be held into position shown in Fig. 65 and set into the tractor with the shifter ring straddling the drive shaft. The throttle control rod should be entered into the throttle valve lever as the assembly is moved down into position. When the dash is in position enter the two rear cap screws which hold the dash to the transmission housing.

132. Position the air washer on the locating pin and start the cap screw which holds the air washer to the top of the dash. Remove the locating pins, one at a time, replacing them with cap screws. Tighten all the cap screws leaving the dash to top of air washer until the last. Next attach the gasoline tank to the side of the air washer. Note: these cap screws are backed up by lock washers. Connect the fuel supply line, attach the fuel system and commutator control rod.

133. Next connect the steering gear drag links. The socket ball and cap should be cleaned and filled with new grease. If the ball and socket is a tight fit as when the tractor is new, the bolt should be drawn down tight and then backed out $\frac{1}{8}$ to $\frac{1}{4}$ of a turn or until the joint works freely without any lost motion. The castle nuts are then drawn down and secured with cotter pins.

134. The fuel tank and steering wheel are then assembled as explained in paragraphs 504 and 505, Volume 1.

The Mixing Chamber

(Continued from page 32)

The Air Valve and Guide

135. The guide is removed with a pair of pliers, or if it is very tight in the chamber body it may be necessary to drive it out with a chisel inserted through the lower end after removing the choke tube and throttle valve.

136. In assembling the air valve in the chamber first drive the guide in until the guide lugs position on the machined part of the chamber. It does not make any material difference which way the lugs are positioned with relation to the incoming air.
137. The ring valve is next placed in the chamber with the flange side up. (See Fig. 42.) It should fit freely on both the guide and in the chamber. The ring and guide fit may be tested before inserting the guide in the chamber; if it is found that they bind it is probably because the ring has been bent out of shape unless there is a high spot on the guide lugs. This may be removed with a file.

138. Never try to correct the fit by filing the ring valve. The weight of this ring is very important and should never be changed.

139. When the ring and guide are in position and after making sure the gasket is in good condition, replace the cover, securing it with four cap screws.

140. If the chamber is detached from the manifold, the fit may be finally checked, turning the chamber alternately upside down and right side up, listening for the sound of the ring as it falls from one position to another.

The Priming and Throttle Valve

141. The priming and throttle valves are of the same construction as those in Model T Holley carburetor. However, as there is no slow speed tube entering at the throttle valve, it is not necessary to use the feelers to position throttle plate in replacing it. The valves should close squarely in the passages. If they are sprung the plates should be removed and straightened or replaced with new ones. The plates and valves are interchangeable and may be used in a new chamber body.

142. To remove a valve, position the plate parallel to the passage and bend up the ends of the staple which holds the plate in the shaft. Next turn the valve into the closed position and draw the staple out with a pair of pliers. The plate is now free in the shaft and may be withdrawn with a pair of pliers, the valve being in the open position. When the plate has been removed the shaft and lever assembly may be withdrawn.

143. In replacing the valve first insert the shaft making sure the lever is in the proper position relative to the chamber body, and insert the plate into the slot so that the holes line up properly with the holes in the shaft. Insert a new staple and bend down the ends.

144. When a new plate is used in the assembly it is necessary to drill it when in positioning the shaft. Position the plate and close the valve. Using the holes in the shaft to locate from, drill the two holes with a No. 42 drill. The assembly is then completed as stated above.

145. If the shafts of any of the valves become worn sufficiently the amount of air leaking by them will affect the running of the engine. This may be overcome temporarily by running with the priming valve partly closed, but the condition should be corrected as soon as possible because dust and grit will be drawn into the cylinders through the opening. In some cases it may be corrected by replacing the shaft; in others it is necessary to replace the chamber body.

The Shifter Valve

146. The method of removing, cleaning and replacing the shifter valve are fully described in Par. 76 to 85. If, however, the chamber is detached it is advisable to support the shifter valve lever on a block when driving out the shaft to lever pin.

The Choke Tube

147. The choke tube is a die cast tube which is inserted into the passage below the air valve guide. It is held in position by means of a retainer screw which is screwed into the chamber body and enters a locating hole in the choke tube.

148. To remove the tube it is necessary to remove the cover and valve guide, or the cover and throttle valve. The retainer screw being run out releases the choke tube which may then be removed through the clear end. If it binds it may be necessary to use a screw driver and light hammer, or if very tight a hardwood plug the size of the opening to drive it out.

149. When replacing the choke tube it is important to have the narrow opening toward the top. See Fig. 42 and the retainer screw entering the small hole.

Replacing the Mixing Chamber

150. When the mixing chamber has been assembled properly, it is assembled to the manifold. The chamber to manifold gasket should be inspected to see that there will be no air leaks and any burrs on the surface of either the chamber body or manifold should be removed with a 10" millfile. After placing the gasket over the studs, position the chamber, tightening it down with the two nuts backed up by lock washers.

(To be Continued)
Ford and Fordson Parts Display

The above picture shows a display of Ford and Fordson parts in the window of Hudkins-Bader Motor Company, of Salina, Kansas. This display has called forth much favorable comment from prospective tractor purchasers who knowing what the Ford has accomplished realize by comparison what they may expect from the tractor.

Repair Shop Records

Our Dealers, the Universal Motor Co. of Richmond, Va., have adopted the following system which gives them a complete daily record of work performed in their repair shop, and also enables them to follow-up customers who have left their cars for repairs.

To watch their service, they have four forms. The first is an 11" x 12" ledger sheet properly ruled and headed. It is a daily service report from the Repair and Service Department. This sheet is kept by the stock clerk in the Tool Crib, and gives a daily check on just what is done in their Repair Department. By the use of this form they can tell each day just what profit their shop is making, by adding the overhead expense charged to this Department.

The second form is also a ledger sheet which is written up on the service floor. It gives the license number, owner's name, address, motor
number, and the class of work performed on the car.

The third form is a 4” x 6” file card on each owner. Each day the record from the above sheet is copied onto these cards. This gives a check on the number of times a customer visits the place, and also calls attention to any new names which might appear on the daily record. A letter is immediately sent to the car owner following his initial call thanking him for his visit. In this way a new customer is usually made.

If it is found by examining the owner’s card record that he is not calling as often as he could be expected to, a salesman is sent to call on him and obtain the following information which is set down on a 4” x 6” card and delivered to the manager:

Name ..............................................
Address ...........................................
Date Car Received ..............................
Do You Still Own Car? ....................... 1
If Sold, How Long Did You Keep It? ....
Reason for Selling ............................
Do You Get Service at Our Service Station? ...
If Not, Why? ...................................
Is Our Service and Repair Work Satisfactory? ....
Remarks ........................................

By this information the manager may determine whether or not the owner has cause for complaint, or whether he has sold the car.

1916 Fenders and Shields

We have a limited stock of 1916 type rear fenders and running board shields on hand at various Branches. We offer these parts subject to prior sale at one-half price less dealers’ regular discount.

Owners of earlier models will no doubt appreciate the opportunity of improving the appearance of their cars if this matter is called to their attention.

Cars bearing motor number from 3,969,151 to 4,055,280 were shipped during the month of May.
Piston Rings

Fig. 68

Piston rings are now machined with a groove near the edge which should be toward the top when installed on the piston. See Fig. 68.

This method of marking supersedes the Ford script, and as the groove and taper are cut at the same time, any possibility of marking the rings incorrectly is eliminated.

Genuine Ford Parts

Fig. 69

The Universal Car Sales & Service Corporation of Long Island City, New York, advertises genuine Ford parts on their service trucks as shown in Fig. 69.

Practical Methods of Repairing Ford Cars

The Wiring

(Continued from Page 36)

151. While the wiring diagram shown in Fig. 39, Vol. 1, is of great value to the repairman when installing the wires, the flat diagrams shown with these articles are better suited for explaining the several circuits. As will be noted, the circuit or circuits under discussion are shown in red, while the remaining parts of the system are shown in black.

152. These diagrams should give the repairman an idea of the wires in which any particular trouble might lie; it is then a simple matter for him to transpose the circuit on to the diagram showing the relative position to the chassis, Fig. 39, Vol. 1.

153. Fig. 70 shows the various signs that are used in the diagrams, together with an explanation of what they mean.

154. The first thing to do in tracing trouble is to determine the circuit or circuits affected and then by breaking that circuit into several sections, the trouble may be located as being in one of them, which should be carefully inspected for the typical faults enumerated above. If the trouble occurs in two separate circuits it is reasonable to suppose that its source lies between the common connection and the supply of current. As, for instance, if upon trying the lights and the ignition on the battery, neither one will act, the trouble must lie between their common connection at the switch and the battery. If the horn will not sound and the car will not run smoothly with the ignition switch on the magneto side the trouble probably lies

CHARACTERS USED IN WIRING DIAGRAM

+ POSITIVE TERMINAL
- NEGATIVE TERMINAL
▌ BATTERY
▼ GROUND
▌▌ CONDENSOR
× WIRES INSULATED FROM EACH OTHER
▌▌▌ SECONDARY OR FINE WIRE COIL
▌▌▌▌ PRIMARY OR HEAVY COIL
▌▌▌▌▌ ELECTRO MAGNET
▌▌▌▌▌▌ CONTACT POINTS

Fig. 70
between their common connection on the terminal block and the magneto.

**Live Wires**

155. Fig. 58 shows the wiring diagram of cars equipped with the starting and lighting system. The wires shown in red are alive at all times (excepting when the battery is disconnected), and should be inspected occasionally to see that their insulation is in good condition and that the wires are in such a position that they will not chafe on any metal parts.

156. As these wires are used on the other circuits they will be discussed under separate headings. However, if the batteries require
re-charging frequently it is probably due to open circuits or a slight ground in these wires. As stated above, open circuits result from loose or dirty connections, as well as parted wires.

157. If the top of the battery is allowed to become wet, dirty, or covered with acid spilled when testing, the current will leak across and gradually discharge the battery. The top of the battery should therefore be wiped occasionally with a rag moistened with household ammonia.
Fordson Tractor Section

The Air Washer

It is safe to say that there is no part of the tractor any more important than the air washer, and no part that is any easier to give proper attention.

The air washer bowl should be kept filled with water at all times. Remove the cap at the bottom of the chamber at least twice a day and drain the water. The bowl should then be flushed out by screwing in the bottom cap and pouring a pail of fresh water into it, then removing the lower cap. After this replace the cap and fill the bowl with fresh clean water.

Neglecting the air washer will cause the owner no end of trouble and expense. In the first place the air washer furnishes a small amount of vapor which facilitates the operation of the engine and helps to maintain a clean condition in the combustion chamber. In the second place it removes the dust and dirt from the air. If the air washer is neglected this dust and grit will be drawn into the cylinders, wearing the pistons undersize and the cylinder walls oversize and out of round, also destroying the valves. When the pistons and rings are worn undersize, this dirt together with unvaporized kerosene will work through into the crank case and wear the bearings on the crank and cam shafts undersize and out of round.

It is very essential that every dealer make it a personal matter to inform every tractor owner of the importance of keeping his air washer float in proper condition at all times. You will find that you will be well repaid in the long run by exerting a little effort in the way of proper instruction.

Tighten Seat Spring

It is necessary to have the seat spring of the tractor tight at all times; not only is it dangerous when loose, but the spring will wear the recess in the dash, so that it will soon be impossible to hold the seat in place.

Lubricating the Minor Parts

The dealer should call the owner's attention to the importance of regularly lubricating the minor parts, such as rear axle bearings, steering joint, hub caps, spindle bodies, spindle arms, fan and commutator. There is a tendency on the part of the owners to neglect these details and soon these parts become worn and need replacing. A few minutes spent in oiling these parts will save hours of time in the repair shop.

Transmission Oil

Our attention has been called to the fact that some Fordson owners are using a graphite grease in the transmission. It has been the experience of ball bearing manufacturers that all grades of graphite grease have a lapping or grinding action on the polished elements of an anti-friction bearing, causing premature wear. We recommend that only a heavy fuel mineral gear oil be used in the transmission.

Stopping the Engine

There is no ignition switch on a tractor engine for the reason that stopping a kerosene engine by shutting off the ignition is very poor practice, as raw kerosene will remain in the cylinder, later working down into the crank case. Every method used in good practice should therefore avoid this condition.

The best method in general practice is to shut off the fuel supply at the sediment bulb valve under the large tank. By so doing the combustion chambers are left dry and free from unvaporized fuel.

In cold weather it may be advisable to swing the shifter valve onto the gasoline side, and, after running so for a fraction of a minute, stop the engine by closing the choke valve. This primes the cylinders for easy starting. It is not advisable to do this in warm weather excepting in an emergency.

Another method in common practice is to turn the shifter valve onto the gasoline side when the gasoline supply is shut off. The main objections to these latter methods is that the float chamber will flood (until the raw fuel in the vapor tube runs out).

The engine should never be stopped by closing the choke valve when running on kerosene excepting in an emergency. It is then advisable to start the engine and shut it off in the proper way.

Use the Tractor Cover

When tractors are left in the field over night they should be covered with the tarpaulin furnished with each tractor. This precaution will facilitate starting the tractor in the morning as it will keep the moisture off of the ignition system and will help preserve the appearance of the tractor.
Practical Methods of Repairing Fordson Tractors

Replacing Mixing Chamber
(Continued from Page 40)

158. If the manifold is assembled to the engine it is necessary to enter the throttle control rod fork into the lever as the chamber is being started on the studs. The vapor tube should be inspected to see that the ring and pack nut are in position. As the mixing chamber moves down, this tube should be entered into the opening. When the nuts have been tightened on the studs, tighten the vapor tube pack nut, connect the gasoline fuel tube and connect the priming rod securing it with a cotter pin.

159. If the manifold has been removed it is next necessary to replace it. First see that the six glands and gaskets are in position in the port holes of the manifold, and that they are in good condition, particularly the inlet port gaskets. It is usually advisable to replace the inlet gaskets to insure against a leak at this point.

160. If the manifold were assembled with cap screws the repairman should place the two pins mentioned in Par. 105 into the two outer holes of the cylinder block. Position the assembly on the engine, entering the throttle control rod and setting the assembly onto the pins. Run down the two inner manifold to cylinder cap screws backed up by lock washers. Remove the two pins from the outer holes and run down the cap screws. Next draw them tight, taking up a little at a time on each one until they are all tight. Connect the priming needle valve adjusting rod, and fuel supply tubes as described above, and in the earlier issues of the Bulletin dealing with the vaporizing system.

Exhaust Shunt Valve

161. The function of the exhaust shunt valve is to control the flow of exhaust gases over the vapor tube. It is seldom the cause of any trouble, but at times it must be removed because of a cracked manifold.

Removing Shunt Valve or Lever

162. To remove the valve it is advisable to first remove the assembly, as described in paragraph 104. Next remove the vapor tube. See paragraph 60. The shifter lever is then removed by running out the combination nut and bushing which secures the lever to the manifold stud. The assembly is then placed on a bench with the shifter valve shaft supported on two blocks or a grooved block, as shown in Fig. 75, and the pin by means of which the valve is raised, is driven out. The valve may then be withdrawn through the opening left by the exhaust outlet and vapor tube.

163. If the stud has been damaged or is to be replaced in the new manifold, it may be removed and installed with a Stillson wrench.
After the stud has been tightened down in the new manifold, insert the shunt valve and install the taper pins through the shaft. There is a clearance in the flange for the vapor tube, and the valves should be installed so that the clearance is in line with the vapor tube hole in the top of the manifold.

**Fig. 77**

164. The shunt valve lever should next be replaced, first engaging the fork with the valve shaft, then slipping the lever over the stud. When in position it should be secured with the combination nut and bushing. The remainder of the assembly may be completed as described above under the separate parts.

**Fuel Stoppage**

165. One of the most baffling troubles for the novice to locate is an obstruction in the fuel line from the tank to the combustion chamber.

166. If you are unable to start the Fordson engine from the small tank, your trouble is most likely to be in the shifter valve. That is located between the air chamber and the intake manifold.

167. In order to remove any foreign matter which is likely to be lodged in the shifter valve, first disconnect the gas line and remove the plug; making sure that the lever is on the “Gas” position, then take a fine wire and insert same through the small hole. (See Fig. 77.)

168. After you have started the engine on gas from the small tank and you find it impossible to operate from the large tank your trouble in all probability will be found in the spray nozzle.

169. You have easy access to the spray nozzle by removing the hexagon plug at the bottom of the float chamber after which the jet may be cleared by inserting a shipping “tag” wire upwards as shown in Fig. 76.

**The Rear Axle**

170. The Tractor rear axle is of the semi-floating type, with a worm-driven differential. The axle is so designed that all parts are easily accessible, it being possible to remove the worm without disturbing the differential or transmission, and also to remove the differential without disturbing the worm.

**Removing the Worm**

171. It is sometimes necessary to remove the worm to replace a damaged or worn part. To accomplish this, drain the oil from the transmission housing by removing the plug in the housing immediately below the shifter plate assembly. If the weather is very cold and the oil does not flow freely, the housing may be drained by removing the drawbar cap. This, however, usually results in oil getting over the housing and floor, and should be practiced only as a last resort. Next run out the four cap screws which hold the draw bar cap to the housing, and remove it. This exposes the end of the worm which may then be removed by setting the gear shifter into neutral and pushing the tractor forward. If the tractor is jacked up, placing a hub cap wrench on the nut and turning it counterclockwise will run out the worm.

**Inspecting the Worm**

172. The worm should show a bright surface on the screw. If it is slightly blue, it indicates that the gear is out of line, or that the tractor transmission has been receiving insufficient or improper lubrication. When this condition is found, it is advisable to remove the differential and inspect the gear, as will be described later.

173. If the worm is badly discolored or worn it should be replaced, and as stated above, the gear should be inspected and replaced, if necessary.

174. The bearings should be washed in kerosene and inspected for broken, cracked or worn balls and races. Broken balls are often the result of insufficient or improper lubrication, as, for example, running the tractor with dirty oil, oil containing graphite or oil of too thin a body. Continually jerking the tractor by speeding up the engine and letting the clutch in suddenly, exerts, particularly when the tractor is attached to a load, a severe strain on the thrust bearing, at times causing a complete failure.

*(To be Continued)*
The Development of Ford Service

The picture on the first page shows the splendid building occupied by E. J. Miles & Co., authorized dealers of Newton, Iowa, also an interior view of their repair shop. The insert in the lower right hand corner shows the building occupied by Mr. Miles when he became a Ford dealer. Within three years his business had outgrown his original quarters and he erected the building shown in the lower left hand insert.

When Mr. Miles started in the automobile business in the old bicycle shop, his equipment for repairing Ford cars consisted of only a few tools other than those furnished with the car. Today his shop is equipped with the latest types of machines, fixtures, repair stands, etc., for rendering efficient service to Ford owners.

This is only one example of the advancement that has been made by our dealers for taking care of their customers.

First Aid “Don’ts”

Don’t think that because you know a little about First Aid, you are a skilled surgeon.

Don’t forget to call a physician in all accident cases.

Don’t put on a bandage too tight. Ask the patient how it feels.

Don’t tie a bandage knot over the wound.

Don’t forget to raise the head in skull injuries.

Don’t fail to lower the head when the face is pale.

Don’t bring a frost-bitten case to a heated room.

Don’t fail to learn the correct method of artificial respiration.

Don’t delay in waiting for help in resuscitating a drowned person or one overcome by electric shock.

Don’t forget that it may take two hours of steady work to resuscitate asphyxia cases.

Don’t put your fingers or handkerchief on a wound.

Don’t wash out a wound with water. It is dangerous.

Don’t forget that if swelling, pain, and throbbing develop, infection is beginning. See a doctor.

Don’t forget that a “clean nail” is as dangerous as a rusty nail.

Don’t misuse the tourniquet. Loosen every 15 minutes.

Don’t just cover up a burn with anything. Learn the correct treatment.

Don’t attempt to set a fracture; let the doctor do it.

Don’t allow an injured man to get cold. It may be dangerous.

The Battery in Summer

The battery should receive extra attention in warm weather due to the evaporation of the water both from the atmospheric temperature and the overcharging.

It is an inherent feature of a starting and lighting system that the battery will overcharge in summer due to the following: First, the resistance in the battery, wires, and between the commutator and brushes is low permitting a higher rate of charging. Second, the engine starts easily causing very little drain on the battery. Third, as the days are longer the lights are not used as much as in the winter months. Fourth, the automobile is driven
on longer trips with fewer engine stops and starts.

The solution should be examined once a week or more often and distilled water should be added to bring it to the proper level.

The condition of the battery may be relieved by occasionally running the starting motor for a minute with the ignition off. Some drivers relieve the battery by burning the lights. This latter method, however, uses up the life of the lamps. It is therefore more expensive than drawing it down with the starting motor.

Never attempt to relieve the battery by disconnecting any of the wiring or adjusting the cut-out as such practice inevitably results in burning out the generator.

Cut-Outs Returned for Credit

Seventy-five per cent of the cut-outs returned for credit have absolutely nothing wrong with them. The accessibility and easy removal of this part leads us to believe that in many cases of trouble with the generator repairmen invariably change the cut-out.

Very often we find generators which do not start charging immediately upon the engine starting. Sometimes the delay is from a few seconds to a full minute; depending upon the condition of the commutator or brushes.

After changing the cut-out the running necessary to try it out, may have cut through the film of hard grease between the commutator and brushes, and the meter will then show the proper charge. The assumption is that the trouble was in the cut-out, while the fact is if the old cut-out were again put into service it would function equally as well as the new one.

Before changing the cut-out see that the commutator of the generator is clean and all connections in the charging circuit (See Fig. 39, Vol. 1, and Fig. 71 of Vol. 2) are clean and tight.

Do not remove the cut-out if it sticks until you are sure that it acts so habitually. If the cut-out sticks, the ammeter registering a heavy discharge, as the engine is slowed down or stopped. To overcome this, speed the engine up until a charge is registered, this treatment will often open the contact point.

Another thing that will affect the cutting in speed, is the setting of the third brush. As the charging rate is decreased the cut-out works at a higher speed, and it is not advisable therefore to reduce the charging rate to summer conditions.

Size of Sand Paper

We notice that some repairmen are using too coarse a sand paper for cleaning the commutator on the starter motor or generator. Nothing coarser than 00 should ever be used as the brush track will be scored destroying the contact and wearing the brushes excessively.

Motor Tongs

We still have in stock a few of the motor tongs 3Z628 shown in Fig. 80. These tongs are particularly valuable in shops not equipped with chain fall and motor hook.

Until our stock is exhausted, we will sell these tongs at $3.00 net.

