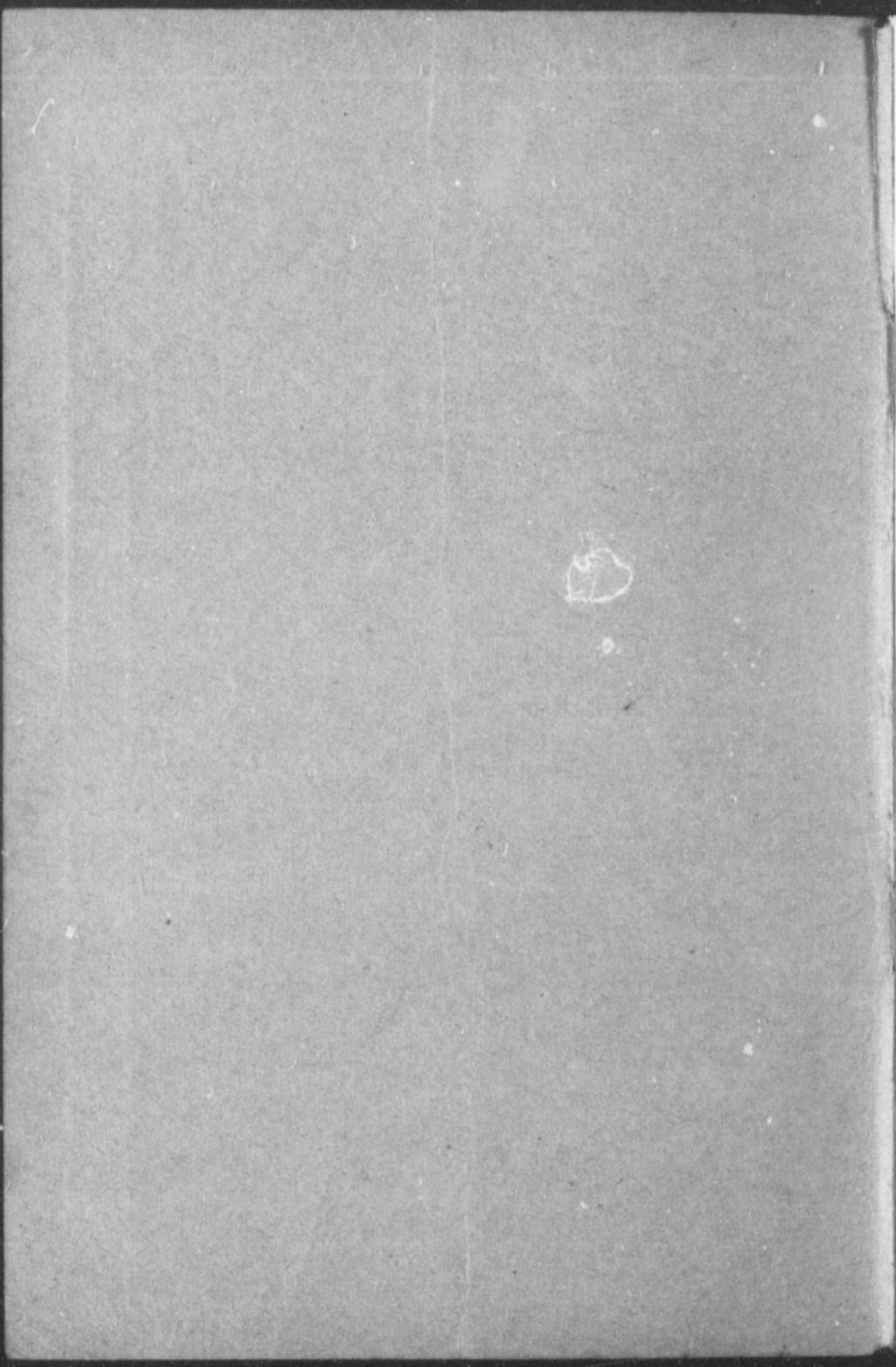


# Ford Manual

CANADIAN EDITION







# FORD MANUAL

For Owners and Operators  
of Ford Cars

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## Foreword

**I**T is a significant fact that nearly all Ford cars are driven by laymen—by owners, who in the great majority of cases have little or no practical experience with things mechanical.

