

**Fordson**

TRADE MARK

**TRACTOR**

**MANUAL  
AND  
PARTS PRICE  
LIST**

**HENRY FORD & SON, Inc.**  
DEARBORN,  
MICH.

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HENRY FORD & SON  
Dearborn, Mich.  
U. S. A.

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*and*  
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Price 25 cents

*Henry Ford & Son, Inc.*  
*Dearborn, Mich., U.S.A.*  
*Factories:*  
*Dearborn, Mich., U.S.A.*  
*Cork, Ireland.*

## Important to Drivers

**I**MMEDIATELY the motor develops a knock the cause must be investigated and the trouble put right. Unless remedied at once, a knock quickly becomes worse, causes a loss of power and puts the motor out of order in a very short time.

The driver must quickly learn to detect when a motor is not firing in one of the cylinders, and must remedy the trouble promptly.

Never attempt to continue work with a Tractor which only fires in two or three cylinders. Besides losing power and wasting fuel, it causes kerosene to get into the crank case, thinning the lubricating oil.

During the first few days tighten up the rear wheel bolts after every hour's run. This is necessary to prevent the wheels getting loose as it takes a little time for them to get set.

## Foreword

**W**HILE no mechanical knowledge or experience is required to drive a Fordson Tractor, it is very desirable that every driver should thoroughly understand his Tractor. The mastery of a thorough knowledge of the construction and the functions of its various parts is by no means a difficult or time consuming task. With such information at his command the driver will be able to maintain his Tractor more economically, prolong its usefulness and at all times be master of the situation when trouble is encountered. The Fordson is of simple construction, easy to understand, and is not difficult to keep in proper adjustment and repair. That the Fordson construction may be thoroughly understood, and that there may be an authoritative guide for the making of Tractor adjustments, this book is published.

## Don't Race the Motor

THE worst abuse that can be given the Tractor is by racing the motor. Drivers must avoid this at all times.

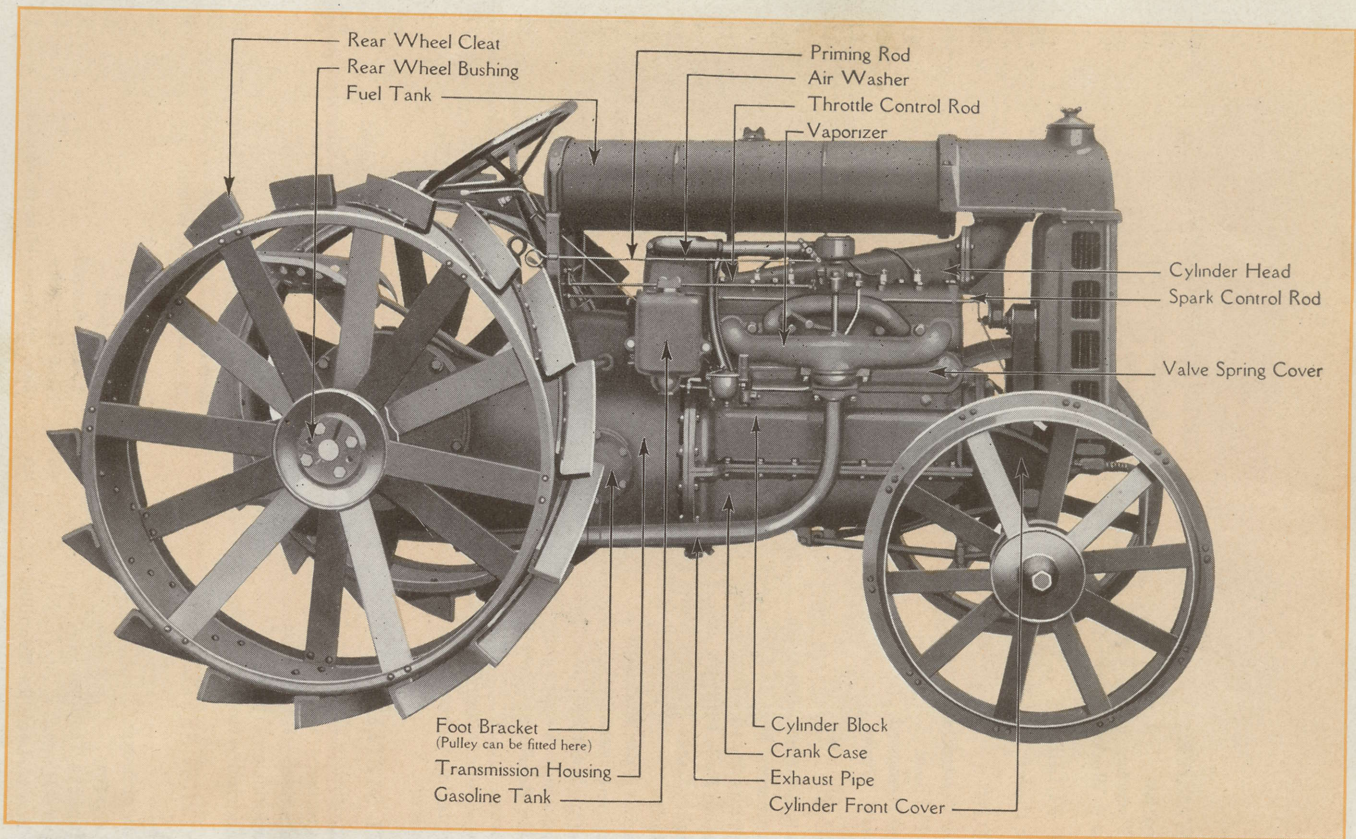
The proper speed to run the motor is 1000 revolutions per minute. This will give the Tractor the correct working speeds as given in Answer No. 22. When the motor is idling cut the speed down as low as possible.

When plowing, learn to close the throttle just as the plow is lifting and open it again when the plow is dropped when entering the furrow.

When starting, do not speed the motor to heat up the vaporizer quickly. This will not accomplish your purpose and is destructive to the Tractor.

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The Fordson Tractor—Vaporizer Side—Plate No. 1

## The Tractor and Its Operation

### Answer No. 1

What must be done before starting the Tractor?

Before starting the Tractor, the instructions given below must be followed: (1) Fill the radiator with clean water. (See Answer No. 2.) (2) Fill the crank case to the proper level with medium, high-grade gas engine oil. (See Answer No. 3.) (3) Fill the transmission housing to the proper level with heavy fluid gear oil. (See Answer No. 4.) (4) Fill the kerosene tank nearly full. (See Answer No. 5.) (5) Fill the gasoline tank nearly full. (See Answer No. 5.) (6) Fill the air washer with clean water. (See Answer No. 6.)

### Answer No. 2

What about the Radiator?

Before starting the engine, fill the radiator (by removing cover at top; see Plate No. 13) with clean fresh water. If clean water cannot be obtained it is advisable to strain it through muslin or other similar material to prevent any foreign substance from getting in and obstructing the small tubes of the radiator. The system will hold approximately 11 gallons. It is important that the Tractor should not be run under its own power unless the water circulating system has been filled. Pour in the water until you are sure that both radiator and cylinder water jackets are full. The water will run out of the overflow pipe to the ground when the entire system has been properly filled. During the first few days that a new Tractor is being driven, it is a good plan to examine the radiator frequently and see that it is kept filled. Soft rain water, when it is to be had in the clean state, is superior to hard water which may contain alkalis and other salts which tend to deposit sediment and clog the radiator.

### Answer No. 3

What about the Engine Oiling System?

Upon receipt of the Tractor see that a supply of medium, high-grade gas engine oil is poured into the crank case through the breather pipe at the left-hand side of the engine. (A metal cap covers it.) At the side of the crank case you will find two small pet cocks. Pour oil in slowly until it runs out of the upper cock. Leave the cock open until the oil stops running, then close it. This will take about 2½ gallons of oil. When the tractor is being worked continuously, oil should be added to get below twice a day. Under no circumstances should it be allowed to get below the lower cock. Always test oil level when the engine is not running and preferably when it is warm.

**Answer No. 4**

**How about the Transmission Oiling System?**

Before starting the tractor see that a supply of heavy fluid gear oil is poured into the transmission housing through the filler hole in the gear shifter cover. Pour the oil in slowly until it reaches the level of the hole; as this oil runs slowly, plenty of time must be allowed for it to reach all parts of the transmission and rear axle. Do not replace the filler cap until you are sure the housing has been properly filled. This system holds about three gallons of oil.

**Answer No. 5**

**What about Fuel?**

As the Tractor uses both gasoline and kerosene both tanks should be filled nearly full. The twenty-one gallon kerosene tank is located above the engine and the one-half gallon gasoline tank is bolted to the air washer on the right-hand side of the Tractor. Strain the fuel to prevent dirt or water in the fuel is sure to cause trouble. When filling the tanks be sure that there are no naked flames within several feet, as the gasoline vapor is extremely volatile and travels rapidly. Always be careful about lighting matches near where gasoline has been spilled.

**Answer No. 6**

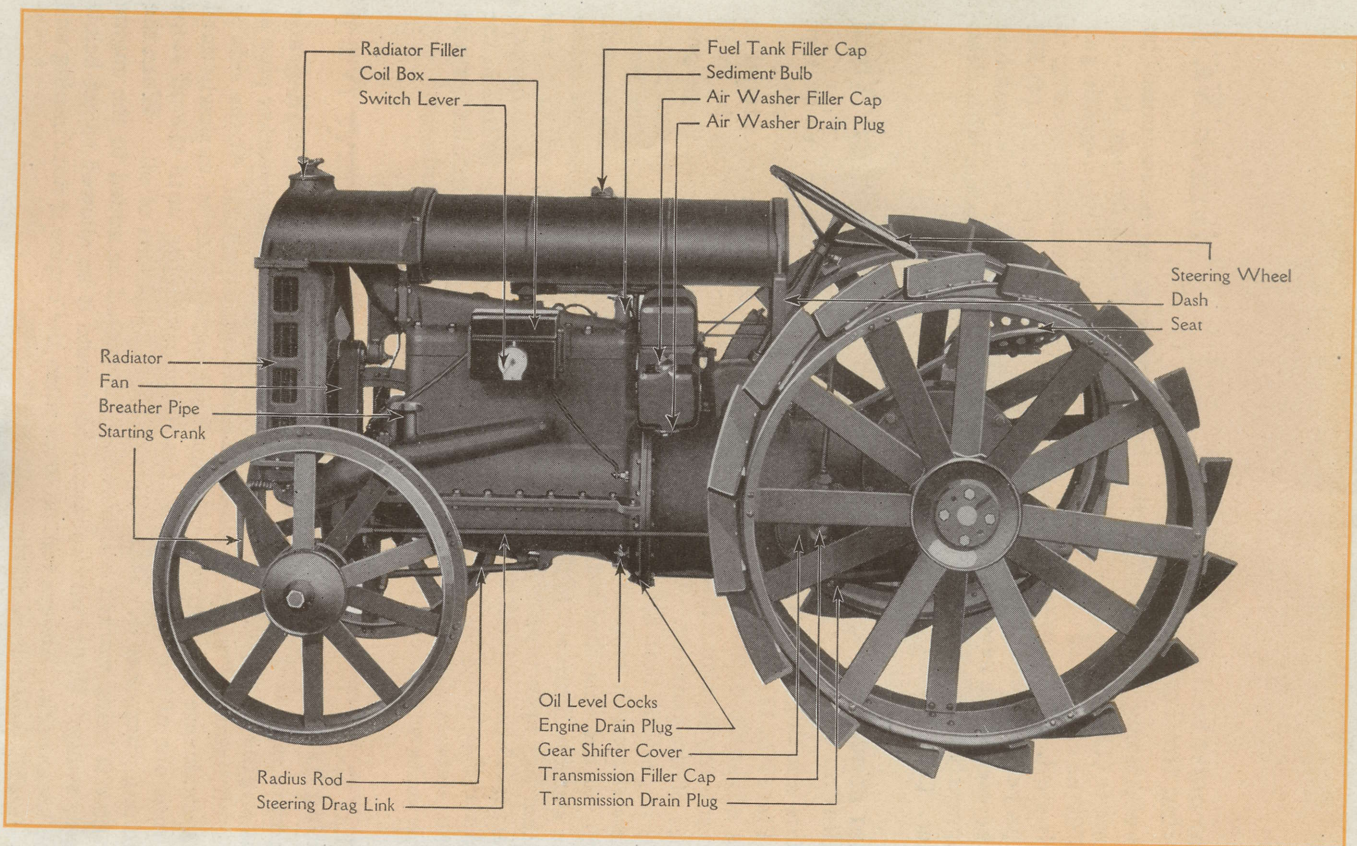
**What about the Air Washer?**

Before starting the engine fill the air washer with clean fresh water (by removing the filler cap at the side). Pour in the water until it runs out through the filler hole and replace the cap. As the engine draws its air supply through the air washer, a certain amount of water is carried off by the air in the form of moisture. It is necessary to make good this loss by frequently adding more water. If the level is allowed to get too low, the air supply will be shut off thereby causing the engine to stop. The air washer should be cleaned out every day by removing the drain plug at the side and flushing out with water.

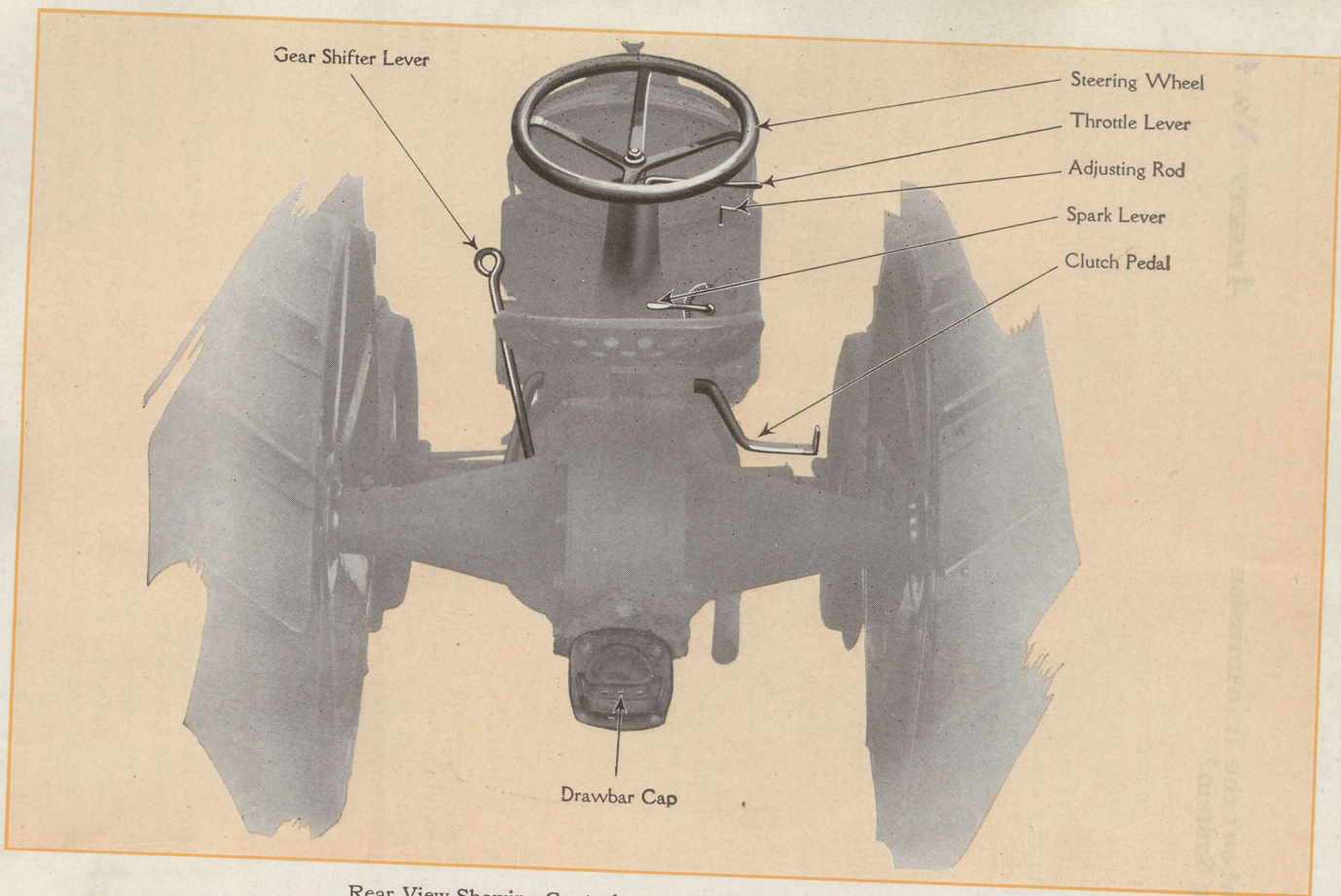
**Answer No. 7**

**How are the Spark and Throttle Levers used?**

Under the steering wheel is located the throttle lever which controls the amount of mixture (fuel and air) which goes into the engine. When the engine is in operation the farther this lever is moved backward toward the driver (referred to as opening the throttle) the faster the engine runs and the greater the power furnished. Mounted on the dash is the spark lever.



The Fordson Tractor—Coil Box Side—Plate No. 2



Rear View Showing Controls and Drawbar Cap—Plate No. 3

This lever controls the spark which explodes the gas in the cylinders of the engine. Moving the lever "upwards" advances the spark. It should be moved notch by notch until the motor seems to reach its maximum speed. If the lever is advanced beyond this point, a dull knock will be noticed in the engine. (See Chapter on Ignition.)

Where should these Levers be when the Engine is ready to crank?

*Answer No. 8*

The spark lever should usually be moved upwards to the third or fourth notch. The throttle should usually be opened about one-third of the way. A little experience will soon teach you where the levers should be placed for proper starting. Care should be taken not to advance the spark lever too far, as the engine may back-kick.

Where are the Levers on the Vaporizer Placed?

*Answer No. 9*

Mounted on the front of the vaporizer is a lever which controls the amount of heat supplied to the kerosene vapor. When starting the tractor move this lever downwards to the "ON" position. This causes the exhaust gases to quickly heat the vaporizer and allows the kerosene to be turned on after running the engine a short time. On the side of the vaporizer near the top is located the Shifter Valve. Turn the small lever on this valve to the horizontal position—uncovering the letter "G"—allowing the engine to start on gasoline. (See Answer No. 61.)

What else is necessary before starting the Engine?

*Answer No. 10*

- (1) See that the gear shifter lever on the side of the transmission is in the neutral (central) position, i. e., the position in which it can be moved freely from side to side. (See Plate No. 5.)
- (2) Turn on the stop cock under the gasoline tank.
- (3) Insert the switch lever in the switch on the coil box and throw the lever to the left as far as it will go—to the point marked "magneto." This switch connects the magneto with the engine, and unless it is on the engine cannot be started. The next step is to crank the engine.

How is the Engine Cranked?

*Answer No. 11*

By lifting the starting crank at the front of the Tractor. Take hold of the handle and push firmly towards the engine until you feel the pin engage the crank ratchet, then lift upwards with a quick swing. With a little experience this operation will soon become an easy matter. Don't, as a

usual thing, crank downward against the compression—for then an early explosion may drive the handle vigorously backward. This does not mean, however, that it is not advisable, when the Tractor is hard to start, to occasionally "spin" the engine by the use of the starting handle—but be sure the spark lever is retarded when spinning or cranking the engine against compression, otherwise a sudden backfire may injure the arm of the operator. When cranking the engine the priming valve on top of the vaporizer should be almost closed. This is done by pulling out the priming rod on the right-hand side of the dash. As soon as the engine commences to fire regularly the priming rod should be pushed back all the way. Do not keep the priming valve closed too long as the motor may get flooded with gasoline and refuse to fire.

**How is the Engine best started in cold weather?**

*Answer No. 12*

As gasoline does not vaporize readily in cold weather it is naturally more difficult to start the engine under such conditions. The usual method of starting the engine when cold is as follows: Before you throw on the magneto switch (1) close the priming valve by pulling the priming rod on the dash; (2) give the crank several quick turns; (3) open the priming valve slightly and throw on the coil switch (being sure to get it on the side marked "magneto"); (4) give the crank one or two turns and the engine should start.

After starting it is advisable to advance the spark two-thirds of the way and let the engine run until it is heated up. If you start out with a cold engine, you will not have much power and are liable to "stall." The advantage of turning on the switch last, or after priming, is that when you throw on the switch and give the crank one quarter turn you have plenty of gas in the cylinders to keep the engine running; thereby eliminating the trouble of the motor starting and stopping. When priming do not keep the priming valve closed too long as the charge that is drawn in is very rich in gas and will not explode readily in the cylinders.

**How is the Engine changed over to Kerosene?**

*Answer No. 13*

By turning the shifter valve on the vaporizer to the vertical position, uncovering the letter "K." (See Plate No. 16-B.) This should not be done until the engine has been running for at least one minute which allows the vaporizer to become thoroughly heated. After about five minutes the shunt valve lever on the vaporizer should be moved upwards a few notches towards the "OFF" position. This prevents excessive heating of the kerosene mixture in the vapor tube. In hot weather the lever can be moved up all the way.

**How does the Foot Pedal operate?**

*Answer No. 14*

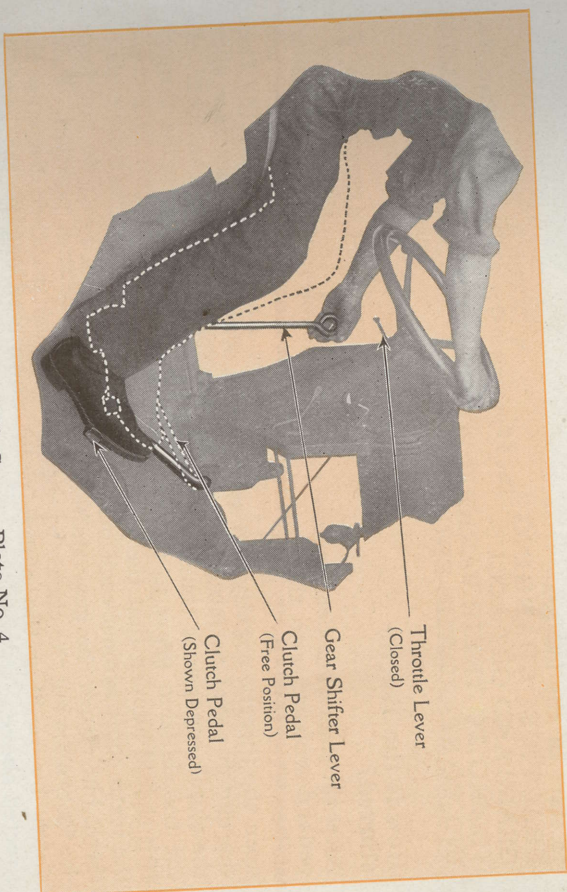
The pedal on the right-hand side of the Tractor operates the clutch. It is used when starting and stopping the Tractor and when changing gears. When pressed downwards it releases the clutch, thus disconnecting the engine from the driving gears. Always allow the clutch pedal to return slowly and smoothly. Sudden engagement of the clutch imposes excessive strain upon all parts and may "stall" the engine. When driving, do not rest the foot on the clutch pedal but use the foot rest.