Practical Methods of Repairing Ford Cars

The Wiring

(Continued from Page 45)

The Starting Circuit

175. If the starting motor does not respond when the foot switch is pressed down, the trouble must lie in the section of the wiring shown in red, Fig. 59. First test the battery with a hydrometer, as explained in Vol. 1, Page 17. Each cell should be tested separately and the solution returned to the cell from which it was drawn. It is important that only enough solution be drawn up to insure proper reading. If too much is drawn into the syringe the float will touch the top, giving an incorrect reading. Shaking the hydrometer lightly insures the float coming to the correct level for the solution. It will be noted that the solution is a little higher on the glass than the true level. A little below half way between these two points is the correct reading. There is a difference in the value of these readings according to the temperature. We are, therefore, giving two
readings, one for the cooler and one for the tropical climate:

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Hydrometer Reading</th>
<th>Indications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cool</td>
<td>1.275 or above</td>
<td>Fully charged</td>
</tr>
<tr>
<td></td>
<td>1.225 to 1.150</td>
<td>Less than half charged</td>
</tr>
<tr>
<td></td>
<td>1.150 or below</td>
<td>Completely discharged</td>
</tr>
<tr>
<td>Tropical</td>
<td>1.200 or above</td>
<td>Fully charged</td>
</tr>
<tr>
<td></td>
<td>1.130 to 1.080</td>
<td>Less than half charged</td>
</tr>
<tr>
<td></td>
<td>1.080 or below</td>
<td>Completely discharged</td>
</tr>
</tbody>
</table>

176. If the hydrometer reading indicates that the trouble is in the battery we recommend that it be taken to a Service Station, where it may receive the attention of skilled battery repairmen.

177. If the battery tests better than half-charged, the trouble must lie elsewhere. The most likely point is the battery and frame (ground) connections. They may be loose or dirty. Next examine the connections at the foot switch and then the one on the starting motor. If these connections, together with the wires, are in good condition, try shorting by the switch, as explained in Paragraph 3, Vol. 2. If the motor does not respond now, the trouble is probably internal and the motor should be removed and tested as explained on Page 165, Vol. 1.

178. The insulation and positioning of the negative wire, which runs from the negative terminal to the frame, is not so important, as the current in this wire is supposed to reach the frame. The positive wire, however, which leads from the positive terminal to the foot switch is very important. The repairman should exercise great care when installing one of these wires to see that there is no possibility of its chafing on any of the metal parts. This wire is secured to the body, as indicated in Fig. 81. This block relieves the tension on the battery terminal and prevents the wire from chafing on the gas tank, sediment bulb, feed pipe or the metal parts of the body. If the block does not hold the wire in the correct position, install a second block between it and the body. Such a block may be cut from a piece of wood or may be secured from the nearest branch.

The Charging Circuit

179. The charging circuit (Fig. 71) is probably the most important circuit on the car, as it is in operation at all times that the engine is running at or above the normal road speed. Its proper functioning determines to a large extent the life of the generator and battery.

180. The functioning of the circuit is indicated by the ammeter located on the instrument board. The hand should remain on or near the zero mark when the engine is idling, no lights are burning and the ignition switch is on the magneto side. It should read 10 to 12 amperes charge at 20 to 25 miles an hour when the lights are off and the ignition is on the magneto side. It should read 4 to 6 amperes discharge when the engine is shut off and the lights are burning.

Short Circuit

181. In tracing a short in this circuit, remember that the current flows from each end, as for example from the generator when running at a charging speed and from the battery to cut-out when the generator does not register a charge. A short in this circuit is usually indicated by the smell of hot insulation, and if this warning is not heeded the wire is likely to melt, resulting in an open circuit. If the short circuit is between the battery and the ammeter, no indication of trouble would be shown on the instrument. If it lies beyond the ammeter it would be registered.

182. An ammeter is a delicate instrument, and if it is affected by a heavy discharge from the battery it is likely to register either a charge or discharge. In this event disconnect the terminal block to starting switch wire at the terminal block. If the ammeter now registers zero the meter is probably all right. Connect the wire and if the hand again jumps over there is either a short in the ammeter, wire from ammeter to cut-out, wire from ammeter to light and ignition switch, in the light and ignition switch, or the cut-out points are sticking. Disconnect the wire from the cut-out and see if the ammeter now returns to zero. If it does the trouble probably lies in the cut-out which should be replaced by a new one.
Open Circuit

183. An open in this circuit is a thing to be guarded against, as running the car for any length of time with the charging circuit will result in a burned out generator. An open is indicated by the ammeter showing no charge when running the engine at a fair rate of speed.

184. The trouble should be located and corrected immediately. If it is necessary to run with the charging circuit open, ground the generator as explained on page 170, Vol. 1. The method of locating the open circuit is to try the lights first with the engine stopped. If they burn the battery to ammeter wires are O. K. and the trouble must be between the ammeter and ground in the generator. If the lights do not burn start up the engine and while running at a fair rate of speed try the lights by snapping the switch on and off rapidly to prevent the bulbs burning out. If they light the trouble lies between the ammeter and the battery ground. If they do not light the trouble is probably at the ammeter connections or in the ammeter.

General

185. If the ammeter flutters when the engine is running it indicates a loose connection in some of the wires of this circuit, dirty commutator, battery overcharged, faulty ammeter, intermittent short circuit in the generator, or a faulty cut-out.

186. The first thing to do is to test the battery. If it tests 1.300 or above, try reducing the charge by running the starting motor for a minute with the ignition turned off. If the battery tests below 1.300 or the above treatment does not overcome the trouble, try all the connections to see that they are tight. Next inspect for a slight ground. Providing the ignition is on the magneto side and the lights are off any grounds would be in the generator, cut-out to ammeter wires, ammeter to light and ignition switch wire, or in the ignition switch.

187. This trouble may be located in the switch if the ammeter hand becomes steady when the ammeter to switch wire is disconnected at the switch. In the same way it may be located in the ammeter to switch wire by disconnecting it at the ammeter.

188. The ground in the ammeter to cut-out wire is located by visual inspection or sometimes by pulling the wire into a new position.

189. To test the cut-out, slow the engine down until the hand on the ammeter comes to rest, and disconnect the wire from the cut-out; speed the engine up until the ammeter would register a charge were it in good condition, then hold a wire on the generator terminal. If a steady reading on the charge side is obtained, the trouble probably lies in the cut-out which should be replaced by a new one.

190. If all these tests fail to locate the trouble, it probably lies in the generator. Remove the dust cap and examine the commutator. If it is dirty, clean it by holding a rag on it while running the engine slowly. If the surface is dull in color hold a piece of sand paper No. 00 (not emery) on it until a bright finish is obtained the entire width of the brush track. A dirty commutator causing a fluttering of the ammeter or a low ammeter reading, usually causes the brushes to arc.

191. If these suggestions fail to overcome the trouble, remove the generator and overhaul it as explained in the article starting in Par. 322, Vol. 1.

The Light Circuits

192. As any trouble would be indicated the same in either the dim or bright light circuits, though not in all cases in each at the same time, and since one of the possible troubles to be experienced is the mixing of the wires, we will discuss both of the diagrams, Figs. 72 and 73, at the same time.

193. The thing to remember in tracing trouble in this system is that if the trouble is indicated when the light switch is on and off, the trouble lies in the switch or other parts of the system as explained under the heading already discussed. As the lights draw comparatively little current they will burn with a loose connection or a weak battery. In fact the lamps will glow even when the battery is fully discharged; such practice is, however, very detrimental to the battery.

194. If the starter and charging circuits work properly, any trouble indicated in the lighting circuits would be between the ammeters and the grounds at the several lamps. In this discussion we will consider that the repairman has determined by trial that the other systems are O. K.

(To be Continued)
The Fordson Tractor Section

Care of Bearings

An anti-friction bearing, particularly of the ball bearing type, is ground to extremely fine limits. The introduction of any fine particles such as graphite flakes, or grit of any kind, can only act in a detrimental manner to the bearings in the proper performance of their duty.

The following instructions concerning the handling of bearings should be carefully followed:

1. Bearings should remain wrapped in the waxed paper and enclosed in the cartons in which they are shipped until ready for use.
2. When bearings are removed from their waxed paper preparatory to assembly, care should be taken in laying them on the workbench to select a clean surface, since quite frequently steel filings or dirt will cling to the oiled surfaces of the bearings and eventually enter the same when in service causing premature failure.
3. When removing anti-friction bearings from any machinery in order to make repairs to adjacent parts, it is advisable to immediately clean the bearings thoroughly in gasoline and apply a generous coating of a good mineral grease, wrapping in paper to shield them from the entrance of dust, dirt, or moisture.
4. When removing bearings from a housing, the pressure should be exerted against the outer raceway only.
5. When assembling bearings on or removing them from shafts, the pressure should be exerted against the inner raceways only.
6. Before assembling bearings, be sure that they are coated with an ample supply of grease between the raceways and surrounding the balls.

Retarded Spark

The gasoline engine piston does not get its impulse from an instantaneous explosion as the blow of a hammer on a chisel, or striking a baseball with a bat. What actually occurs is the heat of combustion expands the gases to many times their original volume. Since they are confined and cannot expand rapidly, a high pressure is built up in the cylinder, the pressure of the confined gases forces the piston downward and the gases expand into the additional space, maintaining a diminishing pressure on the piston until the exhaust valve opens. The temperature of the gas about the time combustion is completed is between 2,200 and 3,000 degrees Fahrenheit. As the gases expand they give up considerable of their heat to the cylinder walls and in work performed on the moving parts. If the engine fires late the gases at unnecessarily high temperatures pass around the valves and into the manifold. It is important, therefore, that the combustion be completed as soon as practicable so that the greatest amount of work may be obtained from the fuel and the exhaust gases may be as cool as possible so that they will not burn the valves and overheat the manifold. Since a period of time elapses between the firing of the spark and the completed combustion, it is necessary to fire the mixture before the piston arrives at top center. In good practice the spark is advanced as far as the engine will stand it without laboring or knocking. The amount of advance varying with the speed of the load on the engine. To save labor and repair parts the owner should study out the best spark setting for the particular work he is doing, remembering always that this setting is in the advance section of the quadrant.

Burned Valves

The valve shown in Fig. 82 is an example of what will happen if the air washer is neglected. The head and stem near the head is badly burned as it would be had the engine been run with a retarded spark. In this case, however, the valve which was comparatively new shows considerable wear on the stem; some of the grit drawn into the cylinders having worked down between the valve stems and their guides. The valve had burned due to the grit cutting out and pitting the seat.
Practical Methods of Repairing Fordson Tractors

The Worm and Bearing

(Continued from Page 48)

195. The bearing is removed from the worm by removing the cotter pins and turning off the nut, using the hub cap wrench with a piece of pipe on the handle to increase the leverage. Some means of securing the worm should be provided to prevent the spline being damaged.

196. When in the field the rear wheel bushing may be used, as shown in Fig. 83. The bushing is drawn out by removing the four cap screws. Two of the screws which were removed are then screwed into the odd holes where, when drawn down evenly, they act as a puller in drawing out the bushing. When the bushing is half way out block it to the rim of the wheel and the wheel is blocked to the ground, as shown in the figure.

197. If the bearing is to be removed in the shop, the 1549 or a 1540 gear with the sides ground flat and held in a vise (See Fig. 84) or otherwise secured may be used as a fixture for holding the worm.

198. The bearing may sometimes be driven out with a block of babbitt, but it is usually necessary to use an arbor press. We are at present working on a universal puller which will pull all the bearings and which may be taken into the field. As soon as we are ready to make delivery on this tool, an announcement will appear in the Bulletin.

199. There are three makes of bearings used. See article on Thrust Bearings, Page 6, Vol. 2. Care should be taken to see that they are properly installed, as explained in the above article, and that the bearing is forced well down against the shoulder. The bearings should be at least a light, press fit on the shaft, to insure against its turning in the inner ring. The bearing is held in place by the large nut which is locked to the shaft by means of a cotter pin. This nut takes the thrust when the tractor is moving forward. It is necessary, therefore, that it be drawn down very tight.

200. To replace the worm, put the gear shifter lever in neutral, and holding the worm
with a hub cap wrench, insert it into the housing, as shown in Fig. 85. By means of the wrench elevate the spline end so that it is in line with the spline in the large transmission gear plate. Turn the worm slowly clockwise, at the same time forcing in on it with the left hand, as shown in the figure. Though this may appear difficult at first, with a little practice the repairman will soon become skilled in replacing the worm.

A broken cap is usually followed immediately by a broken transmission housing. The repairman may, therefore, realize the importance of drawing the screws down evenly and tight.

Removing the Differential

202. When the assembly has been completed, the transmission should be filled with fresh oil. See oiling chart, Fig. 23, Vol. 2.

203. The differential and axle shaft assembly is similar to the Ford truck in general appearance and design. However it may be removed from the tractor without disturbing the worm. If the transmission housing is secured to the motor, the rear end may be held up, by securing a chain hoist to, or blocking under, the draw bar cap. In either case, particularly if the rear end is supported on blocks, the front wheels should be blocked to keep the tractor in position. The operation of removing the differential when the housing is in this position is the same as will be described below when the transmission housing is detached.

204. When the housing is detached, it is necessary to so position it that it will be entirely safe. Probably the best method is to stand it on the flange as shown in Fig. 88.

205. The first thing to do is to remove one of the wheels, then while the helper steadies the assembly by holding on to the axle shaft, remove the other wheel by means of the bolts as explained in Par. 196. Set the flange end on the floor. Block it if necessary to prevent it from slipping and raise the assembly into the position shown in the figure. (To be Continued)
TRACTOR PARTS WASHER

The Fig. 89 shows one of the large washing machines through which all parts must pass before entering into the assembly of a Fordson Tractor. As the parts pass through they are submerged in a deluge of boiling water, together with the necessary ingredients to thoroughly cleanse them. This is the final precaution to prevent grit or foreign substances getting into the assembly, also it is indicative of the care that is taken in our manufacturing operations.

Top Hoods

Due to the fact that only a small percentage of Touring car and Runabout Top Hoods are ever used, we have discontinued supplying them with cars as regular equipment. In the future Top Hoods may be carried by dealers as extra parts in service stock, and furnished at regular catalogue prices.

Rebored Blocks

Our Branches are in a position to furnish new cylinder blocks bored to .031 oversize at $20.00 list. Dealers should be able to use these blocks to good advantage in overhaul jobs when the original block is not in condition for reboring.
Wiring the Commutator Properly

All the commutator wires should be under the choke rod which runs from the carburetor choke valve lever through the radiator. The wire leading to No. 1 terminal (see Fig. 39, Vol. 1 or cut No. 10 of the Manual) should pass under and behind the commutator case spring. The wire to No. 3 terminal should lead under the spring and behind the commutator pull rod as shown in Fig. 90. The side of the lugs through which the wire passes should be away from the cylinder block and parallel to it. When in the above position the wires are subject to little wear and are in no danger of being struck by the fan or fan belt.

Oiling the Generator

The tendency of the average owner is to put too much oil in the generator. Excess oil will work down onto the commutator, cutting down the flow of current and raising the speed at which it will begin to charge the battery. The ball bearing requires very little lubricant. Add only a few drops of oil every two weeks.

Commutator

Our attention has been called to the fact that emery cloth or paper is being used to sand the motors and generator commutators. We wish to warn against such practice as emery is a conductor of electricity and is likely to cause a short circuit.

Timing Valves Properly

It is very important that, after grinding the valve, the proper gap be obtained between the valve stems and push rods as explained in paragraph 227, Vol. 1, of the Service Bulletin. The correct timing at which the motor will develop its greatest power and efficiency is within these limits. Neglecting to maintain the gap within these limits results in loss of power and in many cases burned valves and over-heating.

Gasoline Tank Gauges

In response to a request from dealers for information of the dimensions for gasoline gauges, we are publishing below a table which includes the three styles of tanks used on Ford cars. While the round tank dimensions vary considerably for each gallon, it will be noted that in the square tank each three-quarters of an inch represents a gallon. The oval tank may be roughly estimated by one and one-half inches for the first gallon and three-quarters of an inch for each additional gallon up to nine.

<table>
<thead>
<tr>
<th>Gallons</th>
<th>Square Tank</th>
<th>Round Tank</th>
<th>Oval Tank</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3/4&quot;</td>
<td>1 1/4&quot;</td>
<td>1 1/4&quot;</td>
</tr>
<tr>
<td>2</td>
<td>1 1/2&quot;</td>
<td>2 1/4&quot;</td>
<td>2 1/4&quot;</td>
</tr>
<tr>
<td>3</td>
<td>2 1/2&quot;</td>
<td>3 1/2&quot;</td>
<td>3 1/2&quot;</td>
</tr>
<tr>
<td>4</td>
<td>3&quot;</td>
<td>4 1/4&quot;</td>
<td>4 1/4&quot;</td>
</tr>
<tr>
<td>5</td>
<td>3 3/4&quot;</td>
<td>5 1/2&quot;</td>
<td>5 1/2&quot;</td>
</tr>
<tr>
<td>6</td>
<td>4 1/2&quot;</td>
<td>5 1/4&quot;</td>
<td>5 1/4&quot;</td>
</tr>
<tr>
<td>7</td>
<td>5 1/4&quot;</td>
<td>6 1/2&quot;</td>
<td>6 1/2&quot;</td>
</tr>
<tr>
<td>8</td>
<td>6&quot;</td>
<td>7 1/4&quot;</td>
<td>7 1/4&quot;</td>
</tr>
<tr>
<td>9</td>
<td>6 3/4&quot;</td>
<td>8 1/2&quot;</td>
<td>8 1/2&quot;</td>
</tr>
</tbody>
</table>

Cars bearing motor numbers from 4,055,281 to 4,141,450 were shipped during the month of June.
Practical Methods of Repairing Ford Cars

The Light Circuits
(Continued from Page 53)

Ground

206. A ground in the lighting system would be indicated by a heavy discharge on the ammeter when the switch is on. It will lie in the series of wires indicated by the position of the switch handle (Bright or Dim). Since the tail lamp circuit is lighted when the switch lever is turned to either bright or dim, it is necessary to take it into consideration in each case.

5/111 SHOWING METHOD OF ATTACHING TAIL LAMP WIRE TO REAR CROSS MEMBER WHEN NOT EQUIPPED WITH SPARE RIM CARRIER AND ALSO METHOD OF ATTACHING TAIL LAMP WIRE TO BATTERY BRACKET

Fig. 91

207. Disconnect one at a time, the wires from the connection indicated (dim or on as the switch may be) on the terminal block, Fig. 39, Vol. 1, or Fig. 72 and 73, when necessary remove the tail light wire. If upon removing one of these wires the reading comes back to normal (6 amperes or less) the trouble lies in that wire between the terminal block and the ground through the lamps. If upon removing all the wires in the circuit under tests, the ammeter still registers a discharge, the ignition being on the magneto, the trouble must lie in the switch or switch to terminal block wire which should be removed and inspected.

208. The most likely place to find a ground is where the wires are permitted to lie on or pass through any metal part of the car. Such places are protected by fibre bushings or other additional insulation, and it is the duty of a repairman to see that this protection is in place when replacing any parts of the car. There is a bushing in each hood block through which the wires must pass before entering the lamps. The tail light wire is lead through a series of fibre guides secured to the frame as shown in Figs. 91, 92 and 93. It is important that the wire be slack where it passes under the rear cross member to prevent its chafing.

Open Circuit

209. An open circuit is easily located by the behaviour of the lights. If the tail lamp alone does not burn, the open circuit must lie between the switch and the ground through the tail lamp bulb. As it is hardly possible that a wire is broken at any point, the opening must be at or near the connection, or in the bulb.

210. The first place to look is the bulb as it is the most delicate part of the circuit and periodic failure is to be expected. If replacing the bulb with one that is known to be right does not bring about the desired result go over all the tail light wire connections, tightening and cleaning them with sand paper when necessary. After the switch has been in operation for some time, it is possible that the contacts become dirty and require cleaning. This is done by dismantling the switch and brightening up the contact points with fine sand paper (size 00). Never use emery in your electrical work.

METHOD OF ASSEMBLING WHEN CHASSIS IS EQUIPPED WITH SPARE RIM CARRIER

Fig. 92

211. In the same way an open circuit is located and treated in either the dim or bright circuits of the head lamps. If both lamps are affected it is reasonable to believe that the
trouble lies in the switch, or switch to terminal block wire. If only one lamp does not burn the trouble is probably between the terminal block and the ground in that lamp.

**Crossed Circuits**

212. There is little or no chance of the light wires becoming crossed with the magneto circuit as they are away from the magneto terminal on the terminal block. All the terminals on the switch are plainly marked so there should be no possibility of mixing the wires at this point. Furthermore where the wires parallel each other they are bound together which prevents chafing. However, it is possible to mix the wires at the lamps so that the bulbs burn bright when the switch indicates dim. This condition may be corrected by removing the plug from the lamps and inserting it again after having turned it half way around.

**The Ignition Circuits**

213. The Ford car is so wired that the ignition may be operated on current from either the magneto or the battery by setting the switch on the circuit desired. Fig. 74 shows the complete system of wires which receive current from the magneto. When the horn is not sounding the wires between the horn switch and ground in the horn are dead and would appear in black in the diagram. If the ignition switch were on the battery side and the horn silent, no current would be generated by the magneto and the wires from the magneto through the horn and to the ignition switch would appear in black on the diagram.

214. As we wish to show all the wires to be considered in the ignition system at one time, all the coil units, spark plugs, and wires are shown in red, while in reality only one of these systems or units is in operation at a time and there is an interval between the time the spark stops in one cylinder and the time it begins in the next. As shown in the diagram No. 3 cylinder is firing.

215. The first thing to do in tracing trouble after it has been determined that it is in the ignition system is to see whether it lies between the source and the switch or between the switch and the spark plugs. This is done by trying the switch first on the battery side and then on the magneto. If the system functions properly on the battery and not on the magneto, hunt for the trouble between the switch and the ground on the magneto coil support. If the ignition works on the magneto and not on the battery the trouble lies between the switch and the battery and may be located as explained under the explanation of lighting circuit. If it will not work on either the trouble is between the switch and the plugs.

**Weak Source**

216. If the trouble is indicated as being in the magneto as explained above, the first thing to do is to try the source. With the engine running or while someone cranks it, hold a screwdriver from the terminal post on the transmission cover to the cylinder. If the screwdriver is moved about maintaining the contact on both the cylinder and the terminal post a good live spark should result. If it does not the trouble lies in the magneto or terminal post. If there is a good live spark the trouble lies between the terminal post and the connection on the switch. Try sounding the horn. If the horn sounds the trouble lies between the switch and the terminal block. If it does not sound, the trouble probably lies at the terminal block on the dash on the terminal post on the transmission cover. See that the connections at both these points are tight and that the wire is in good condition and not resting against any metal part which might cause a short circuit. As may be seen by the diagram it is possible that a ground in the wire leading from the terminal block to the horn switch would also affect the ignition, as there is a comparatively small amount of current flowing from the magneto.

217. If upon trying the magneto with a screwdriver as explained above, no spark is obtained, remove the terminal post by running out the three screws in the base. Examine the spring to make sure it has not been broken or become weak. Examine the contact on the coil support for dirt. If dirt is found on the coil support contact, clean it with a screwdriver.

(To be Continued)
**Fordson Tractor Section**

**Tractor Labor Operation Time Costs**

In response to requests from our dealers, we have compiled time costs on the tractor repair operations. Dealers may use these costs as a basis on which to compute the labor charge for any repairs. By using this list as a guide, our dealers will be enabled to establish flat rate charges on tractor repairs.

When repairs are performed in the field, dealers should add to the above charges, a mileage fee sufficient to cover cost of transportation.

### The Engine Division

The following time applies when parts are assembled in tractor.