The simplicity of the Ford car and the ease with which it is operated renders an intimate knowledge of mechanical technicalities unnecessary for its operation.

And the further fact that there are nearly six thousand Ford service stations distributed throughout the civilized world—where adjustments and repairs may be had with no annoying delay—gives to Ford owners a singular freedom from mechanical annoyances which beset owners of cars having limited service facilities and distribution.

But while it is not imperative, it is, however, altogether desirable that every Ford owner should thoroughly understand his car. With such knowledge at his command he is always master of the situation—he will maintain his car more economically—prolong its usefulness—and he will also derive more pleasure from it, for it is a truism that the more one knows about a thing the more one enjoys it.

The mastery of a thorough knowledge of Ford construction is by no means a difficult or time-consuming task. The Ford is the simplest car made. It is easy to understand. And it is not difficult to keep in proper adjustment and repair.

That the Ford construction may be thoroughly understood—and that there may be an authoritative guide for the making of Ford adjustments—this book is published.

## The Car and its Operation

*What must be done before starting the car?*

### *Answer No. 1*

Before trying to start the car, fill the radiator (by removing cap at top) with clean, fresh water (Use Anti-freeze mixture in cold weather—See Answer No. 39). If perfectly clean water cannot be obtained it is advisable to strain it through muslin or other similar material to prevent foreign matter from getting in and obstructing the small tubes of the radiator. The system will hold a little less than two and a half Imperial gallons. (On 1916 and earlier models the cooling system holds not quite three gallons). It is important that the car 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 over-flow pipe onto the ground when the entire water system has been properly filled. During the first few days that a new car is being driven it is a good plan to examine the radiator frequently and see that it is kept properly filled. The water supply should be replenished as often as may be found necessary. Soft rain water, when it is to be had in a clean state, is superior to hard water, which may contain alkalies and other salts which tend to deposit sediment and clog the radiator. (See chapter on Cooling System).