**How does the Gear Shifter Lever operate?**

*Answer No. 15*

It is on the left-hand side of the Tractor and engages the gears in the transmission. The lever may be moved to five different positions. When in the neutral (central) position no gears are engaged; the lever must be in this position when the engine is started.

The four positions of the lever which are reached from the neutral position are: Low, Intermediate (Plowing), High, and Reverse. (See Plate No. 5.)



How to Shift Gears—Plate No. 4



### How are the various Gear Changes made?

By moving the gear shifter lever, from the neutral position, into the desired positions as given below: (See Plate No. 5).

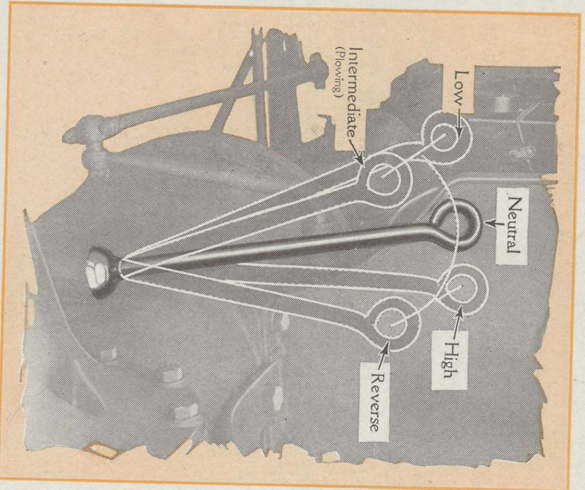
**Low:** Move the lever outwards to the left from the neutral position, and push forward.

**Intermediate (plowing):** Move the lever outward to the left from the neutral position and pull backward.

**High:** Move the lever inward to the right from the neutral position and push forward.

**Reverse:** Move the lever inward to the right from the neutral position and pull backward. **ALWAYS RELEASE THE CLUTCH BEFORE ENGAGING OR DISENGAGING GEARS.** Engage the gear in which it is desired to operate the tractor. It is not necessary to start in the low gear.

**PRACTICE CHANGING GEARS AND GET ACCUSTOMED TO THEIR VARIOUS POSITIONS BEFORE ATTEMPTING TO START THE ENGINE.**



### How is the Tractor started?

#### Answer No. 17

After the engine has been started proceed as follows: (1) Push the clutch pedal downward with the foot, releasing the clutch. (2) Move the gear shifter lever into the desired position. (See Answer No. 16.) (3) Then open the throttle slightly and as the speed of the engine increases allow the clutch pedal to return slowly by gradually raising the foot. As the clutch engages, it transmits the driving effort of the engine through the transmission gears to the rear axle, setting the tractor in motion. If it should happen that the gears are in such a position that the ends of the teeth come against each other instead of sliding past, do not force them, but return the gear shifter lever to the neutral position. Raise the clutch by pushing the clutch pedal down and engage the gears as directed above.

## Shifting Gears

**N**O attempt must be made to engage or disengage gears until clutch pedal has been pushed down all the way.

When changing gears, if the clutch is not entirely disengaged the teeth on the gear wheels will make contact, breaking off their edges so that in time they will not remain in mesh.

Always slow down engine by closing the throttle when changing gears.

## H i t c h

**A** LWAYS pull a load from the **Drawbar Cap**; never hitch a chain or rope around the rear axle housing.

When pulling a heavy load, or when the Tractor gets stuck, be sure to keep your foot on the clutch pedal. Do not race the engine or let the clutch in suddenly, as such procedure might cause the front end of the Tractor to lift up. Release the clutch immediately if the front end of the Tractor starts to raise off the ground—this will bring it down at once.

If Tractor gets stuck, pull out in low gear.

**Do not attempt to pull tree stumps, or to do similar work which will bring the Tractor to a sudden standstill.**

**How is the Tractor stopped?**

*Answer No. 18*

(1) Partially close the throttle. (2) Release the clutch by pushing the clutch pedal downward. (3) Move the gear shifter lever into neutral position—disengaging the gears. (4) Allow the clutch to re-engage by releasing the clutch pedal.

To stop the engine, close the throttle and throw off the switch. If the Tractor is going to stand over night or long enough to cool off, the engine can be started easier if it is stopped by turning the shifter valve on to gasoline and pulling the priming rod as far as it will go. This has the effect of shutting off the air and filling the cylinders with a rich gasoline vapor which facilitates starting.

**Can the Engine be started on Kerosene when it is warm?**

*Answer No. 19*

Yes, if the engine has not been stopped more than a minute it can be started again without shifting on to gasoline. Before cranking, however, it is necessary to pull the priming rod all the way, and as soon as the engine starts push the rod back again as it is apt to "flood" the engine.

**How is the Spark controlled?**

*Answer No. 20*

Good operators drive with the spark lever advanced just as far as the engine will permit. But if the spark is advanced too far a dull knock will be heard in the motor, due to the fact that the explosion occurs before the piston in the cylinder has completed its stroke. The spark should only be retarded when the engine slows down under a heavy load or when idling. Care should be taken not to retard the spark too far, for when the spark is late, instead of getting a powerful explosion, a slow burning of the gas with excessive heat will result. The greatest economy in fuel consumption is obtained by driving with the spark advanced sufficient to obtain the maximum power.

**How is the speed of the Tractor controlled?**

*Answer No. 21*

By changing the gears to suit load conditions. Always use the highest gear ratio on which the Tractor will give the necessary pull. A little experience will soon teach the driver the proper gears to engage, and the best speed at which to run the engine. The speed of the engine is controlled by opening or closing the throttle to suit conditions, and should be kept nearly constant at all working speeds of the Tractor. When running at 1,000 revolutions per minute the engine delivers its greatest driving effort and this is the speed at which it should be run when the Tractor is working.

What are the Tractor Speeds?

*Answer No. 22*

When the engine is running at 1000 revolutions per minute the four gear changes give the Tractor the following speeds:

Low:  $1\frac{1}{2}$  miles per hour.

Intermediate (plowing):  $2\frac{3}{4}$  miles per hour.

High:  $6\frac{1}{2}$  miles per hour.

Reverse:  $2\frac{3}{4}$  miles per hour.

Use the gear changes to obtain variations in the Tractor speed—Never run the engine above the proper speed.

The speed can be judged by observing the number of complete turns made by the rear wheels in one minute:

In low gear the rear wheels turn 12 times per minute.

In intermediate gear the rear wheels turn 22 times per minute.

In high gear the rear wheels turn 54 times per minute.

In reverse gear the rear wheels turn 21 times per minute.

Is it advisable for Tractor Drivers to make their own adjustments?

*Answer No. 23*

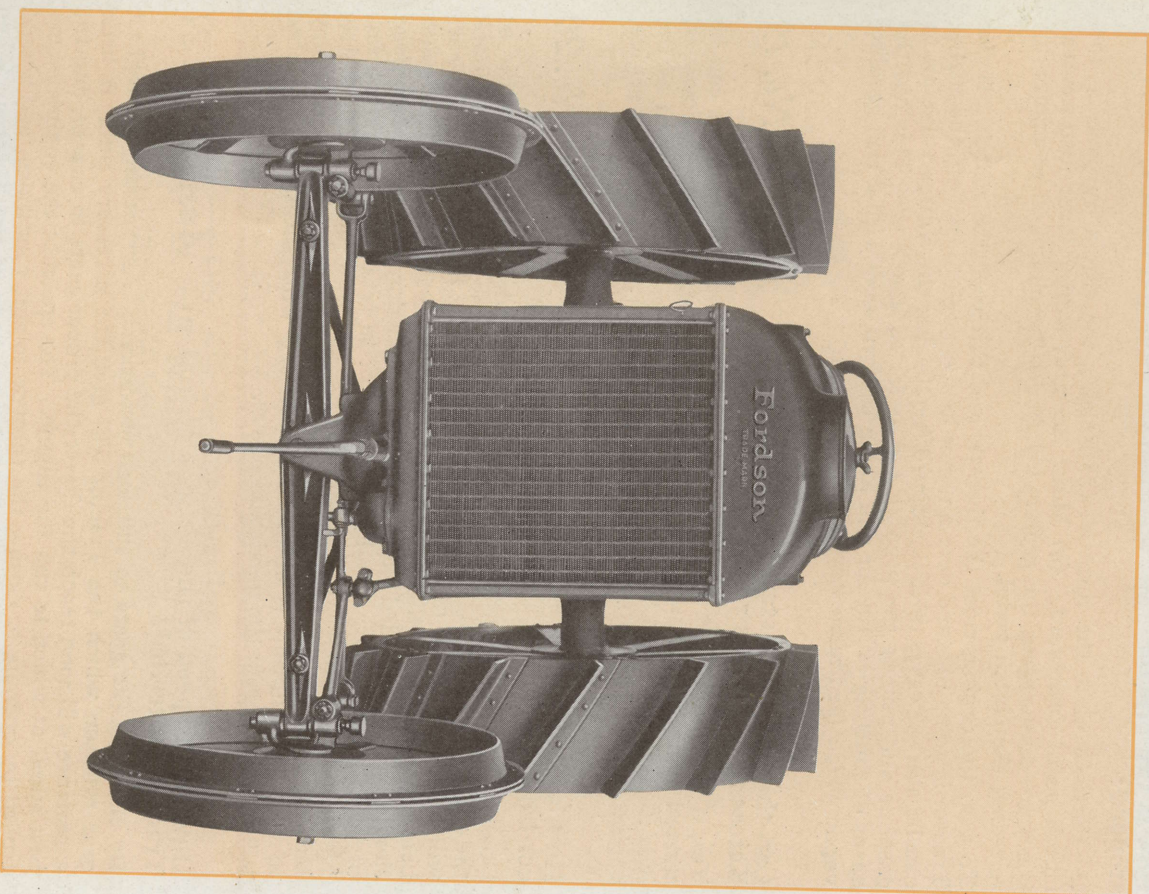
The Tractor being of simple construction and very accessible, most of the adjustments the driver will soon learn to make for himself. In making any extensive repairs or replacements it is best to employ the services of a skilled mechanic who thoroughly understands the Tractor.

What attention does the Tractor need?

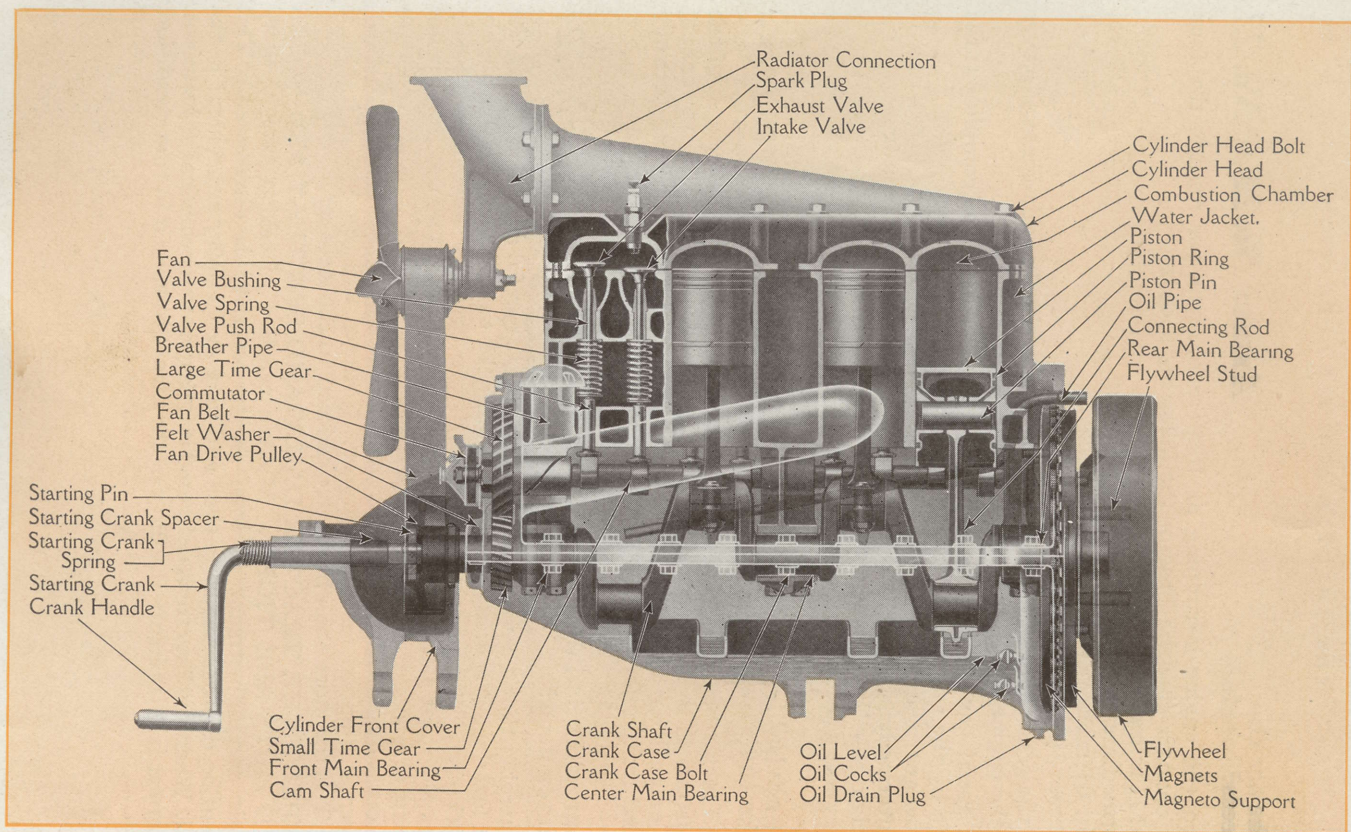
*Answer No. 24*

Remember that a new machine requires more careful attention during the first few days it is being driven than after the parts have been thoroughly "worked in." The Tractor which is driven carefully when new, usually gives the most satisfactory service in the end. See that the Tractor has plenty of oil and water before starting work. If the Tractor is left in the open over night, see that it is properly covered. The Tractor Cover is supplied for that purpose. Nothing will shorten the life of the Tractor more than being left exposed to the weather.

**INSPECT THE TRACTOR DAILY AND SEE THAT ALL BOLTS AND NUTS ARE TIGHT.** Make a practice of taking care of every repair and adjustment as soon as its necessity is discovered. This attention requires but little time and may avoid delay or accident in the field. When the Tractor is delivered it is in proper mechanical adjustment. Afterwards it is plainly the duty of the owner to keep it in that condition.



Front View of the Fordson Tractor—Plate No. 6



Sectional View of the Fordson Engine—Plate No. 7

## The Fordson Engine

**What is the principle of the Tractor Engine?**

*Answer No. 25*

Gasoline or kerosene vapor when mixed with air and compressed is highly explosive. In the gasoline or kerosene engine such a mixture is drawn into a cylinder, where it is compressed by an advancing piston, and then exploded by an electric spark, which sends the piston downward and through the connecting rod imparts a rotary motion to the crank shaft. (See Plate No. 7.)

**What are the functions of the Pistons?**

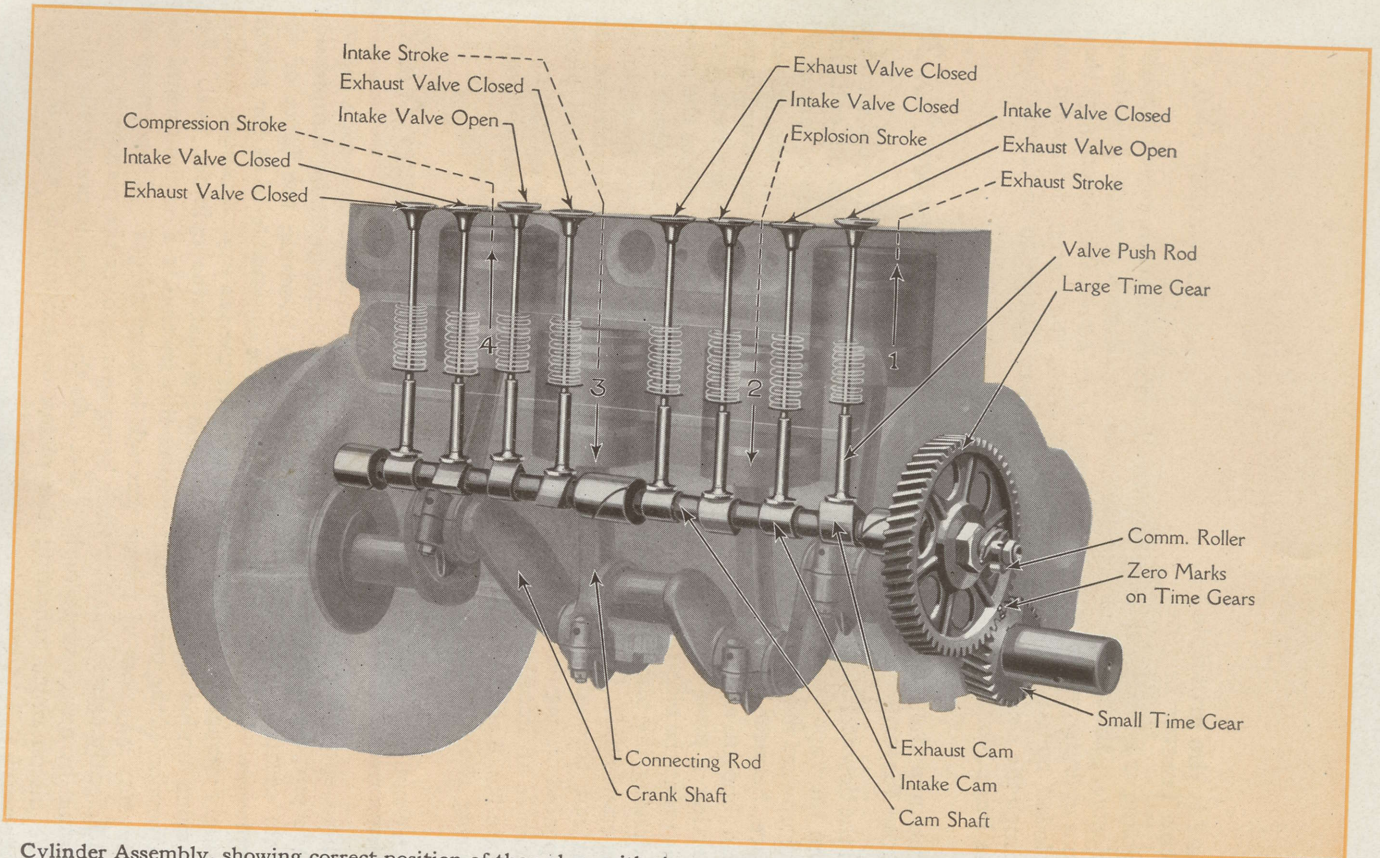
*Answer No. 26*

On the downward stroke the suction of the piston draws the fresh mixture from the vaporizer, through the intake pipe and valve into the cylinder. The upward movement of the piston compresses the gas into a very small space, between the top of the piston and the depression in the cylinder head, known as the "combustion chamber." (The compressed gases exerting a pressure of approximately 45 pounds per square inch.) At this point the electric spark, generated by the magneto explodes the gases—driving the piston downward—thus producing the power which turns the crank shaft. On the next stroke upward the piston drives the exploded gas out through the exhaust valve and pipe. These operations are repeated in regular order in each of the four cylinders. Each piston receives an impulse (i. e., force of an explosion) every two revolutions. Plate No. 8 shows clearly the relative positions of the pistons and valves during the different strokes.

**Why are the Piston Rings necessary?**

*Answer No. 27*

Three springlike rings are fitted into the grooves around each piston; their purpose is to prevent any part of the gas charge under compression from escaping past the pistons, and thus lessening the force of the explosion. Without these rings it would be impossible to fit the pistons snugly enough in the cylinders to prevent the gas from escaping, without causing undue friction of the piston against the cylinder wall. The expansion of the piston rings reduces this friction to a minimum and still prevents any loss of power through leakage of gas. These rings are sufficiently elastic to allow their being sprung over the pistons in case it should be necessary to replace one. As the friction is practically all on the piston rings, renewing the piston on account of wear is seldom necessary.



Cylinder Assembly, showing correct position of the valves with time gears properly set according to punch marks on the gears, also the relative position of pistons in their strokes as indicated above. The firing order of the cylinders is 1, 2, 4, 3—Plate No. 8

### How is the Connecting Rod and Piston Removed?

*Answer No. 28*

Remove the cylinder head (see Answer No. 40), drain oil from the engine and remove radius rod and crank case; then disconnect connecting rod from crank shaft and take the piston and rod out through top of cylinder.

### How are new Piston Rings fitted?

*Answer No. 29*

If the piston rings are worn or scored they should be replaced. In overhauling the engine always remove the piston rings and clean them as well as the grooves. When fitting a new ring, try it around the piston by placing its outside edge in the groove to which it is eventually to be fitted, make certain it is a good fit but not tight in any position. Now place the ring in the cylinder in which it will eventually work. If it is too large in circumference to enter the cylinder, take a small fine-cut file and while holding the ring in a vise file the slot just a little and again try the ring in the cylinder. The slot should close up, leaving from .004 inch to .006 inch clearance between the ends of the ring. Great care must be taken when trying the ring in the cylinder to make sure that it is inserted absolutely square; otherwise, bad fitting will result and consequent "sluggish" running of the engine. On one side of the ring will be found a punch mark. This side must be placed towards the top of the piston in replacing. If the piston pin is worn and has appreciable shake in the piston, the entire piston should be replaced.

### What is the Valve Arrangement?

*Answer No. 30*

One intake and one exhaust valve are located in each cylinder. The former admits the fresh gas drawn from the vaporizer through the intake pipe. The latter permits the exploded gas to be driven out through the exhaust pipe. The valves are alternately opened and closed (see Plate No. 8) by the cams on the cam shaft striking against the push rods, which in turn lift the valves from their seats.