<table>
<thead>
<tr>
<th>No.</th>
<th>Operation</th>
<th>Hours Min.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Overhaul engine</td>
<td>16</td>
</tr>
<tr>
<td>2</td>
<td>Change engine</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>Install or refit one piston or connecting rod</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>Install or refit two or more pistons or connecting rods</td>
<td>4 30</td>
</tr>
<tr>
<td>5</td>
<td>Tighten connecting rod bearing</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>Replace two or more connecting rod bearings</td>
<td>2 45</td>
</tr>
<tr>
<td>7</td>
<td>Replace camshaft</td>
<td>3 30</td>
</tr>
<tr>
<td>8</td>
<td>Replace cylinder front cover or gasket</td>
<td>7</td>
</tr>
<tr>
<td>9</td>
<td>Replace cylinder head or gasket</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>Remove carbon and grind valves</td>
<td>3</td>
</tr>
<tr>
<td>11</td>
<td>Remove carbon only</td>
<td>1 30</td>
</tr>
<tr>
<td>12</td>
<td>Remove broken cylinder head bolt</td>
<td>2 45</td>
</tr>
<tr>
<td>13</td>
<td>Replace or clean crank case and oil tube, and install new gaskets</td>
<td>1 30</td>
</tr>
<tr>
<td>14</td>
<td>Drain crankcase and change oil</td>
<td>30</td>
</tr>
<tr>
<td>15</td>
<td>Replace starting crank</td>
<td>15</td>
</tr>
<tr>
<td>16</td>
<td>Tighten one crank shaft line bearing</td>
<td>2</td>
</tr>
<tr>
<td>17</td>
<td>Tighten two or three crank shaft line bearings</td>
<td>3</td>
</tr>
<tr>
<td>18</td>
<td>Tighten all bearings on crank shaft</td>
<td>4</td>
</tr>
<tr>
<td>19</td>
<td>Replace oil pipe (no other work necessary)</td>
<td>4 30</td>
</tr>
<tr>
<td>20</td>
<td>Replace cylinder water jacket plug, front or rear</td>
<td>1</td>
</tr>
<tr>
<td>21</td>
<td>Stop oil leak in or around valve cover</td>
<td>1 15</td>
</tr>
<tr>
<td>22</td>
<td>Replace large time gear</td>
<td>2</td>
</tr>
<tr>
<td>23</td>
<td>Replace cylinder front cover</td>
<td>1 30</td>
</tr>
<tr>
<td>24</td>
<td>Replace fan bracket</td>
<td>1</td>
</tr>
</tbody>
</table>

The following time applies when parts are brought in or shipped in for repair.

<table>
<thead>
<tr>
<th>No.</th>
<th>Operation</th>
<th>Hours Min.</th>
</tr>
</thead>
<tbody>
<tr>
<td>26</td>
<td>Overhaul engine</td>
<td>10</td>
</tr>
<tr>
<td>27</td>
<td>Re bore cylinders only</td>
<td>1 30</td>
</tr>
<tr>
<td>28</td>
<td>Re bore cylinders including fitting of pistons</td>
<td>2</td>
</tr>
<tr>
<td>29</td>
<td>Re bore and reabbitt cylinder block including fitting pistons</td>
<td>3 30</td>
</tr>
<tr>
<td>30</td>
<td>Reabbitt cylinder block only</td>
<td>1</td>
</tr>
<tr>
<td>31</td>
<td>Reabbitt cylinder block, fit crank shaft and run in.</td>
<td>2 30</td>
</tr>
<tr>
<td>32</td>
<td>Reabbitt and re bore cylinder block including fitting pistons, crank shaft, connecting rods and running in.</td>
<td>6 30</td>
</tr>
<tr>
<td>33</td>
<td>Reabbitt and re bore cylinder block fit pistons, valves, push rods, cam shaft, crank shaft, connecting rods and running in.</td>
<td>8</td>
</tr>
<tr>
<td>34</td>
<td>Re bore, and fit pistons and valves</td>
<td>3</td>
</tr>
<tr>
<td>35</td>
<td>Re bore, fit pistons, valves, push rods, straighten and fit cam shaft</td>
<td>4 15</td>
</tr>
<tr>
<td>36</td>
<td>Fit pistons, crank shaft, and run in (rebo red block)</td>
<td>1 15</td>
</tr>
</tbody>
</table>

### The Fuel Division

The following time applies when parts are assembled in tractor.

<table>
<thead>
<tr>
<th>No.</th>
<th>Operation</th>
<th>Hours Min.</th>
</tr>
</thead>
<tbody>
<tr>
<td>37</td>
<td>Straighten crank shaft</td>
<td>30</td>
</tr>
<tr>
<td>38</td>
<td>Straighten cam shaft</td>
<td>30</td>
</tr>
<tr>
<td>39</td>
<td>Replace small time gear on crank shaft</td>
<td>15</td>
</tr>
</tbody>
</table>

### Fuel Supply

The following time applies when parts are assembled in tractor.

<table>
<thead>
<tr>
<th>No.</th>
<th>Operation</th>
<th>Hours Min.</th>
</tr>
</thead>
<tbody>
<tr>
<td>46</td>
<td>Overhaul fuel system complete</td>
<td>4</td>
</tr>
</tbody>
</table>

### Air Washer and Tubes

The following time applies when parts are assembled in tractor.

<table>
<thead>
<tr>
<th>No.</th>
<th>Operation</th>
<th>Hours Min.</th>
</tr>
</thead>
<tbody>
<tr>
<td>47</td>
<td>Replace large fuel tank</td>
<td>30</td>
</tr>
<tr>
<td>48</td>
<td>Replace gasoline tank</td>
<td>30</td>
</tr>
<tr>
<td>49</td>
<td>Replace fuel line (either one)</td>
<td>15</td>
</tr>
<tr>
<td>50</td>
<td>Replace sediment bulb</td>
<td>15</td>
</tr>
<tr>
<td>51</td>
<td>Overhaul sediment bulb</td>
<td>30</td>
</tr>
<tr>
<td>52</td>
<td>Clean all fuel lines including shifter valve and spray nozzle</td>
<td>30</td>
</tr>
<tr>
<td>53</td>
<td>Repair small leak in the fuel tank</td>
<td>1 15</td>
</tr>
</tbody>
</table>

### Float Chamber

The following time applies when parts are assembled in tractor.

<table>
<thead>
<tr>
<th>No.</th>
<th>Operation</th>
<th>Hours Min.</th>
</tr>
</thead>
<tbody>
<tr>
<td>54</td>
<td>Replace float chamber assembly</td>
<td>30</td>
</tr>
<tr>
<td>55</td>
<td>Overhaul float chamber assembly</td>
<td>1</td>
</tr>
<tr>
<td>56</td>
<td>Replace or tighten spray nozzle or needle valve seat</td>
<td>1 15</td>
</tr>
</tbody>
</table>

### Manifold

The following time applies when parts are assembled in tractor.

<table>
<thead>
<tr>
<th>No.</th>
<th>Operation</th>
<th>Hours Min.</th>
</tr>
</thead>
<tbody>
<tr>
<td>57</td>
<td>Replace manifold and vapor system complete</td>
<td>30</td>
</tr>
<tr>
<td>58</td>
<td>Replace vapor tube and clean shifter valve when necessary</td>
<td>1</td>
</tr>
<tr>
<td>59</td>
<td>Replace manifold</td>
<td>3</td>
</tr>
<tr>
<td>60</td>
<td>Replace shunt valve</td>
<td>1 30</td>
</tr>
<tr>
<td>61</td>
<td>Replace inlet and exhaust port gaskets</td>
<td>30</td>
</tr>
<tr>
<td>62</td>
<td>Replace manifold outlet</td>
<td>30</td>
</tr>
<tr>
<td>63</td>
<td>Replace exhaust tube</td>
<td>15</td>
</tr>
</tbody>
</table>

### Mixing Chamber

The following time applies when parts are assembled in tractor.

<table>
<thead>
<tr>
<th>No.</th>
<th>Operation</th>
<th>Hours Min.</th>
</tr>
</thead>
<tbody>
<tr>
<td>64</td>
<td>Replace mixing chamber</td>
<td>30</td>
</tr>
<tr>
<td>65</td>
<td>Overhaul mixing chamber</td>
<td>1 30</td>
</tr>
<tr>
<td>66</td>
<td>Clean gasoline passage in shifter valve</td>
<td>15</td>
</tr>
<tr>
<td>67</td>
<td>Replace shifter valve</td>
<td>30</td>
</tr>
<tr>
<td>68</td>
<td>Replace shifter valve lever</td>
<td>30</td>
</tr>
</tbody>
</table>

The following time applies when parts are brought in or shipped in for repair.

<table>
<thead>
<tr>
<th>No.</th>
<th>Operation</th>
<th>Hours Min.</th>
</tr>
</thead>
<tbody>
<tr>
<td>69</td>
<td>Overhaul air washer</td>
<td>30</td>
</tr>
<tr>
<td>70</td>
<td>Overhaul air washer (dismantle, clean and inspect)</td>
<td>1 30</td>
</tr>
<tr>
<td>71</td>
<td>Replace air washer float or baffle plate</td>
<td>30</td>
</tr>
<tr>
<td>72</td>
<td>Replace primary or main air tube, tube flange or gaskets</td>
<td>15</td>
</tr>
<tr>
<td>No.</td>
<td>Operation</td>
<td>Hours Min.</td>
</tr>
<tr>
<td>-----</td>
<td>-----------------------------------------------</td>
<td>------------</td>
</tr>
<tr>
<td>92</td>
<td>Overhaul sediment bulb</td>
<td>30</td>
</tr>
<tr>
<td>93</td>
<td>Repair small leak in air washer float</td>
<td>30</td>
</tr>
<tr>
<td>94</td>
<td>Overhaul fan assembly</td>
<td>30</td>
</tr>
<tr>
<td>95</td>
<td>Overhaul dash assembly</td>
<td>1</td>
</tr>
<tr>
<td>96</td>
<td>Replace magnets on flywheel</td>
<td>4</td>
</tr>
<tr>
<td>97</td>
<td>Replace magneto coil support</td>
<td>4</td>
</tr>
<tr>
<td>98</td>
<td>Replace commutator wire loom</td>
<td>30</td>
</tr>
<tr>
<td>99</td>
<td>Replace commutator case or brush</td>
<td>30</td>
</tr>
<tr>
<td>100</td>
<td>Replace coil box</td>
<td>1</td>
</tr>
<tr>
<td>101</td>
<td>Overhaul coil box</td>
<td>30</td>
</tr>
<tr>
<td>102</td>
<td>Special tune up adjust carburetor and gaskets, changing points if necessary: clean spark plugs and commutator case and roller</td>
<td>1</td>
</tr>
<tr>
<td>106</td>
<td>Replace magnets on flywheel</td>
<td>30</td>
</tr>
<tr>
<td>107</td>
<td>Overhaul coil box</td>
<td>30</td>
</tr>
<tr>
<td>158</td>
<td>Rebush spindle body and arm</td>
<td>30</td>
</tr>
<tr>
<td>160</td>
<td>Rebush spindle arm</td>
<td>15</td>
</tr>
</tbody>
</table>

### Transmission Division

<table>
<thead>
<tr>
<th>No.</th>
<th>Operation</th>
<th>Hours Min.</th>
<th>No.</th>
<th>Operation</th>
<th>Hours Min.</th>
</tr>
</thead>
<tbody>
<tr>
<td>162</td>
<td>Overhaul transmission including clutch and shifter plate</td>
<td>6</td>
<td>163</td>
<td>Overhaul transmission only</td>
<td>5</td>
</tr>
<tr>
<td>164</td>
<td>Install disc in or replace transmission housing plate</td>
<td>1</td>
<td>165</td>
<td>Overhaul clutch</td>
<td>30</td>
</tr>
<tr>
<td>166</td>
<td>Overhaul shifter plate</td>
<td>1</td>
<td>167</td>
<td>Replace bearing or gear on drive or transmission shaft</td>
<td>15</td>
</tr>
<tr>
<td>168</td>
<td>Replace steering connecting rod and line up assembly</td>
<td>30</td>
<td>169</td>
<td>Overhaul shifter plate</td>
<td>30</td>
</tr>
<tr>
<td>170</td>
<td>Rebush or install belt pulley gear on drive shaft</td>
<td>15</td>
<td>171</td>
<td>Replace or install belt pulley gear on drive shaft</td>
<td>3</td>
</tr>
</tbody>
</table>

### Cooling System Division

<table>
<thead>
<tr>
<th>No.</th>
<th>Operation</th>
<th>Hours Min.</th>
<th>No.</th>
<th>Operation</th>
<th>Hours Min.</th>
</tr>
</thead>
<tbody>
<tr>
<td>111</td>
<td>Replace starting pin or lower pulley</td>
<td>30</td>
<td>165</td>
<td>Overhaul transmission including clutch and shifter plate</td>
<td>6</td>
</tr>
<tr>
<td>112</td>
<td>Replace and adjust fan belt</td>
<td>15</td>
<td>166</td>
<td>Overhaul transmission only</td>
<td>5</td>
</tr>
<tr>
<td>113</td>
<td>Replace fan assembly</td>
<td>30</td>
<td>167</td>
<td>Install disc in or replace transmission housing plate</td>
<td>1</td>
</tr>
<tr>
<td>114</td>
<td>Overhaul fan assembly</td>
<td>45</td>
<td>168</td>
<td>Overhaul clutch</td>
<td>2</td>
</tr>
<tr>
<td>115</td>
<td>Replace lower tank to cylinder front cover gasket</td>
<td>1</td>
<td>169</td>
<td>Overhaul shifter plate</td>
<td>1</td>
</tr>
<tr>
<td>116</td>
<td>Replace radiator core or header gaskets</td>
<td>2</td>
<td>170</td>
<td>Replace shifter plate</td>
<td>30</td>
</tr>
<tr>
<td>117</td>
<td>Replace radiator core or header gaskets</td>
<td>30</td>
<td>171</td>
<td>Replace or install belt pulley gear on drive shaft</td>
<td>15</td>
</tr>
<tr>
<td>118</td>
<td>Replace upper tank to fan bracket gasket</td>
<td>15</td>
<td>172</td>
<td>Overhaul clutch</td>
<td>30</td>
</tr>
<tr>
<td>119</td>
<td>Replace fan bracket to cylinder head gasket</td>
<td>15</td>
<td>173</td>
<td>Replace bearing or gear on drive or transmission shaft</td>
<td>15</td>
</tr>
<tr>
<td>120</td>
<td>Replace top tank cover</td>
<td>15</td>
<td>174</td>
<td>Overhaul shifter plate</td>
<td>30</td>
</tr>
<tr>
<td>121</td>
<td>Replace side member (each)</td>
<td>45</td>
<td>175</td>
<td>Replace or install belt pulley gear on drive shaft</td>
<td>15</td>
</tr>
<tr>
<td>122</td>
<td>Replace top tank or top tank to core gasket</td>
<td>1</td>
<td>176</td>
<td>Overhaul clutch</td>
<td>30</td>
</tr>
<tr>
<td>123</td>
<td>Replace bottom tank or bottom tank to core gasket</td>
<td>1</td>
<td>177</td>
<td>Replace bearing or gear on drive or transmission shaft</td>
<td>15</td>
</tr>
<tr>
<td>124</td>
<td>Replace all gaskets</td>
<td>3</td>
<td>178</td>
<td>Overhaul shifter plate</td>
<td>30</td>
</tr>
<tr>
<td>125</td>
<td>Replace one or two small leaks (when core is removed)</td>
<td>30</td>
<td>179</td>
<td>Replace or install belt pulley gear on drive shaft</td>
<td>15</td>
</tr>
<tr>
<td>126</td>
<td>Replace headers (when core is removed)</td>
<td>30</td>
<td>180</td>
<td>Overhaul clutch</td>
<td>30</td>
</tr>
<tr>
<td>127</td>
<td>Replace tubes (when core is removed)</td>
<td>30</td>
<td>181</td>
<td>Replace bearing or gear on drive or transmission shaft</td>
<td>15</td>
</tr>
<tr>
<td>128</td>
<td>Replace broken or leaky drain cock</td>
<td>15</td>
<td>182</td>
<td>Overhaul clutch</td>
<td>30</td>
</tr>
</tbody>
</table>

### Dash and Control Assembly Division

<table>
<thead>
<tr>
<th>No.</th>
<th>Operation</th>
<th>Hours Min.</th>
<th>No.</th>
<th>Operation</th>
<th>Hours Min.</th>
</tr>
</thead>
<tbody>
<tr>
<td>183</td>
<td>Replace dash assembly or gasket</td>
<td>1</td>
<td>187</td>
<td>Replace clutch pedal, cam, release plate, or lever, or adjust clutch</td>
<td>1</td>
</tr>
<tr>
<td>184</td>
<td>Replace dash including steering gear and clutch pedal</td>
<td>2</td>
<td>188</td>
<td>Replace any of the control or adjusting rods</td>
<td>30</td>
</tr>
<tr>
<td>185</td>
<td>Replace steering shaft</td>
<td>1</td>
<td>189</td>
<td>Replace steering arm</td>
<td>30</td>
</tr>
<tr>
<td>186</td>
<td>Replace steering arm rear</td>
<td>1</td>
<td>190</td>
<td>Replace steering sector or pinion</td>
<td>30</td>
</tr>
<tr>
<td>187</td>
<td>Replace wheel or spider</td>
<td>1</td>
<td>191</td>
<td>Replace clutch pedal</td>
<td>30</td>
</tr>
<tr>
<td>188</td>
<td>Replace any of the control or adjusting rods</td>
<td>30</td>
<td>192</td>
<td>replace clutch pedal, cam, release plate or lever</td>
<td>30</td>
</tr>
</tbody>
</table>

### Front System Division

<table>
<thead>
<tr>
<th>No.</th>
<th>Operation</th>
<th>Hours Min.</th>
<th>No.</th>
<th>Operation</th>
<th>Hours Min.</th>
</tr>
</thead>
<tbody>
<tr>
<td>193</td>
<td>Overhaul front axle including rebushing, straightening and lining up and adjusting wheels</td>
<td>30</td>
<td>196</td>
<td>Overhaul dash including steering gear and clutch pedal</td>
<td>1</td>
</tr>
<tr>
<td>194</td>
<td>Rebush spindle bodies and arms (each)</td>
<td>2</td>
<td>197</td>
<td>Replace steering shaft</td>
<td>30</td>
</tr>
<tr>
<td>195</td>
<td>Replace or straighten axle (no other repairs necessary)</td>
<td>1</td>
<td>198</td>
<td>Replace steering arm</td>
<td>30</td>
</tr>
<tr>
<td>196</td>
<td>Rebush spindle body (each)</td>
<td>45</td>
<td>199</td>
<td>Replace steering sector or pinion</td>
<td>30</td>
</tr>
<tr>
<td>197</td>
<td>Rebush radiator core or header gaskets</td>
<td>1</td>
<td>200</td>
<td>Install wheel on spider</td>
<td>15</td>
</tr>
<tr>
<td>198</td>
<td>Rebush radiator core or header gaskets</td>
<td>1</td>
<td>201</td>
<td>Replace clutch pedal, cam, release plate or lever</td>
<td>30</td>
</tr>
</tbody>
</table>

The following time applies when parts are assembled in tractor.
### Rear System Division

<table>
<thead>
<tr>
<th>No.</th>
<th>Operation</th>
<th>Hours</th>
<th>Min.</th>
</tr>
</thead>
<tbody>
<tr>
<td>206</td>
<td>Overhaul rear axle assembly</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>207</td>
<td>Install felt washer on axle one side</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>208</td>
<td>Replace axle shaft or differential gear one side</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>209</td>
<td>Replace axle shaft or differential gear two sides</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>210</td>
<td>Replace worm or worm bearing</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>211</td>
<td>Replace worm and gear</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>212</td>
<td>Line up differential</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>213</td>
<td>Replace axle housing right or left each</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>214</td>
<td>Replace transmission housing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>215</td>
<td>Replace draw bar cap</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>216</td>
<td>Overhaul rear axle and transmission</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>217</td>
<td>Install new races (each wheel)</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>218</td>
<td>Replace extension rim when necessary to drill wheel</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>219</td>
<td>Install grousers, each wheel</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>220</td>
<td>Install extension rim when necessary to drill wheel</td>
<td>30</td>
<td></td>
</tr>
</tbody>
</table>

### Wheel Division

<table>
<thead>
<tr>
<th>No.</th>
<th>Operation</th>
<th>Hours</th>
<th>Min.</th>
</tr>
</thead>
<tbody>
<tr>
<td>230</td>
<td>Install new cleats, each wheel</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>231</td>
<td>Install new cleats, complete wheel</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>232</td>
<td>Install new cleats, complete wheel</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>233</td>
<td>Install grousers, each wheel</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>234</td>
<td>Install extension rim when necessary to drill wheel</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>235</td>
<td>Install grousers, each wheel</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>236</td>
<td>Install extension rim when necessary to drill wheel</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

### Miscellaneous Division

<table>
<thead>
<tr>
<th>No.</th>
<th>Operation</th>
<th>Hours</th>
<th>Min.</th>
</tr>
</thead>
<tbody>
<tr>
<td>256</td>
<td>Install belt pulley</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>257</td>
<td>Overhaul belt pulley when removed from tractor</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>258</td>
<td>Replace seat or seat spring</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>259</td>
<td>Paint tractor</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

### Combination Operations

<table>
<thead>
<tr>
<th>Operation</th>
<th>Hours</th>
<th>Min.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operations 4 and 10 combined in one order</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Operations 3 and 10 combined in one order</td>
<td>4</td>
<td>30</td>
</tr>
<tr>
<td>Operations 12 and 10 combined in one order</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Operations 19 and 96 combined in one order</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Replace large time gear when radiator is removed</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Replace camshaft when radiator is removed</td>
<td>30</td>
<td></td>
</tr>
</tbody>
</table>

### Adjustment of Front Wheels

It is very important that the bearings on the front wheels of the tractor be properly adjusted. (See page 59 of the Tractor Manual.) The proper adjustment is made by taking up adjusting nut so tight that the wheel will bind, at the same time revolving the wheel to insure all working surfaces coming in contact, then back off adjusting nut one-third to two-thirds of a turn sufficient to allow the wheel to rotate freely but with no end play, then lock adjusting nut in this position with cotter key. Next put on hub cap filled with grease.

Operating the tractor without having the bearings adjusted properly is likely to result in serious damage to the bearings.

### The Cotter Pin

The importance of properly securing the bolts with the correct sizes of cotter pins is illustrated in Fig. 94. As will be noted, the cotter pin hole in the connecting rod clamp cap screw is worn through the top of the head. The pin was sheared off permitting the cap screw to work loose. At this point no serious damage would have occurred had the owner stopped to determine what causing the knocking; instead the tractor was driven until the loose rod failed, making it necessary to replace practically all the engine parts.

### The Gasoline Inlet Shutoff Cock

On the earlier Tractors the shutoff cock was placed at the gasoline tank. On the later design it was installed at the mixing chamber.

When replacing the petcock on the old style we recommend that the necessary
Practical Methods of Repairing Fordson Tractors

Removing Differential

(Continued from Page 56)

218. Next run out the cap screws which hold the axle housing to the transmission housing and draw one of the housings off of the shaft. The differential may then be removed from the transmission housing. Each man takes hold of a side as shown in Fig. 86, and they pass the axle through into the position shown in Fig. 87. The axle is then stood on end, one of the men blocking the lower end of the assembly with his foot as shown in Fig. 88.