*What about Gasoline?*

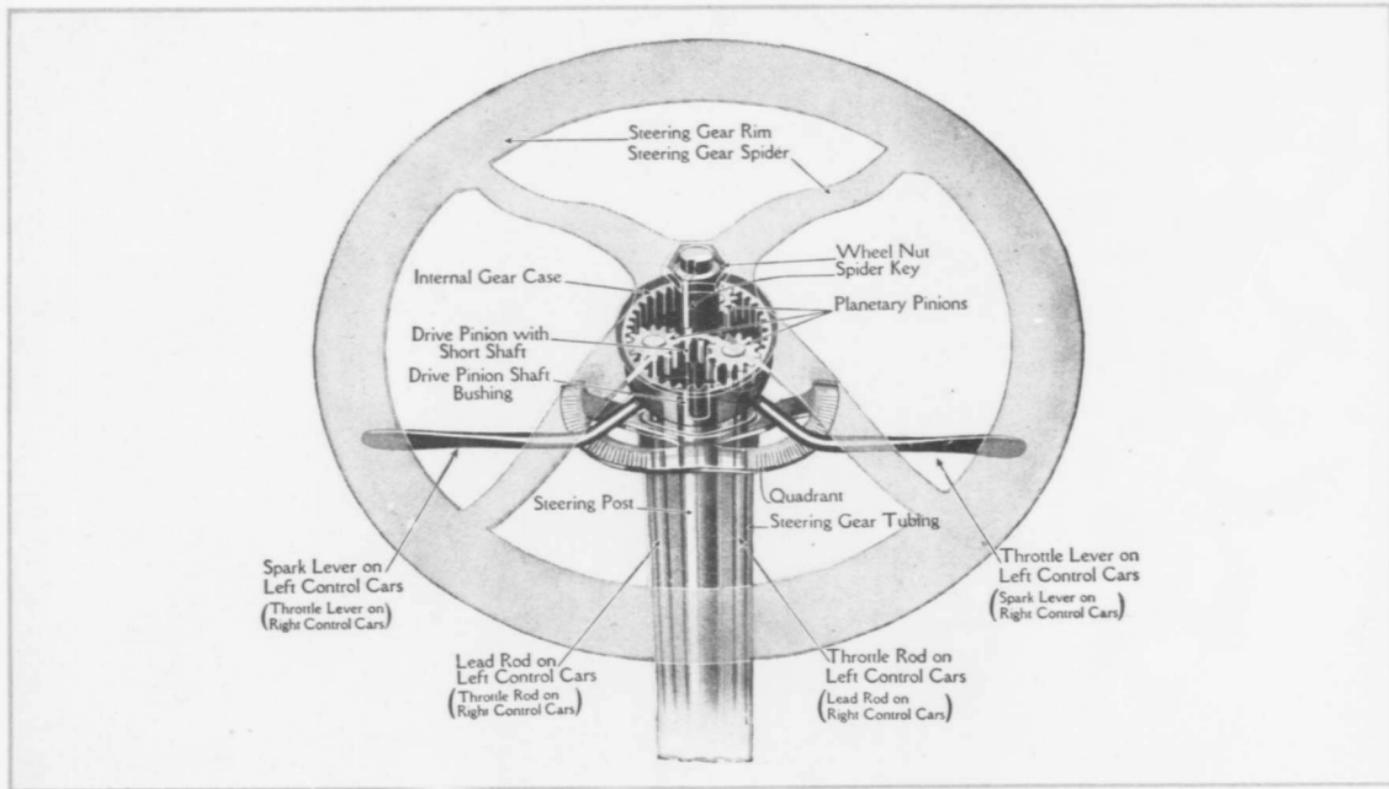
### *Answer No. 2*

The eight-gallon gasoline tank should be filled—nearly full—and the supply should never be allowed to get low. Strain the gasoline through chamois skin, to prevent water and other foreign substances from getting into the tank. Dirt or water in the gasoline is sure to cause trouble. When filling the tank be sure that there are no naked flames within several feet as the vapor is extremely volatile and travels rapidly. Always be careful about lighting matches near where gasoline has been spilled, as the air within a radius of several feet is permeated with the highly explosive vapor. The small vent hole in the gasoline tank cap should not be allowed to get plugged up, as this would prevent proper flow of the gasoline to the carburetor. The gasoline tank may be drained by opening the pet cock in the sediment bulb at the bottom.

*How about the Oiling System?*

### *Answer No. 3*

Upon receipt of the car see that a supply of medium light, high-grade gas engine oil is poured into the crank case through the breather pipe at the right front corner of the engine (See Cut No. 4, also point F—Cut No. 22). Under the car, on the right hand rear side of the fly wheel casing (the reservoir which holds this oil) there are two pet-cocks. Open the upper one of these and pour in the oil slowly



Steering Wheel Assembly showing the three reduction gears meshing with the teeth in the internal gear case and the pinion attached to the steering wheel. (Cut No. 1)

(through the breather opening) until it runs out of the open pet-cock. Leave the cock open until the oil stops running, then close it. After the engine has become thoroughly limbered up, the best results will be obtained by carrying the oil at a level midway between the two cocks—but under no circumstances should it be allowed to get below the lower cock. All other parts of the car are properly oiled when it leaves the factory, but it will be well to see that all grease cups are filled and that oil is supplied to necessary parts (see Cut No. 22, also chapter on Lubrication, Page 53).