### How are Valves Timed?

*Answer No. 31*

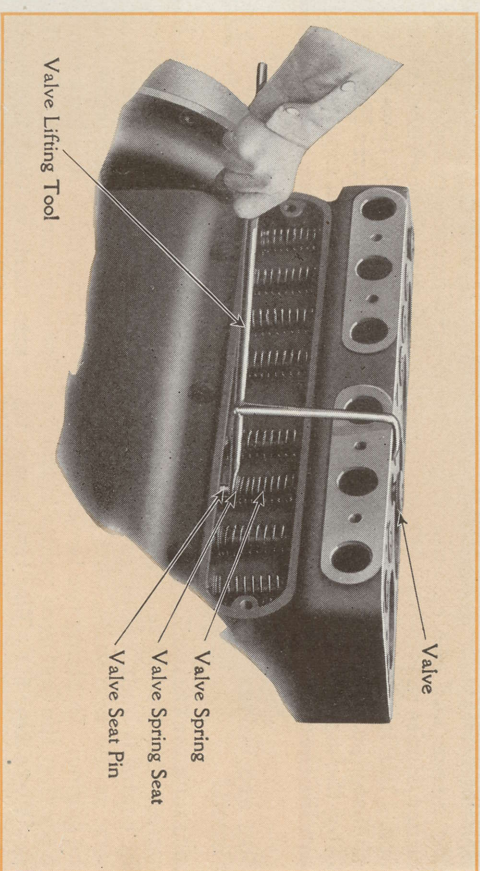
In timing the engine the points of opening and closing of the valves are, of course, what should be considered. As the valves are properly timed when the engine is built, the necessity for retiming would occur only when such parts as the cam shaft, time gears or valves are removed in overhauling the engine. In fitting the large time gear to the cam shaft it is important to see that the first cam points in the direction opposite to the zero mark. (See Plate No. 8.) The time gears must also mesh so that the tooth marked zero on the small time gear will come between the two teeth on the large gear at the zero point. The time gears now being properly set,

the exhaust valve on No. 1 cylinder is open and the intake valve closed, the other valve being in the position indicated in Plate No. 8. The opening and closing of the valve being as follows: The exhaust valve opens when the piston reaches  $\frac{1}{4}$  inch of bottom center, the distance from the top of the piston head to the top of the cylinder casting measuring  $4\frac{1}{8}$  inches. The exhaust valve will close on top center, the piston then being  $\frac{1}{8}$  inch above cylinder casting. The intake valve opens  $\frac{1}{8}$  inch to  $\frac{1}{16}$  inch after top center, the distance from top of the piston then being from  $\frac{1}{4}$  inch to level with cylinder casting, and closes  $\frac{1}{16}$  inch to  $\frac{1}{32}$  inch after bottom center, the distance from the top of the pistons to the top of the cylinder casting measuring from  $4\frac{1}{8}$  inches to  $4\frac{1}{2}$  inches. The clearance between the push rod and valve stem should be .020 inch and should be measured when the push rod is on the heel of the cam. When retiming, the opening of the intake valve and the closing of the exhaust valve are the points which should be observed.

**What about the care of the Valves?**

**Answer No. 32**

They seldom get out of order, but they do get dirty as a result of carbon collecting on the valve seat. These carbon deposits, by preventing proper closing of the valves, permit the gases under compression to escape, resulting in loss of power and uneven running of the motor. If, when turning the engine over slowly, there is lack of resistance in one or more cylinders, it is probable that the valves need regrounding. As the life of the engine depends largely upon the proper seating of the valves, it is necessary that they be ground occasionally.



How to Use the Valve Lifting Tool—Plate No. 9

**How are Valves removed for grinding?**

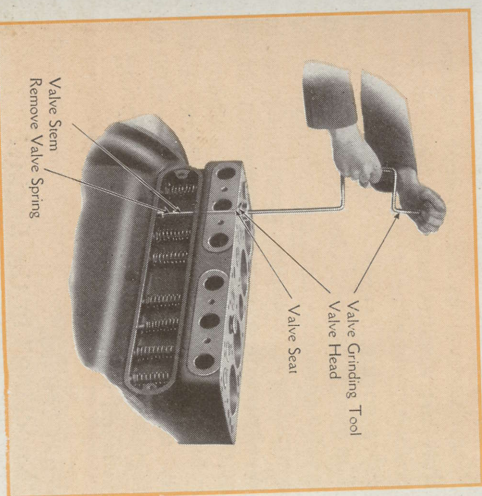
**Answer No. 33**

(1) Drain radiator; (2) remove cylinder head (see Answer No. 40); (3) remove valve spring cover from the side of the cylinder; (4) raise valve spring with lifting tool and pull out the little pin under the valve spring seat. (See Plate No. 9.) The valve may then be lifted out by the head preparatory to grinding. Remove and grind only one valve at a time so that no mistake can be made in replacing.

**How are Valves ground?**

**Answer No. 34**

For this work use a good prepared grinding compound, or a paste made of ground glass and oil. A convenient way is to put a small amount into a suitable dish adding a spoonful or two of kerosene, and a few drops of lubricating oil to make a thin paste. Place the mixture sparingly on the bevel face of the valve. Put the valve in position on the valve seat and rotate it back and forth (about a quarter of a turn) a few times with a grinding tool. (See Plate No. 10.) Then lift slightly upon the seat, change the position and continue the rotation, and keep on repeating this operation until the bearing surface is smooth and bright. The valve should not be turned through a complete rotation, as this is apt to cause scratches running round the entire circumference of the valve and seat. When the grinding is completed the valve should be removed from the cylinder, thoroughly washed with kerosene and the valve seat wiped out thoroughly. Extreme care should be taken that no abrasive substance gets into the cylinders or valve guides. This can be avoided if the grinding paste is applied sparingly to the bevel face of the valve. If the valve seat is worn badly or seamed it is best to have it reseated with a valve seating tool. The operation requires considerable skill, and perhaps had better be done by an expert mechanic. Care should be exercised against making too deep a cut necessitating the retiming of the valves.



Method of Grinding Valve—Plate No. 10

### When the Valves and Push Rods are worn—What?

*Answer No. 35*

When the valves or push rods become worn so as to leave too much play between them, thus reducing the lift of the valves and diminishing the power of the motor, it is best to replace the push rods with new ones. The clearance between the push rods and the valve stem should be .020 inch and must never be greater than  $\frac{3}{8}$  inch nor less than  $\frac{1}{8}$  inch. If the clearance is greater the valve will open late and close early, resulting in uneven running of the motor. If the clearance is less than  $\frac{1}{8}$  inch there is a danger of the valve remaining partly open all the time. If replacing the push rod does not leave the proper clearance, the valve should also be replaced. We do not recommend drawing out the valve stems, as the operation requires experience, and the price of the new part does not warrant the time and expense necessary to do the work properly.

### What about the Valve Springs?

*Answer No. 36*

When the valves fail to seat themselves properly, there is a possibility that the springs may be weak or broken. A weak inlet spring would probably not affect the running of the engine, but weakness in the exhaust valve spring causes a very uneven action which is difficult to locate. The symptoms are a lag in the engine due to the exhaust valve not closing instantaneously, and, as a result, a certain percentage of the charge under compression escapes, greatly diminishing the force of the explosion. Weakness in a valve spring can usually be detected by the following method: Remove the plate which encloses them at the side of the cylinder and insert a screw-driver between the coils of the spring while the engine is running. If the extra tension thus produced causes the engine to pick up speed, the spring is obviously weak and should be replaced with a new one.

### What causes "Knocking" in the Engine?

*Answer No. 37*

There are several causes which may be enumerated as follows: (1) Carbon knock, which is by far the most common, resulting from carbonizing of cylinders; (2) knock caused by too advanced a spark; (3) connecting rod knock; (4) crank shaft main bearing knock; (5) knock due to loose-fitting piston or broken ring; (6) knock caused by piston striking the cylinder head gasket. When the engine knocks from any cause whatsoever, the matter should be properly investigated by an experienced mechanic and the difficulty remedied.

### How may the different Knocks be distinguished?

*Answer No. 38*

(1) The carbon knock is a clear, hollow sound most noticeable when pulling hard, particularly when the engine is heated. It is also indicated by a sharp rap immediately on advancing the throttle. (2) Too advanced spark will be indicated by a dull knock in the engine. (3) The connecting rod knock sounds like the distant tapping of steel with a small hammer, and is readily distinguished when the engine is allowed to run free. (4) The crank shaft main bearing knock may be distinguished when the Tractor is pulling hard as a dull thud. (5) The loose piston knock is heard upon suddenly opening the throttle, when the sound produced might be likened to a rattle. The remedies for these knocks are treated under their proper division.

### How is Carbon removed from Combustion Chamber?

*Answer No. 39*

Remove the cylinder head (see Answer No. 40). Then with a putty knife or screw driver scrape from the cylinder and piston heads the carbonized matter, being careful to prevent the specks of carbon from getting into the cylinders or bolt holes or under the valves. Before replacing the cylinder head wipe off each valve and valve seat with a clean cloth. In replacing cylinder head be careful that it is tightened down properly.

### How is the Cylinder Head removed?

*Answer No. 40*

(1) Open the small cock under the radiator and drain off all water. (2) Shut the stop-cock on the sediment bulb and remove the fuel tank. (3) Disconnect all wires from engine and remove coil box; do not disconnect commutator but remove it along with the wires. (4) Remove the four bolts holding the cylinder head to radiator connection. (5) Remove the 22 cap screws which hold the cylinder head in place. (6) Take off the cylinder, taking care not to damage the gasket. In replacing the cylinder head clean the surfaces on the cylinder head and turn the motor over so that No. 1 and No. 4 pistons are at top center; place the gasket over so that No. 1 and No. 4 pistons are at top center; place the gasket in position over the pistons and then put the cylinder head in place. Be sure and draw the cylinder head cap screws down evenly (i. e., give each a few turns at a time). Do not tighten them on one end before drawing them up at the other.

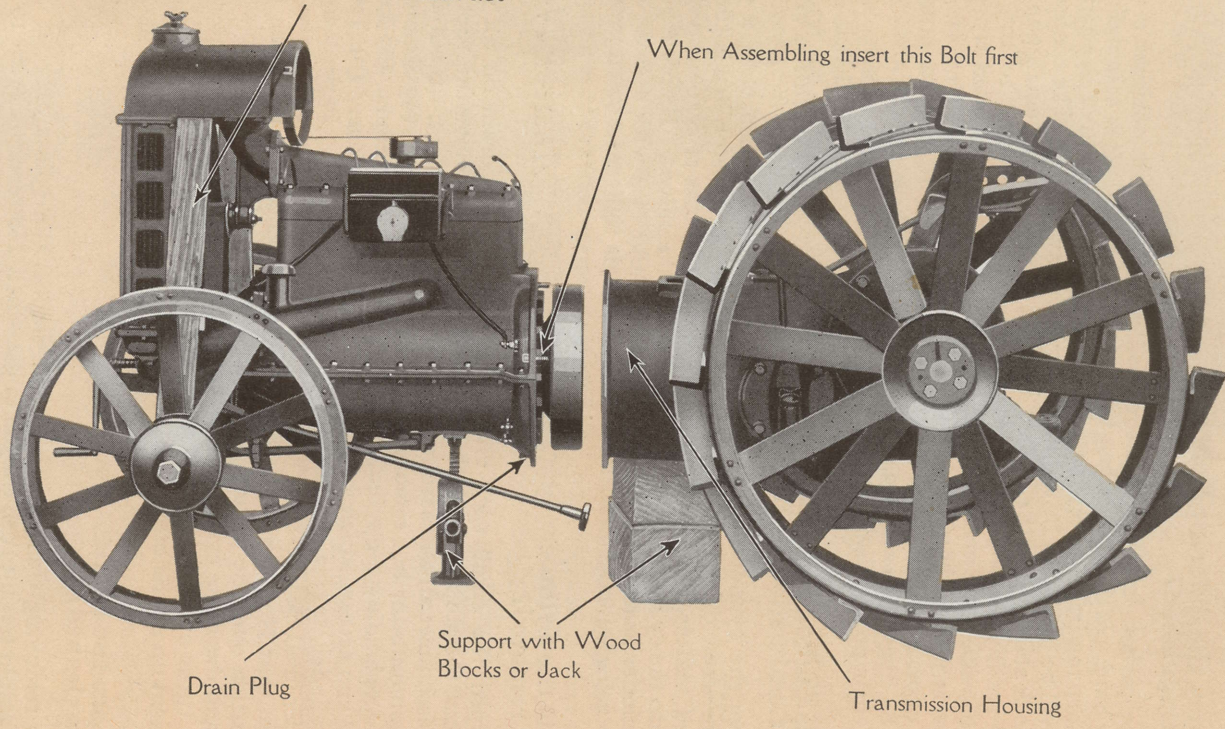
### How are the Spark Plugs cleaned?

*Answer No. 41*

After removing the plugs from the engine, the points may be cleaned with an old tooth-brush dipped in gasoline. However, in order to do the work thoroughly, the plugs should be taken apart by securing the large hexagon steel shell in a vise and loosening the pack nut which holds the

Support Radiator with Wood Block on each side

When Assembling insert this Bolt first



Removing Engine from Transmission—Plate No. 11

porcelain in place. The carbon deposit can then be easily removed from the porcelain and shell by a small knife. Care should be exercised not to scrape off the glazed surface of the porcelain, otherwise it will be apt to carbonize quickly. In assembling the plug care should be taken to see that the pack nut is not tightened too much so as to crack the porcelain. The distance between the sparking points should not be more than  $\frac{3}{8}$  of an inch, about the thickness of a smooth dime. Dirty plugs are usually a result of using too rich a gas mixture, or from an excess of oil being carried in the crank case.

**Connecting Rod Bearings—  
How adjusted?**

*Answer No. 42*

Connecting rod bearings may be adjusted without taking the engine apart by the following method: (1) Drain off the oil from the engine. (2) Remove the radius rod and crank case—exposing connecting rods. (3) Take off the first connecting rod cap and remove a shim from each side. (4) Replace cap, being careful to see that punch marks correspond, then tighten bolts until it fits shaft snugly. (5) Test tightness of bearing by turning engine over with the starting handle. It may be necessary to remove the cap several times and remove or add shims as required. Experienced mechanics usually determine when bearing is properly fitted by lightly tapping each side of the cap with a hammer. (6) Then loosen the bearing and proceed to fit the other bearings in the same manner. (7) After each bearing has been properly fitted and tested, tighten the cap bolts and the work is finished. Remember there is a possibility of getting the bearings too tight, and under such conditions the babbitt is apt to come out quickly unless precaution is taken to run the motor slowly at the start. It is a good plan after adjusting the bearings to run the engine free for some little time (keeping it well supplied with water and oil) before working it. Whenever possible these bearings should be fitted by an expert mechanic.

**Crank Shaft Main Bearing—  
How adjusted?**

*Answer No. 43*

Should the stationary bearings in which the crank shaft revolves become worn (which will be evident by a pounding of the motor) they may be adjusted without taking the engine apart as follows: (1) Drain the oil from the engine. (2) Remove the radius rod and the crank case—exposing the crank shaft and main bearings. (3) Remove the rear main bearing cap. (4) Between the two halves of the bearing will be found a number of shims .003 in. and .006 in. thick. Remove shims of equal thickness from each side of the cap; then place the cap in position and tighten up as much as possible without stripping the bolt threads. (5) Test the tightness of the bearing by turning the engine over with the starting crank. If the crank shaft cannot be turned with one hand, the contact between the bearing surfaces is evidently too close and will require shimming



up. In case the crank shaft moves too easily more shims should be removed; the correct adjustment being obtained by removing or adding thin or thick shims as determined by trial. (6) Then loosen the bearing and proceed to fit the center bearing in the same manner. Repeat the operation with the front bearing, with the other two bearings loosened. (7) When the proper adjustment of each bearing has been obtained place a little lubricating oil on the bearings, also on the crank shaft; then draw the caps up as closely as possible—the necessary shims, of course, being in place. Do not be afraid of getting the cap bolts too tight, as the shims under the cap and the oil between the bearing surfaces will prevent the metal being drawn into too close contact. If oil is not put on the bearing surfaces, the babbit is apt to cut when the motor is started up before the oil in the crank case can get into the bearing. Be careful to lock all bearing cap bolts with wire before replacing crank case.

**How is the Engine removed from the Transmission?**

*Answer No. 44*

When it is necessary to disassemble the engine or transmission for repairs or adjustment proceed as follows: (1) Drain the oil from the engine. (2) Empty radiator and water jackets by opening the small cock under the radiator. (3) Close stop cocks on sediment bulb and gasoline tank and remove fuel tank. (4) Remove the air washer and gasoline tank. (5) Disconnect the steering arm from the drag link and the control rods from the commutator and vaporizer. (6) Remove the dash by unscrewing the four cap screws holding it to the transmission housing. (7) Jack up the transmission housing as well as the engine separately, being careful to prop up the radiator to the front axle so as to prevent the engine tilting over when it is disconnected. (8) Remove the bolts from the cylinder flange holding the engine to the transmission housing; the rear part of the Tractor can then be drawn away from the engine. (See Plate No. 11.)

When assembling the Tractor, it is important that the two bolts, one on each side of the cylinder flange, just above the crank case, be inserted first. The holes in which these two bolts fit are smaller and being reamed accurately they bring the engine and transmission into correct alignment.

**What about the Gaskets?**

*Answer No. 45*

In taking the Tractor apart care should be exercised, so that the paper gaskets are not torn. If they are damaged, they should be replaced with new ones. Many of the gaskets used in the Tractor are made of paper, and if desired may be made from ordinary newspaper. Particulars of the gaskets which can be so replaced are given in the Parts List. It is best when fitting a new gasket to varnish one side with shellac. It will then stick to one surface and is not so liable to be torn when the joint is taken apart.

## The Cooling System

**What is the purpose of the Cooling System?**

*Answer No. 46*

The heat generated by the successive explosions in the cylinders would soon overheat and ruin the engine were it not cooled by some artificial means. The Tractor engine is cooled by the circulation of water in jackets around the cylinders. The heat is taken from the water by radiation in its passage through the thin metal tubing of the radiator—to which are attached thin copper fins, which assist in the rapid radiation of the heat. The fan, just back of the radiator assists in the cooling of the water by sucking the air through the fins and around the tubes.

**How does the Water circulate?**

*Answer No. 47*

The cooling apparatus of the Tractor is known as the Thermo-Syphon system. As hot water is lighter than cold, it always seeks the higher level, consequently when the water is heated in the cylinders, it rises to the top tank and is replaced in the cylinders with cooler water from the bottom tank, which, in turn, is supplied through the radiator tubes. This circulation then continues only so long as the water level is above the upper connection. No pump or mechanical device is necessary to keep the circulation constant. (See Plate No. 12.)

**What are the causes of Overheating?**

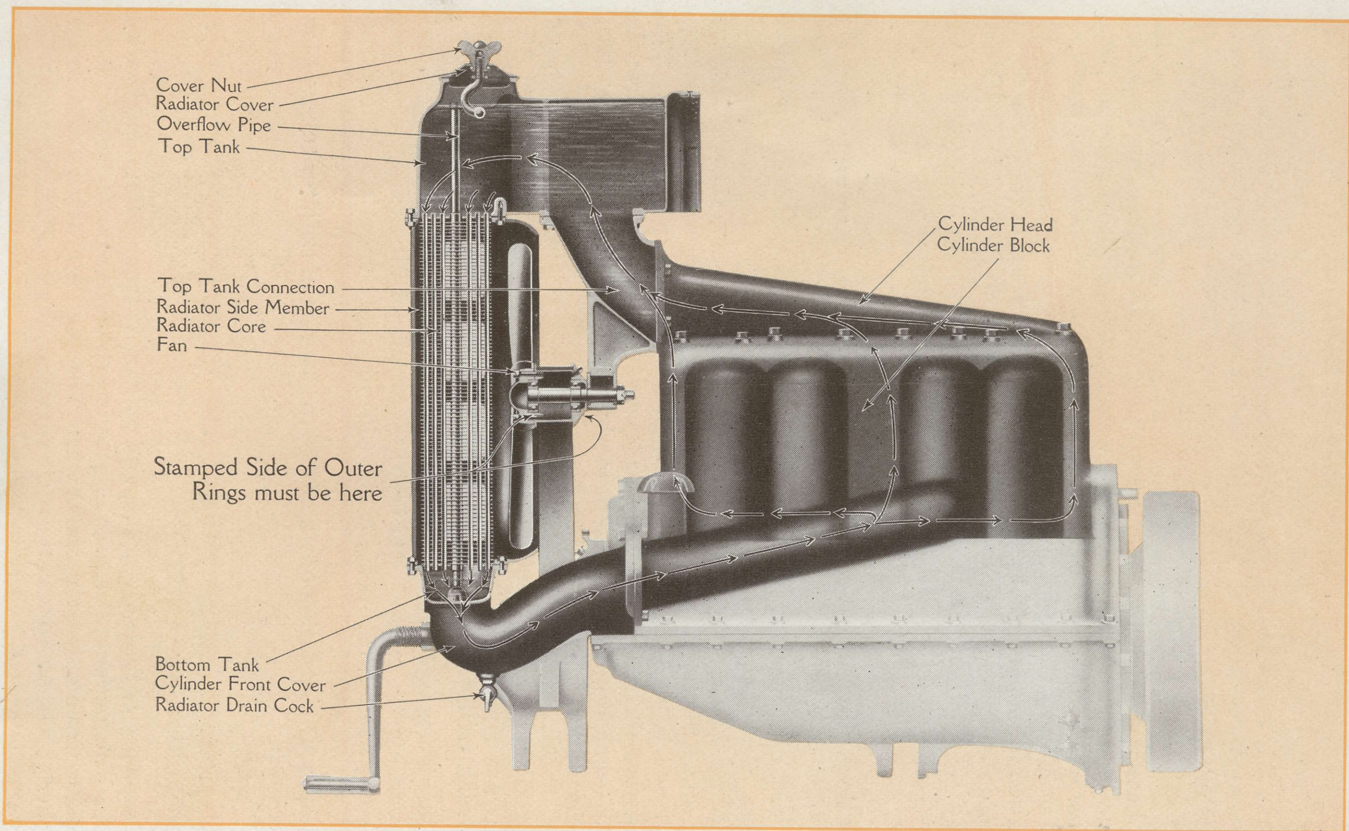
*Answer No. 48*

The engine may be overheated by (1) carbonized cylinders; (2) spark retarded too far, causing late ignition; (3) poor ignition; (4) not enough or poor grade oil; (5) racing engine; (6) improper vaporizer adjustment; (7) fan not working properly on account of broken or slipping belt; (8) improper circulation of water due to clogging of radiator tubes or low water level.

**What should be done when Radiator overheats?**

*Answer No. 49*

The capacity of the radiator being 11 gallons no trouble from overheating should be experienced if the radiator is kept full. Don't be alarmed if it boils occasionally—especially when working on heavy ground in hot weather. Remember that the engine develops the greatest efficiency when the water is heated nearly to boiling point. But if there is continuous



The Thermo-Syphon Cooling System Showing Course of Water—Plate No. 12

overheating when the engine is working under ordinary conditions, find the cause of the trouble and remedy it. The chances are that the difficulty lies in improper driving or carbonized cylinders. By reference to the proper division of this book each of the causes which contribute to an overheated radiator is treated and remedies suggested. No trouble can result from the filling of a heated radiator with cold water, provided the water system is not entirely empty, in which case the engine should be allowed to cool before the cold water is introduced.