219. The next operation is to remove the remaining housing. This is accomplished by tapping the housing lightly with a lead hammer as shown in Fig. 95. Both of the men should hold on to the housing, turning it a little each time it is tapped. Hold it securely to prevent its dropping suddenly on the floor. When it becomes loose lay the assembly on the floor and while one man holds the end down the other draws off the housing as shown in Fig. 96. If the floor is constructed of stone, a block of wood should be placed under the gear. This leaves the differential assembly free from its housing. The assembly is then placed on the bench where it may be disassembled or any necessary work performed on it.

220. A simple and convenient method of holding the assembly is shown in Fig. 97. Simply cut a slot in the end of the bench wide enough to take the axle shaft and provide some means of locking it in. In the case shown, a hinge bar is provided which swings into place after the assembly is in position.

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changes be made to install it at the mixing chamber. As this point is considerably above the level of the gasoline in the tank there is no tendency of the valve to leak when the engine is not running, and any small leak would be of little consequence and would not affect the operation of the engine.
One of the items of greatest expense in the manufacture of a product, is that of transportation in the shop. Motor as well as hand trucks are costly to operate, require extra handling of the stock, and frequently prove to be a source of delay.

With the end in view of reducing this cost to a minimum, the several departments at the tractor plant were laid out along platform conveyors which are power-driven and capable of carrying any of the several tractor parts. The machines are so arranged that the parts pass from one operation to the next on tables or gravity conveyors. The departmental inspection is performed on or near a roller conveyor, which places the stock onto the main conveyor. Thus the stock is carried from the receiving room through the machine shop and assemblies to the loading dock, with a minimum of handling. Painting and boxing for foreign shipments as well as assembling operations, are performed on special power conveyors.

Fig. 98 shows a part of one of the main conveyors with its tributaries. This conveyor is 230 feet long. In the background may be seen one of the overhead combined power and gravity type. That the conveyors have solved the problem of transportation may be realized by the fact that after two years there are only 21 trucks in the entire foundry and shop.
Testing the Cut-Out

Fig. 99 shows a method of testing the cut-out when the generator is assembled in the car and the engine is running. As stated in the caption, care should be exercised that the pliers or wire does not touch any metal part other than the contact. This test is used when the ammeter does not register either way with the engine running at a fair rate of speed, lights off and the ignition on the magneto.

With the pliers in position shown, the ammeter will indicate as follows:

1. Full discharge, cut-out is probably OK, generator is not functioning properly because of internal trouble. Remove dust cover to examine pig tail, terminal, or insulated brush holder for ground.

2. Slight discharge indicates that the cut-out is probably OK but the generator is not functioning properly because of dirty commutator, brush not seated properly, open or short circuits.

3. Neither charge or discharge indicates an open circuit between the generator and the batteries or in the generator. The possibility of its being in the generator may be eliminated if a good live spark results when the generator terminal is shorted to the housing.

4. Proper charge indicates that the system, other than the cut-out and its two connections, is OK. If when the pliers are removed, the ammeter returns to and remains at 0, tighten the cut-out to generator terminal and the ammeter wire connections. This failing, remove the cut-out carefully, as it may be repaired if not damaged by careless handling.

Besides tracing, this practice will often correct the trouble by burning the dirt from under the brushes, blowing a slight short circuit, or charging a demagnetised field.

Glass for Cars

Due to the shortage of material it is often necessary for dealers to obtain windshield and other glass locally. If such a contingency arises, the sketches shown in Figs. 102 and 103 will be found useful in ordering the part required. The thickness of the windshields may vary from 1/8 to 3/8 inches, while the side glass should be held to 5/16 to 7/16 inches.

Safety First

The Chipping Screen

One of the most dangerous operations performed in the garage is chipping steel or other parts with a cold chisel, as the chips fly off striking other operators and often rebounding and striking the one who is doing the chipping.

To prevent this the Ford Motor Company has provided screens as shown in Fig. 100. They consist of two upright posts set on wooden bases between which is stretched some light canvas. The screen is easily moved about and adjusted to the work and is very compact when rolled up for storing.

Old Style Time Gear

We are still in a position to supply the old style Time Gear Part No. 3047. These Gears should be used as replacements on the earlier cars.
Sign Board Advertising

The accompanying cut, Fig. 101, shows a sign board, advising the public that genuine Ford parts may be purchased from the New Jersey Auto Company of Newark, N. J. These dealers are very enthusiastic over this means of advertising which they find is a valuable aid in their campaign against the use of spurious parts in their territory.

Practical Methods of Repairing Ford Cars

Weak Source
(Continued from Page 60)

221. When the contact has been cleaned turn the engine over and try for a spark between the contact and the cover if a good live spark results the magneto is O. K. Put the post back, making sure that the gasket is in good condition and drawing the screws down evenly by taking each screw down a little at a time. When assembled try for spark again. Now if there is no spark the trouble is in the terminal post. A volt meter will not register when used on a dead magneto.

222. If all the coils vibrate weakly and the engine is hard to start, remove the terminal post and examine as explained in paragraph 217. If this does not overcome the trouble take the reading with a volt meter. A low reading AC (alternating current) volt meter, one registering from 0 to 30 volts should be used. Fig. 29, Vol. 1 shows the instrument placed ready for reading. One side of the volt meter is connected to the contact post on the transmission cover while the other side is pressed against any clean part of the cylinder or transmission cover as a ground, throttle the engine down to 400 R. P. M. (revolutions per minute) and the meter should register seven volts or better.

223. To set the engine at 400 revolutions remove the valve cover on the right hand side of the engine and count the pulsations of one of the push rods. Since any cylinder fires once every two revolutions of the crankshaft, two times the number of pulsations will give the engine speed, or for example, for a speed of 400 revolutions there should be 200 pulsations of the push rod.

224. Weak magnetos are caused by: 1, too great a gap between the coil and the magnets; 2, short circuited coils; 3, grounded coils; 4, weak magnets.

225. Dead magnetos are caused by extreme cases of any of the above causes or by an open circuit.

226. These conditions may be prevented by changing the oil frequently. The oil becoming dirty carries the current to the ground. We recommend that the crankcase be washed out about every thousand miles. This may be done by draining the oil from the plug at the lowest point of the crankcase. To insure that all the oil is out of the engine the front of the car should be jacked up about six inches. When the oil stops flowing put the drain plug back and pour about a gallon of kerosene into the breather pipe.

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(Continued on Page 67)

Remove the jack and start the motor. Run it slowly for about thirty seconds putting a little pressure on each of the transmission bands. Drain the kerosene in the same manner as the oil, turn the motor over by hand to throw the kerosene off the fly wheel and pour a little oil into the breather. This will carry out any kerosene that may be retained in the connecting rod pockets. When this oil stops flowing, put the drain plug back and fill the case with new motor oil to a level between the pet cock in the crank case.

227. Never use gasoline to clean any parts of a machine as gasoline has no lubricating qualities. It evaporates, leaving the parts and surface dry. Even in cases where oil is rubbed into the working surface before assembling the parts are liable to seizure.

228. Another preventive of trouble is keeping foreign parts out of the crankcase. Any loose parts, particularly iron and steel, may be picked up by the magnets and carried around, tearing the insulation from the coils, or jamming between the coils and the coils’ support. When working on the transmission through the door and cover it is best to fasten a wire or string to all tools or parts to prevent losing them. When a part is dropped into the case, revolve the transmission slowly, examining the magnets as they come to the top. If the transmission cover has not been removed it should be for this operation. In some cases small parts drop to the bottom and may be removed through the drain hole. Another method of moving parts is to drag a rag around by means of the flywheel. If the rag fits sufficiently tight between the flywheel and the crankcase it will pick up the part and bring it to the surface. It is vitally important that the part be removed, even if it is necessary to take off the crankcase.

Fordson Tractor Section

Keep the Air Washer Clean

Fig. 104 shows a handful of dirt which was taken from a tractor after a few hours’ run in a dusty field. If the air washer had not been functioning properly this dirt would have passed through the combustion chamber where a considerable portion of it would have clung to the pistons and cylinder walls and worked down between the valve stems and the guides.

Every owner should be made to realize how important the air washer is in extending the life of the tractor.

Splitting the Tractor

When removing a fly wheel it is important that the rear end be drawn back far enough to remove all possibility of the wheel striking the drive shaft. The weight of the fly wheel together with long leverage of the shaft, is likely to crack the transmission plate or spring the shaft.

Do the Repair Work Under Cover

When repair work is performed on the farm the Tractor should be run under cover where there is a concrete or other floor capable of supporting the weight on jacks. Before it is run into the building, the Tractor should be washed off. The space about the Tractor should be swept clean, and every precaution should be taken to keep the parts free from grit.

Owners often tear down the Tractor before calling the repairman. It behooves the dealer to warn him of the difficulties to be experienced if the proper housing is not provided in which to perform the work.

When necessary to repair the Tractor in the field, a box and cover should be provided in which the parts will find protection from the dust. It is easily seen that it is next to impossible to keep all the dirt out of an assembly when working in a dusty field.
Practical Methods of Repairing Fordson Tractors

Disassembling the Differential Assembly

229. The assembly is positioned on the table with the worm gear to differential case bolt nuts up. Withdraw the cotter pins from these bolts and start the nuts with a pair of "L" socket wrenches as shown in Fig. 105. Next run off the nuts with a speed wrench.

Next, run off the nuts with a speed wrench. Fig. 105

See Fig. 97, and drive out the bolts with a punch as shown in Fig. 106. If the bolts are driven off on the table side they will drop where they are out of the way and may be left until ready for assembly. The upper half may then be lifted up by the bearing and then gripping it by the flange raise it off of the shaft; the shaft with the gear assembled may then be lifted off. Next lift off the worm gear and take out the spider with the gears assembled to it. The final operation is to lift out the remaining axle shaft.

Inspecting the Differential

230. The tractor axle is subjected to much greater wear than either the truck or pleasure car. First, because of the uneven traction obtained in plowing. Second, because of the greater and continued strain on all parts. Third, there is no cushion relief as is obtained with pneumatic tires.

231. The axle shaft, as is the case on the truck and car, receives the greatest wear, and should be replaced if the bearings become flaky, or show over .010 wear. The shaft should be inspected for cracks or checks by hanging it on a string and striking it with a hammer. A solid shaft will give a clear tone, while a harsh tone will result from striking a cracked one. Another method of testing is to wipe the shaft with a clean rag until there is no oil on the surface, then exert a slight pressure on the shaft by means of a straightening press. Any slight cracks would be easily detected by the oil coming out on the clean surface of the shaft on that point.

232. The gears should be inspected for chips or cracks, both in the teeth and the body. They should be a press fit on the splines of the shaft. This fit may be checked on an arbor press by striking the gear with a lead hammer.

233. If it is necessary to remove the gear, first force it over onto the shaft until the lock ring has been exposed. The two halves of the ring are then removed, after which the gear is backed off of the shaft. In replacing, the gear is forced until the lock ring groove is exposed. The rings are then put in place and the gear is backed off until it rests against the ring.

234. The two halves of the differential case should be inspected for cracks in the webs and flanges, and to see that the bearing is a tight fit on it. Inspect the bearing to see that the balls are not cracked nor pitted. See that the races are smooth and that the ball retainers are in place and also that the bearing is installed in the proper direction as explained in page 6, Vol. 2.

235. If the bearings are damaged they should be replaced by new ones. Drive it off with a brass bar, striking on the inner ring first on one side, then on the other.

236. To replace the bearing, put a block of wood over the bearing; striking upon this with a hammer will drive the bearing into place with no danger of damaging it.

237. See that the differential gear bearing surface is smooth and has no high spots in it. Burrs may be removed with a file, the end of which is ground to a lesser radius than the bearing.
238. The spider and spider gears should be inspected for cracks, and for fit on the arms of the spider. As the traction in the field is often unequal on the wheels, the wear between the spider and gears is greatly in excess of what it is in the car or truck. This play may usually be taken out by replacing the spider. However, it is sometimes necessary to replace the gears also.

239. The ring gear should be inspected for cracks and to see that the teeth present a bright, smooth surface the full width of the gear. If they are worn deep on one side the gears should be replaced. If it is slightly worn on one side, it indicates that the gear is out of line with the worm. This condition is always accompanied by excessive heating of the rear axle housing, and may be corrected by shimming one side of the housing as will be explained later.

240. The axle housings should be examined for cracks, and the faces of the flanges as well as the corresponding surfaces on the transmission housing, should be inspected for burrs which cause them to stand out of line when assembling. The dust caps, felt, and steel washers should be removed, as shown in Fig. 109. When they are removed, the roller bearings may be taken out and inspected. These bearings are inspected and repaired as explained in paragraph 263, Vol. 1.

241. If the roller bearing sleeve is badly worn or cracked, it should be replaced by a new one. See paragraph 248, Vol. 1. Of course the puller would have to be made of larger stock than the one for pulling the car axle sleeves. Unlike the car, the roller bearing sleeves are interchangeable and may be installed on either side.

242. The sleeves are replaced in much the same manner as explained in paragraph 248, vol. 1. The bearing washers and dust cap should be installed after the axle housings are in place in the tractor.

**Assembling the Differential**

243. In assembling any piece of machinery always remember to oil all working surfaces or running parts. The oil used should be as heavy, if not heavier, than the lubricant to be used in that part of the assembling.

244. Place one of the differential housing with the bearing assembled over the slot in the table with the bearing down. Spread some oil on the differential gear thrust and the axle shaft radial bearing, and insert one of the axle shafts with the gear assembled, taking care not to drop it into place.

(To be Continued)
A Marvelous Record!

It is a source of justifiable pride to know that the production of Ford cars for the fiscal year ending July 31st, 1920, in the factory in Highland Park, reached the astounding figures of 941,042 cars. While the Ford Motor Company of Canada, Ltd., of Ford, Ont., made 55,618 cars, an aggregate for the year of new Ford cars totalling 996,660 cars.

We estimated August 1st, 1919, that in the following twelve months we would make one million cars. Well, we came mighty close to it, didn’t we? As we are averaging 3,500 cars daily at the present time, if we could have had just one day more we would have gone over the million mark.

Add to this that during the same twelve months the company made 79,008 tractors, and there were made at the plant in Ford, Ontario, 2,647 tractors, an aggregate of 81,655 tractors.

Now, fellow workers, women and men, and Dealers and Dealer organizations, aren’t you proud of being a member of a company which has accomplished such tremendous results in production? Isn’t it something far above the ordinary to stand in the ranks of an organization that leads the world in its bigness, not only in its tremendous production of cars and tractors but in all the things that go to pioneer the higher standards of industrial righteousness?

Almost one-half of all the motor cars in the world are Ford cars. In the United States and Canada, a little better than one-half of all the motor cars are Ford cars.

They tell us there are a little more than 300,000 farm tractors in the United States, and we know that we have built more than 144,352 Fordson farm tractors.

Isn’t it something to be proud of, an organization whose product is serving mankind wherever civilization has planted her feet? In every part of the globe, from far-off dark Thibet, and the frozen places of Siberia and Alasks, Greenland, the Arctic Circle, and in the sunny climes of Siam and Java, in India and Africa, and our own God-blessed America, the Ford car is giving its splendid, helpful service to civilization. It is the solution of the question of economical transportation and it has added unlimited pleasure and happiness to millions of people who never could have seen such pleasure but for the Ford car. And the Fordson farm tractor making possible the cultivation of the waste places of the earth, through its service in adding to the productivity of every acre of farm land, giving a valuable service in a hundred other ways and adding its share to the sum total of the prosperity and happiness of man.

And made by US; and each individual on the pay roll of the Ford Motor Company and taking part in the splendid activities of the Company, is a part of US.

Congratulations to every member of the great Ford Family. The promise of production for 1920 will exceed, we hope, by at least 25%, the marvelous record of the past year.

C. A. BROWNELL.
Garage Discount on Parts

Collingwood & Edwards, our dealers of Findlay, Ohio, advise that our garage discount on parts has greatly increased their wholesale business, and as a result spurious parts are fast disappearing in their territory.

When this policy was first put in effect a few difficulties were encountered which they have been able to overcome. The most prominent obstacles in the way of successful operation of this plan were as follows:

Individual owners being present while garage men were purchasing parts, noticed the discount, and demanded it when purchasing parts for themselves. If the discount was not allowed, the customer was invariably offended. Garages would oftentimes send the car owner for the repair parts, advising him to ask for discount, on the ground that they were for the garage. When the customer came to settle for the repairs he would be dissatisfied if the discount were not extended to him. Repair men from garages were constantly obtaining repair parts for their friends on the grounds that the parts were for the garage.

Collingwood & Edwards have installed a system which they believe effectively does away with these difficulties. All garages entitled to a discount are charged regular list price when purchasing the parts. The book-keeper keeps a record of all parts purchased by those entitled to a discount, and at the end of the month mails them a check for the discount to which they are entitled.

This method does away with the little annoyances that were constantly coming up, and furthermore our dealers advise that the garages receiving this discount in a lump sum generally turn it back for more stock, thus increasing their stock of parts.

In any communities where difficulties as above mentioned have been encountered, we believe that the system adopted by Collingwood & Edwards should be installed.

Sedan Curtains

We have discontinued furnishing side and back curtains as regular equipment for the Sedan. We can still supply these parts, however, and owners desiring these curtains may obtain them through their dealer.

Value of Service Bulletin

While we realize the value of a joint discussion of the Bulletin at a monthly meeting of your organization, we feel that the greatest value can only be obtained by individual study, preferably before the meeting.

Some dealers and their service superintendents do not make it a point to see that each man reads the Bulletin. It is not enough that the copies be properly bound, but the men should be sold on the proposition of reading it.

One way of checking up who has and who has not read the Bulletin is to have each man sign his name on the shop copy of each issue.

The cuts which accompany the articles are often of greater value in conveying an idea than all the copy which could be written and unless the individual sees these, your organization is not getting its full share of the benefits to be derived from this medium.

Return Postal Card

Charles G. Hanna Co., our dealers of Syracuse, N. Y., write us that they are obtaining splendid results by following up repair jobs performed in their shop. On page 34 of the June 1st Bulletin we show facsimile postal card used by one of our Detroit dealers for this purpose.

Charles G. Hanna Co. state that in order to secure a report on every repair job, they enclose with their communication a stamped postal for reply.

Spurious Brushes

Generators have been returned to us for credit equipped with brushes other than those approved by us as explained on page 26, Volume 2.

Let us call your attention to the importance of using the approved type, first, because of the composition and hardness and, second, because of the construction. In some of these brushes a rivet used for holding the "pig tail" in place was set so low that after a few months running it cut the commutator segment, causing a short circuit.

The use of other than standard equipment invariably causes trouble and lends confusion in tracing it.

Cars bearing motor numbers from 4,141,450 to 4,233,350 were shipped during the month of July
Courtesy

The following is a message from our Dealer, Dutee Wilcox Flint, of Providence, R. I. It was originally written for the members of his own organization, but the thought is big enough for us all.

BUSINESS IS SENSITIVE. IT GOES ONLY WHERE IT'S WELCOMED, BUT WALKS OUT WHERE ILL TREATED.

Dear Sir:

We want to talk to you a little about service to the CUSTOMER.

First of all - without customers there would be no FORD business.

Therefore, the most important thing - first, last and all the time - IS THE CUSTOMER.

The customer may be cranky, eccentric, peculiar and hard to get along with - but remember - we are not here to change the customer's disposition - to find fault with it - or to be offended at the customer's lack of common decency or courtesy.

We are here to serve him - to fill his wants - for the reason that he has come into our place of business and has favored us with a visit, and is going to give us his patronage.

The true test of salesmanship - the one which shows you have tact as well as talent - is to be able to take this cranky, ill-natured unreasonable person and smile at him while you please him.

Every person who buys goods of us, whether he is a foreigner or an American, whether he has on greasy overalls or the finest broadcloth, really represents "bread and butter" to everyone connected with this business.

This letter is not sent in any sense of fault-finding, but just to give to you our thought that COURTESY SHOULD PREVAIL.

NOTHING COSTS SO LITTLE AS COURTESY, AND NOTHING RETURNS SUCH BIG DIVIDENDS!

Let's make our business famous for its unfailing courtesy!

Yours truly,

DUTEE W. FLINT.

"TROUBLE, KNOCKING AT THE DOOR, WAS ABOUT TO ENTER, BUT HEARD A LAUGH AND HURRIED AWAY."
Practical Methods of Repairing Ford Cars

Inasmuch as dealers are now to repair cut-outs we will discontinue the articles on the magneto for the present and run a series on the cut-out.

Repairing and Adjusting the Cut-out

245. Indications of trouble in the cut-out are, generally speaking, indications of trouble in other parts. As the cut-out is enclosed it has small chance of getting out of order unless tampered with or affected by defective operation of some other part of the charging circuit.

246. The cut-out will be affected by the following:

1. Open circuit between the cut-out and ground through the battery. Continued operation under these conditions will burn out the voltage and series coil.

2. Running with a dirty commutator or at speeds which cause the current to cut in and out, will pit the points and eventually cause them to stick.

3. If the base is sprung in assembling the cut-out to the generator, the adjustment may be thrown out. It is very important therefore to fit them carefully, bending the arms to position in a vise or with a pair of pliers.

247. Cut-out troubles are indicated on the ammeter in four ways:

1. The meter registers no charge when the engine is running at a fair rate of speed, lights off and the ignition on the magneto. In this case the meter will jump from 0 to 8 or 10 amperes charge.

2. The motor registers a discharge when the engine is stopped and the lights are off.

3. Ammeter registers more than four amperes discharge (no lights burning and ignition on the magneto) before points open as the engine is gradually slowed down.

248. Remember that in the first case the trouble may be due to dirty commutator, loose connections or short or open circuit in the field or armature, and make tests accordingly before tampering with the cut-out.

249. In the second case the brushes may not be seated properly, the commutator may be dirty, or there may be a slight short in field or armature, or the third brush may be set improperly as would be indicated by a low charging rate.

250. In the third case there may be a short circuit in the wire between the ammeter and the switch.

251. Besides the above, it is always necessary to consider that the ammeter may be wrong.

252. When it has been determined that the trouble lies in the cut-out as explained on page 66, Vol. 2, the seal may be broken and the cover removed for examination, adjustment or repair.

253. There are several styles of cut-outs in use, and the methods of securing the cover varies in each case. The dash type is secured
by the "dents" in the cover fitting into corresponding "dents" in the base. The cover is removed by inserting a screw driver between the cover and base first on one side and then on the other. (See Fig. 111.)

254. The large generator type is secured by two punch marks just above the arms by which the base is secured to the generator. This cover may usually be removed with a steady pull raising the generator terminal end first. The latest style of this cut-out is secured with a bar through the end of which the seal is made. Cut off one side of the seal and push it out. The bar may then be withdrawn from the opposite side. (See Fig. 112.) This frees the cover which may be lifted off. It may be necessary to relieve it at the terminal with a screw driver.

255. There are two cut-outs with metal finish covers. These covers are secured to the base by screws through the ammeter wire terminals. In one there is only a single screw; in the other the screw to the right through which the seal wire passes is the one to remove.

256. While a test stand is much more convenient it is possible to adjust a cut-out in place on the generator. One advantage in so doing is that the adjustment remains permanent, or in other words, it is not disturbed in assembling it to the generator.