#### How often should Water be put in the Radiator?

Several times a day in hot weather. The radiator at all times ought to be kept full or trouble is sure to follow. It is a good plan to make it a habit to fill the radiator always before starting the Tractor and whenever a stop is made for oil or fuel. The importance of keeping the radiator filled cannot be impressed too often upon the new driver. To remove the radiator cover for filling, unscrew the nut on top a few turns then push the cover back over the tank. (See Plate No. 13.)

#### Answer No. 50

#### Will the Radiator freeze in Winter?

As the circulation does not commence until the water becomes heated, it is necessary to use an anti-freezing solution in the circulating system in winter when the temperature is much below freezing point. In case any of the radiator tubes happen to be plugged or jammed they are bound to freeze and burst open if the driver undertakes to get along without using a non-freezing solution. Wood alcohol or denatured alcohol can be used to good advantage for a non-freezing solution.

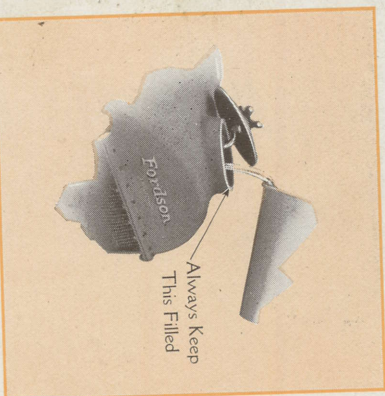
#### Answer No. 51

The following table gives the freezing points of solutions containing different percentages of alcohol:

20%	solution freezes at 15° above zero.
30%	solution freezes at 8° below zero.
50%	solution freezes at 15° below zero.

A solution composed of 60% water, 10% glycerine and 30% alcohol is commonly used, its freezing point being about 8 degrees below zero.

On account of evaporation fresh alcohol must be added frequently in order to maintain the proper solution. If a non-freezing solution is not being used in frosty weather, it is essential that the radiator be drained if the Tractor is left out during the night and refilled next morning.



Filling Radiator—Plate No. 13

**Answer No. 52****How about cleaning the Radiator?**

The entire circulating system should be thoroughly flushed out occasionally. Simply open the drain cock in front of the engine under the radiator and flush out the entire system by pouring water into the top tank from whence it will flow down through the tubes and also through the water jackets in the cylinder and out at the drain cock. Should the tubes become clogged inside and the water will not remove the obstruction, they can be cleared by means of a thin strip of soft copper wire or cane inserted through the filler hole. When the fins and tubes become clogged outside with chaff, seeds, dust, etc., they should be cleaned, because otherwise the air circulation is retarded.

**Answer No. 53****How are Leaks and Jams in the Radiator repaired?**

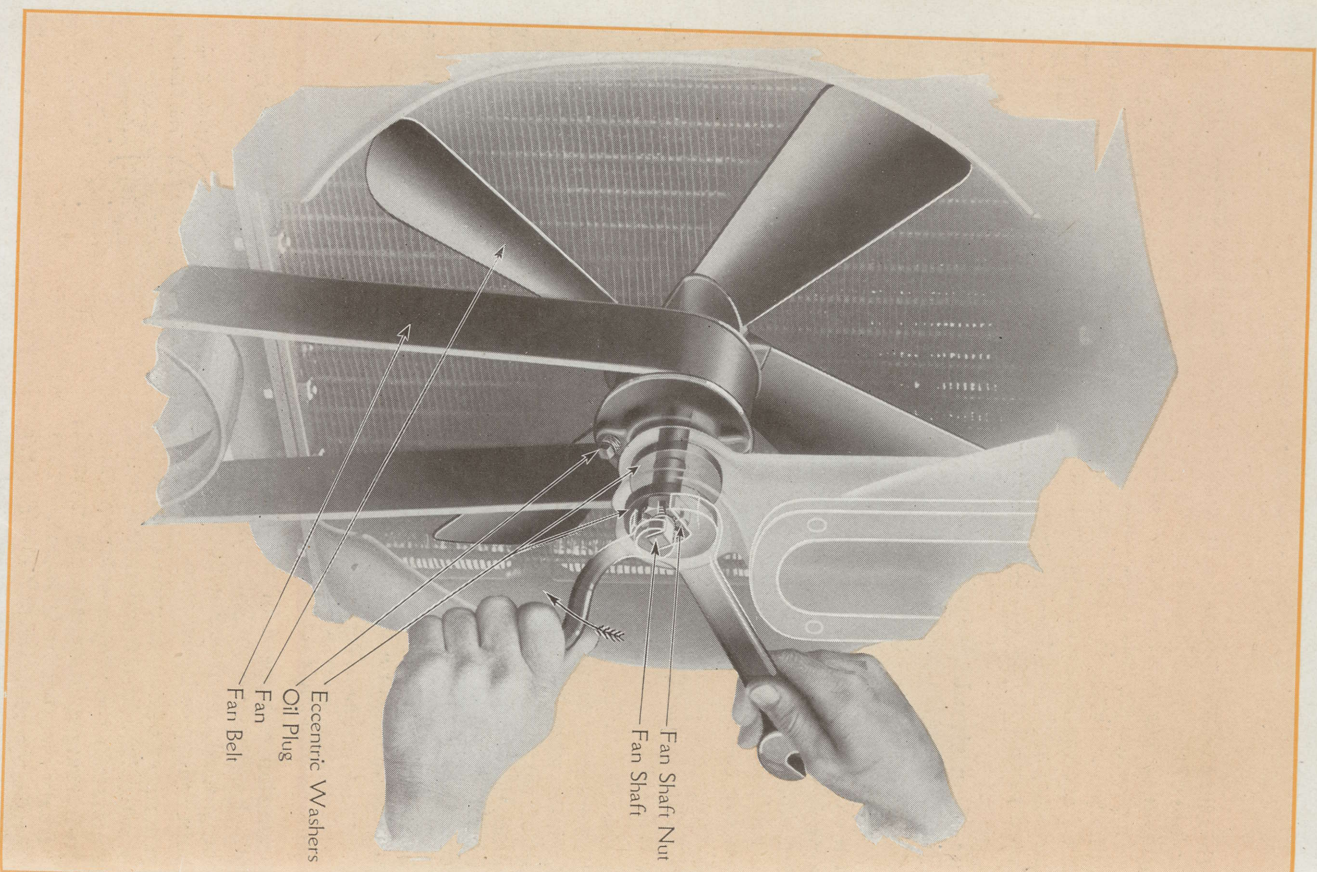
A small leak may be temporarily repaired by applying brown soap or white lead, but the repair should be made permanent with solder as soon as possible. A jammed radiator tube is a more serious affair. While the stopping of one tube does not seriously interfere with the circulation, it is bound to cause trouble sooner or later, and the tube will freeze in cold weather. Remove the radiator core and insert a new tube. If the entire radiator is badly choked or broken, it is advisable to install a new core.

**Answer No. 54****To remove Radiator—How?**

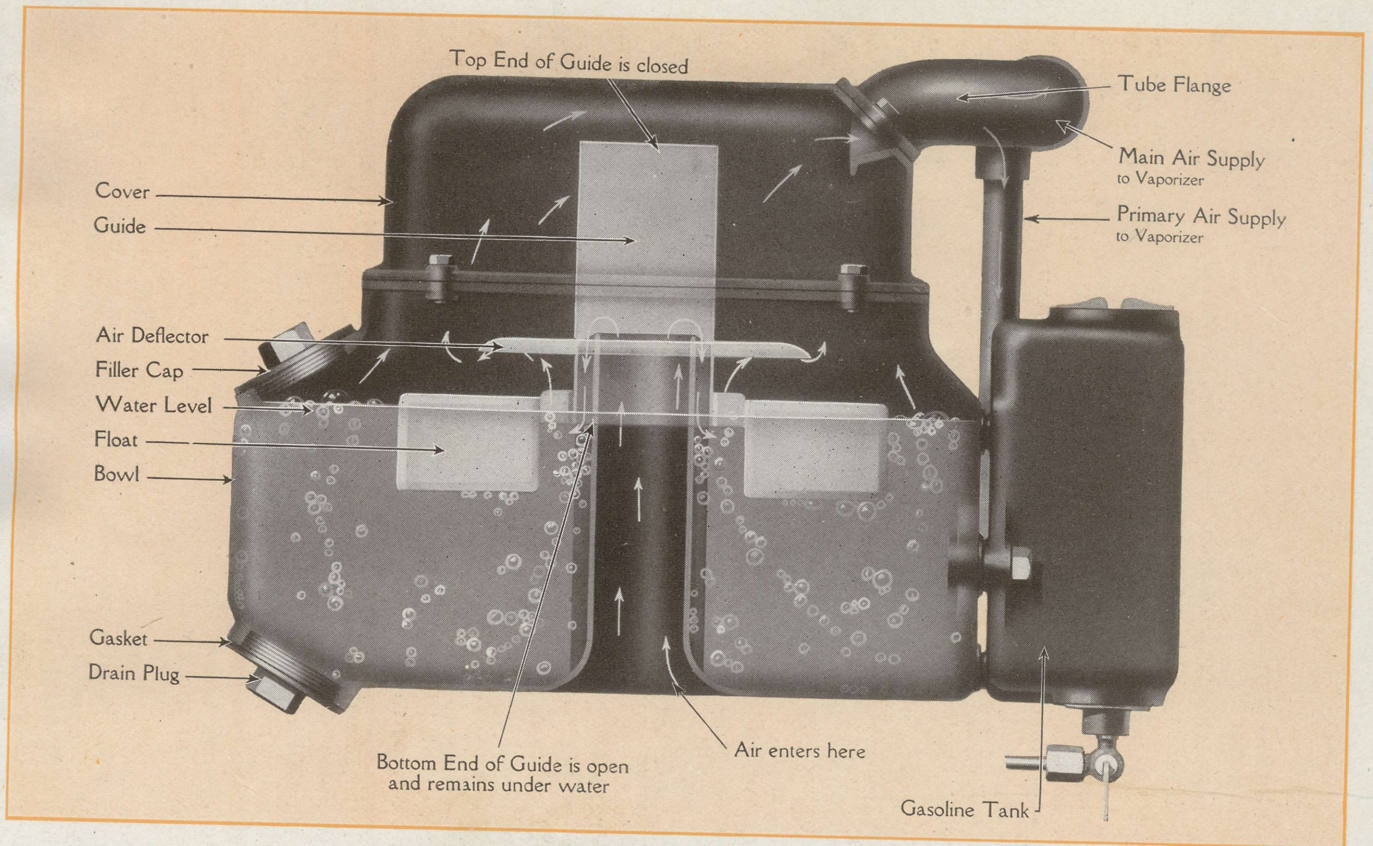
(1) Drain off water by opening cock under radiator. (2) Remove the fuel tank. (3) Remove the four bolts holding radiator connection to cylinder head. (4) Unscrew the three cap screws under the radiator which holds same to cylinder front cover, and lift off radiator. Be careful not to damage the copper asbestos gaskets used to keep the connections water tight.

**Answer No. 55****What attention does the Fan require?**

It should be lubricated once a week by unscrewing the oil plug and filling the hub with cup grease. The belt should be inspected frequently and tightened when necessary. To do this, remove the cotter pin holding the nut on rear end of the fan shaft; loosen the nut a little, then place a wrench on the square end of the shaft and turn until the belt is sufficiently tight, hold the wrench in this position and tighten up the nut, afterwards replacing the cotter pin. (See Plate No. 14.) Do not tighten the belt too much as it may cause undue wear on the bearings. The belt is sufficiently tight when it will just slip when the fan is pulled around by hand. Be sure there is always plenty of clearance between the fan blades and fan belt and that the fan shaft nut is kept tight.



Adjusting Fan Belt—Plate No. 14



Air Washer Showing Principle and Operation—Plate No. 15

## The Air Washer

**What is the purpose of the Air Washer?**

*Answer No. 56*

It serves two purposes. First: To remove all dust and solid matter from the air before it enters the cylinders of the engine, preventing excessive wear to the pistons and cylinder walls. Second: It moistens the air in its passage through the water and helps to avoid pre-ignition of the gas mixture in the cylinders.

**How does the Air Washer Operate?**

*Answer No. 57*

The suction of the pistons in the cylinders draws the air into the air washer through the central passage. It is then guided downward and into the water. In its passage through the water it gets rid of all dust and becomes moist. The air is then drawn off through the tube flange on top to the vaporizer. (See Plate No. 15.)

**What is the function of the Float?**

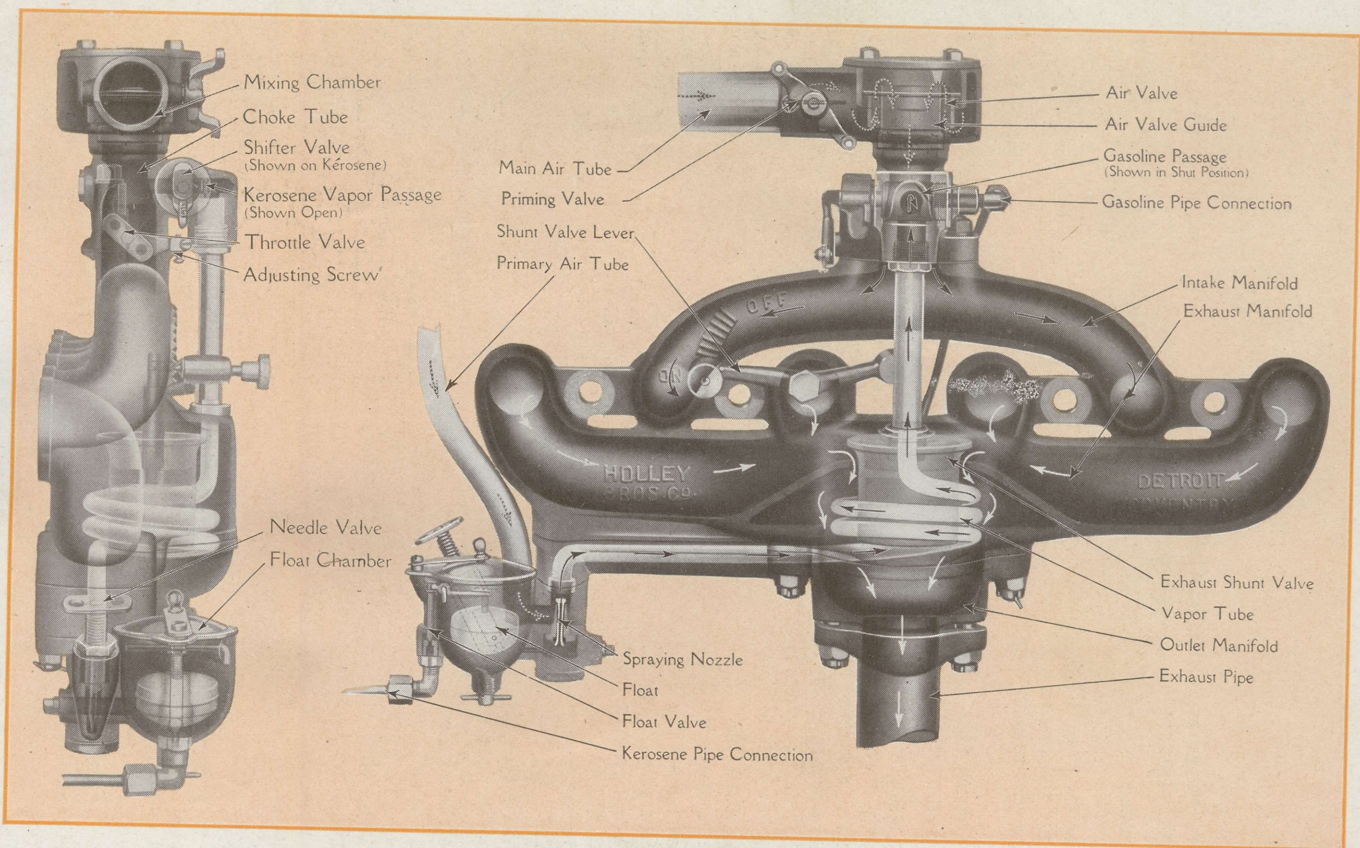
*Answer No. 58*

In order to get proper operation of the air washer, it is necessary that the air should enter the water at a certain distance below the water level. To compensate for the variation in the water level a float is used. The float then keeps the open end of the air guide at the proper distance under water.

**What attention does the Air Washer need?**

*Answer No. 59*

The dust collected from the air causes the water to become muddy and in a short time would prevent its proper operation. The water and mud should be removed every day by unscrewing the drain plug at the side and the air washer flushed out. Replace the plug and fill up to the level of the filler hole with clean water. If the water level is allowed to become low the guide fixed to the float cuts off the air supply, causing the engine to miss fire and stop.



The Vaporizer—Plate No. 16

## The Fuel System

What is the purpose of the Vaporizer?

*Answer No. 60*

It is the device in which the fuel is mixed with the correct proportion of air to form a "charge" which is sucked into the cylinders and then exploded by an electric spark. The vaporizer is so constructed as to allow for varying the proportions of air and fuel to meet conditions.

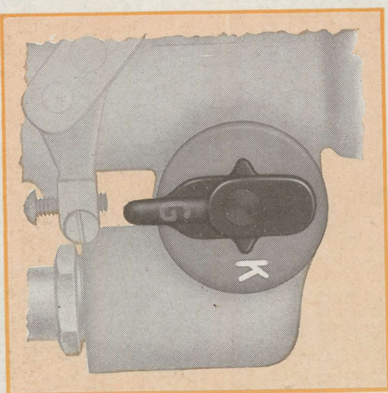
How does the Vaporizer work?

*Answer No. 61*

The tractor having two fuel systems, i. e., gasoline and kerosene, the vaporizer is also fitted with two devices to work with either. The view of the vaporizer on page 40 shows its operation.

When using gasoline for starting, the shifter valve is turned to the horizontal position, uncovering the letter "G." When in this position the gasoline enters the mixing chamber through a small passage drilled in the shifter valve. In the mixing chamber it is vaporized by the air drawn through the main air tube and past the priming valve. No heat is necessary to vaporize the gasoline.

After the engine has been running at least one minute, the shifter valve is turned to the vertical position, uncovering the letter "K." (See Plate No. 16-B.) The path of the kerosene mixture is shown on the illustration by black arrows, the black and white arrows indicate the path of the entering air, while the white arrows show the path of the exhaust gases after they leave the cylinder. The kerosene enters the float chamber through the float valve controlled by a metallic float. From the float chamber the fuel passes through a hole, regulated by a needle valve, to the spraying nozzle. When leaving this nozzle the fine spray is mixed with a small amount of air entering through the primary tube and is drawn up the heated vapor tube where it is completely vaporized and forms an extremely rich vapor. The heated vapor then passes through the shifter valve and enters the mixing chamber at the choke tube; there it is mixed with the balance of the air drawn through the main air tube. The mixture is then in the proper proportion



Shifter Valve on Kerosene—Plate No. 16-B

for perfect combustion and is sucked into the cylinders through the intake manifold. The volume of gas mixture entering the cylinders being regulated by the throttle valve just under the choke tube.

**What is meant by a "Lean" and a "Rich" mixture?**

*Answer No. 62*

A lean mixture has too much air and not enough fuel. A rich mixture has too much fuel and not enough air. A rich mixture will not only quickly cover the cylinder, pistons and valves with soot, but will also tend to overheat the cylinders, and is likewise wasteful of the fuel. It will often choke the engine and cause misfiring at low speeds.

The mixture should be kept as lean as possible without the sacrifice of any of the power of the engine. Too lean a mixture will result in back-firing through the vaporizer, for the reason that the gas burns slowly in the cylinder, and is still burning when the inlet valve opens again, causing the gas in the intake manifold to ignite. A rich mixture is shown by a heavy exhaust smoke. Proper mixture will cause very little smoke or odor.

**What is the purpose of the Air Valve?**

*Answer No. 63*

It is located at the top of the mixing chamber and automatically controls the quantity of air entering the vaporizer. It is so proportioned that while on its seat it admits the air necessary for idling and lifts gradually as the throttle valve is opened. It gives the correct proportion of air to the mixture at any speed and load.

**What is the purpose of the Exhaust Shunt Valve?**

*Answer No. 64*

It is used to regulate the amount of heat necessary to vaporize the kerosene in the vapor tube. When the valve lever is at the "On" position, the exhaust from the cylinder passes around the vapor tube giving the maximum heating effect. This is the position necessary for starting. When the lever is shifted to the "Off" position, the exhaust then passes through the center of the shunt valve and does not pass around the vapor tube. This gives a lower temperature to the mixture and should only be used when the Tractor is doing heavy pulling in hot weather. If the engine is left running without load the lever must be shifted to the "On" position and the spark fully retarded, otherwise the engine will smoke and the spark plugs will get dirty.

**What is the purpose of the Float?**

*Answer No. 65*

It automatically controls the flow of kerosene into the vaporizer. The float should close the valve when the kerosene reaches the proper level, indicated by a groove inside the float chamber. The level must not be above this line or more than one-eighth of an inch below.

**What makes the Vaporizer leak?**

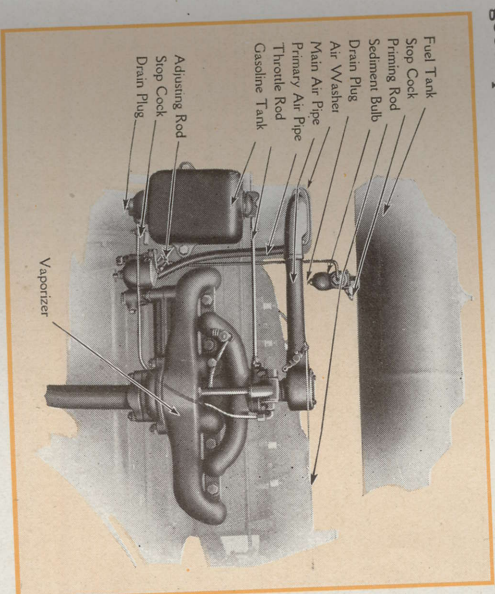
*Answer No. 66*

The flow of kerosene entering the vaporizer through the fuel pipe is automatically regulated by the float valve raising and lowering on its seat. Should any particle of dirt become lodged in the seat, which prevents the valve from closing, the kerosene will overflow and leak out upon the ground.

**How is the Vaporizer adjusted?**

*Answer No. 67*

The vaporizer has but one adjustment—the kerosene needle valve. The usual method of regulating is to start the engine on gasoline and run it for one or two minutes—keeping the shunt valve open. Turn down the needle valve lightly to its seat, then open it two and one-half turns. Turn the shifter valve on to kerosene, retard the spark lever to about the fourth notch and open the throttle until the engine is running at a good speed. The flow of kerosene should then be cut off by screwing the



The Vaporizer and Fuel Connections—Plate No. 17

turn to the left, particularly before the engine has been thoroughly warmed up.

**Can the Tractor be run on Gasoline instead of Kerosene?**

*Answer No. 68*

Yes, if desired gasoline can be used with results quite as good as those obtained when using kerosene. It should, however, be put into the fuel

needle valve down to the right until the engine begins to misfire, then gradually increase the kerosene supply by opening the needle valve until the engine reaches its highest speed and no smoke comes from the exhaust. (This usually takes half a turn.) After the best adjustment has been found the driver should observe the angle of the adjusting rod on the dash. In cold weather it will probably be found necessary to turn the adjusting rod one-quarter has been thoroughly

tank and used in exactly the same manner as kerosene. Running the tractor for a period of more than five minutes from the small gasoline tank may burn out the vapor tube.

**When there is water in the Vaporizer—What?**

*Answer No. 69*

The presence of water in the gasoline or kerosene tank, even in small amounts, will prevent easy starting and may cause the engine to misfire and stop. As water is heavier than either gasoline or kerosene, it settles to the bottom of the tank and into the sediment bulb. It is advisable to frequently drain the sediment bulb under the kerosene tank and also the gasoline tank by removing the pipe plug in the bottom.

During cold weather the water which accumulates in the sediment bulb may freeze, preventing the flow of kerosene to the vaporizer. Should this happen, wrap a cloth around the sediment bulb and keep it saturated with hot water for a short time. The water should then be drained off. In the event of water getting down into the carburetor and freezing, the same treatment may be applied.

**When there is dirt in the Vaporizer—What?**

*Answer No. 70*

The gasoline passage in the shifter valve being very small, a minute particle of grit or other foreign matter will clog up the hole and prevent the engine from starting. Should this occur, remove the shifter valve and clean out the small hole.

Should dirt get into the kerosene it may clog the spraying nozzle, causing the engine to misfire and slow down. The nozzle can be taken out and cleaned by removing the plug which screws into the float chamber just under the nozzle.

**If Engine runs too fast or chokes with Throttle retarded—What?**

*Answer No. 71*

If the engine runs too fast with throttle fully retarded, unscrew the throttle lever adjusting screw until the engine idles at suitable speed. If the engine chokes and stops when the throttle is fully retarded the adjusting screw should be screwed in until it strikes the boss, preventing the throttle from closing too far. When proper adjustment has been made, tighten the lock screw so that the adjustment will not be disturbed.

## The Ignition System

*Answer No. 72*

**What is the purpose of the Ignition System?**

It furnishes the electric spark which explodes the charge in the combustion chamber, thus producing the power which runs the engine. The spark lever placed on the dash controls the instant at which the charge be correctly placed in the cylinder. It is important that the charge be correctly ignited at the proper time, in order to obtain satisfactory results in running the Tractor.

*Answer No. 73*

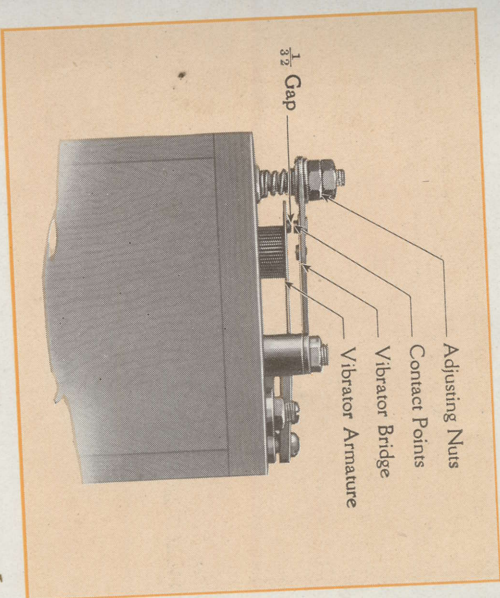
**How does the Magneto generate the Current?**

The magneto is an integral part of the engine, consisting of two sections, one attached to and rotating with the flywheel, and the other fastened to the cylinder casting. In revolving at the same rate of speed as the engine, the sixteen magnets on the flywheel passing the stationary coil spools create an alternating low tension electric current in coils of wire which are wound around spools fastened to the stationary part of the magneto, and is carried from these coils to the magneto connection wire leading to the coil box on the side of the engine. (See Plate No. 19.)

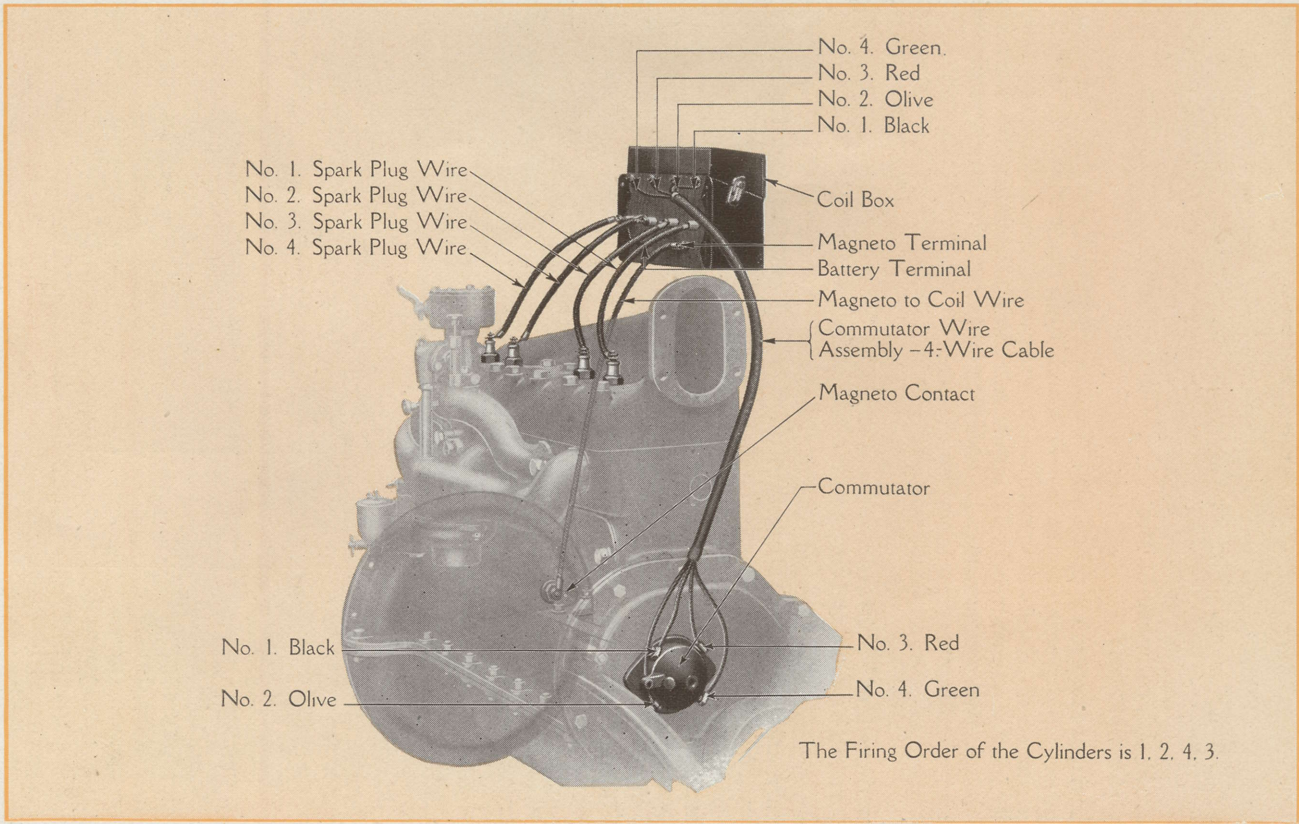
*Answer No. 74*

**How is the Coil Vibrator adjusted?**

The coil unit is properly adjusted when it leaves the factory and should not be disturbed unless to install new points or to reduce the gap between the points, which may have increased from wear. If the points are pitted, they should be carefully filed flat with a fine double-faced file and the adjusting nut turned down so that when the spring is held down the gap between the points will be a trifle less than  $\frac{3}{16}$  of



Coil Vibrator—Plate No. 18



The Wiring System—Plate No. 19

an inch. Then set the lock nut so that the adjustment cannot be disturbed. Do not bend or hammer on the vibrators as this would affect the operation of the cushion spring on the vibrator bridge and reduce the efficiency of the coil. (See Plate No. 18.)

**Answer No. 75**

**How is a Weak Unit detected?**

With the vibrators properly adjusted, if any particular cylinder fails to fire or seems to develop only a weak action, change the position of the unit to determine if the fault is actually in the unit. The first symptom of a defective unit is the buzzing of the vibrator with no spark at the plug. Remember that a loose wire connection, faulty spark plug or worn commutator may cause irregularity in the running of the motor. These are the points that should be considered before laying the blame on the coil.

**Answer No. 76**

**How may short-circuit in Commutator Wiring be detected?**

Should the insulation of the primary wires (running from coil to commutator) become worn to such an extent that the copper wire is exposed—the current will leak out (i. e., short-circuit) whenever contact with the cylinder block or other metal parts is made. A steady buzzing of one of the coil units when the engine is running will indicate a "short" in the wiring. When driving the tractor the engine will suddenly lag and pound on account of the premature explosion. Be careful not to crank the engine downward against compression when it is in this condition, as the "short" is apt to cause a vigorous kick-back.

**Answer No. 77**

**Does the Coil Adjustment affect starting?**

Yes. When the vibrators are not properly adjusted more current is required to make and break the contact between the spark plug points. result, at cranking you do not get a spark between the spark plug points. Do not allow the contact points to become "ragged," otherwise they are apt to stick and cause unnecessary difficulty in starting and when running they may cause an occasional "miss" in the engine.

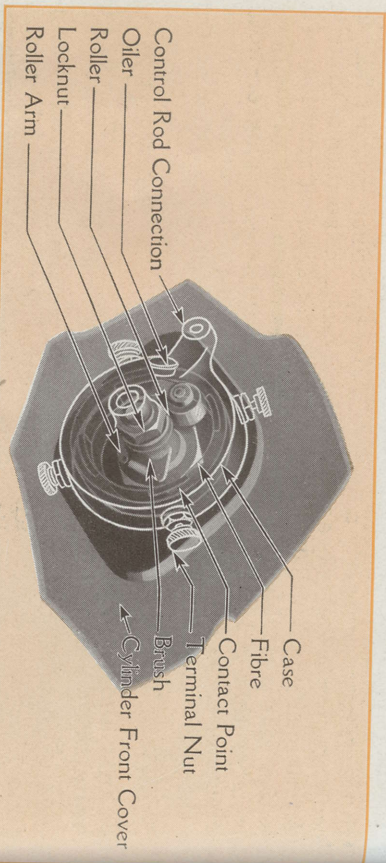
**Answer No. 78**

**What is the purpose of the Commutator?**

The commutator (or timer) determines the instant at which the spark plugs must fire. It effects the "make and break" in the primary circuit. The grounded wire on the magneto allows the current to flow through the metal parts to the metal roller in the commutator. Therefore, when the commutator roller in revolving touches the four commutator contact points, to each of which is attached a wire connected with a coil unit,



an electrical circuit is passed through the entire system of primary wires. This circuit is only momentary, however, as the roller passes over the contact point very rapidly and sets up the circuit in each unit as the roller touches the contact point connected with that unit. The commutator should be kept clean and well oiled at all times.



The Commutator—Plate No. 20

### What about the Spark Plugs?

One is located at the top of each cylinder and can easily be taken out with a spark plug wrench after the wire connection is removed. The high voltage current flows out of the secondary coils in the coil box, and in reaching the contact points in each spark plug it is forced to jump a  $\frac{3}{8}$  of an inch gap, therefore forming a spark which ignites the charge in the cylinders. If the spark plugs become carbonized or sooted, the high tension current instead of jumping between the points of the spark plugs will pass through the carbon accumulation directly to the metallic shell. This will cause the cylinder to misfire. When in this condition the plugs should be removed and cleaned. (See Answer No. 41.)

### What are the indications of Ignition trouble?

#### *Answer No. 80*

The uneven sputter and bang of the exhaust means that one or more cylinders are exploding irregularly or not at all, and that the trouble should be promptly located and overcome. Misfiring, if allowed to continue, will in time injure the engine and entire mechanism. A good driver will be satisfied only with a soft, steady purr from the exhaust. If anything goes wrong, stop and fix it immediately if possible.

### How can one tell which Cylinder is missing?

#### *Answer No. 81*

This is done by manipulating the vibrators on the spark coils. Open the throttle until the engine is running at a good speed, and then hold the two outside vibrators (No. 1 and No. 4) with the fingers so down the two outside vibrators (No. 2 and No. 3) running. If they cannot buzz. This cuts out the two corresponding cylinders (No. 1 and No. 4), leaving only No. 2 and No. 3 running. If they explode regularly it is obvious the trouble is either in No. 1 or No. 4. Relieve No. 4 and hold down No. 2 and No. 3, and also No. 1; if No. 4 cylinder explodes evenly it is evident the misfiring is in No. 1. In this manner all of the cylinders in turn can be tested until the trouble is located. Examine both the spark plugs and the vibrator of the missing cylinder.

### If the Coil and Plugs are right what else might cause misfiring?

#### *Answer No. 82*

The trouble is probably due to an improperly seated valve, worn commutator, or short-circuit in the commutator wiring. Weakness in the valves may easily be determined by lifting the starting crank slowly the length of the stroke of each cylinder in turn, a strong or weak compression in any particular cylinder being easily detected. It sometimes happens that the cylinder head gaskets (packing) become leaky, permitting the gas under compression to escape, a condition that can be detected by running a little lubricating oil around the edge of the gasket and noticing whether bubbles appear or not.

### Does a worn Commutator ever cause misfiring?

#### *Answer No. 83*

Yes. If misfiring occurs when running at high speeds, inspect the commutator. The surface of the circle around which the roller travels (see Plate No. 20) should be clean and smooth, so that the roller makes a perfect contact at all points. If the roller fails to make a good contact on any one of the four contact points, its corresponding cylinder will not fire. Clean these surfaces, if dirty. In case the fibre contact points and roller of the commutator are badly worn, the most satisfactory remedy is to replace them with new parts. The spring should be strong enough to make a firm contact between the roller points even if they are worn or dirty.

### How is the Commutator removed?

#### *Answer No. 84*

Remove cotter pin from commutator control rod and detach latter from commutator. Loosen the nut which holds the commutator spring to the stud; this will release the commutator case, and this part can be readily

removed. Unscrew lock nut; withdraw steel brush cap and lift out the retaining pin. The brush can then be removed from the camshaft.

In replacing the brush care must be exercised to see that it is replaced so that the exhaust valve on the first cylinder is closed when the brush points upward. This may be ascertained by removing the valve door and observing the operation of No. 1 valve.

In replacing commutator case be careful to see that the lug connection points towards the right-hand side of the Tractor and is horizontal. If the wires have been disconnected, be careful to replace them in the correct order. It is better to remove wire and commutator case together.

### Does cold weather affect the Commutator?

#### Answer No. 85

It is a well-known fact that in cold weather even the best grades of lubricating oil are apt to congeal to some extent. If this occurs in the commutator, it is possible that it may prevent the roller from making perfect contact with the contact points embedded in the fibre. This, of course, makes difficult starting, as the roller arm spring is not stiff enough to brush away the film of oil which naturally forms on the contact segment. To overcome this, as well as any liability of the contact points to rust, we recommend a mixture of 25 per cent kerosene with the commutator lubrication oil, which will thin it sufficiently to prevent congealing or freezing. Probably in starting the engine in cold weather only one or two cylinders will fire for the first minute or so, which indicates that the timer is in the condition described above, and as a consequence a perfect contact is not being made on each of the four segments.

### How is the Magneto removed?

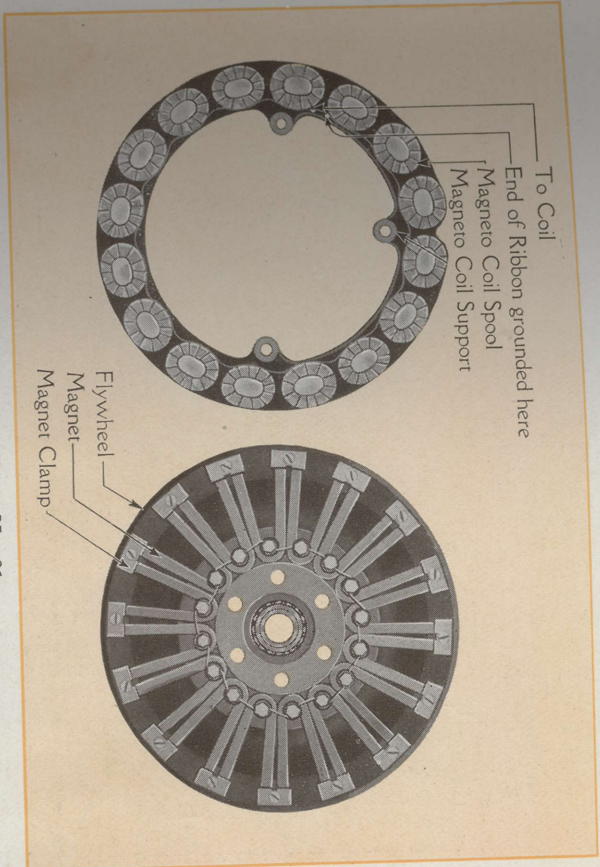
#### Answer No. 86

(1) Disconnect the engine from the rear of the Tractor. (See Answer No. 44). (2) Remove crank case. (3) Remove the six nuts from the studs holding the flywheel to the crank shaft. (4) Remove flywheel. You will then have access to the magneto and entire magneto mechanism. In taking out these parts or any parts of the Tractor, the utmost care should be taken so that the parts are so marked that they may be replaced properly.

### When the Magneto gets out of order—What?

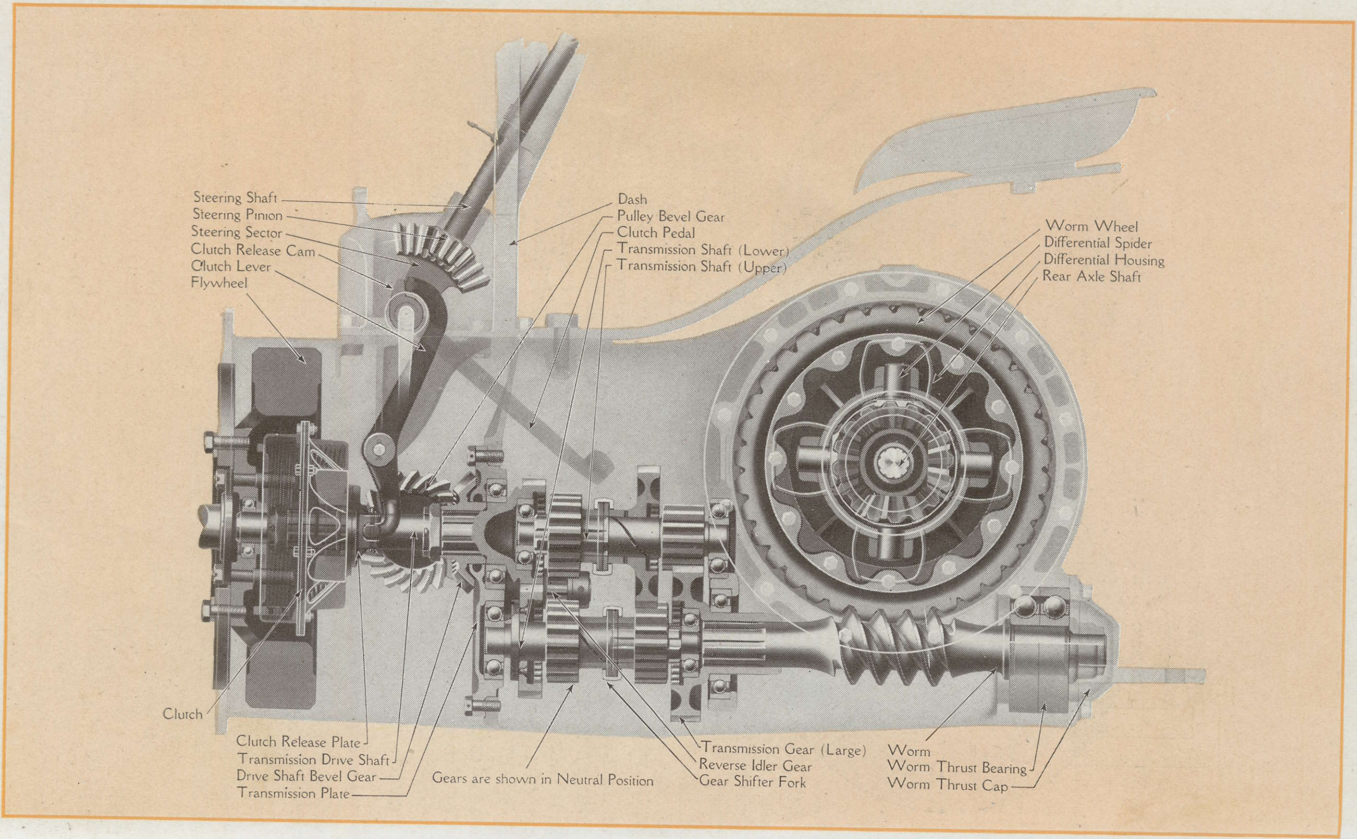
#### Answer No. 87

The magneto is made of permanent magnets and there is very little likelihood of their ever losing their strength, unless acted upon by some outside force. For instance, the attachment of a storage battery to the magneto terminal will demagnetize the magneto. Should this occur, it is not advisable to try to recharge them but rather install a complete set of new magnets.



The Magneto—Plate No. 21

The new magnets will be sent on a board in exactly the same manner as they should be when installed on the flywheel; great care should be taken in assembling the magnets and lining up the magneto, so that the faces of the magnets are even and are separated from the surface of the coil spool  $\frac{1}{8}$  inch. The magneto is often blamed when the trouble is a weak current caused by waste or other foreign matter accumulating under the magneto contact spring, which is screwed into the side of the cylinder block; this should be taken out and the foreign substance removed.



The Fordson Transmission and Clutch Assembly—Plate No. 22

## The Transmission

Answer No. 88

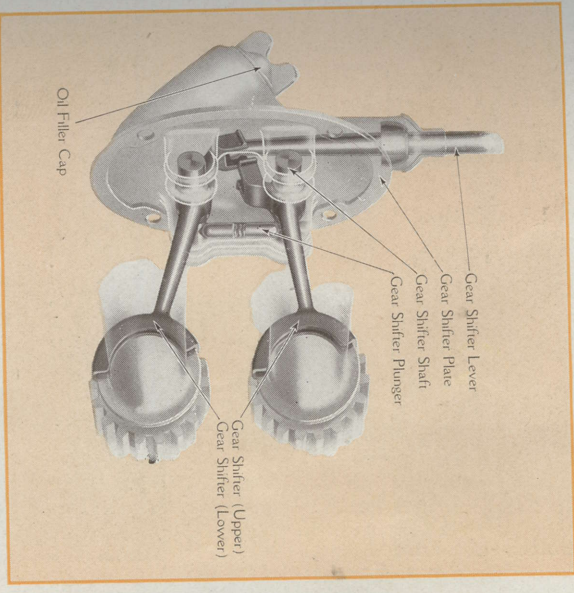
**What is the function of the Transmission?**  
 It is that part of the Tractor which lies between the engine and the rear axle. It is the device by which the Tractor is enabled to move at different speeds to suit the various working conditions, and by it the Tractor is reversed.