257. We will now consider the repairs necessary on a cut-out. They are:

1. Mechanical; such as loose rivets, armature spring out of place, broken parts, points burned out or sticking. In each of the above cases the cut-out should be changed. The screw which holds the cut-out to base may be loose, vibration would open the coils by crystallization or wear the fibre, allowing the screw to ground against the base.

2. Adjustment: Not sufficient clearance between the armature and the core when the points touch. Too much gap when points are apart. Too much or too little tension on tension spring. Points dirty. All of these may be corrected unless the core is loose or the points are worn so that they cannot be brought together before the armature and core meet, in which case the cut-out would have to be changed.

3. Electrical: Such as a short circuit in the voltage coil, short circuit in the service coil, open circuit in the voltage coil, or an open circuit in the service coil. With the exception of the times when these troubles are internal, it is possible to repair electrical trouble.

258. The equipment necessary to repair and adjust the cut-out is as follows:

- One direct current voltmeter reading from 0 to 10.
- One direct current ammeter reading both ways from 0 to 20.
- One small screw driver.
- One small goose bill pliers.
- One small soldering iron.

259. The solder used may be the 50-50 used in radiator repair work, but instead of the acid a non-conducting neutral soldering paste should be used as a flux.

**Meter Remains at 0**

260. We will now suppose that by the process of elimination the trouble has been located as being in the cut-out, and that the indications are the same as described in paragraph 247, No. 1. Since no current is registered it is evident that the circuit in the service coil remains open. The trouble may be due to:

1. Dirty contact points.
2. Open circuit in the series coil.
3. Short circuit in the series coil.
4. Open circuit in the voltage coil.
5. Short circuit in the voltage coil.
6. Too great a gap between armature and core.
7. Armature striking core or other part before points come together.
Open Voltage Coil

261. To determine the type of trouble remove the cut-out from the generator, leaving the ammeter wire attached. Connect the voltmeter to the terminal post at the generator yoke as shown in Fig. 114. Start the engine and set it at such a speed that the meter registers 9 volts. With the voltmeter still in place, set the cut-out on the generator, the base brackets held firmly against one of its screws and the arm making contact with the terminal. Look at the meter and see if the voltage has dropped from \( \frac{1}{2} \) to 1 volt. If not, the voltage coil is open. Repeat the test to make sure you are reading the meter properly.

(To be Continued)
Fordson Tractor Section

The Air Washer Cap

One driver to save the trouble of cleaning the air washer when in the field, punched a hole in the air washer cap as shown in Fig. 116. It worked so well that he continued to operate this way for a time, but as a result of his lax methods the cylinder block and all bearing parts in the engine had to be replaced. The air washer, as every other part of the tractor, is put on for a definite purpose, and it is the owner's duty to himself to see that it is functioning properly at all times.

Fig. 116

Installing Standard Bearings

While the "standard" bearing is of the double thrust type, we have found that better results are obtained where the ball slot is assembled towards the side which takes the thrust on the outer ring. The worm bearing should, therefore, be assembled with the slot toward the worm.

Tractor Numbers

When replacing a cylinder block on the tractor it is very important that the motor number be stamped on the new block. In the first place, we do not issue credit on tractor parts unless the number as well as the owner's name is given, and in the second place, the number is the only means of describing the tractor in a bill of sale or when registering it in any of the State or county records.

Much time and trouble will be saved, to the owner, to the dealer, and this office if the dealers see to it that these instructions are carried out in their territory.

Put the Machinery Under Cover

It is estimated that one-half the depreciation of farm machinery is due to damage resulting from exposure to the weather. The average farm machine is used only three or four weeks during the year, and the remainder of the time is idle.

On many farms the machinery stands outside exposed to rust and rot, and even when it is not entirely ruined much time and money is required to put it into adequate running condition.

The Wisconsin Agricultural Department issued a statement that a $400.00 implement shed pays interest at the rate of 22% per year when housing $1,000.00 worth of machinery.

Practical Methods of Repairing Fordson Tractors

Assembling the Differential

(Continued from Page 78)

262. Try the spider to see that it fits into the radial slot in the housing. If it requires considerable exertion to force it into place try a new spider, as springing this part throws the gears out of line, causing them to bind and run hot when working in loose soil. If it fits nicely oil the arms and install the four spider gears with the taper of the teeth pointing toward a common center, the same as the car or truck. It is impossible to assemble the housing if the gears are not installed properly on the shaft. When this is done place the worm gear in position as shown in Fig. 117. Squirt some oil in the center of the spider and on the back of the spider gears. Next install the shaft with the gear assembled and after oiling the gear and shaft set the differential housing in position as shown in Fig. 118.

263. When all the parts are in position line up the bolt holes and insert the bolt as shown in Fig. 119. If the bolts are inserted from the bottom it is not necessary to invert the assembly to put in the cotter pin. While the bolts are usually a snug fit in the assembly, it may be necessary to hold the head while
running down the nuts with a speed wrench. When the nuts have been run down to an easy speed tighten them by drawing them down a little at a time, crossing from one side to another until all are tight.

266. Take care that neither the wrench nor vise are clamped on the bearing surfaces of the shaft. The end play in a tractor differential is not so important as it is in the car because noise is not an objectionable feature. New jobs are fitted .012 to .020. However, there should not be over 1/32" play as the teeth would be in danger of failing when they are too far out of mesh.

264. The earlier tractors were assembled with a wire run through all the differential bolts. Later it was found that more satisfactory results could be obtained by locking each bolt individually with a cotter pin.

265. When the assembly is completed it should be tried to prove that it turns freely. Hold one of the shafts in a vise and turn the other with a Stillson wrench.

267. When the assembly has been checked and found to be correct install it in the transmission housing. First shellac the flanges of the axle housing and place a paper gasket on each, lining them up on cap screws inserted through the flange.

268. If the axle was pulled down because it was running hot and nothing material was found wrong with it, the trouble was probably due to the gear not lining up properly with the works. Such a condition would be noted by a burnished appearance on one side of the teeth. To correct this add an extra shim (gasket) between the axle and transmission housing on that side which is burnished. When the gaskets are in place position the housing near the transmission assembly.

269. The differential may be installed either way; but as stated above it should be installed so that the worm and gear bear in the original position. The gear is started to mesh with the worm and forced into position with a slight rotary motion.

(To be Continued)

**Starter Wiring Notes**

Our attention has been called to the fact that some repairmen are installing fuses in the generator circuit. We wish to warn against this practice by the novice, as it inevitably results in a burned out generator unless a proper fuse be installed in the generator field circuit.
The Fordsons Then and Now

An interesting comparison between the early and present Fordson tractors is shown in the accompanying photographs. When one looks at the two machines he realizes the vast amount of energetic thought and effort that has been expended in placing such a compact, neat and powerful tractor as the Fordson on the market.

Henry Ford actually built a tractor of the steam type before he started work on his gas car and, incidentally, that tractor and the first car are still in very good running condition on the farm at Dearborn, where Mr. Ford occasionally demonstrates both to visitors.

With the development of the gasoline engine some 15 years ago Mr. Ford began work with the idea of building a light but powerful farm tractor. By 1908 he had a workable tractor; it plowed and harrowed and did much other work on the farm. Then ensued nine more years of experimental work before the first tractor was put on the market, and in slightly less than two and one-half years one hundred thousand tractors had been assembled at the Dearborn plant and today over one-third of the tractors in the world are FORDSONS.

At present Fordson tractors are being turned out at the Dearborn Plant, Foreign and Domestic assembling plants at the rate of over 400 per day. Production is increasing daily, and plans call for a total of 200,000 during 1920.
**Test Lamp**

A test lamp may be made as shown in Fig. 122. One wire from the wall socket is attached to the terminal of the lamp socket, the other wires from the terminals of the wall and lamp sockets are arranged with test points as shown. When the test points are not in electrical contact, the lamp will not burn. Each time before using the lamp it should be tested by touching the test points together to see that it will light.

**Generator Brushes**

We note that the brushes on Generators sent to the Branches for repair are often not seated properly on the commutator.

As stated in the repair articles, the brushes should seat all the way across. (See Fig. A-124.) Generators with brushes seated as shown in B and C of the same figure will not obtain the full charging rate and will run hot.

A generator with improperly seated brushes cuts in late, causing the repairman or owner to believe that his cut-out is not functioning properly.

It is very important that the third brush be set correctly and properly tightened to the holder. See that the holder is so set that the brush lies parallel to the segment as shown in Fig. 123A instead of across the segment as Fig. B. This latter condition obtains when the brush holder support has been bent or there is some obstruction under the fibre insulator, or the insulator is damaged.

**Changing Transmission Bands**

In changing transmission bands on motors equipped with a starter, one of our dealers has found that he can save from fifteen to thirty minutes by the following procedure: Take all the bolts and cap screws out of the cover, raise the cover about two inches and pull the starting motor with the bendix in place on the shaft, the bendix cover remaining in place on the transmission cover. In replacing the motor is attached to the cover before the latter is bolted down to the crankcase.

*Contributed by W. B. Hawkins of the McCarty Sherman Motor Co., Denver, Colo.*

August 25 was a banner day, when the Ford Motor Company at the Home Plant, domestic and foreign branches assembled 4,975 cars, thus establishing a new record for a day's production.

**Solid Tire Truck Wheels**

We have discontinued equipping trucks with solid tires. All trucks will now be furnished with pneumatic tires and demountable rims. However, we can still supply solid tire truck wheels with or without the tires through service stock.
Practical Methods of Repairing Ford Cars

The Cutout

(Continued from Page 78)

270. If an open voltage coil is indicated see that the terminal wires are properly soldered. One of these wires is secured to the base so that it is in connection with the ground (generator yoke), the other wire is soldered to the core yoke which connects it with the generator terminal. The circuit in this coil is always closed, and a small amount of current, 1/4 ampere, is passing through it even after the service coil cuts in. If either of these connections is broken, solder the wire back in place, using very little of the paste and taking care not to get any of the solder between the coils and the base, or core yoke, where it is likely to cause a ground or short circuit. When soldering to the core yoke be sure that a flat joint is made or it may touch the cover, causing a ground.

Shorted Voltage Coil

271. If the voltmeter returns to 0, or registers an appreciable drop, of say more than one volt, it indicates a short circuit in or before the voltage coil. Such a condition is caused generally by running the car with the charging circuit open without grounding the generator as explained on page 170, Vol. 1, thus burning away the insulation. In such cases the cutout should be replaced by a new one.

272. In some cases the terminal wire leading to the base makes contact with the magnet yoke, unsolder the wire and slide a tube, made by rolling up a piece of paper, over the wire, after which resolder the wire to base.

273. Another instance of short circuit occurs when one of the screws (on the under side of the base) works loose, or is sufficiently long to touch the yoke.

274. Again, if the cover is not provided with some paper insulator and the soldered connection to the core support is a little high, the cover will conduct the current to the base, thus grounding it. It sometimes happens that the solder will cut the paper insulator.

275. On the black cover cutouts, it is possible to jam the cover down sufficiently to cause a ground. (See Fig. 125, "a" and "b.")

276. Lastly, the short circuit may be caused by a loose or foreign part in the assembly.

Dirty Points

277. Dirty or pitted points may be detected by visual inspection. They may be cleaned or smoothed down with a piece of fine sand paper or with one of the files used on the coil unit point. If sand paper is used it is advisable to purchase the paper which is sanded on both sides.

278. After cleaning the points, hold the keeper (armature) down to see that the points make a good contact and that the keeper is not touching the yoke, core, or coil. There should be between 1/64 and 1/32 of an inch clearance.

Keeper Striking

279. This condition is found by holding the keeper down and inspecting as stated above.

Too Great a Gap Between Keeper and Core

280. If there is too great a gap between the keeper and the core, the keeper will not be drawn down until the voltage has built up beyond the normal voltage (7 to 9 volts). If the gap is too great the cutout will not function at all. Ordinarily the gap between the points when open should be from 1/64 to 1/32 of an inch.

281. If the gap is correct and the points will not close, it may be that the tension spring is too strong. The tension is relieved by bending the anchor upward or on the other type pressing down on the spring. The engine being gradually accelerated and it should cut out before the hand on the ammeter goes below 4 amperes discharge, the engine being gradually retarded. If it is impossible to obtain the above adjustment the trouble probably lies in the coils or magnet and the cutout should be replaced by a new one.

Open Circuit in the Series Coil

282. An open circuit in the series coil is detected by holding the points together while the cutout is in place on the generator. If the engine is not running, the ammeter should show 18 to 20 amperes discharge and the points will remain together until they are pulled apart or the cutout is removed. It is important to do this as soon as the test has been made to prevent the battery discharging. If no discharge is registered the coil is open. If the open occurs at either end of the coil,
the ends may be tacked down with a little solder. If the open is at other than either of these points, the cutout must be replaced by a new one.

**Short Circuit in the Series Coil**

283. If the series coil is short circuited the hand of the ammeter will remain at zero or will jump back and forth as it would were the commutator dirty or the brushes not seated properly. This condition will also be accompanied by arcing at the points. With the engine running at a fair rate of speed hold the points closed and see if the meter reading is steady, indicating that the generator is O. K. If it is, the coils are shorted and the cutout should be replaced by a new one.

**Meter Reads Discharge After Engine Stops**

284. This condition is caused by:

1. Ground in series coil;
2. Points remaining closed:
   A. Points sticking.
   B. Keeper remaining down.

**Ground Circuit in Series Coil**

285. A ground in the series coil may be detected by the ammeter showing a discharge when the points are open. Examine the leads to see that they are not touching the base, yoke or cover. If they are, move them away and cover any bare spots with shellac. Replace the cover and repeat the test.

**Points Remaining Closed**

288. The points may remain closed either because the points are sticking due to a fused or pitted condition or the keeper may not be moving away due to a weak tension spring or its touching the core or yoke.

289. This condition is indicated by a discharge when the engine is running slowly or stopped, the meter reading a normal charge when the engine is running at a fair rate of speed.

290. First remove the cover and examine the points to see if they are sticking or are pitted. If they are badly fused together the cutout should be replaced by a new one. If the points are not too badly pitted they may be dressed down with a piece of fine sand paper or a coil unit point file.

291. The cutout should then be adjusted as explained in paragraph 280.

**Repairing the Switch**

292. Arrangements have been made to furnish repair parts for light and ignition switches. In the future the dealers will be expected to make their own repairs. There are four different makes of switches used at the present time. The parts for each switch are shown in the accompanying cuts.

**The Clum Switch**

293. Clum switch, the name of which is stamped in the center of the switch back assembly, may be identified by the “mag” and “gr’d” terminals being raised above the others and the buss bars on the “Bat” “Coil” and “Tail” terminals.

**Disassembling the Clum Switch**

294. The interior of the switch is exposed by pressing in on the switch back assembly, at the same time turning it counter-clockwise. This exposes the ignition and light contact assemblies, which consist of connectors and contacts assembled to a fibre ring. These assemblies may then be lifted out of the body, exposing the contact ring guide and lock cylinder assembly.

295. The light ring guide is secured to the switch handle (lever) by means of two screws backed up by lock washers. When the screws have been removed the guide may be taken out of the body and the handle is permitted to slip off of the barrel.

*(To be Continued)*
Fordson Tractor Section
Demonstrating Power Farming

A. T. Smith, our dealer of St. Johns, Michigan, has worked out the following plan for demonstrating power farming and promoting the sale of Fordson tractors: Mr. Smith leases a farm, or a portion of a farm generally of 40 to 60 acres, in each township in his territory. As far as possible this land is obtained on the main travelled highway.

Fordson tractors and Ford trucks together with the necessary implements are used exclusively on these farms in preparing the ground, sowing crops and harvesting them. Mr. Smith believes that by operating several small farms in this manner he reaches more prospects than by operating one large farm. At any rate an interest in power farming has been stimulated in this territory, and tractor sales increased.

In the accompanying photograph is shown a threshing scene on one of Mr. Smith’s farms. A Fordson tractor is furnishing the power for the thresher, while Ford trucks, together with the tractor, haul bundles to the machine and draw away the grain.

Plugging Sand Holes
To take care of castings which develop an oil or water leak due to a sand hole, the simplest approved method is to plug the hole by drilling it with a No. 9 drill and tapping it out with a No. 14-24 taper tap. In drilling the hole, the drill should be set at such an angle as to follow the direction of the sand hole as closely as possible. The tap is not run all the way through the work, which permits the plug to bind in the taper. A magnet clamp screw, part 3278, may be used as a plug.
Cut the end off, leaving only three or four threads in place. Cut the screw part way through, a little above the thread, as shown in Fig. 127. When this has been screwed in, it is easily broken off, after which it should be flattened down with a ball peen hammer and dressed off to the surface of the casting with a file. For larger holes or porous castings, drill with a 21-64 drill and tap for $\frac{3}{8}$ pipe, using part S-583 to fill the hole.

All such plugs should be screwed in from the outside where there will be no possibility of their working loose and getting into the working parts. Do not attempt to make repairs in the cylinder bore or combustion chamber.

**Bushings for Axle and Dash**

Due to grit, and often lack of lubrication, the front axle spindle bolt holes and the holes in the dash for the steering shaft become worn. These holes may be rebushed by drilling and reaming them with a 1.186 to 1.187 inch reamer. Model T transmission bushings, part No. 3320 are then forced into these holes and reamed with the same reamer used when they are assembled in the transmission.

It is necessary to use two of them in the axle, cutting off the protruding ends.

When reaming the dash, it is advisable to leave a shoulder on the lower end of the hole to prevent the bushing working down should it become loosened in the hole.

**Grousers**

We are now in a position to furnish the grousers (extension cleats) shown in Fig. 240, Bulletin No. 21, Volume 1. Dealers may obtain these cleats from the Branches.

**Wiring Main Bearing Cap Screws**

In Fig. 128-A is shown the correct method of wiring main bearing cap screws. The wire is interwoven between the two screws, which prevents them from working loose. This method also reduces the possibility of the wire breaking from vibration resulting in the screws working loose and causing severe damage to the motor.

In Figs. 128-B and 128-C are shown the methods of wiring used by some repairmen. Both of these methods are poor practice, as the screws are much more likely to work loose, also the wire break from the vibration of the motor.
Practical Methods of Repairing Fordson Tractors

Assembling the Differential to the Tractor
(Continued from Page 80)

296. When the differential is in place and the housings have been installed, run down and tighten all the cap screws, drawing each down a little until all are tight, crossing from one side to the other as shown in Fig. 129. Next oil and install the roller bearings, driving them home with a rawhide mallet or a block of wood and common hammer. When they are in place position the steel washer on the axle shaft. As the felt washer becomes dead when oil soaked, it is advisable to install new ones. If, however, no new ones are available, wash the old ones with kerosene or gasoline and install them after they have been wrung out and dried. The felt washer is set into the dust cap and together they are driven onto the shaft and onto the housing.

297. The wheels are next installed. They are first set well onto the shaft and the bushing is forced into it as far as it will go; position the wheel so that the cap screws line up with the tapped holes in the hub; start all four of the screws and draw them down evenly, taking each one a little at a time until all are tight and the wheel is properly secured.

Note: The operator or owner should be instructed to tighten these cap screws every day until the bushing takes a "permanent set."

298. Figs. 130 to 134 show the five positions of the tractor transmission gears with lines tracing the path of the power transmitted.

299. The gear “A” is forged integral with the drive shaft “J.” The center is cut out for the upper shaft bearing and is splined internally to receive the teeth of the gear “B.” “D” is integral with the shaft upon which “C” turns freely, and to which “B” is splined. “F” is cut in a forging which is a combined gear and shaft upon which “G” turns freely and to which “H” is splined. These splines permit the gears to slide freely along but turn integral with the shaft. The gear “I” corresponds with the gear “A,” but it is splined to, instead of being combined with the worm shaft. This is to relieve the transmission of any of the thrusts, the worm sliding back and forth as the direction of the thrust changes. The gears of the upper shaft mesh continually with a corresponding gear on the lower shaft with the exception of “B” and “G” which mesh with
the idler gear “E.” “C” has internal splines to match the teeth of the gear “D.”

300. When the transmission is in neutral, the sliding gears “B,” “C,” “G” and “H” are located centrally on the shafts without engaging the end gears. If the engine is running and the clutch is in the neutral position, the motion passes from “A” into “F” through the lower shaft to “H” hence into “C” which turns freely on the upper shaft. When in any of the other positions, all the gears have motion but only a few at a time are used in the transmission of power.

301. In the low gear position, the gear “C” is forced over the gear “D.” The motion follows the same path as when the gears were in neutral only now the gear “D” turns with “C” and since this is in mesh with “I” the train of gears between the rear axle and the engine is complete.

302. When in intermediate, the gear “B” is forced into the gear “A.” “B” being engaged with both “A” and the shaft. The power now travels through the upper shaft to “D” hence into “I.”

303. In high gear “H” is slid into “I” hence the power is transmitted through “E” and its shaft directly to the worm. Reverse is obtained by engaging “G” with “E.” The power is then delivered by “G” to the idler which turns the upper shaft through “B.” The train is completed by “D” and “I.” The worm turns in the reverse direction because of the odd number of gears in the train, seven in all. You will note that each of the forward speeds has an even number, such as 6, 2, and 2. (See Figs. 131, 132, 133.)

304. As there are no wearing parts in the transmission, the gears and shaft being hardened and supported and run on ball bearings, it is seldom necessary to perform any repair operations on this part of the tractor, however the gears sometimes become chipped due to “clashing” and the bearings fail, due to improper care of the lubrication. It is sometimes necessary to replace the bronze bushings in the idler (reverse gear).

305. Trouble in the transmission is first noted by the gears meshing hard or coming out of mesh under a load. If one of the gears freezes on the shaft due to the oil becoming low, a squeal together with the loss of power will announce the fact.

Removing the Transmission

306. To get at the gears, it is first necessary to split the tractor as explained in paragraph 88, Vol. 2. Drain the oil from the transmission and remove the shaft plate by running out the four cap screws which hold it to the transmission housing. The clutch is then removed as explained in paragraph 91, Vol. 2, exposing the transmission plate. Withdraw the locking wire and run out the eight cap screws which hold the transmission plate to the housing. The plate together with the drive and lower shaft may then be removed by grasping the drive shaft and drawing it forward, at the same time moving it up and down to loosen it.