**How does the Transmission operate?**

By moving the sliding gears on the two transmission shafts it brings different sets of gears into action.

Four different speeds can be obtained, three forward and one reverse. As shown on Plate No. 22 the gears are in the neutral (central) position. In this position no power is transmitted, even though the clutch is engaged. It is from this position that all gear changes are made.

The four views on Plate No. 24 show clearly the different working positions of the sliding gears and the sets of gears they engage. The heavy line indicates the path of the power transmitted. The gear changes are made by the movement of the gear shifter lever on the left-hand side of the Tractor.

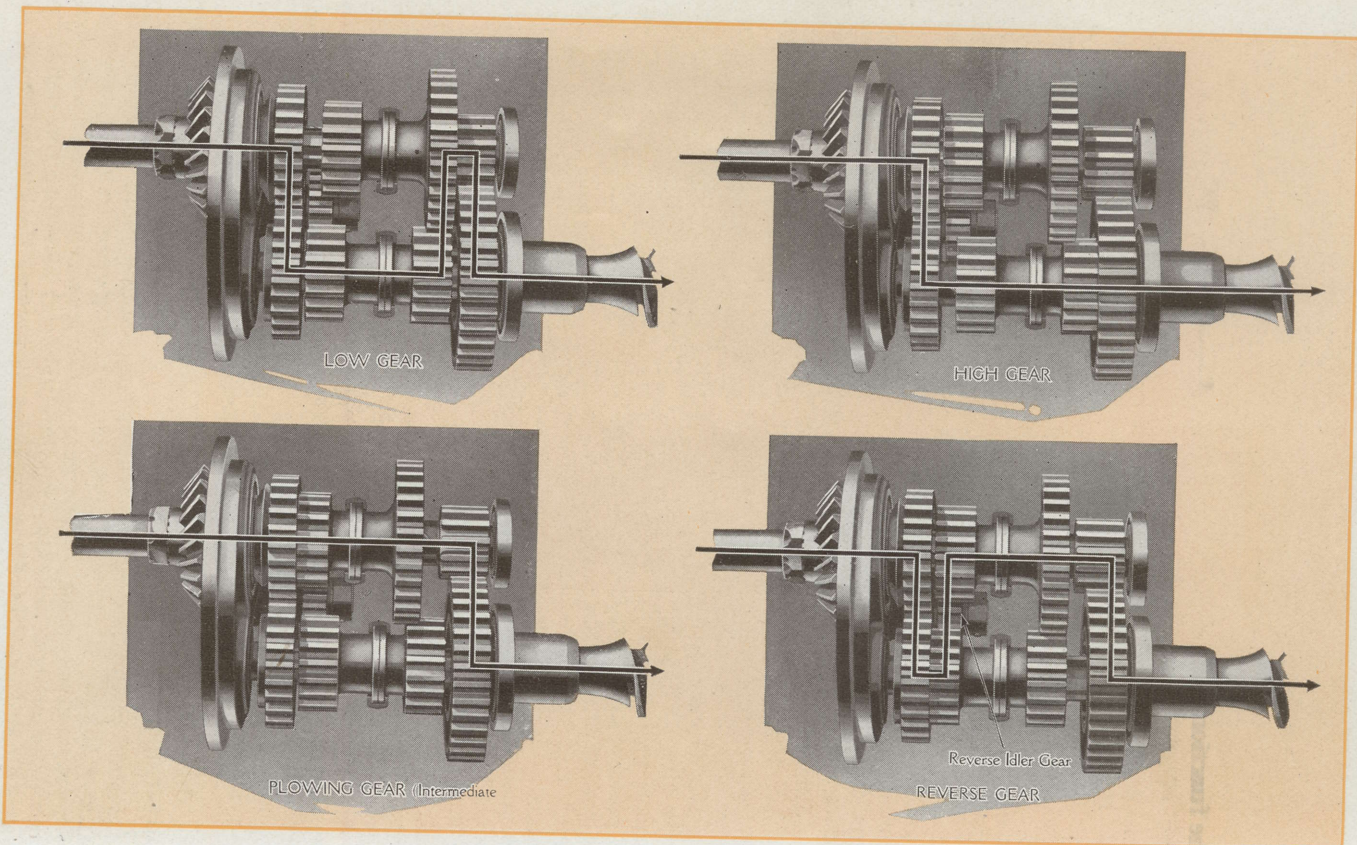


The Gear Shifter Assembly—Plate No. 23

**How does the Gear Shifter operate?**

It is bolted to the side of the transmission housing and is fitted with two gear shifters which hold in place the sliding gears on the upper and lower transmission shafts. The gear shifter lever when moved sideways—from the neutral position—fits into the end of either the upper or lower gear shifter. (See Plate No. 23). By moving the lever when it is so

Answer No. 90



View showing the four positions and different sets of gears that are engaged—Plate No. 24

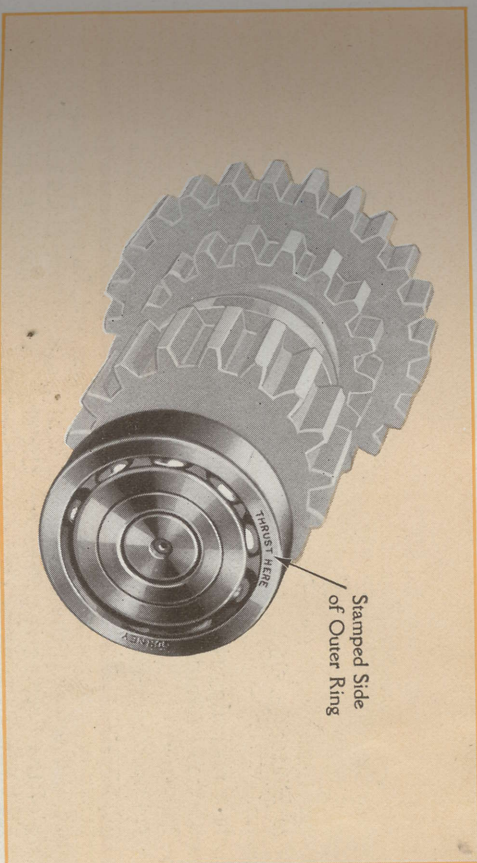
placed it slides the gears along the shaft causing them to mesh. A spring plunger holds the gear shifters in the position to which they are shifted while an interlocking pin prevents accidental engagement of more than one set of gears.

**DO NOT ATTEMPT TO SHIFT GEARS BEFORE DISENGAGING THE CLUTCH.**

### Answer No. 91

**What attention does the Transmission require?**

As the transmission gears are hardened and the shafts run on ball bearings, there will be practically no wear if they are kept free from grit and well supplied with a good grade of oil. No adjustments are provided or are necessary. If the bronze bushing in the reverse gear wears in time, it should be replaced by a new bushing. If an attempt is made to change gears without first disengaging the clutch it will chip or break the ends of the gear teeth. Should this happen, the transmission should be taken apart and washed out with kerosene to remove any particles of steel which would damage the gears or bearings.



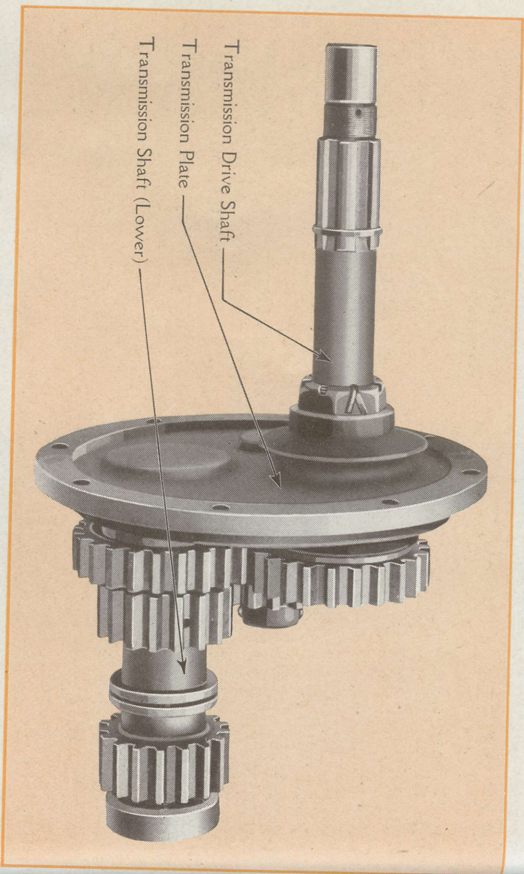
Replacing Ball Bearings—Plate No. 25

**How are the Transmission Gears removed?**

### Answer No. 92

After removing the rear half of the Tractor from the engine as described in Answer No. 44, proceed as follows: (1) Drain the oil from the transmission housing by removing the drain plug just under the gear shifter cover. (2) Remove the gear shifter cover by unscrewing the

four cap screws holding it to the transmission housing. (3) Unscrew the clutch drum nut from the end of the transmission drive shaft and draw off the clutch. (4) Remove the eight cap screws holding the transmission plate; then by pulling on the drive shaft, the plate together with the



Showing the Transmission Plate and Gears as they are removed in one unit—Plate No. 26

lower transmission shaft can be removed from the housing in one unit. (See Plate No. 26.) (5) Remove the upper transmission shaft with its gears.

Before replacing the gears in the housing clean them well with kerosene; the housing should also be flushed out with kerosene to remove any grit or gummed oil. Also clean and examine all ball races. If it has been found necessary to remove the ball bearings, be very careful in assembling them on the shafts again, that they are replaced in exactly the same position as before removing; i. e., the stamped face of the outer rings must face towards the ends of the shaft. (See Plate No. 25.) The inner ring of the bearing is pressed on the shaft while the outer ring slips into its seat when the parts are being assembled.

**What is the purpose of the Clutch?**

If the engine was connected directly to the transmission and through it to the rear wheels, it would be impossible to engage or disengage the gears without breaking the teeth. To overcome this difficulty the engine is connected to the transmission drive shaft by means of the clutch, the frictional engagement of which allows the engine to pick up its load gradually and start the tractor without jolt or jar.

## The Clutch

*Answer No. 93*

**How does the Clutch operate?**

By the frictional engagement between two sets of plates, forced together by springs. The driving set of plates fit on six studs fixed in the flywheel; the set of driven plates fit six keys in the clutch drum which is fixed on the drive shaft. When the clutch is engaged—by allowing the clutch pedal to rise—the six springs force all the plates together, the resulting friction causing them to revolve as one solid unit. When the clutch is disengaged—by pressing down on the clutch pedal—the spring pressure on the plates is released, allowing them to slip past each other, thus permitting the engine to run free. Plate No. 27 shows the relative assembling positions of these parts. The clutch is lubricated by the oil splashed up by the flywheel. No adjustment is necessary in the clutch. If it slips when working, it will be due to weak springs and they should be replaced by new ones. If the clutch sticks and does not release easily it should be taken apart and examined; bent clutch plates usually cause this trouble. If any of these be found they should be removed and replaced by new ones.

*Answer No. 94*

**How is the Clutch controlled?**

By the pedal on the right-hand side of the Tractor. It acts on the clutch release plate causing the clutch housing to move in a forward direction. This releases the spring pressure from the clutch plates.

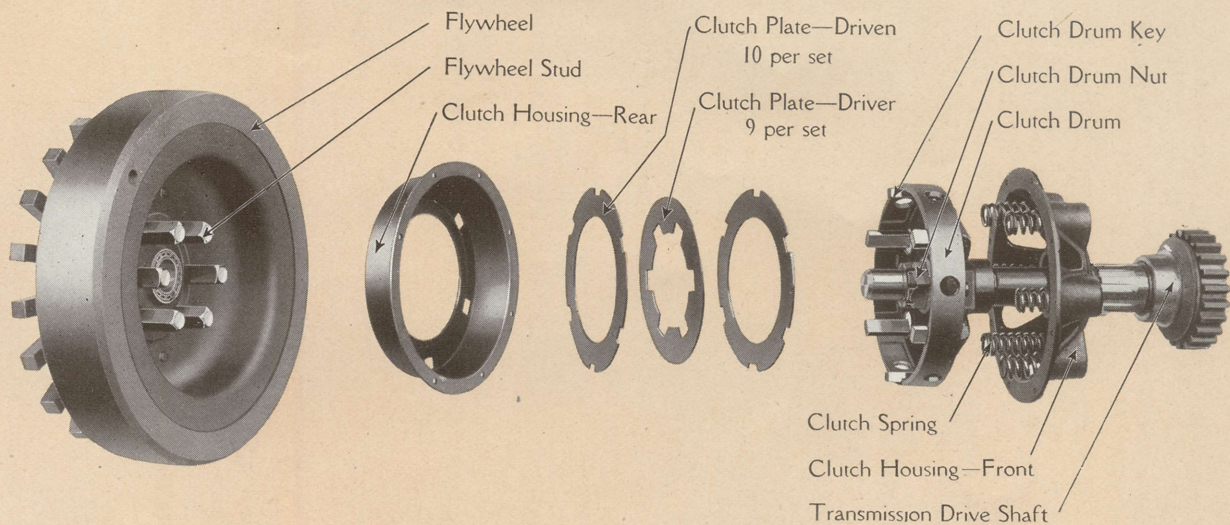
*Answer No. 95*

After engaging gears always let the pedal rise gently and when driving do not rest your foot on the pedal, as it will cause unnecessary friction and wear the clutch release plate.

**How is the Clutch removed?**

Remove the engine from the rear part of the Tractor. (See Answer No. 44.) Remove the nut on the end of the drive shaft which holds the clutch in place and pull the clutch off. The clutch can then be taken apart by removing the eight bolts holding the front and rear hous-

*Answer No. 96*



Clutch Parts in their Relative Assembling Positions—Plate No. 27

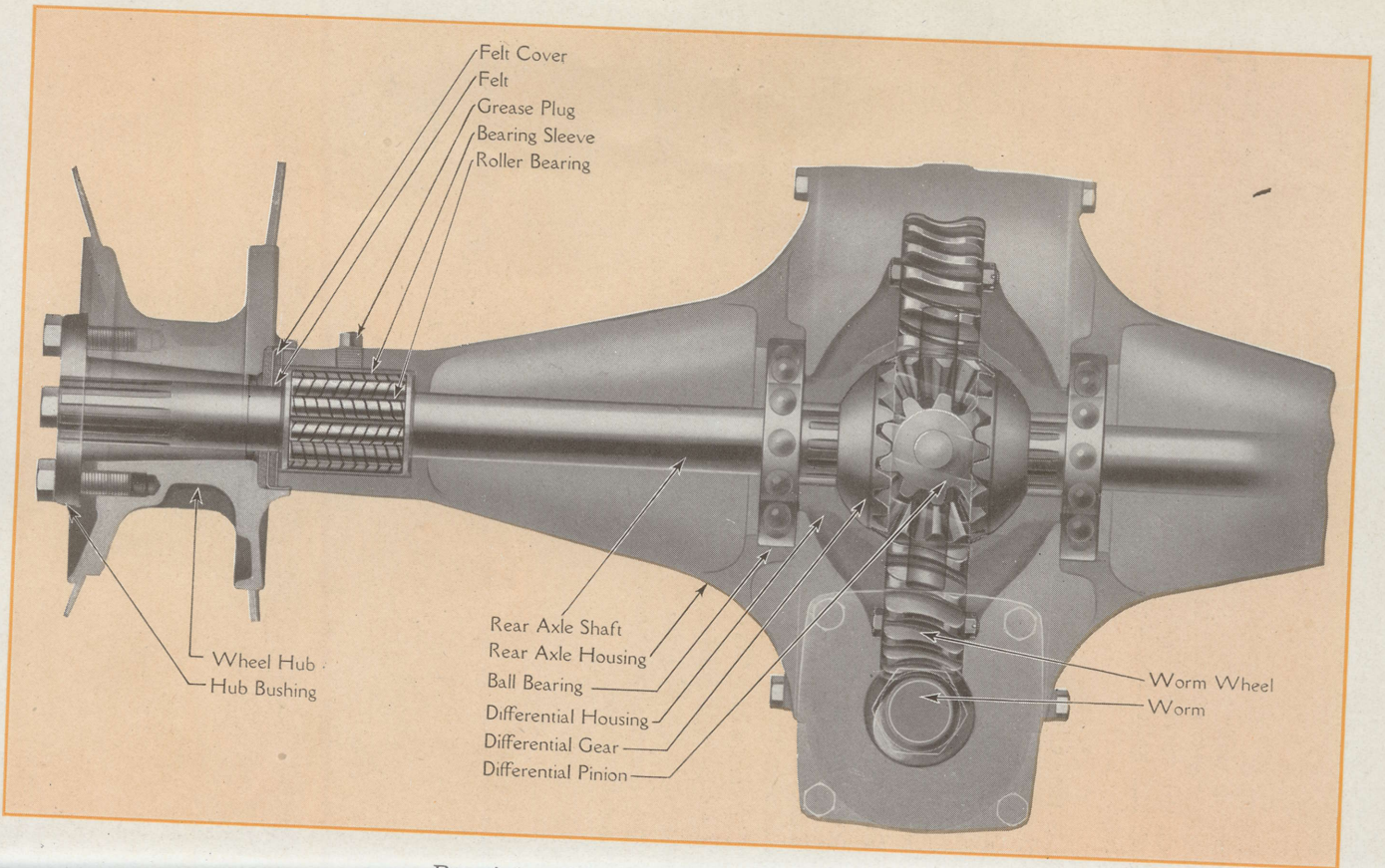
ings together. In assembling, oil the plates well and be sure they are replaced in their proper order; that is, the driving and the driven plates must alternate, and the two end plates must be driven plates (have the slots on the outside edge). When replacing the clutch on the drive shaft, be sure the split ring is in place and that the clutch drum fits over it properly.

### Answer No. 97

#### How is the Clutch Pedal adjusted?

After the Tractor has been in use for some time the wear on the clutch release plate may cause the clutch pedal to strike the foot rest, before the clutch is fully disengaged. When this happens it can be adjusted in the following manner:

- (1) Remove the air washer.
- (2) Remove the dash.
- (3) Take out the pin holding the steering gear sector on the steering arm (inside the dash) and remove the steering arm.
- (4) The cam which fits on the end of the clutch pedal can now be removed.
- (5) Advance the cam one or two notches to the right and replace, being sure that the split ring, which it holds, is in place.
- (6) Try out the new position of the clutch pedal and if it is satisfactory replace the dash.



Rear Axle and Wheel Assembly—Plate No. 28

## The Rear Axle

**What about the Rear Axle?**

*Answer No. 98*

It applies the power, received through the transmission, to the rear wheels. The principal parts of the assembly are the worm and worm wheel, the differential, the axle shafts, and bearings. (See Plate No. 28.) It is lubricated by the same oil bath as the transmission.

**What is the purpose of the Differential?**

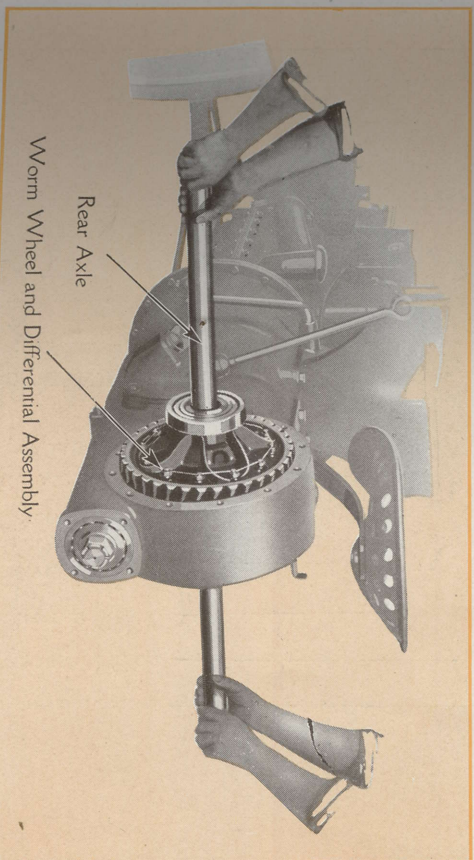
*Answer No. 99*

It is the set of bevel gears installed in the center of the rear axle and compensates for difference in speed of rotation of the two rear wheels when making a turn.

**How is the Rear Axle Assembly removed?**

*Answer No. 100*

(1) Drain the oil from the transmission housing. (2) Jack up the rear end of the Tractor and remove the rear wheels. (See Answer No. 103.) (3) Remove the twelve cap screws from each of the rear axle housings and draw them off. (4) The rear axles and differential can then be lifted out in one unit. (See Plate No. 29.) The worm wheel and differential housings can then be taken apart by removing the twelve bolts holding them together. The relative assembly positions of these parts is shown in Plate No. 30.



Removing Rear Axle Assembly—Plate No. 29

Answer No. 101

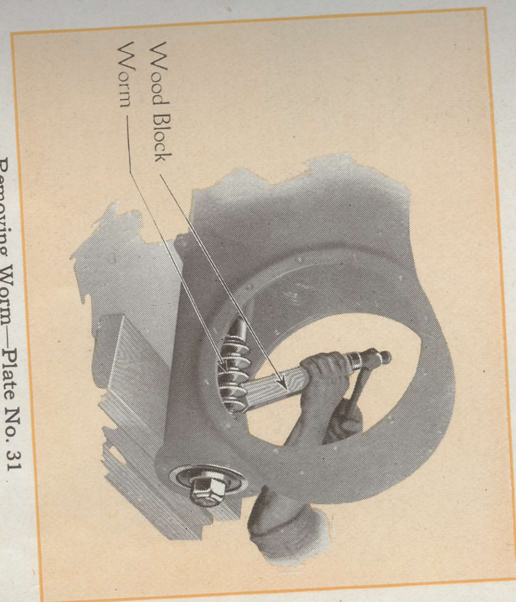
How is the Worm removed?

Remove drawbar cap by unscrewing the four bolts holding it to the transmission housing.

Push the tractor forward and the thrust on the worm will force it out.

To replace, insert the worm and turn to the right, screwing it in as far as it will go, then push the tractor slowly backward. If worm does not go in properly, put the tractor in low speed

(see Answer No. 16), then crank motor slowly (switch turned off), at the same time moving the tractor forward. In this way the splines of the worm will be drawn into place. splines of the transmission gear, and the worm will be drawn into place. If worm wheel has been removed insert a block of wood through the rear of the housing, and the worm can be gently tapped out through the rear. (See Plate No. 31.)