(To be continued)
### Parts Bearing Our Copyrighted Trade Mark

**Ford**

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<tr>
<td>T-2760</td>
<td>Front axle only.</td>
<td>T-3413</td>
<td>Transmission band assembly.</td>
</tr>
<tr>
<td>T-2762</td>
<td>Steering gear connecting rod.</td>
<td>T-3414</td>
<td>Transmission band gear.</td>
</tr>
<tr>
<td>T-2803</td>
<td>Front hub assembly less flange, bolts and nuts.</td>
<td>T-3428</td>
<td>Slow speed notch.</td>
</tr>
<tr>
<td>T-2815C</td>
<td>Rear hub (tapered) less flange, bolts and nuts.</td>
<td>T-3432</td>
<td>Speed lever.</td>
</tr>
<tr>
<td>T-2819</td>
<td>Hub cap.</td>
<td>T-3434</td>
<td>Reverse pedal.</td>
</tr>
<tr>
<td>T-2853</td>
<td>Front cross member.</td>
<td>T-3436</td>
<td>Brake and reverse pedal support.</td>
</tr>
<tr>
<td>T-3001</td>
<td>Cylinder head.</td>
<td>T-3440</td>
<td>Clutch pedal.</td>
</tr>
<tr>
<td>Part No.</td>
<td>Name</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------</td>
<td>----------------------------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T-3442</td>
<td>Clutch pedal support.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T-3447</td>
<td>Slow speed connecting clevis.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T-3455</td>
<td>Hand brake lever assembly.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T-3465</td>
<td>Hub brake lever on controller shaft.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T-3516C</td>
<td>Steering gear post.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T-3519</td>
<td>Steering gear drive pinion.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T-3530</td>
<td>Lead rod lever.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T-3531</td>
<td>Throttle rod lever.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T-3539B</td>
<td>Steering post bracket with bushing.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T-3660C</td>
<td>Tail lamp and license bracket assembly.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T-3800</td>
<td>First leaf, main leaf.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T-3802B</td>
<td>Second leaf.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T-3803B</td>
<td>Third leaf.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T-3804B</td>
<td>Fourth leaf.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T-3805B</td>
<td>Fifth leaf.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T-3806B</td>
<td>Sixth leaf.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T-3807B</td>
<td>Seventh leaf.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T-3808</td>
<td>Front spring clip.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T-3813</td>
<td>Front spring hanger.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T-3818B</td>
<td>Front spring perch, right.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T-3819B</td>
<td>Front spring perch, left.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T-3833</td>
<td>Rear spring clip.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T-3840</td>
<td>Rear spring hanger.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Part No.** | **Name**                      |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>T-3900</td>
<td>Starting crank only.</td>
</tr>
<tr>
<td>T-3906</td>
<td>Starting crank ratchet.</td>
</tr>
<tr>
<td>T-3947</td>
<td>Radiator shell.</td>
</tr>
<tr>
<td>T-3947B</td>
<td>Radiator shell.</td>
</tr>
<tr>
<td>T-3957</td>
<td>Fan bracket.</td>
</tr>
<tr>
<td>T-4026B</td>
<td>Muffler head, front.</td>
</tr>
<tr>
<td>T-4037B</td>
<td>Long exhaust pipe.</td>
</tr>
<tr>
<td>T-4040B</td>
<td>Muffler head, rear.</td>
</tr>
<tr>
<td>T-4809</td>
<td>Front fender iron, right or left.</td>
</tr>
<tr>
<td>T-812</td>
<td>Running board, right or left.</td>
</tr>
<tr>
<td>T-5001</td>
<td>Coil (starter type), less switch.</td>
</tr>
<tr>
<td>T-5004</td>
<td>Coil box cover.</td>
</tr>
<tr>
<td>T-5005B</td>
<td>Switch cover.</td>
</tr>
<tr>
<td>T-5007B</td>
<td>Coil unit 3 1/2&quot; x 2 1/4&quot; x 5&quot;.</td>
</tr>
<tr>
<td>T-5008B</td>
<td>Vibrator with tungsten point.</td>
</tr>
<tr>
<td>T-5055B</td>
<td>Cut-out, electric.</td>
</tr>
<tr>
<td>T-5103</td>
<td>Bracket assembly (mounting).</td>
</tr>
<tr>
<td>T-5104</td>
<td>Bushing.</td>
</tr>
<tr>
<td>T-5137</td>
<td>Pinion.</td>
</tr>
<tr>
<td>T-6511BX</td>
<td>Head lamp assembly, used with dimmer on magneto.</td>
</tr>
<tr>
<td>T-6511CX</td>
<td>Head lamp assembly, two bulb type.</td>
</tr>
<tr>
<td>T-6511TD</td>
<td>Head lamp assembly, with “Tu-Lite” bulb.</td>
</tr>
</tbody>
</table>

**Counterfeit Connecting Rods**

While rods bearing either one of the trade marks shown in Fig. 135 are genuine, rods bearing both of these trade marks are spurious and should not be accepted in exchange for new ones.

**About Ford Motor Numbers**

Upon applying for licenses, owners are quite frequently confronted with the fact that at some time or other their cylinder block was replaced and the mechanic who made the change neglected to transfer the motor number from the old block to the new one. As Ford motors are numbered consecutively and we have no reserve numbers, we are not in position to supply new numbers in such cases. Cars built prior to May 1, 1915, bore a plate on the dash registering the car number. If this number is given when writing to us we can determine the motor number, but without it we have no means whatever of ascertaining the motor number. Cars made subsequent to May 1, 1915, do not bear a car number, and the only recourse an owner has in such a case is to his Bill of Sale.

**Replacement of Ammeter**

It is not considered advisable for dealers to attempt repairs on ammeters. In lieu of furnishing repair parts for this instrument, we will supply a new ammeter in exchange at $1.00 net each.

**Get the Service Bulletin to the Repair Man**

The following is an extract of a letter received at this office:

"I would like to know if it is possible for me in any way to get the Ford Service Bulletin. I am willing to pay for it. I see one once in a while, but seldom."

This letter was written by a repair man who has been employed by one of the Ford Dealers for the past year.

We ask your sincere co-operation in getting the information in the Service Bulletin to the repair man.

Cars bearing motor numbers from 4,233,351 to 4,329,900 were shipped during the month of August.
PROFITABLE SERVICE

That service is an important and profitable part of the Ford business, is demonstrated by the accompanying photographs of the Anaheim & Cherry Garage located at Long Beach, California.

Mr. L. C. Harvey, proprietor, was granted a service contract on April 4, 1919. As the smaller building proved to be entirely inadequate, the present up-to-date building was erected to care for the ever-increasing business.

The building is indicative of the profit which is possible in a properly equipped service station, and is a credit to the foresight and initiative of the proprietor.

Exchange on Ignition Switches

On page 84 of Bulletin No. 11 we advised that we expected dealers to make repairs on light and ignition switches and that we would run a series of articles on the repair of these parts. It has been decided, however, to standardize on one type of switch. The light and ignition switches will be manufactured according to our specifications. When the new type switch is in production we may furnish repair parts and, if so, will instruct the dealers through the columns of the Service Bulletin in the proper repair methods. In lieu of repairs on the four types of switches that we have been using as standard equipment, we will replace such switches with one of the same type or with the new type switch as soon as it is in production at $1.00 net each. Should it be necessary to replace the starting switch located in the bottom of the car, it will be necessary for the owner to purchase a new switch outright, as the price of this part does not permit of an exchange.
SAFETY FIRST

Machine Repairs are Necessary
BUT—

Close Down Equipment First

1—Lock Switch.
2—Throw Belt Off. If You Don't It
May Creep Over and Start Machine.
3—Hang "DANGER, Do Not Start"
Sign on Control Lever or Starting
Button.

Belt Shifter Crept Over
and Caused This

You Are Never Too Safe

Generator Tests

The following tests and determinations may
be made with one of the ammeters which are
sold as standard equipment with the Ford
Starting and Lighting System. The standard
6-volt battery, preferably one which has been
in use is used and the connections are made as
shown in Fig. 137.

1. The correct reading is from two to four
amperes, the generator running at a slow,
steady speed, no arcing at the brushes.

2. A heavy discharge, the hands going
beyond the limit of the instrument indicates
trouble in the head, such as third brush not
seated, fields open probably at third brush or
ground connection, third or positive brush
holder or pig tail shorted. To prove an open
field, raise the third brush and connect "A"
to it. If open no reading will be shown on the
ammeter.

3. No reading on the ammeter indicates
dirty commutator or brushes not seated upon
it due to the brushes sticking in the holders,
worn too short to make proper contact or
spring out of shape so that it presses against
the holder.

4. Ammeter fluctuating between 18 and
20 indicates short circuit in the armature.
5. Ammeter reading 6 with a higher RPM indicates a shorted field.

6. If the ammeter is normal but there is a decided flash at one point on the commutator, an open armature is indicated. Turn the armature over by hand, one segment at a time; if there is a point where the armature will not start to rotate, that coil is open.

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**Fordson Tractor Section**

**Airplane Used for Delivery of Fordson Part**

A short time ago a record was made for Montana and perhaps the entire continent in the delivery of a tractor part to a farmer who did not want to be delayed in his harvesting. The Fergus Motor company, Ford and Fordson dealers of Lewistown, Mont., conceived this plan of quick action and delivery of a Fordson tractor part to a farmer of the Danvers country by airplane.

Fred Ferrell, manager of the company, had just returned to his office from a ride in the clouds with Lieut. Furber, when a telegram arrived from Danvers asking that the tractor part be delivered at once. Mr. Ferrell at once communicated with Lieut. Furber, and 15 minutes later W. C. Perkins, another officer of the company, was seated in the airplane with the part in his possession.

Danvers is just 18 and two-thirds miles from Lewistown by the Milwaukee railroad. The distance by the air route has not been recorded but any way it required just 20 minutes to make the trip out by airplane, in the face of a strong head wind. To say that the folks of the Danvers country were surprised when they saw an airplane drop down in their midst is stating it mildly. The farmer who wired the order in acknowledged that for quick service the feat was a world beater.

The trip back to Lewistown was made in about 16 minutes.

Now Ferrell and Perkins are talking about making air deliveries a regular feature of their business.

**Preventing Freezing**

As cold weather comes on, it is necessary to take some precaution to prevent freezing.

The circulating system may be filled with a mixture of water and alcohol and cared for as explained in the Radiator Repair Book or on page 106, volume 1, of the Service Bulletin.

The capacity of the cooling system is 12 gallons. The table below gives the approximate point at which the different alcohol solutions freeze.

<table>
<thead>
<tr>
<th>Alcohol Solution</th>
<th>Freezing Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>20% solution</td>
<td>15° above zero</td>
</tr>
<tr>
<td>30% solution</td>
<td>8° below zero</td>
</tr>
<tr>
<td>50% solution</td>
<td>15° below zero</td>
</tr>
</tbody>
</table>

Due to the rush of cold air through the air washer, it is necessary to use a substitute for the water, which would soon freeze. While some operators run the Tractor with the float removed or raised in the air washer, we recommend that kerosene be used to replace the water, as even in winter there is possibility of dirt or dust getting into the cylinders. The kerosene should be used only in extremely cold weather, water being used as late in the season as possible, draining it at night to prevent freezing. In extremely cold climates kerosene may also be used in the cooling system.

Never use gasoline in either the cooling system or air washer, as it is too inflammable for these purposes and its use is liable to result in a disastrous fire.

**How Cylinders and Heads Are Cracked**

The water in the cooling system should never be allowed to get low but if it does the cylinders should be allowed to cool before the system is re-filled.
passage for the water between the cylinder head and the core. The filler neck is considerably larger on the Tractor than on the Model “T” permitting a larger quantity of water to be poured in at a time. If water is poured into a Tractor which has been run dry, it will follow the path shown in Fig. 138. When the water hits the hot cylinder, a crack results. This crack invariably occurs between the second and third cylinders where the two exhaust ports are side by side.

**Fordson Piston Rings**

Fordson piston rings are now coming through with a groove cut near the top edge the same as the Model “T.” They should be assembled as shown in Fig. 68, Vol. 2. These rings, like the Model “T”, are cut with a taper and it is important that they be properly assembled.

**Preparing Plows for Field Work**

In removing varnish and paint from bases, rolling coulters and jointers, don’t use lye. The best results will be obtained with a varnish remover. Where lye is used for this purpose these parts are frequently pitted, thus making it impossible for plows to “scour up” properly.

**Spark Plugs**

A certain percentage of our tractor production is now being equipped with “Bethlehem” spark plugs. These plugs will be distributed through our Branches at a price of 60 cents each, subject to the regular discount.

**Tractor Fuel Tank Gauge**

The following table gives the dimensions for making a measure stick for the tractor fuel tank:

<table>
<thead>
<tr>
<th>Gallons</th>
<th>Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 1/16</td>
</tr>
<tr>
<td>2</td>
<td>1 1/2</td>
</tr>
<tr>
<td>3</td>
<td>2 1/8</td>
</tr>
<tr>
<td>4</td>
<td>2 1/4</td>
</tr>
<tr>
<td>5</td>
<td>2 3/8</td>
</tr>
<tr>
<td>6</td>
<td>3 1/8</td>
</tr>
<tr>
<td>7</td>
<td>3 3/8</td>
</tr>
<tr>
<td>8</td>
<td>4 1/16</td>
</tr>
<tr>
<td>9</td>
<td>4 1/4</td>
</tr>
<tr>
<td>10</td>
<td>5 1/16</td>
</tr>
<tr>
<td>11</td>
<td>5 1/2</td>
</tr>
<tr>
<td>12</td>
<td>5 3/8</td>
</tr>
<tr>
<td>13</td>
<td>6 1/8</td>
</tr>
<tr>
<td>14</td>
<td>6 3/8</td>
</tr>
<tr>
<td>15</td>
<td>7 1/16</td>
</tr>
<tr>
<td>16</td>
<td>7 1/4</td>
</tr>
</tbody>
</table>

**Tractor Valve Timing**

We show in Fig. 139 the position of the piston and crankshaft at the opening and closing of the valves. As in timing the Model “T”, we recommend that the valves be timed by the piston travel.

That our Michigan dealers have faith in the tractor may be realized by the slogan adopted at their meeting early in September—

“10,000,000 Tractors in the Next Ten Years”
Practical Methods of Repairing Fordson Tractors

Removing Transmission

(Continued from Page 88)

306. Fig. 140 shows the repair man removing the transmission plate as described on page 88. When it has been removed the upper shaft and transmission large gear are exposed.

Fig. 140

They are held in place simply by the friction of the bearings and gears and may be drawn out by hand. These parts and assemblies should then be washed in kerosene and inspected.

Inspecting Transmission Parts

307. All bearings should be inspected to see that they are tight on the shaft and are properly installed as explained on page 6 and page 79, Vol. 2, and as shown in Fig. 141.

308. The bearings should have very little, if any, end play and practically no lateral play—no more than should be in a good babbit bearing.

309. There are six causes for gears coming out of mesh:
1. Worn gear teeth.
2. Sprung shaft.
3. Too much play between shaft and gears.
4. Short shaft and gear.
5. Shifter locking pin spring weak or broken.

310. The first four may be corrected when overhauling the transmission. To detect or correct the two latter it is necessary to overhaul the shift plate assembly, which operation will be described later.

311. The drive shaft and transmission plate assembly should be inspected for end play. If there is too much end play between the drive shaft and the plate the oil from the engine will flow into the transmission due to the pumping effect of the shaft. This end play may be checked while the plate is still assembled to the transmission housing by drawing it out and forcing it in again. If the plate has been removed it may be clamped in a vise while checking.

Disassembling and Assembling Transmission Parts

Removing and Replacing Bearings and Gears

312. All bearings should be removed on an arbor or screw press using plates which are undercut so that the pressure may be carried on the inner race. Such plates may be purchased individually or in sets from the equipment companies.

313. In removing the bearings from the free gear end of the shaft, the plates should be set under the gear instead of immediately under the bearing. Thus the additional surface of the splines will be brought to bear on the inner race.

314. When these bearings are removed the two sliding gears may be drawn off the shaft, after which the remaining bearing may be pressed off.

315. When the worn parts have been replaced by new ones assemble the gear and bearings in the shaft. As in removing the pressure should be exerted on the inner race. Pressure on the outer race is very likely to damage the bearing. To provide a proper press table slot use the plates mentioned in removing the bearing. The shaft should be entered squarely into and forced down until its shoulder fits snugly against the inner race.
316. Next oil the holes in the sliding gears and place them on the shaft which also should be oiled. Take care that the proper gears are installed on each shaft. The upper shaft, the one with the small gear cut into it, takes the large sliding gear and one small splined gear. Remember how they should be assembled with the shifter flanges of the gears together.

317. The lower shaft has two small sliding gears, one with a smooth and one with a splined bore. It is impossible to get them on the shaft wrongly as the splines run only half way.

318. When the gears are in place see that the smooth bore gears turn freely and that all the shifting gears slide freely on the shaft. If they are right, assemble the bearing as explained above and on page 6, vol. 2.

Removing and Replacing Drive Shafts

319. To remove the drive shaft it is necessary to provide some means of holding it while running off the nut which holds the pulley gear in place. Probably the best method is to clamp a scrap reverse gear, part S-341, in the vise. The gear of the drive shaft is then set over this as shown in Fig. 142. The nut may then be run off with a hub cap wrench as shown in Fig. 143. It is usually necessary to use a piece of pipe as an extension handle to start the nut.

(To be Continued)
Fordson Exhibit Michigan State Fair

The Fordson exhibit at the Michigan State Fair was unique in the history of tractors, in that it showed the complete process necessary in supplying bread to the consumer, and in each state of the process the power was supplied by Fordson tractors.

The exhibit was held in a large field adjacent to the automobile building. In the field the tractors could be seen performing the several operations of plowing, preparing the soil on through separating the wheat and baling the straw. The wheat was then taken to the covered part of the exhibit, in which a small flour mill, also operated by a Fordson, milled it into flour at the rate of 15 barrels per day. The flour was then mixed into
bread which was baked in the oven of an electric stove, the current being generated by a dynamo driven by a Fordson.

Under the same roof several other Fordson tractors were shown; one, a sectioned tractor operated by an electric motor attached to the crank showed the visitors the action of the enclosed parts.

A feature which should be of particular interest to dealers was the tractor parts display shown in Fig. 146. Every part of the tractor was shown with a neat card calling attention to the special feature of that part or group of parts.

Seals for Cut-Outs

Dealers wishing to seal cut-outs after they have been opened for adjustments, etc., should use wire solder. Insert a short piece of No. 14 part No. 77475 wire solder through the hole in the cut-out for this purpose, then press down both ends of the solder with a pair of pliers. In the case of cut-outs where wire solder cannot be inserted in the hole, use a piece of wire, twist the ends together, drop a little solder on the ends and press down with the pliers. We will not supply any special seals for use in sealing cut-outs.

Tire Carrier

We find that some of the dealers are not installing the tire carriers properly. Each tire carrier is provided with three holes so that it may be lag-screwed to the sill of the body, as shown in Fig. 147. This is very important, as it greatly reduces the overhang.

Safety First

Finger Rings

Finger rings should not be worn when doing any form of manual labor. The ring is likely to catch on some part resulting in amputation of the finger. The owner of the hand shown in Fig. 148 lost a finger when his ring caught in a piece of revolving machinery. Strained lacerations and at times amputation result from handling any tools while wearing rings. Be safe, preserve the ring, remove it during working hours.

Four to One Gear

To meet the demand for a greater gear reduction on closed cars used in hilly country or over heavy roads, we are supplying a ten tooth pinion, part No. 2597-C which will mesh with the standard ring gear, part No. 2518, giving a four to one ratio.

When installing this pinion on a new car or one which has been run only a few hundred miles, it is not necessary to install a new ring gear. However, on cars which have been run some distance it is usually necessary to install a new ring gear to get a quiet axle. A sufficient stock of these pinions should be carried by every dealer.

Present Type Fan Belts

The new type fan belt, part No. 3964-D, should be used only on cars equipped with the new type fan pulley, part No. 3962-B. This belt will not give satisfactory service with the former type pulley.
Fordson Exhibit Michigan State Fair

The Fordson exhibit at the Michigan State Fair was unique in the history of tractors, in that it showed the complete process necessary in supplying bread to the consumer, and in each state of the process the power was supplied by Fordson tractors.

Fig. 150

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**Tire Carrier**

![Diagram of Tire Carrier]

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Another Mechanic Complains

(Extract from his letter)

I am one of the old shop employees of the . . . . . . Company of this city and am sending you a request for your weekly or monthly service bulletin which you publish for all authorized dealers.

I happened to get a hold of a Service Bulletin and it is just the thing for us fellows but our Company does not let us get a hold of them so we can study the hints you give.

You say "put the Bulletin where it will produce the best results," and that means among us mechanics.

I would appreciate your sending the Bulletin to me as a personal favor. May I expect a reply from you?

Yours truly,

National Fire Prevention Day
October 9th

It is estimated that the loss in the United States by fires during 1918 was $290,000,000, and that the property loss every year is approximately three times the annual production of gold and silver.

These figures accentuate the need for greater vigilance in the prevention of fires, and more equipment to extinguish them. The saving of life should also be taken into consideration by providing sufficient exits, installing fire alarm systems and conducting fire drills for employees.

The Government has set aside October 9th as National Fire Prevention Day. Every establishment in the country should make a special effort to remove all danger of fire on that day, by a thorough inspection of all equipment and conditions.

Practical Methods of
Rebabbitting Cylinder Blocks and
Running in Crank Shaft

320. Because many of the dealers are now doing their own rebaubitting on cylinder blocks, we feel that an article on this subject would not be out of place.

321. The first operation is to remove all the old babbitt. This is best accomplished by cutting out a strip at the bottom of the bearing (see Fig. 149), after which the two remaining pieces may easily be driven out, usually dragging the babbitt out of the anchor holes. Any babbitt which remains in these holes should be drilled out.

322. The success of pouring depends largely on the next operation, namely, to provide a clean dry surface for the babbitt. Dirt and grit will work up in the hot metal spoiling the boring tool or scoring the crank shaft. If water or oil is present, even in the smallest quantity, there will be blow holes in the babbitt. If it is present in large quantities, it will be impossible to pour the babbitt at all.

323. The babbitt is the most important consideration. As there are many different mixtures on the market, only babbitt purchased from the Ford Motor Company should be used. This babbitt is harder than most babbitts and is the only kind which will "Hold Up." Any arrangement which will not pour this babbitt satisfactorily should not be used.
324. The temperature of the metal is also very important. Perfect bearings can be poured only with metal between 800 and 840 degrees Fahrenheit. If no pyrometer is available, this temperature may be estimated by the appearance of the metal. At about 900 degrees the pot and metal turn red and the metal "Burns" coating rapidly when the scum is scraped off. When at the proper temperature the metal appears like quick silver and tarnishes slowly when the scum is scraped off, the coat of tarnish showing all colors. When too cold the metal acts sluggish and the tarnish takes on a dull appearance. Some mechanics check the temperature with a piece of soft pine. The stick should char immediately, but will not catch fire unless held in the metal for some time. The stick should be perfectly dry as the moisture would cause the metal to fly off endangering the operator.

325. The equipment for forming the bearings should be set up according to the instructions of its manufacturer.

326. If there are no plugs in the bar to fill the oil holes, it is necessary to fill these with asbestos waste before pouring the bearing to prevent the babbitt flowing through them. This waste together with the babbitt which covers it is later punched out.

327. While many equipment manufacturers advise heating the block and molding bar, we have obtained our best results at the Home Plant by pouring into cold blocks; this success being due in a large measure to the cleaner condition of the parts. Heating with an open flame results in a deposit of carbon.

328. While bringing the metal to heat the ladle used in pouring the bearings should be in the pot in order that it may be about the same temperature as the metal. When ready to pour either two ladles or a two-lip ladle should be filled with babbitt, pushing the scum back to provide only clean metal for the bearings. The bearings should then be poured rapidly from both sides at the same instant as shown in Fig. 150. Sufficient babbitt to more than form the bearing should be poured. The bearings set quickly so that the bar may be moved immediately the bearing has been poured.

329. The next operation is to cut off the "wing." The chisel should be introduced from the inside of the bearing as shown in Fig. 151.

330. The final operation in repairing the rough bearings is to peen them to conform to the cylinder block. At the Home Plant this is done with a special tool. (See Fig. 152.) It may, however, be done by the use of a round bar .010 larger than the bar used in pouring the bearings. The bar should be laid in the bearing and struck with a lead hammer.

331. The bearing is now ready to be line reamed. This should be done according to the instructions accompanying the machine or fixture. It is important that the finished bearing be the correct distance below the lower surface of the block and as there is no adjustment on the center distance of the time gears it is essential that the fixture locates from both ends of the cam shaft hole. (See Fig. 155.)

332. If the caps are to be bored at the same time as the cylinders, as is done at the Branches and Home Plants, temporary shims .0126 are placed under each side of the tap before drawing down the bolt. These shims are later replaced by thinner ones when installing the crankshaft.

333. When the bearings have been bored, the edges should be dressed off on the 45 degree. The boring turns up a wire edge which should be removed with either a file or a bearing scraper. The surface on which the cap rests
should be free from dirt, babbit or burrs. The ends of the bearings should be finished off at 45° radius to clear the radius in the crankshaft. The tool used for reaming the bearings may be provided with a cutter for this purpose or this may be done with a bearing scraper, no special care being necessary as the radius is not a working surface.

339. The alignment of the bearings should be checked. The proper way to do this is with a test bar or straight edge which will cover the three bearings at once. In using the bar lay down strips of thin cigarette paper on the bearings with one end protruding. Lay the bar in place and try to withdraw the papers. If the bearings are in line all papers will feel the weight of the bar.

340. The alignment of the bearings may be checked by the crank shaft which should first be straightened to a limit given in Fig. 157. The shaft is tried in the bearing by tapping the ends and center to test for rock. Another way is to put a narrow strip of thin paper in the bottom of each bearing. The shaft is then laid in place and by pulling on the papers the fit of the shaft may be tested in all excepting the main “rear” bearing in which the end clearance may be sufficiently small to grip the paper giving a false impression.

341. After checking the shaft in one position it should be turned half way around and checked again. If found to be O. K. oil the bearings, both in the block and on the shaft and replace the shaft.

342. New or rebabbitted caps should be used in assembling the crankshaft, and sufficient shims should be placed equally under each side to allow the bearing .006 rock; that is the bearing will be drawn down .002 to .003 for burning in. These shims may be purchased from the Branch. They vary from .002 to .0025" thick. Ordinarily two or three shims should be placed under each side. The bolts should then be drawn down as tightly as possible without straining the threads.

343. The tightness of the bearings may be tested with the turning bar. Loosen two of the caps and try to turn the crankshaft over with the turning bar. The bearing should hold the shaft so that taking an 18" to 20" hold on the bar the repair man will be
able to turn the shaft over. In the same way test the other two bearings. With more than one bearing tight the repair man should be unable to turn the shaft until after the block has been run in.

344. The next operation is to run in the shaft. This requires a running in stand. The speed varies with the different makes of stands, the strain on the stand and the driving unit being the main consideration.

345. The bearings should smoke freely and should be oiled while they are being run in. If they do not smoke it indicates a loose fit and some shims should be removed from each side, the bearings being tightened and run in again.

346. When sufficiently run in the shaft may be turned over by the hand wheel on the running in stand or by means of a 20" bar equipped with pins to fit into the holes (not dowel pin holes) in the crankshaft flange.

347. When this condition is obtained the main "rear" bearing cap should be removed and inspected. There should be a bearing the entire length of the cap and covering at least 80% of the surface. If the cap does not meet these requirements, it should be rerun taking out one or more shims from each side.

348. While it is not necessary for an experienced operator to remove the other caps it is advisable for the beginner to do so on the first few blocks so that he may be sure his work is correctly done.

Fordson Tractor Section

**GENUINE FORDSON CONNECTING ROD TRADEMARKS**

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<th>SCF-P</th>
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Connecting rods bearing one of the trade marks shown above, may be accepted in exchange. Rods bearing any other trade marks or without a trade mark are to be considered as imitation parts.
Paint the Tractor

The paint on a tractor serves two purposes: first, it gives the tractor a finished appearance, and second, it protects the metal against rust. The latter is the best reason for keeping it painted. Every farmer knows how a coat of paint protects his house and buildings. The destructive effects of the elements on steel or iron is much greater than on wood. Exposed steel structures are painted at least once a year, while in some cases, such as large bridges, etc., a crew of painters are kept busy the year round.

When a tractor is overhauled, the dealer should persuade the owner to have it painted, the cost is slight compared to the benefits to be derived, such as longevity, reduced depreciation, and the addition to the prosperous appearance of the farm.

Before the coat of paint is applied all dirt and grease should be removed, after which the loose paint should be scraped off and the rust spots rubbed down with sandpaper.

Replacing the Cam Shaft Gear

We have had a few inquiries relative to a puller for removing the cam shaft gear. We do not consider it practicable to remove this gear from the shaft when it is assembled in the engine, hence will not supply this puller. Should it be necessary to replace this gear, we believe it advisable to remove the cam shaft with gear from the motor and press the gear off and on with an arbor press.

Cracked Manifold

Fig. 160 shows a cracked manifold. The manifold shows by the burned and scaly condition of that part of the manifold which houses the vapor tube, that it had been overheated, and the crack was due to the stress and strain of the abnormal expansion. This over-heating could have been caused either by running the engine with weak compression, a retarded spark, or without the proper clearance between the valve stem push rods. The same crack could have resulted from running with the water low in the cooling system. But in this case the inlet manifold also would probably have been discolored.
Practical Methods of Repairing Fordson Tractors

Removing and Replacing Drive Shaft

(Continued from Page 16)

349. It is now necessary to force the gear off the shaft, which may be done by dropping the assembly carefully as shown in Fig. 144, the end of the shaft striking on a block of wood or soft metal. Another method used in good practice is to support the plate on blocks, driving the shaft out with a lead hammer. (See Fig. 145.) Securing the plate in a vise and striking it with a steel hammer (Fig. 161) is poor practice, as the hammer turns over the end of shaft and the plate will be cracked by the blow, causing an oil leak when assembled in the transmission. The idler gear may be removed by drawing out the cotter pin after which it may be slipped off.

350. When replacing the drive shaft first install the bearing as described under the heading "Removing and Replacing Bearings and Gears." This assembly is then set on the gear held in the vise. (See Fig. 142.) The play between the plate and bearing is taken up with discs placed between them. One or more discs should be installed as the case requires. Place the discs on the bearings and set the plate over them. The pulley gear is then set onto the shaft and is drawn down with a nut. When the nut is snug try the end play. If there is none and the shaft may be turned by hand, install the cotter pin, completing the assembly.

351. If the idler gear needs rebushing the old bushing is easily pushed out and a new one pushed in on a press. Ream it with a 1.224 to 1.225 reamer, after which the gear should be installed on the pin and locked in place with the cotter pin.

Installing the Transmission

352. The first thing to do is to replace the large transmission gear. Start it on the worm and force it well back until the bearing seats on the shoulder in the housing. In the same way install the upper shaft completing the assembly, as shown in Fig. 162. Next wipe a little shellac on the shoulder in the housing and position the gasket. If no shellac is available a heavy oil or grease may be used. In fact some mechanics prefer to use grease for setting gaskets.

353. The lower shaft is then installed in the transmission plate in the same manner that the upper shaft was installed in the housing.

354. This assembly is then entered into the housing, taking care that dowel pin is in place, and forced back as far as it will go. The lower shaft is entered into the large transmission gear by reaching through the hole left by the shifter plate. In the same way the upper shaft is entered into the drive shaft gear. While this operation may be performed by one man, it is easier and quicker to have one man force in on the drive shaft while the other meshes the gears and enters the shafts. When the plate is well back against the shoulder, enter the cap screws and tighten them down, as in tightening all large surfaces the bolts or cap screws should be tightened a little at a time, crossing from one side to the other as shown in Fig. 129 until all are tightened. The assembly may then be completed as explained in "Replacing the Clutch" starting with Par. 125, Vol. 2.
IN THE upper insert is shown the new building just completed by the McGlamery Auto Co., our dealers at Greensboro, N. C. This building contains 40,000 square feet of floor space devoted entirely to taking care of Ford interests in that territory. The location of the different departments permits of the greatest degree of efficiency in serving Ford and Fordson owners.

The center picture shows the parts store, which is located just to the rear of the sales room, and has a separate entrance from the street. This store is light and spacious, which, together with the orderly arrangement of the stock, enables them to render excellent service to their customers. The manager’s office, also the general offices are located on the mezzanine floor, thus giving the management a view at all times of the sales room and parts store.
The Generator Third Brush

Some repairmen are more or less careless about the seating of the generator third brush. If the brush is sanded in one position and moved to another, it is likely to ride on one edge. As very little current is drawn by the third brush, this condition might not cause arcing. However, the generator will "sing" and in extreme cases the current will drop to zero as the speed is increased to 1,000 or 1,200 R.P.M.

Battery Handle

It is often convenient to carry a battery or support its weight with one hand. This is made possible by a handle made from a one-

inch strip of \( \frac{1}{8} \)" steel by turning up the ends as shown in the accompanying sketch. The ends are slipped under the handles of the battery which are gripped by the upturned ends.

Service Card

Couch & Hass Company, Inc., Ford Dealers at Brooklyn, N. Y., advise us that the use of the card, facsimile of which is shown below, brings into their service station from 40 to 50 jobs a week which might otherwise go to some other garage. The use of similar cards by dealers will, no doubt, increase their service work.

Installing Tulite Auto Bulbs

The Tulite Bulbs should be installed with the word "Ford" as shown in Fig. 166. This is important as it brings the "bright" and "dim" coil contacts into proper position for the light wire. When installing the wire plugs in the rear of the lamps turn it so the lamps burn as per the indication on switch (bright or dim) thus keeping all cars standard.

Part No. 5132 which, as formerly listed, included clamp ring and third brush holder ("A" Fig. 167) is now being shipped without them ("B" of the same figure). This change was made so that further use may be obtained from these parts, which are seldom damaged.

On page 74 of Bulletin No. 10, Volume 2, we stated that we were not furnishing side and back curtains as regular equipment for the sedan. Sedans are being equipped with back curtains but not side curtains. Owners desiring to equip their cars with side curtains may purchase them through the local dealers.

Cars bearing motor numbers from 4329901 to 4426385 were shipped during the month of September
Practical Methods of Repairing Ford Cars

Ignition Circuit
(Continued from Page 70)

Repairing the Weak Magneto
355. It is almost impossible for the magnets to lose their strength unless acted upon by some outside force as the current from the storage battery. This might occur by mixing the wires on the terminal post or not properly insulating the battery wire on the block by means of the extra rubber insulation. (See Fig. 8, Vol. 2.)

356. When the trouble has been found to lie in the magneto it is necessary to remove the engine and take off the transmission cover and crankcase. Before taking off the transmission, try the crankshaft for end play, the engine being held in a vise on a bench (see Fig. 168), or otherwise secured.

Fig. 168

Force the transmission as close as possible to the engine block by pressing against it and turning it about a quarter turn one way and then the other. After measuring the gap between the core of the coils and the face of the magnet clamps (see Fig. 169), pull the transmission away from the block and try the gap again. The difference between these two readings is the amount of end play. On a new motor allow .004 inch end play while repaired motors may have as high as .008 inch.

357. End play up to .015 of an inch, while detrimental to a smooth running engine, should not cause a weak magneto. When more than .008 play is found a new main bearing cap should be fitted. To measure the gap a set of feelers should be used (see Fig. 169). They consist of a number of thin metal blades with their thickness marked upon them and may be purchased at any hardware store. A set of feelers should be in every repairman's kit.

358. The transmission is removed by taking out the four bolts or cap screws which hold it to the crankshaft. Fig. 168 shows the repairman in the act of removing these cap screws with a 32-1179 wrench. When the cap screws have been removed grasp the transmission firmly and pull it out from the crankshaft. It is usually advisable to support the transmission against the body during the time that the last cap screw is being run out as the weight of the overhanging transmission is sufficient to pull it off the crankshaft.

359. The magnets and coils are now exposed for examination and test.

360. The coil support assembly is carefully inspected and tested before leaving the department in which it is manufactured and meter readings are taken while the engine is running on the block test. Any short circuits would, therefore, be caused by a blow or burned out insulation, either of which could be detected by visual inspection.

(To be Continued)
Tools and Testing Devices for Use in Adjusting and Repairing the Electrical System of the Model "T" Car

Fig. 170
F. B. Test set for locating trouble in the starting and lighting systems; price, $4.50.

Fig. 172
F. B. Coil Unit and Magneto Tester with Coil Unit Adjusting Tools; price, $4.50.

Fig. 171
F. B. Tester, for determining condition of the battery; price, $1.50.

Fig. 173
F. B. Coil Unit Adjusting Tools; price per set, $2.50.
Motor and Generator Repair Tools

1—Pole Piece Spreader ........................................... $19.00
For expanding motor and generator frame so as to get the proper air gap between the armature and pole piece, which air gap must be maintained within a few thousandths of an inch in order to give the best performance.

2—Pole Piece, Double Gauge ............................. $15.00
A special "Go" and "No Go" gauge for measuring the polar diameter of generator and motor and for checking up the air gap.

3 Pole Piece Screw Driver ................................... $ 7.00
A specially designed fixture for disassembling and reassembling the pole pieces from motor and generator frame.

4—Screw Driver Wrench ................................. $ 0.70
A standard wrench for operating pole piece screw driver.

5—Armature Ejector ........................................ $12.25
Special tool for pushing armature assembly and bearing out of drive end bonnet.

6—Pinion Puller .......................................... $ 3.75
Used for pulling generator drive pinion off generator shaft.

7—Small Bearing Puller .................................. $ 7.25
Used for pulling small ball bearing off generator shaft.

8—Large Bearing Puller .................................. $ 9.50
Used for pulling large ball bearing off generator shaft.

9—Combination Bonnet Fixture ........................... $13.25
Used for pulling plain bearing out of blind end bonnet on starting motor and ball bearing out of blind end bonnet on generator. Also, for re-inserting plain bushing in motor end bonnet. All of these bearings must be placed accurately and line up properly, which this tool does automatically.

10—Brush Sander ........................................... $ 7.50
The fixture loc!tes from the bearing in the brush end bracket and from the inside of the yoke. Two individual bushings are furnished, one for the generator and one for the motor brushes.

11—Bearing Driver ......................................... $ 0.95
Used for driving small ball bearings on generator shaft.

12—Pole Screw Punch .................................. $ 0.25
Used for locking and unlocking pole screws in frame.

13—Third Brush Wrench ................................ $ 0.30
Used for setting generator third brush.

14—Brush Lifter ......................................... $ 0.25
Used for lifting brushes on generator and motor.

The foregoing tools may be purchased directly from the manufacturer, the F. B. Electric and Manufacturing Company, Detroit, Mich., at 20% discount, excepting the F. B. Test set shown in Fig. 170 which is subject to 15% discount. All prices are F. O. B. Detroit.
Fordson Tractor Section

Braking with a Tractor

When traveling down hill the engine is used to control the tractor speed. To do this the gears are left in mesh and the speed is controlled by opening and closing the throttle in much the same way as when traveling on level ground. There is one important difference, that is the difficulty experienced in shifting gears with the tractor motion accelerating. The transmission is directly connected to the rear axle and being in motion it is difficult to shift the gears.

It is, therefore, imperative that the transmission be set at the proper speed before attempting the descent. The heavier the load or steeper the grade, the lower speed required.

To stop on a grade turn the tractor and load so that it is side-wise to the slope. If this is impossible, stall the engine by choking it with the priming rod. The rear wheels should then be blocked.

When ready to start the transmission is set in neutral and the engine is started in the regular way, after which the proper speed is selected and the tractor is driven away in the usual manner.

While it requires a great deal of skill it is possible to engage the gears with the tractor in motion. To do this, speed up the engine until it runs at the speed it would were the gears engaged, then throw out the clutch and shift the gears with a quick motion.

Never set the gears in reverse to brake on a hill as the engine and tractor will be stalled and the bearings, shafts and gears will be subjected to severe strain.

Care of Cooling System

The Tractor cooling system is required to dissipate a large amount of heat. Free circulation for a large volume of water and close contact of the water to the metal of the tubes and cylinders is, therefore, very important. To insure the above condition the water should be drained frequently, the radiator being flushed out and refilled with clean water. When the opportunity presents itself, as when the tractor is in the dealer's shop, a hose should be connected to the drain cock, flushing the radiator with a full stream of water.

It is a good idea to give the cooling system a thorough cleaning in the fall as a blocked
tube will invariably freeze in cold weather. This may be done by draining the system and filling it with a solution composed of one-half pound of lye to five gallons of water. Put this in the system and run the engine for about five minutes. Drain the solution and fill the system with clean water. After running the engine again for a short period, drain the system and fill it with fresh water, which may be left in.

Another method of cleaning the system is to fill it with a solution of two pounds of washing soda dissolved in a pail of hot water. This is poured into the system which is then filled with water and allowed to stand for 24 hours, after which the system should be drained and thoroughly washed out with fresh water.

A Device for Starting Tractors

An effective device for starting stiff tractors (Fig. 177) may be made from a coupling (a) made to the dimensions given in Fig. 178, a universal joint (b), a scrap drive shaft (c), and a wheel puller (d), (Fig. 179).

The drive shaft is cut off to a length of three feet, and is squared on this end to fit into the end of the wheel puller, which has the bolt hole filed out square to take it. The other end fits into the universal joint, and it in turn fits in and is pinned to the coupling. This device is attached to the left rear wheel of a truck or car. The car is backed into line with the tractor, and the wheel is jacked up.

The tractor is then moved forward and the coupling engaged to the crank, leaving sufficient space for the crank to move forward in the coupling when the engine starts.

Practical Methods of Repairing Fordson Tractors

The Shifter Plate

361. The shifter plate assembly is located on the left hand side of the transmission housing. It is that unit by which the transmission gears are set and held in their several positions at the will of the operator.

362. The main feature of this unit is the simple but effective method of locking one shaft in the neutral position while the other is engaged in one of the speeds, either forward or reverse. This is effected by a pin which works in a hole in the plate between the two shafts, it is the proper length to extend from the outside diameter of one shaft and into a hole of the other shaft, hence when one shaft
363. The shifter shaft is held in position by means of a spring and plunger which fits into one of the three holes in the front end of the shifter arm shaft.

364. The shifter plate assembly is a very simple device and requires no special attention unless subjected to strain or abuse.

365. As enumerated in paragraph 309, a bent shifter, weak or broken spring will cause the gears to come out of mesh. If this happens, or if it is hard or impossible to mesh the gears, remove and examine the shifter plate. After draining the oil from the transmission, set the gears in neutral and run out the four cap screws by which the plate is held to the housing. Insert two pins in the lower holes to prevent the gears being moved out of position when the plate is withdrawn. See paragraph 90 at the bottom of first column page 30, Vol. 2. Grasp the shifter lever with one hand and the filler neck with the other and withdraw the shifter plate. The assembly is then taken to a repair bench for inspection and repair.

366. Clamp it in a vise by means of the filler neck and try the action by shifting it into its several positions. The action should be a little stiff but positive.

367. Set the assembly in the neutral position and inspect the grooves in the shifter arms to see that they are in line. If they are not they should be bent into position by means of a bending bar. If the grooves are badly worn, the arm or arms should be replaced by new ones.

368. The arms are removed by cutting the head off the rivets and driving them out with a drift. When the rivets have been removed, drive the shaft out with a punch as shown in Fig. 181. Care should be exercised when the upper shaft is being driven out to see that the plunger and spring do not jump out and become lost. It is necessary to first remove the upper shaft as described above, when this has been removed, the lower rivet may be sheared and the shaft driven out the same way.

369. If for any reason it is necessary to remove or replace the shifter lever, it may now be done. Turn the assembly up-side-down in the vise and striking on the lower end of the lever, shear the pin which secures the ball to it. The lever may then be laid on the vise and the pins driven out of both the ball hole and the ball retainer.

To be Continued.
The Banner Fork Coal Mine, recently acquired by the Ford Motor Co., is situated in one of the small valleys opening into the Cumberland river, opposite Pine Mountain, Kentucky. At the present time the capacity of the mine is over 40 cars per day.

The average daily consumption of coal at the coke ovens is 2,500 tons, while at the Highland Park and Rouge Plants 1,250 tons are required daily for power purposes. The acquisition of this mine is another step toward insuring a constant supply of coal.
Importance of Proper Lubrication

The satisfactory operation of the automobile and tractor is probably more dependent upon proper lubrication than any other one thing. During the past six years the consumption of gasoline has increased 1600%; during the same period of time the production of crude oil has increased but 400%, thereby necessitating the production of from four to five times as much motor fuel from a given quantity of crude oil as previously. The result is that our present motor fuel is of such a low grade as to complicate very seriously the proper operation of motor vehicles. Poor lubrication, resulting in unsatisfactory operation of the motor car, truck, or tractor, can be traced directly to the poor grade of fuel that is being used. This heavy fuel causes difficult carburetion and is also the cause of a rich mixture being drawn into the combustion chamber. This is particularly true in starting or during the colder months of the year. When this mixture reaches the combustion chamber it immediately condenses and in this liquid form finds its way past the pistons and rings destroying the film of oil between the pistons and cylinder walls, and finally working its way into the crankcase where it mixes with the crankcase oil, breaking it down and destroying its viscosity or lubricating qualities. If the motor is operated with this broken-down oil unnecessary wear on the working parts is the result. In order to determine the wear on the working parts of a motor when not properly lubricated, the following experiment was conducted:

An old motor was completely overhauled, put on the block, and the crankcase filled with the proper grade of lubricant. This motor was run for 60 consecutive hours under full load. At the expiration of this test the motor was disassembled and all working parts "mic'd"; positively no wear could be detected. The motor was then reassembled, put on the block again, and this time the crankcase filled with a broken-down oil and run for 60 consecutive hours under full load; when the motor was disassembled and "mic'd" again a wear to the amount of .002" in some of the important parts was found. This brings out clearly the importance of proper lubrication. In order to counteract the effects of the poor fuel that is being used at this time, the oil in the crankcase should be changed more frequently—at least from 500 to 700 miles.

In the tractor, which uses kerosene for fuel, the lubrication is further complicated. Unvaporized fuel gathers in larger quantities, mixes with the oil in the crankcase even to a greater extent than in the automobile engine. The remedy in this case is exactly the same as that in the case of the car,—change the oil. The oil in the crankcase of the tractor should be changed at least every forty hours of continuous service. The use of a sufficient quantity of the proper grade of oil, renewed at the proper intervals, will do more to lower the maintenance cost of the automobile and tractor than any other one thing.

Transmission Assembly Clearance

It is important that there be a clearance (play) in the transmission as shown by the black line, Fig. 184. This clearance may be checked by sliding the brake drum back and forth on the shaft.

Dust Hoods

In order to close out our stock of touring car and runabout top dust hoods, which are no longer regular equipment, we will sell them at $1.50 each less the usual discount. Dealers should be able to dispose of a large number of these to customers at this reduced price.