Removing Worm—Plate No. 31

Answer No. 102

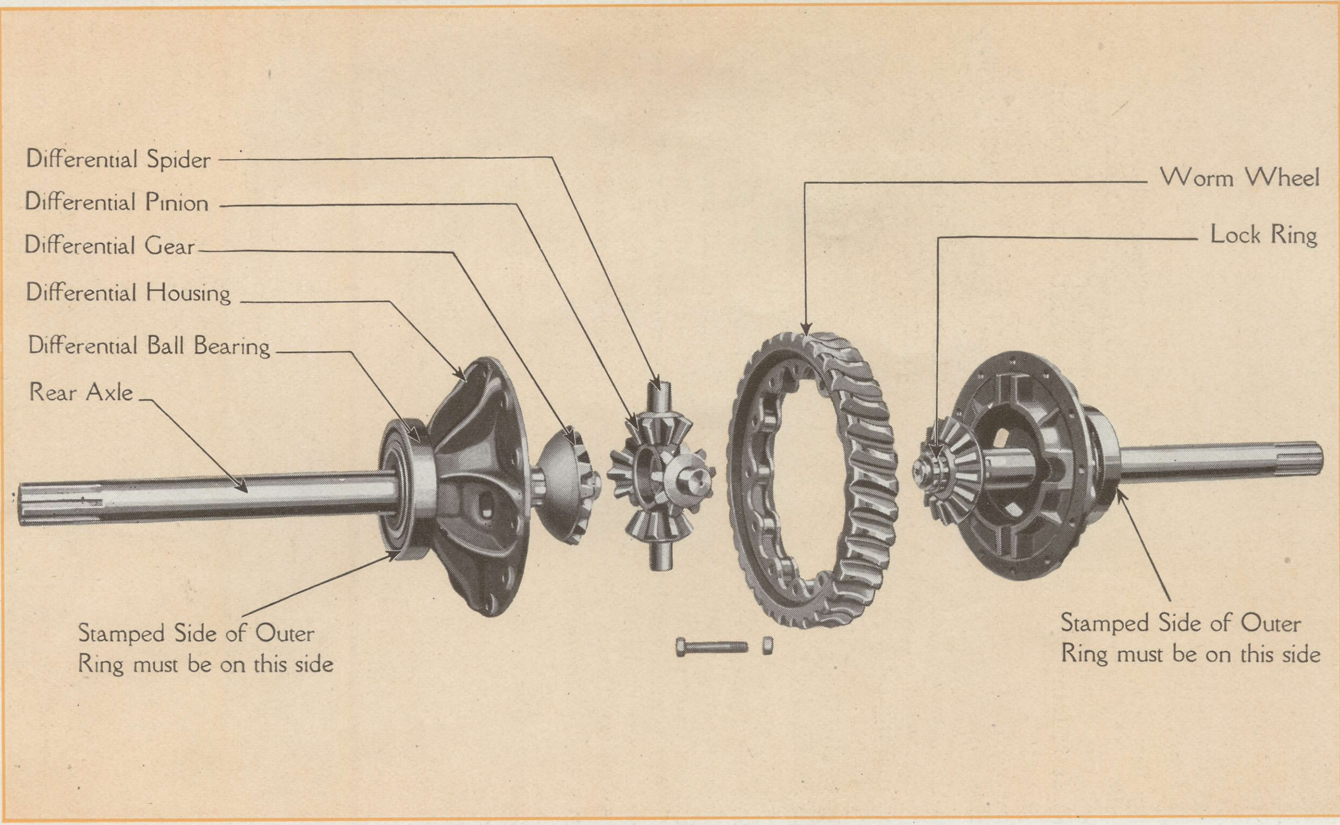
How is the Differential Gear removed from the Rear Axle Shaft?

(1) Press the gear back along the shaft until the split locking ring is exposed. (See Plate No. 32.) (2) Remove the ring and press the gear off the shaft.

Answer No. 103

How are the Rear Wheels removed?

(1) Jack up the rear axle until the wheel is clear of the ground. (2) Remove the four bolts from the hub using the box wrench and bar sent in the tool box. (3) Then insert two of the bolts in the tapped (threaded) holes of the rear wheel bushing, tighten up the bolts evenly until the wheel is free on the bushing. (See Plate No. 33.) (4) Apply the hooked end of the bar to the flange and force the bushing off the axle. When replacing the wheel, the four screws are inserted in their respective holes and tightened up equally; the ends of the rear axle being kept flush with the outside of the bushing.



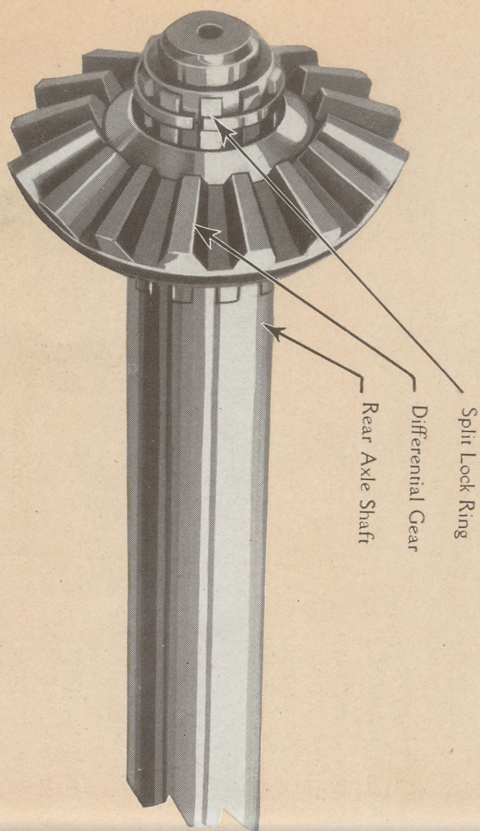
Differential and Rear Axle in their Relative Assembling Positions—Plate No. 30



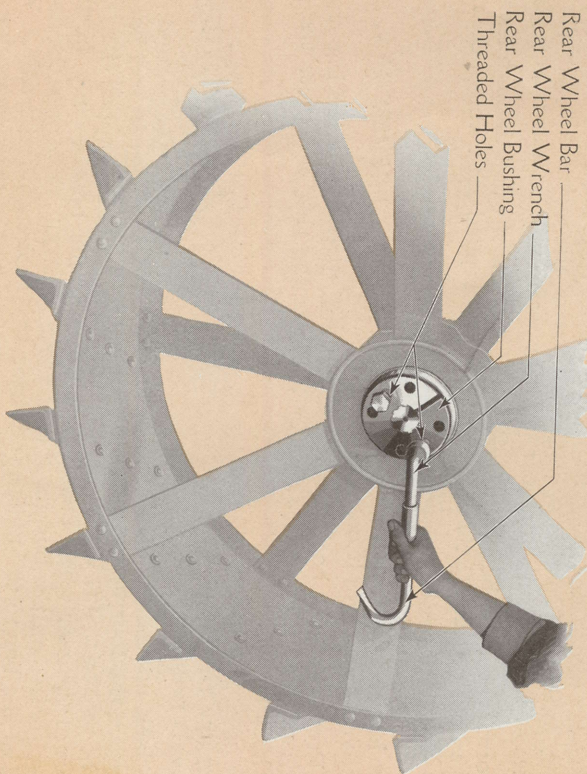
**Answer No. 104**

**What attention do the Roller Bearings require?**

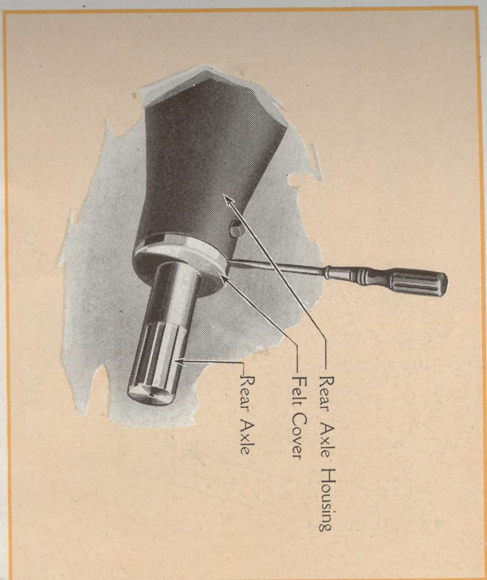
The roller bearings at each end of the rear axle housing should be well lubricated by occasionally removing the plugs and inserting grease. The felt washers which protect them from dust and dirt need replacing when dirty or badly worn. To do this remove the rear wheel. (See Answer No. 103.) The felt washer is inside the felt cover on the end of the housing. This can be removed as shown on Plate No. 34. When replacing the felt cover, the edge should be bent into the groove in the end of the rear axle housing, to prevent it from coming off.



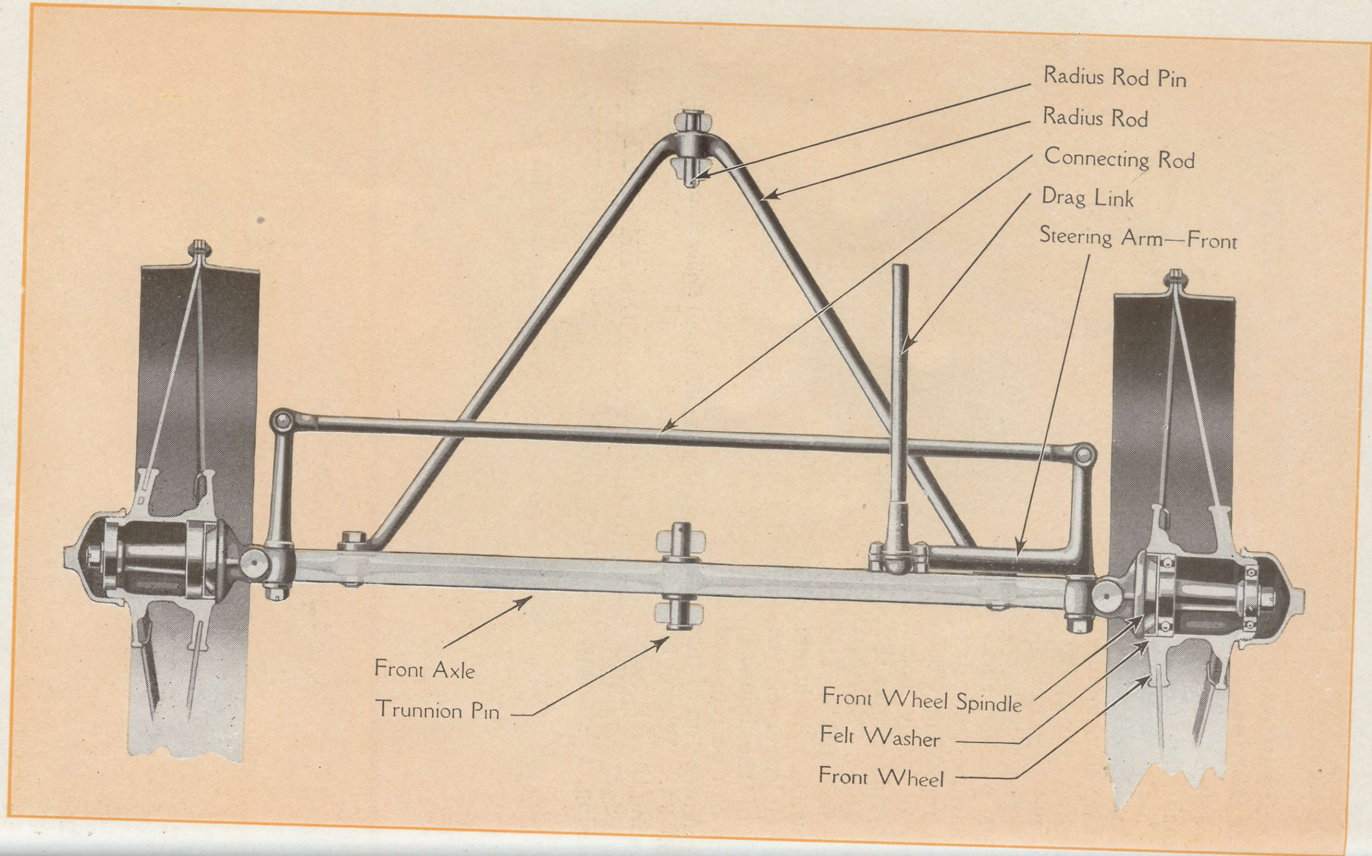
Removing Differential Gear—Plate No. 32



Removing Rear Wheel—Plate No. 33



Removing Rear Axle Felt and Roller Bearing—Plate No. 34

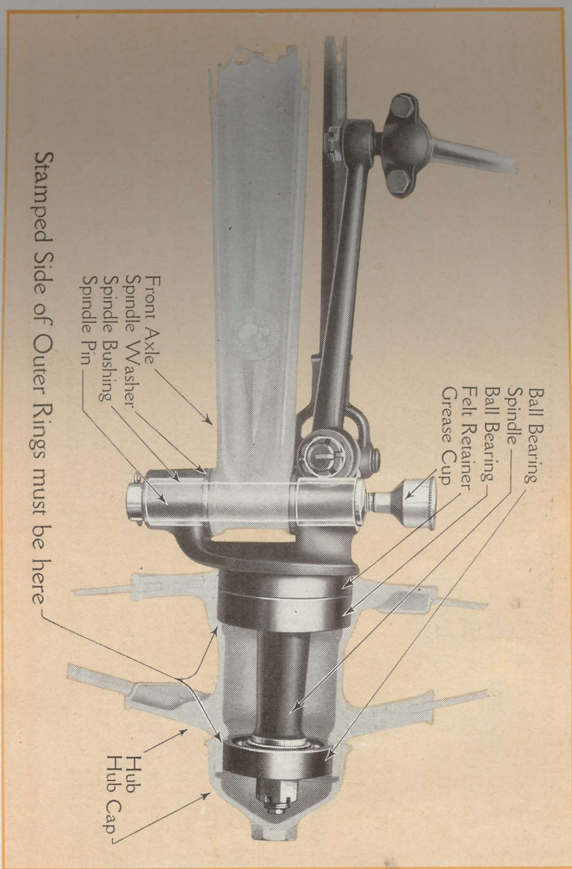


## The Running Gear

**What attention should the Running Gear have?**

It should be carefully gone over every week to see that all bolts and connections are secure, and any looseness in the steering joints should be taken up. The working parts should be well lubricated at all times and kept free from dust and mud. The boots (not shown on plates) on the steering drag link and on the steering connecting rod should be kept packed with grease and tightly laced. Their proper use adds greatly to the life of the joints.

**Answer No. 105**



Front Wheel Spindle—Plate No. 36

**In case of accident how is the Front Axle straightened?**

**Answer No. 106**

Should the axle or spindle become bent, extreme care must be used to straighten the parts accurately. Do not heat the forgings, as this will distemper the steel, but straighten them cold. If convenient it would be better to send such parts to a regular repair shop, where they may be properly straightened by fixtures designed for that purpose. It is very essential that the wheels line up properly, as improper alignment will cause defective steering and strain the parts.

### How is the Front Axle removed?

*Answer No. 10*

Jack up front of tractor so that wheels can be removed. (See Answer No. 108.) Disconnect steering drag link from the steering arm—rear. Disconnect radius rod from crank case. Remove the front axle trunion pin and front axle.

### How are the Front Wheels removed?

*Answer No. 108*

Take off hub cap, jack up front of tractor, take out cotter pin and unscrew nut from end of wheel spindle. The wheels can then be drawn off along with the end ball bearing. The other ball bearing can then be removed, allowing the felt washer and retainer to be taken off. If the felt is worn or very dirty, replace with a new one. Before opening the wheel, clean hub and spindle with kerosene and then fill up the hub and cap with fresh grease. Be careful in replacing the ball bearings that the stamped faces of the outer rings face each other. (See Plate No. 36.)

### How is Steering Gear tightened?

*Answer No. 109*

Should the steering gear become loose, that is, so that a slight movement of the wheel does not produce immediate results, it may be tightened in the following manner: Disconnect the two halves of the ball sockets which surround the steering arm ball and file off the surface until they fit snugly around the ball. If the ball is badly worn, replace by a new one. If the yoke pins in the steering spindle arms appear to be loose, the steel bushings should be replaced with new ones. The bushings in the front wheel spindle should also be replaced by new ones if the spindle pin is too loose. Excessive movement of the spindle in a vertical direction can be remedied by renewing the two spindle washers. (See Plate No. 36.)

## Braking the Tractor

**D**O not run the Tractor downhill with the gears in neutral or with the clutch released.

Use the engine to regulate the speed of the Tractor. By engaging the gears either in low or intermediate speeds and then closing the throttle the Tractor can move only as fast as permitted by the engine which on low gear is a safe speed even on a very steep hill.

In low gear for every turn made by the rear wheels the engine must turn over 85 times and thus acts as an effective brake.

## Lubrication

**T**HE 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—on no account must the motor oil 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 engine bearings and cut down spark plug trouble.

### The Lubricating System

What attention does the Lubricating System require?

*Answer No. 110*

The most important feature in the maintenance of the Tractor is proper lubrication. Plate No. 37 shows the points of lubrication, and the chart on page 73 specifies the attention required. This chart should be studied carefully and often. Only high-grade oils should be used and the instructions regarding times and kind of oil should be carefully followed. Frequent inspection and lubrication is essential to insure the proper running and long life of the Tractor.

What about the Engine Lubrication?

*Answer No. 111*

The oiling of the engine must be given close attention. Use only a **medium, high-grade gas engine oil**. It should have sufficient "body" so that the pressure between the bearing surfaces will not force the oil out and allow the metal surfaces to come in contact. Heavy and inferior oils have a tendency to carbonize quickly, also to gum up the piston rings, valve stems and bushings.

The engine is oiled by the splash system, from the big oil reservoir in the crank case. (See Plate No. 7). Oil should be added at least twice per day, and under no circumstances should the level be allowed to drop below the lower pet cock. It is best to test the oil level and fill the engine when it is warm. This will avoid the possibility of adding too much oil, as when cold the oil is sluggish and may not run freely out of the pet cock. If too much oil is put in the engine it will form carbon in the cylinders and also dirty the spark plugs.

How often should the Oil in the Engine be changed?

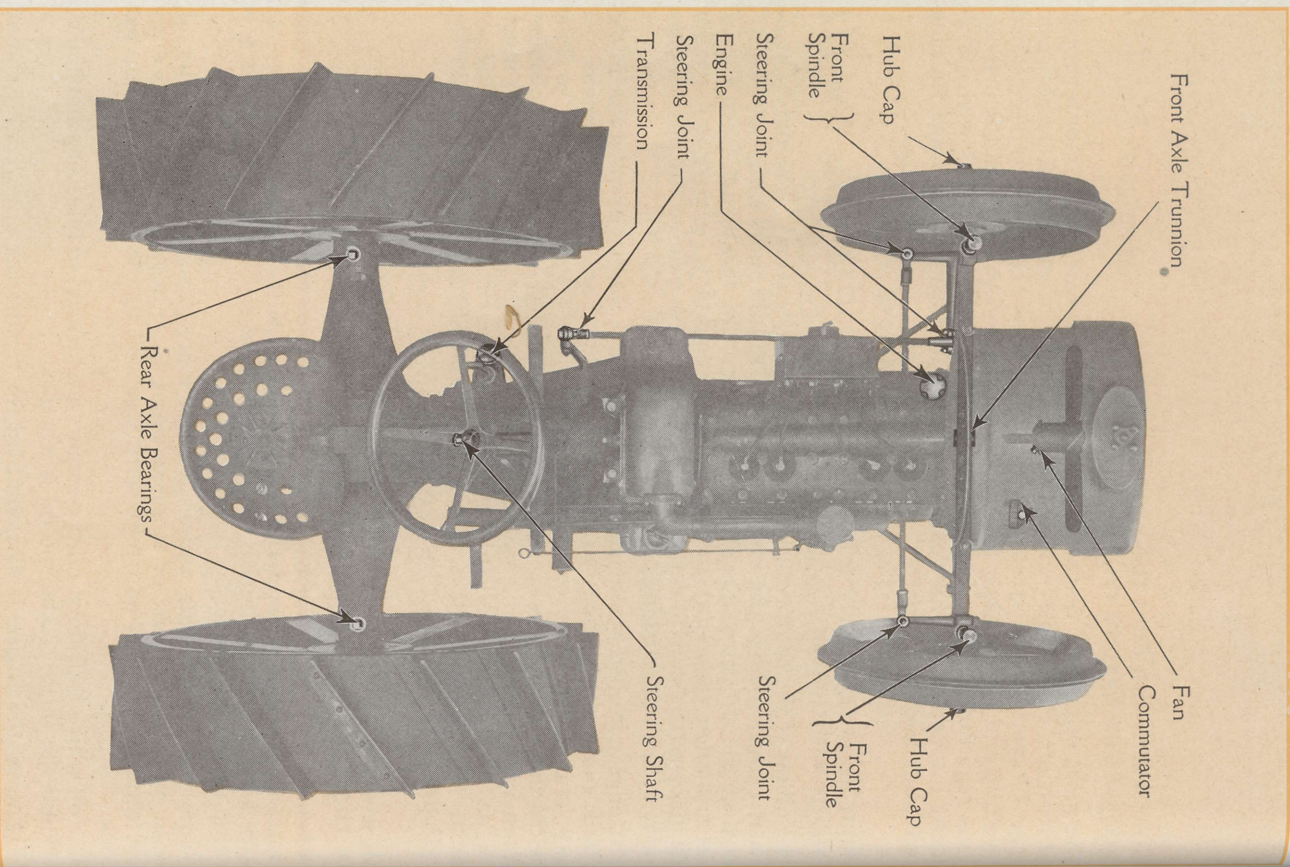
*Answer No. 112*

When a new tractor has been driven a few days the oil in the crank case must be drained off and the engine refilled with entirely fresh oil. It will be necessary to repeat this operation every week if the tractor is being used continuously.

Remove the drain plug underneath the crank case and drain off the oil, flush out with a quart or so of kerosene to remove sediment and dirty oil, replace the plug and refill with fresh oil to the level of the top pet cock.

The oil which is drained off the engine can be used to lubricate machinery around the farm, so that no oil is wasted.

Whenever the engine is disassembled for repairs the opportunity should be taken to thoroughly clean out the oil pipe which is located in the upper half of the crank chamber.



### Lubricating Chart

PART	HOW OFTEN	WHAT TO USE	WHAT QUANTITY
Engine	Twice a day	Medium gas engine oil	Up to top pet cock
Transmission	Once a day	Heavy fluid gear oil	Up to level of filler opening
Commutator	Once a day	Engine oil	A few drops
Two Front Spindles	Once a day	Cup grease	A few turns
Front Axle Trunnion	Once a day	Engine oil	Oil thoroughly
Radius Rod Pin	Once a week	Engine oil	Oil thoroughly
Fan	Once a week	Cup grease	Fill up
Two Rear Axle Bearings	Once a week	Cup grease	Fill up
Steering Shaft	Once a week	Cup grease	A few turns
Front Wheel Hubs	Every other week	Cup grease	Fill up
Four Steering Joints	Every other week	Cup grease	Fill up boot

As the life and efficient working of the Tractor depend on proper lubrication, it cannot be too often brought to the attention of drivers and mechanics that neglect in this direction may be the cause of endless and serious trouble.

View of Tractor Showing Lubricating Points—Plate No. 37

### What about the Clutch and Steering Gear Lubrication?

*Answer No. 113*

The Clutch and Steering Gear are lubricated by the oil in the crank case which is thrown up by the flywheel. They receive a plentiful supply of oil and require no attention if the oil in the crank case is kept at the proper level.

### What about the Transmission and Rear Axle Lubrication?

*Answer No. 114*

The transmission and rear axle are lubricated by a single oil bath in the transmission housing. Use only a **heavy fluid gear oil**. It should, however, be able to flow readily at ordinary temperatures. **On no account should a light or engine oil be used.**

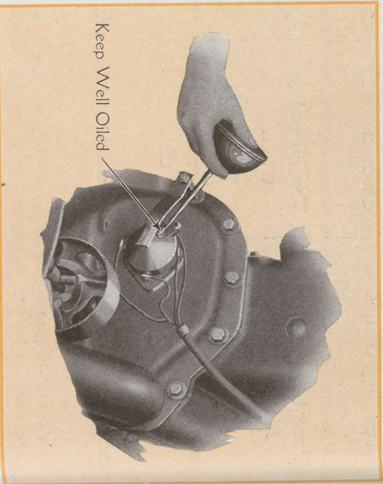
The oil level should be inspected every day. Add oil when the motor is warm, and be sure it has reached every part before replacing the filler cap. The oil should be poured in until it reaches the level of the filler cap hole. It is necessary to drain off the oil every two weeks and replace with fresh oil. Remove the drain plug underneath the housing, and after all oil has been drawn off, flush it out with a quart or so of kerosene. Replace the plug and refill with fresh oil. This operation should be done when the tractor is warm, as the oil will then flow more readily.

Should the oil be left unchanged too long, or if a light oil is used, the transmission housing will become very warm when the tractor is in use. This condition must be remedied immediately or excessive wear will be caused to the moving parts.

### How often should Commutator be Oiled?

*Answer No. 115*

Keeping the commutator well oiled is a matter of far greater importance than many drivers believe, and is necessary in order to have a smooth operating engine. Do not be afraid to put a little oil into the commutator every day. Remember that the commutator roller revolves very rapidly, and without sufficient lubrication the parts soon become badly worn. When in this condition perfect contact between the roller and the four contact points is impossible, and as a result the engine is apt to misfire when running at a good rate of speed.



Oiling the Commutator—Plate No. 38

### Points on Maintenance

*Answer No. 116*

#### How about cleaning the Tractor?

The Tractor should be kept free from rust or dust. If they are allowed to accumulate, it may in time get carried into the bearing surfaces and cause unnecessary wear. Wash the Tractor frequently and keep it well painted to prevent rusting. When washing, care must be taken that no water reaches the wiring coil box or spark plugs, as this would result in a short-circuit and failure of the ignition system.

The most important point in maintenance of a Tractor is proper and efficient lubrication and cleaning. Frequently inspect the Tractor. See that it is kept properly adjusted and that all bolts and screws are tight.

#### What attention do Ball Bearings require?

*Answer No. 117*

The ball bearings used in the Tractor will last indefinitely if they are kept well lubricated and free from grit. When the Tractor is being overhauled or repaired the ball races should be cleaned with kerosene and examined carefully. If any chipping of the balls or pitting of the races is found, the bearing should be replaced by a new one. It is impossible to replace a broken ball.

Be careful that all bearings are replaced with the stamped face of the outer ring in the correct position. (See Plate No. 25.)

#### What should be done when the Tractor is stored?

*Answer No. 118*

Drain the water from the radiator and then put in about a quart of denatured alcohol to prevent freezing of any water that may possibly remain. Drain the water from the air washer. Drain off the kerosene and gasoline. Drain off the dirty oil from the crank case and refill with fresh oil, crank the engine enough so that the different parts get covered with oil. Cover the Tractor with the Tractor cover and store in a dry place.

## Summary of Engine Troubles and Their Causes

### (a) ENGINE FAILS TO START

1. Gas mixture too lean or poor grade of gasoline.
2. Water in fuel.
3. Vibrators adjusted too closely.
4. Water or congealed oil in commutator.
5. Magneto contact point obstructed with foreign matter.
6. Gasoline supply shut off.
7. Lack of water in air washer.
8. Water frozen in bottom of gasoline tank.
9. Coil switch off.
10. Water on spark plugs or wire terminals.

### (b) ENGINE LACKS POWER—RUNS IRREGULARLY

1. Poor compression on account of leaky valves.
2. Imperfect gas mixture.
3. Spark plugs dirty.
4. Coil vibrator burned or improperly adjusted.
5. Air leak in intake manifold.
6. Weak exhaust valve spring.
7. Too great clearance between valve stem and push rod.
8. Spark plugs dirty or points imperfectly adjusted.
9. Commutator contact imperfect.
10. Burnt out Vapor Tube—See Answer No. 68.

### (c) ENGINE STOPS SUDDENLY

1. Fuel tank empty.
2. Water in fuel.
3. Dirt in vaporizer or feed pipe.
4. Magneto wire loose at either terminal.
5. Magneto contact point obstructed.
6. Overheated on account of lack of oil or water.
7. Gas mixture too lean.

### (d) ENGINE OVERHEATS

1. Lack of water.
2. Lack of oil.
3. Fan belt torn, loose or slipping.
4. Carbon deposit in combustion chamber
5. Spark retarded too far.
6. Gas mixture too rich.
7. Water circulation retarded by sediment in radiator.
8. Dirty spark plugs.
9. Lack of water in air washer.

### (e) ENGINE KNOCKS

1. Carbon deposit on piston heads.
2. Loose connecting rod bearings.
3. Loose crank shaft bearings.
4. Loose Piston Pin.
5. Spark advanced too far.
6. Engine overheated.
7. Gas mixture too rich.

**What type of Plow should be used?**

*Answer No. 119*

## Plowing with the Tractor

A self-lifting two-bottom plow is the proper outfit to use. The tractor will pull, in plowing gear, two 14-inch bottoms in the heaviest soil. The conditions, however, will determine the size of bottoms to be used. The tractor must be able to do the work in plowing gear as it will not be found as economical to plow continuously in low gear. By using the self-lifting plow the driver can operate both the tractor and the plow from the tractor seat, as all operating levers are within easy reach. The two wheel tractor plow is attached without the use of chains, and can be readily backed when necessary.

**How is the Plow attached?**

*Answer No. 120*

Attach the clevis shackle of the plow to the center hole of the draw-bar cap of the tractor. This must be done without a chain or other flexible connections so that the plow can be backed up. (See Plate No. 39.) The center of the draft of the plow must be in line with the center of the tractor, otherwise difficulty will be found in steering and a loss of power will result owing to side draft. Plate No. 42 shows the proper position of the plow behind the tractor.

**Where is the center of draft of the Tractor and Plow?**

*Answer No. 121*

The center of draft of the tractor lies midway between the two driving wheels. The center of draft of the plow lies about midway between the two bottoms; and when hitched to the tractor the center of draft of the plow and tractor will be in line and will run parallel to the furrow. (See Plate No. 39.)

**How about the position of the Tractor when plowing?**

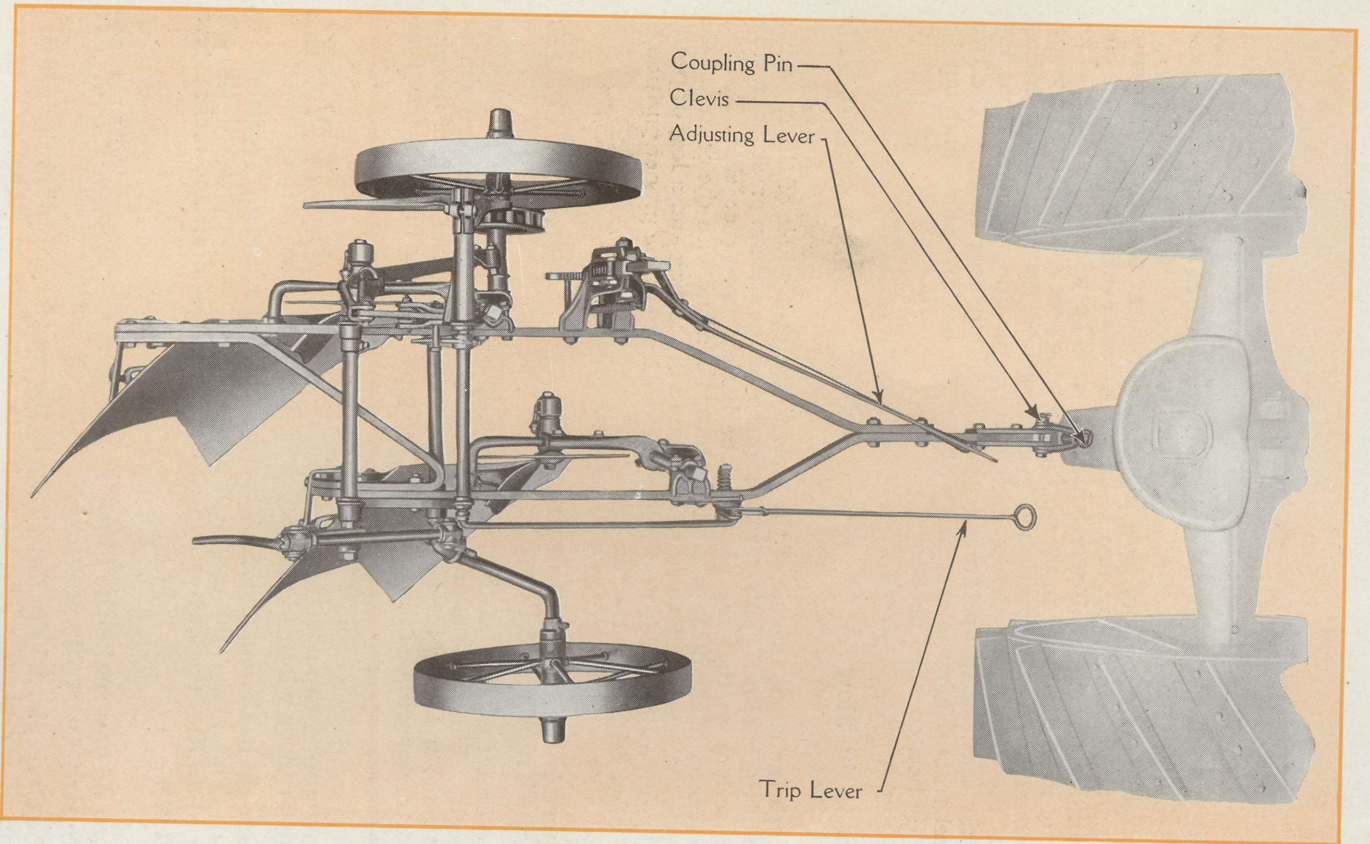
*Answer No. 122*

The right hand front and rear wheel must be in the furrow. (See Plate No. 41.) This brings the center of draft of the plow in line with the center of draft of the tractor and eliminates all side draft and makes steering easy.

**How do you make the Plow properly enter the ground?**

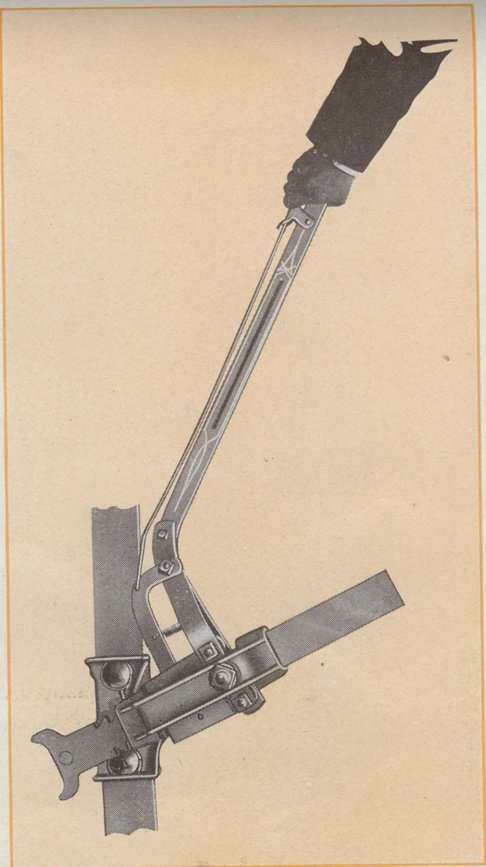
*Answer No. 123*

The clevis plates have three holes in the rear for adjusting the penetration of the plow. The clevis plates should be so adjusted that the



Top View of Plow Showing Operating Levers and Method of Attaching Plow to Tractor—Plate No. 39

bottom of the landside on the rear base will touch the ground slightly, or will be raised not more than one-half an inch off the bottom of the furrow when plowing. If the plow is hitched too low, it will not enter the ground quickly enough, and will cause unnecessary friction on the bottom of the landside. If it is hitched too high, the bottoms will run on the points of the shares, causing wear and heavy draft. The proper time to make your final clevis adjustment is after you have opened up the land and the furrow wheel of the plow is running in the furrow.



Adjusting Lever for Varying the Depth of Furrow—Plate No. 40

**How is the Furrow Depth adjusted?**

**Answer No. 124**

By working the adjusting lever attached to the plow. When it is desired to plow deeper grasp the end of the lever, at the same time pressing the hand latch firmly against the lever; then move the lever up and down. (See Plate No. 40.) To plow shallower, move the lever up and down, but do not hold the hand latch.

**How is the Plow adjusted for opening land?**

**Answer No. 125**

As the tractor and plow wheels are on unplowed ground when opening land, it is necessary to have a different adjustment to the bottoms than that used after the back furrow has been plowed. This is done by turning the screw crank in the rear of the plow. The adjustment depends on the depth of the furrow desired by the front bottom.





Position of Tractor when Plowing, Showing Wheels in the Furrow—Plate No. 41



View Showing the Proper Position of Plow Behind Tractor—Plate No. 42

How is the Plow adjusted after the land is opened?

*Answer No. 126*

After you have opened the land and the furrow wheel is running in the furrow, turn back the screw crank sufficiently to level the plow.

How is the Plow dropped?

*Answer No. 127*

By pushing the trip lever firmly downwards when the tractor has entered the furrow and the rear wheels have just passed off the headland. The plow may be dropped while in motion or when standing.

How is the Plow lifted?

*Answer No. 128*

By raising the trip lever attached to the plow when the rear wheels of the tractor have just passed on to the headland. The trip lever is raised slowly until the plow begins to rise; the tractor being kept moving until the locking device engages. (See Plate No. 43.)

How do you lay out the land for Plowing?

*Answer No. 129*

The lay of the land and the shape of the field will determine the best method. When planning your plowing avoid traveling with the plow out of the ground as much as possible. For making turns a headland of about twenty feet is required.

What about Plowing hilly land?

*Answer No. 130*

When plowing hilly land it sometimes becomes advisable to hitch the clevis shackle into the holes on either side of the drawbar cap of the tractor in order to counteract the tendency of the plow to slide down hill.

### **Belt Pulley**

For stationary work a pulley is fitted on the right side of the tractor, which is operated from the engine clutch. Twenty-two horse power is available at the pulley which runs at 1000 revolutions per minute. The pulley is nine inches in diameter and uses a six-inch belt. This equipment is optional.



View Showing How Plow is Lifted—Plate No. 43

## Specifications

### Fordson Tractor

#### ENGINE

Four-cylinder, four-cycle, cylinders are cast en bloc. Cylinder bore is four inches; piston stroke is five inches.

**REMOVABLE CYLINDER HEAD:** Allows easy access to the valves, pistons and cylinders; the crank case is easily removed so that all interior parts of the engine may be reached without taking the tractor apart.

**HORSE POWER:** The engine develops twenty-two horse power when running at 1000 revolutions per minute and using kerosene. It will maintain a drawbar pull of 1800 pounds at plowing speed. In low gear a drawbar pull of 2500 pounds is obtained.

**LUBRICATION:** Splash system; the oil circulation is maintained by oil thrown off the flywheel by centrifugal action.

#### COOLING

Thermo-Syphon system. The very large water jackets and radiator tanks used with a vertical tube radiator insure a continuous flow of water and efficient cooling. This works in connection with a belt-driven ball bearing fan.

#### IGNITION

Special design magneto, built in, and made part of the engine, used in combination with four coils and a commutator. This system is simple and reliable.

#### VAPORIZER

The Tractor is equipped with a special design vaporizer, which heats the kerosene vapor, and mixing it with fresh, cool air, supplies a dry explosion mixture to the cylinders. To start the engine, gasoline is used, and after about one minute, when the vaporizer is sufficiently heated, it is shifted to kerosene.

**FUEL:** Is supplied by gravity from a twenty-one gallon overhead tank.

#### CONTROL

Steering is by bevel pinion and sector, being entirely enclosed and lubricated by oil splash. The steering wheel is located in the center of the tractor. Directly under it is the throttle lever. The spark lever is mounted on the dash.

## Specifications—Continued

### Fordson Tractor

The gear shifter lever is on the left side of the Tractor and the clutch pedal on the right. The seat is in the center of the Tractor, bringing the driver within easy reach of all controls.

#### AIR WASHER

The air supply is drawn through water. The wear on the cylinder walls is thus greatly reduced because of all dust having been removed.

#### CLUTCH

Multiple steel disc running in oil.

#### TRANSMISSION

Constant mesh, selective type, three speeds forward and one reverse; all shafts run on ball bearings. Gears are made of Vanadium Steel and hardened. Final drive is by worm and worm wheel. All gearing is entirely enclosed and runs in oil.

#### DIFFERENTIAL

Four pinion bevel type and is carried on ball bearings.

#### REAR AXLE

Is of Vanadium Steel and rotates in roller bearings.

#### FRONT AXLE

"Y" beam section. Drop forging made of Vanadium Steel. It is attached in the center directly to the front of the engine giving a three-point suspension to the Tractor.

#### WHEELS

**FRONT WHEELS** have steel spokes cast in the hub and riveted to the steel rims. They are mounted on ball bearings.

**REAR WHEELS** also have the spokes cast in the hub and riveted to the rims. These rims are 42 inches in diameter, 12 inches in width and are fitted with special cleats designed to give proper traction in the field. By withdrawing a tapered bushing from the hub, the wheels are quickly removed.

**WHEELBASE** is 63 inches, tread between wheels being 38 inches. The tractor will turn in a twenty-one foot circle.

Part No.	Name of Part	Plate No.	Specifications	Price	No. Req. per Tractor	Mailing Weight
<b>MISCELLANEOUS FITTINGS AND ACCESSORIES—Continued.</b>						
1984	Wescott Wrench	65	10" Keystone	1 50	1	1 lb., 8 oz.
1985	Combination Spark Plug and Cylinder Head Wrench	65	9 1/2"	35	1	10 oz.
2095	1/4" x 1/2" Nut Wrench	65	Steel	75	1	1 lb., 4 oz.
2094	1/4" Cap Screw Wrench	65	Steel	75	1	1 lb., 4 oz.
2366	Rear Wheel Wrench	65	Steel	75	1	2 lb., 4 oz.
2097	Rear Wheel Bar	65	Steel	75	1	2 lb., 6 oz.
2197	Front Hub Cap Wrench	65	Steel	1 00	1	1 oz.
1044	Manifold Gland	65	Steel	05	6	2 oz.
1621	Manifold Lock Washer	65	1/8" x 1 1/2" x 12 thds.	05	4	2 oz.
587	Manifold Cap Screw	61	Mall. Iron	50	1	13 oz.
2200	Exhaust Tube Assembly	65	Steel 2" dia.	1 50	1	3 lb., 2 oz.
1996	Exhaust Tube Flange	65	Steel	20	1	7 oz.
2346	Exhaust Tube Bracket	65	1/4" x 1" x 28 thds.	05	1	1
2348	Exhaust Tube Bracket Cap	65	1/4" x 28 thds.	05	1	1
1743	Seat Nut	65	Steel	00	1	5 lb.
1633	Seat Spring	65	Steel	1 00	1	10 lb.
2461	Seat Spring Bolt and Nut	65	1/2" x 2" x 13 thds.	05	1	2 oz.
1746	Seat Spring Cap Screw	65	3/4" x 10 x 1 1/2"	20	1	5 oz.
2191	Seat Spring Cap Screw Lock Washer	65	3/4" Std.	05	1	1 oz.
1749	Foot Bracket	65	Cast Iron	1 00	1	4 lb.
560	Foot Bracket Cap Screw	65	1/2" x 1 1/2" x 13 thds.	05	6	2 oz.
1824	Wire for Locking Screws and Nuts	65	Iron Wire	05	1	2 oz.
2237	Brass Wire for Locking Bolts and Nuts	65	Brass	05	1	2 oz.
2187	Tractor Cover	65	Canvas	15 00	1	6 lb., 8 oz.

**COTTER PINS**

Part No.	Name of Part	Per Doz.	Price
1963	1/8" x 3/8" Cotter Pin	08	
1767	1/8" x 1/2" Cotter Pin	08	
H-234-62	1/8" x 3/4" Cotter Pin	08	
1061	1/8" x 1" Cotter Pin	08	
594	3/8" x 1" Cotter Pin	08	
2403	3/8" x 1 1/4" Cotter Pin	08	
1672	3/8" x 1 1/2" Cotter Pin	08	
1806	3/8" x 1 3/4" Cotter Pin	08	
726	3/8" x 2" Cotter Pin	08	
1592	3/8" x 2 1/4" Cotter Pin	15	
1671	3/8" x 2 1/2" Cotter Pin	15	
1593	3/8" x 2 3/4" Cotter Pin	15	

\*2001 Exhaust Tube Assembly Includes parts 2200 and 1987.

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124	Valve Spring Seat Pin	90	1381	Connecting Rod Cap Bolt Nut	90
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577	Gear Shifter Lever Bushing Bolt	90			
584	1/2" x 20 thds. Std. Plain Nut	94			
587	No. A Woodruff Key	97			
588	3/32" x 1/4" Cotter Pin	100			
608	3/32" x 1/2" Cotter Pin	100			
614	Starting Crank	90			
624	Rear Wheel Cleat, Right	100			
676	Rear Wheel Cleat, Left	100			
686	Cylinders Front Cover Bolt	100			
710	1/2" x 16 thds. Plain Nut, Slotted	100			
722	1/2" x 16 thds. Plain Nut	100			
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1063	Gear Shifter Lever Plate Retainer	112			
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1070	Connecting Rod Shim	90			
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1152	Differential Housing Bolt	100			
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