Cars bearing motor numbers from 4,426,386 to 4,526,540 were shipped during the month of Oct.
Practical Methods of Repairing Ford Cars

Ignition Circuit

Repairing Magneto

(Continued from Page 107)

370. Examine the coil support assembly for broken or burned insulation, repair or replace it if necessary. If the insulation is broken and the coil is badly damaged, replace the coil support assembly by a new one. If the insulation has been broken, leaving the coil in good condition, it may be fastened back. Clean the damaged coil with gasoline. When dry coat it with shellac and press the end of the damaged tape back into position, holding them down until they stick.

371. Some cases of ground (short circuit) may be detected by visual inspection as when a cotter pin or other metal is jammed under a coil or when the connection between two coils is touching the support. There are some cases that can hardly be detected visually. These may be found by testing with a lamp similar to the one shown in Fig. 122. When using a test lamp care should be taken to prevent the exposed ends of the wires from touching any part of the building that is a conductor as the flash resulting therefrom might injure the operator.

372. To use the light break the connection C (Fig. 185), by heating with a soldering iron. Bend the loose end of the wire away from the support. The coil support should be set on a dry board or other non-conductor to prevent grounding one of the wires in the building. Hold the exposed end of one of the wires against the contact B while the other is held against some exposed metal on the support as the face of the core or the spot face surfaces around the cap screw holes marked D. If the lamp lights there is a ground. It is possible to repair a ground coil but repaired coils are seldom satisfactory. Put on a new coil support assembly.

373. In case it is necessary to repair the grounded coil, proceed as follows: break the connection between the coils directly opposite the contact. (See Fig. 185.) This connection, as all other soldered connections, should be broken with solder iron. The coils have now been divided into two parts, try the light as before, if it does not light, the half connected to the contact is all right. Break the center connection on the other side, and using the end of the coil wire in place of the contact try for the ground. Break the connections in the section or sections which show a light, and try each individual coil. The coils which show a light are grounded. Force a screw driver or a chisel under the grounded coil raising it from 1/8 to 1/4 of an inch. Clean under the coil with a piece of string, wash it out with gasoline. Run shellac under the coil and tap it back in place. Try it with a lamp. If it shows no light, solder back all the connections except the grounded C and try the light as in the first place. Finally solder the ends of the coils at C. Cover any spot on the coil, connecting wires, or support, which may have been bared, with shellac or oil proof varnish.

374. Both repaired or new coil support assemblies should be carefully inspected before being assembled to the engine block. The insulation must be in good condition and thoroughly impregnated with shellac or oil proof varnish. The surface of the cores A...
(Fig. 185) should be clean to the metal and all should lie in the same plane. To prove this lay the support face down on the surface plate, tapping around the back to note any rocks. If no surface plate is available, run a straight edge across three cores at a time to note high or low cores. (See Fig. 186.)

375. It is important that the spot face surface around the bolt holes be clean to insure a good electrical contact with the cylinder blocks. The back of the coil support should be parallel to the face of the core. To prove this lay it on a surface plate or place a straight edge across the core, and measure down to the back of the four bolt holes. (See Fig. 187.) A new support should be within a few thousands. If the old support is within one sixty-fourth of an inch it may be shimmed into place.

Fig. 187

Magnets

376. If nothing can be found wrong with the coil the trouble must lie in the magnets. If the magneto has caused trouble since the last time the magneto was overhauled, take a magnet and try each magnet at the end. (See Fig. 188.) If the test magnet is held with the same side up each time, you should find that one magnet will stick, the next will not stick, etc. When there are two magnets in rotation which stick or two which do not stick it is because the magnets are not properly set. Remove and reset them as described below.

377. When the magnets are weak it is better to replace them with a new set rather than to charge the old ones as they should be aged and drawn to a certain test reading to give the best results.

378. To remove the magnets lay the transmission on the table with the magnets facing down. With a chisel cut the ends off the brass screws which hold the ends of the magnet. The transmission should now be turned over to remove the magnets. A bench with a recess cut out for the transmission drums is easily made and will be found very useful for this operation. (See Fig. 189.) Now remove the clamp screws, clamps, cap screws and washers. The old magnets may now be taken from the flywheel and removed far enough from the work to insure that they will not be mixed with the new ones.

Fig. 189

379. The new magnets come on a board. Unless disturbed, they are set in their relative position which they should occupy on the flywheel. They should be free. If two or more magnets stick together they must be turned over or have their relative position changed. It is very important to have them placed properly as magnets out of place will cause a weak magneto.
380. "Take the magnets, one at a time, and place them on the flywheel positioning the washers and cap screws to keep them in place. After the first magnet is in position see that each following magnet does not stick to the one already in position. If it does change its position to the other side of those magnets already assembled or turn it over.

381. When all the magnets are in place position the supports, clamps and screws. New screws should be used as the ends of the old ones will not come through far enough to rivet. These old screws may be used as suggested on page 85, Vol. 2, for plugging. The spacer on the clamp should be between the two magnets toward the center of the flywheel. Tighten the clamp screws all the way around and then tighten down the cap screws.

382. Inspect the assembly, first to see that the clamps are square with the ends of the magnet; second, that all cap and clamp screws are tight; third, to see that the surface of the clamps lie in the same plane. This may be done with a scale or on a surface plate in the same manner as described in paragraph 374. If one of the clamps or any part of it is high tap it lightly on the high spot with a hammer and take up on the screw.

383. When everything is in its proper shape run a piece of .014 gauge brass wire through the holes in the capscrews to hold them from coming loose. Brass wire should be used as iron wire will not stand the twisting. Next turn the transmission over and peen the ends of the brass screws to keep them from working loose.

Stripped Holes in Flywheel

384. It sometimes happens that threads in the flywheel become stripped. To repair this, drill the hole oversize and tap it out for a plug. The plug is a piece of steel rod cut to the same thread as the oversize hole; with a hack saw cut part of the way through the rod just above the thread. (See Fig. 190.) Next the plug is screwed into the hole with a pipe wrench. When tight, break the rod by striking it with a hammer. Peen the plug on both sides of the wheel and then cut it off flush with the face using a sharp cold chisel.

385. Mark the center of the plug with center punch and with this mark as the center drill and tap the plug for the size screw used. When repairing the hole for the crankshaft flange cap screw a \( \frac{1}{8} \) hole should be drilled using the edge of the plug as the center and a piece of \( \frac{1}{6} \) rod should be hammered into the hole as an anchor. The other holes need no anchor when the plug has been perfectly riveted. The table below gives the drill and tap sizes for repairing these holes.

| Oversize   | 21/64" |
| Tap        | \( \frac{1}{8} \) x 24 |
| Drill      | 7/32" |
| Countersink| \( \frac{1}{4} " \) with \( \frac{1}{4} " \) drill |
| Tap        | \( \#14 \) x 24 |

Fordson Tractor Section

Radiator Tag

It has been the practice of one of the manufacturers of tractor radiator cores, to attach a small metal tag on the back face of the core. We recommend that this tag be removed immediately, as it has been found that the vibration causes the tube to which it is attached, to become severed.

This tag is located a little above the center of the core on the fan side.

Installing Timken Worm Shaft Thrust Roller Bearing

When installing the Timken Worm Shaft Roller Bearing be sure to examine the transmission housing to see how much it has been expanded over the diameter of the cups. If the housing is worn 1-32 or more, a new housing should be used when installing the Timken Roller Bearing. If a housing worn to this extent is used, it will be only a short time before the worm, worm wheel and bearing will break down.
Wooden Block for Tractor Wheels

In response to requests we are publishing a sketch of a wooden block which fits between the lugs of the tractor wheels (see Fig. 191) when the tractor is to be used on pavements. The sketch, Fig. 192, is for the right hand wheel. For the left hand, simply change the positions of the angles 51° 50' and 128° 10'.

The blocks are secured to the wheels by means of bolts through the holes in the flange, the blocks being set in place and marked for drilling to correspond to these holes.

A Coil Box Switch

The early Tractor coil boxes were fitted with an ignition switch similar to the Model T. It was found that it increased the life of the tractor to stop the engine by shutting off the fuel supply. The switch was, therefore, eliminated in the later tractors. If the switch gets out of order, remove the coil box back and bottom, solder the (magneto terminal to switch) wire to the buss bar in the hole, from which the (buss bar to switch) wire has been removed. This brings the box up to the standard specifications.

We show in Fig. 193 a trademark which should be added to the list of Genuine Fordson connecting rod trademarks shown in Fig. 158, Volume 2 of the Service Bulletin.
Practical Methods of Repairing Fordson Tractors

The Shifter Plate

(Continued from Page 112)

386. To install the new lever, first slip the ball retainer over it with the bell end opening toward the ball end. Next insert the new lever through its hole in the plate, and slip the ball into position so that the rivet holes line up. Drive in the rivet and peen it over. The lever is then pulled back until the hole in the ball retainer lines up with the hole in the lever. It is then riveted as shown in Fig. 182. The lower shifter and shaft are next assembled and riveted Fig. 194. It is important that the holes in the shaft be in the proper position. As you face the inside of the plate the single hole should be toward the left. (See Fig. 195.)

387. The lower shifter is the one with the longer reach, the fork for the shifter lever ball doubling back. This is assembled to the shaft so that the shifter lever fork and the holes for the locating pins are toward the top of the assembly.

388. Next install the locating pins as shown in Fig. 195, squirting a little oil into each one of them. When this is done, the upper shifter and shaft may be installed.

389. The upper shaft is assembled the same as the lower, excepting that the holes are turned down to engage the locating pins. It is necessary to set the lower shaft in the neutral position to permit the upper shaft to clear the locking pin. When assembled complete, the grooves in the shifter should be checked, as explained in paragraph 367 to see that they are in line and the lever should be tried to see that the shifter moves into all positions.

390. The plate may then be assembled to the housing. Remove the old gasket and position the new one securing it with shellac or grease. Next see that the transmission gears are all in the neutral position, with the shifter flanges close together. Grasp the shifter lever with the one hand and the filler...
neck with the other and enter the shifters into the hole, sliding the lower holes of the shifter plate over the dowel pins mentioned in par. 365 and making sure that they slide over the flanges of the gears; when it is in position, secure it with the four cap screws.

391. The shifter may then be tried to see if it will move the transmission into the several positions. It may be necessary to start the engine to do this, although turning the engine over by hand will usually permit the gears to locate in any position. When it is found that it works properly, fill the transmission housing with oil. The tractor is then ready for operation.

The Dash Assembly

392. The dash assembly includes the dash together with a steering shaft, gear and piston, steering rod, clutch pedal, clutch pedal clamp, clutch lever and clutch lever bracket. The dash is located directly behind the air washer, the steering wheel and control being within easy reach of the operator's feet.

393. It is seldom that this assembly gets out of order or shows any appreciable wear. It is, however, always advisable to clean it thoroughly when overhauling a tractor. At times it becomes necessary to dismantle it to replace a part or adjust the clutch cam.

394. The assembly is removed as described under "Splitting the Tractor," paragraph 88, volume 2. The assembly may then be taken to a bench where the necessary work may be performed.

395. The first thing to do in dismantling is to remove the clutch lever bracket assembly by running out the four cap screws which secure it to the under side of the dash. As this assembly is put together with one shaft and several cotter pins, it is so simple to replace any part that we need not devote any further space to it here.

Commencing with this issue, the Bulletin will be published monthly instead of semi-monthly.
The Reamer

The reamer is a very delicate tool and is easily damaged by being struck by hard substances. If it is a long reamer it may easily be bent out of line by careless handling when in use or by storing it on an uneven surface with some other object on top of it. Reamers are very susceptible to rust and a small amount of rust on the land (see Fig. 202) will cause the reamer to cut rough. By exercising a little care in using, storing and raising a reamer, its length of service may be considerably extended.

Each time a reamer is put into stock it should be given a coat of oil to prevent its rusting and should be stored in a wooden case or wrapped in a rag to prevent the possibility of any hard object striking the cutting edge.

There are two styles of reamers, generally termed machine and hand reamers. Because the machine has the power to push the reamer through the work and as longevity is an important consideration on production, the machine reamer has a land between 1/64 and 1/32 of an inch wide, while the hand reamer has .009 or less (1/128 of an inch).

When the reamer begins to cut undersize its life may be slightly extended by raising it. This is accomplished by drawing a piece of hardened steel along the face of the tooth. Never stone the reamer on the outside diameter as this throws a burr into the flute, requiring that the reamer be refaced, which operation requires skill and special machinery.

Data for Use in Obtaining Licenses

<table>
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<tr>
<th>Year</th>
<th>Motor Numbers</th>
<th>Coupe</th>
<th>Sedan</th>
<th>Runabout</th>
<th>Touring</th>
<th>Chassis</th>
<th>Truck Chassis</th>
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<td>Aug. 1 to July 31</td>
<td>855,501 to 1,362,200</td>
<td>1540</td>
<td>1730</td>
<td>1395</td>
<td>1510</td>
<td>1200</td>
<td>1200</td>
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<tr>
<td>1915 to 1916</td>
<td>1,362,201 to 2,113,500</td>
<td>1540</td>
<td>1730</td>
<td>1380</td>
<td>1500</td>
<td>980</td>
<td>1450</td>
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<tr>
<td>1916 to 1917</td>
<td>2,113,501 to 2,756,251</td>
<td>1580</td>
<td>1745</td>
<td>1385</td>
<td>1480</td>
<td>980</td>
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</tr>
<tr>
<td>1917 to 1918</td>
<td>2,756,252 to 3,277,851</td>
<td>1580</td>
<td>1715</td>
<td>1390</td>
<td>1500</td>
<td>980</td>
<td>1450</td>
</tr>
<tr>
<td>1918 to 1919</td>
<td>3,277,852 to 4,233,350</td>
<td>1580</td>
<td>1750</td>
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<td>1500</td>
<td>1060</td>
<td>1395</td>
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<td>1919 to 1920</td>
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<td>1400</td>
<td>1500</td>
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</table>

When cars are equipped with starter add 90 pounds. When equipped with demountable rims and tire carrier add 45 pounds.

Piston Rings

Piston rings are now manufactured by a slightly different process, which gives the ring greater tension. This present type ring is marked as shown in Fig. 201. When assembling rings on the piston, the edge bearing the groove should be placed toward the top. In making motor repairs, it is advisable to install the new style rings in the two lower grooves and use the former type ring in the top groove. This plan will enable dealers to consume their stock of the old type rings.

Detecting Spurious Connecting Rods

One way of telling a spurious rod is by the way the babbitt bearing is set. The genuine rod is first tinned so that the babbitt sticks to both the rod and the cap while spurious rod manufacturers depend on anchor holes similar to those in the cylinder block to hold the bearing in place.

The 3rd brush holder and generator brush holder support have been redesigned to give greater rigidity. As the new parts 5132-D Generator Brush Holder Assembly and 5132-B Small Brush Holder are not interchangeable with 5132 and 5131, it will be necessary to use 5132-C Generator Brush Holder Assembly, which includes the Small Brush Holder, when replacing either of the old style parts.
Head Lamp Wire Bushing

It is very important that the bushing part T-4082X be properly installed in the hood block, as shown in Fig. 203. If this is not done, the insulation will be cut through causing a short circuit, ruining the battery or even setting fire to the car. The later hood blocks have a smooth hole in top, making the bushing unnecessary.

Every Owner Should Know That:

The water evaporates from the battery and should be replaced with distilled water.

Loose connections cause a heavy drain on the battery and often are the cause of headlight bulbs burning out.

Watching the ammeter occasionally, particularly when starting and stopping, might save the generator or battery burning out.

The meter should read a charge of 8 to 12 amperes when running at 20 miles an hour.

The charging rate may be adjusted or corrected in a few minutes at any Ford service station.

If the generator is charging at a higher rate than 12 amperes, the battery and generator may be destroyed.

If no charge is registered the generator may be burned out if run even a short distance without grounding it.

The generator may be grounded as shown in Fig. 245.

Replace Field Coils

By the use of Tools 1, 2 and 3, shown on page 109, it is possible for dealers to properly install field coils in the generator and motor yoke. Dealers may obtain these field coils from branches as repair parts.

Do not attempt to install coils or new pole pieces without some device for holding the pole pieces in place; the torque of the screw being turned in will swing the pole piece out of position, permitting it to work loose thru vibration of the car.

Bendix Gear Stop

To prevent the Bendix Gear meshing too deep, the shoulder on the later armature shafts comes about one inch closer to the end. To bring the old shafts up to standard we furnish a bushing, part #1757-X, which may be slipped over the shaft and forced down until it rests against the shoulder. The bushing should be face down until there is from 4 29, 32 to 4 15/16 inches between the shoulder and the center of the Bendix set screw hold. (See Fig. 204.)

Don’t Allow Employes to Accept Tips

We show below, facsimile of a sign that hangs in a conspicuous place in the garage of Couch-Haas Company, Inc., one of our dealers in Brooklyn, New York. We believe that a similar sign should be posted in the garage of every dealer. This will be carrying out the policy which was in effect when service was handled at our Branches.

Cars bearing motor numbers from 4,526,541 to 4,617,925 were shipped during the month of Nov.
Practical Methods of Repairing Ford Cars

The Holly N. H. Carburetor

396. Fig. 200 shows a sectional phantom view of the Holly N. H. Carburetor which is now being installed on Ford cars.

397. This carburetor, as the old style G Holly Carburetor, is of the no-moving part type operating on the air bleeding principle with two venturi points, one at the throttle, the other at the spray needle passage.

398. The distinctive features of this carburetor are, first, its small horizontal choke which permits the air to pass straight through the carburetor at a higher velocity, giving a greater suction and eliminating the frictional losses due to any change in the direction of flow. Second, the two holes in the primary air passage which gives a cleaner mixture at the lower throttle.

Fig. 200

399. When the throttle is in the idling position, air is bled through the hole “A,” Fig. 206, cutting down the amount of gasoline at “B.” As the throttle is advanced the suction occurs at “A” and there is a bleeding effect at “B” which diminishes as the throttle advances, effectively controlling the mixture until the suction drops back to the choke.

400. This carburetor is capable of giving the standard performance outlined in paragraph 299, Volume 1, and any incorrect adjustment is indicated as outlined in paragraph 300. The method of obtaining the correct adjustments, paragraph 302, Volume 1, applies also to the N. H. model.

401. This carburetor is secured to the inlet manifold and connected to the controls in the same manner as the earlier types. When necessary to overhaul it, shut off the gasoline at the sediment bulb and remove it in the usual way.

402. The repair bench shown in Figure 174, Volume 1, may be used without addition or change.

403. The tools listed on page 120 are sufficient to perform all the operations. However, a scale must be used to set the float and the $\frac{1}{3}$" screw driver should be used to remove the float valve seat or a special tool for this purpose may be purchased from the equipment company.

404. The float chamber bowl is held in place by a hex head screw which screws into the threaded end of the body. Removing this screw not only releases the bulb but also exposes the spray nozzle which may then be removed by means of a large screw driver.

405. The spray needle is removed by packing off the clamp nut, after which the needle may be run out. When the air passage vent plug is removed with a small screw driver these passages may be cleaned out with compressed air or a wire when necessary.

406. When assembling first install the spray nozzle. This should always be done before the needle is in place to prevent damaging the seat. See that there is a gasket between the nozzle and the shoulder and the body.

407. The air passage and vent plug and needle valve may then be installed. Run the needle valve down until it seats, then back it out about $1\frac{1}{2}$ times and clamp it with a clamp nut until there is sufficient pressure on the stem to prevent the needle jarring out of adjustment.

408. The float is made of cork and is attached in the same manner as the model G. When it is removed the float valve and seat are exposed. The inspection and repair of these parts is the same as for the G carburetor. The float level adjustment is from $\frac{3}{8}$ to $\frac{5}{16}$ of an inch above the flange measured from the shoulder. (See paragraph 355, and Figure 193, Volume 1.)

409. The float valves are interchangeable with the Model G but the valve seats are not.

410. The choke and throttle valves are replaced as explained in paragraph 408, Volume 1.

The Magneto

(Continued from Page 117)

Assembling

411. The procedure in assembling is as follows: Assemble the coil support to the cylinder block using the same number of
shims as were removed. Start the cap screws and draw them down. Now hold a 12" scale or any other straight edge across the crank shaft flange and measure down to the face of the core at four points as shown in Fig. 207. This will tell whether or not the coil support is parallel with the face of the flange. If the coils are lower on one side than on the other, shim up with paper washers at the bolt holes. If you have none in stock you can cut them from paper. (See Fig. 208.)

412. Now having cleaned the flange, making sure there are not burrs on it by passing a straight edge over its surface and having cleaned the fly wheel, making sure there is no dirt or foreign part in the recess, you are ready to hang the transmission on the crank shaft. The weight of the transmission should be supported on the thigh as shown in Fig. 209. Be sure that the dow pins are in place in the fly wheel and enter them into the holes in the crank shaft. When they are in place insert a cap screw, running it down until it begins to bear. Turn the transmission half way around and put in another. Draw down the two evenly by turning first one and then the other, but before going any further try the gap between the coils and the magnet at four points. Turn the transmission half a turn and try the gap again same points. If there is any difference in these readings there must be a burr on the flange. Remove and inspect. The gap should be .030 of an inch. There is a tolerance of from .025 to .040 but .030 gives the best result.

413. It is safer to have a little more gap on the bottom or unsupported part of the coil. For example, new jobs are set up .020 at the contact half and .030 at the bottom half. If the gap is too wide, put the necessary number of shims, part No. 3272, behind the coil support. If too narrow, take out some shims. The steel shims are .015 of an inch while the paper ones are .005 of an inch thick. Never try to correct the spacing by putting shims between the fly wheel and the crank shaft flange as this may cause the transmission to run out or work loose.

414. When the gap is within the specifications, remove the transmission and wire the magneto support cap screw with No. 14 gauge brass wire.

415. Replace the transmission and secure it to the crank shaft by means of the four cap screws. Care should be taken to draw them down evenly taking up a little at a time on each of the four screws until all are tightened. Tighten the screws diagonally opposite to each other instead of taking them in rotation. When they are tight secure them with brass wire. This will prevent their working out.

(To be Continued)
Fordson Tractor Section

Removing End Play in the Camshaft

If there is considerable end play in the camshaft of the tractor, it can be taken up by the use of a TT-1023, rear axle felt retainer washer. In order to use this part it is necessary to remove the radiator assembly, the front axle assembly and the cylinder front cover. After these parts are disassembled, the washer mentioned above should be placed over the large hexagon nut, which holds the cam gear in position. If the washer is too thick, file same evenly or add an extra gasket between the cylinder and the cylinder front cover.

End play in the camshaft is commonly caused by removing the oil strainer from the breather pipe. It is imperative that the oil strainer be in the breather pipe at all times.

How Neglect of the Air Washer Affects the Pistons

When the air washer is neglected, the wear on the pistons and rings is enormous, as may be realized by the effect on the piston shown in Fig. 210. It will be noted that the wear is greatest between the top ring and its grooves. While the owner must have been notified of the condition in his engine by the weak compression when cranking, and later by the slapping of the pistons, he ran his tractor until it was necessary to replace practically all the engine parts. Fig. 211 shows the piston pin taken from the piston.

In Fig. 212 we show a device which may be used for lifting tractor engines when the cylinder head has been removed. The lower end of the fixture fits into the center water hole of the cylinder block, while a chain fall is hooked through the eye. This device may be made locally from the dimensions given.

In Fig. 280 of Vol. 1 there should be a gasket between the adjustment needle pilot and the casting. It will be impossible to get a satisfactory adjustment if this gasket is not in place.