*How are Spark and Throttle Levers used?*

### *Answer No. 4*

Under the steering wheel are two small levers. The inside one (the one nearest the center of the car), is the throttle lever which controls the amount of mixture (gasoline and air) which goes into the engine. When the engine is in operation, the farther this lever is moved downward towards the driver (referred to as "opening the throttle") the faster the engine runs and the greater the power furnished. The other lever (the one nearest the outside of the car) controls the spark, which explodes the gas in the cylinders of the engine. Moving this lever down—towards the driver—"advances the spark" and it should be moved down 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. 5*

The spark lever should usually be put in about the third or fourth notch of the quadrant (the notched half-circle on which the levers operate). The throttle should usually be opened about five or six notches. A little experience will soon teach you where these 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."

*What else is necessary before cranking the Engine?*

### *Answer No. 6*

First, see that the hand lever, which comes up through the car floor, just inside the door on the driver's side of the car, is pulled back as far as it will go. The lever in this position holds the clutch in neutral and engages the hub brake, thus preventing the car moving forward when the engine is started. Second, after inserting the switch key in the switch on the coil box, throw the switch lever as far to the left as it will go—to the point marked "magneto." This switch connects the magneto with the engine. The engine cannot be started until it is on—and the throwing off of this switch stops the engine. The next step is to crank the engine.

IMPORTANT—Read carefully chapter on Lubrication, page 53

*How is the  
Engine cranked?*

### *Answer No. 7*

By the lifting of the starting crank at the front of the car. Take hold of the handle and push firmly towards the car till you feel the crank ratchet engage, then lift upward clockwise with a quick swing. With a little experience this operation will become an easy matter. Do not 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 car 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 back-fire may injure the arm of the operator.

When the engine is cool it is advisable to prime the carburetor by pulling on the small wire at the lower left corner of the radiator while giving the engine two or three quarter turns with the starting handle.

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

### *Answer No. 8*

As gasoline does not vaporize readily in cold weather it is naturally more difficult to start the motor under such conditions. The usual method of starting the engine when cold is to turn the carburetor dash adjustment one-quarter turn to the left (see Cut No. 10) in order to allow a richer mixture of gasoline to be drawn into the cylinders, then hold out the priming rod, which projects through the radiator, while you turn crank from six to eight one-quarter turns in quick succession. Another method of starting a troublesome cold engine is as follows: Before you throw on the magneto switch, (1) close throttle lever; (2) hold out priming rod while you give crank several quick turns, then let go of priming rod (being careful that it goes back all the way); (3) place spark lever in about third notch and advance throttle lever several notches; (4) throw on switch (being sure to get it on side marked "Magneto"); (5) give crank one or two turns, and the motor should start. After starting the motor it is advisable to advance the spark eight or ten notches on the quadrant and let the motor run until thoroughly heated up. If you start out with a cold motor 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 motor running, thereby eliminating the trouble of the motor starting and stopping. After motor is warmed up turn carburetor adjustment back one-quarter turn.

To facilitate starting many drivers make a practice of stopping the engine by walking around in front of the car and pulling out on the priming rod, which has the effect of shutting off the air suction and filling the cylinders full of a very rich gasoline vapor. This should not be done unless the car is going to stand over night or long enough to cool off. If the motor is stopped in this way and then started when hot, starting is apt to be difficult on account of the surplus gasoline in the carburetor and cylinders.

If the motor is very cold it may be necessary to warm the carburetor and intake pipe (by pouring hot water over them, or in some similar way) to facilitate starting. Be very careful not to get any water in the carburetor air intake—it would make starting almost impossible. Some owners who keep their cars in cold buildings in the winter, make a practice of heating a couple of bricks each night, by leaving them on the stove or just inside the door of the furnace. In the morning the bricks (which can easily be handled with a piece of old sacking) are placed alongside the carburetor, the hood is closed and a robe thrown over it for a few minutes till the air under the hood warms up.

The motor can then be started quite easily.

Special directions for driving and caring for a Ford car in cold weather are given on Page 62.

*How do the Foot  
Pedals operate?*

### *Answer No. 9*

The first one towards the left operates the clutch and by it the car is started and its operation largely controlled. When pressed forward the clutch pedal engages the low speed gear. When this pedal is half-way forward the gears are in neutral (i. e., disconnected from the driving mechanism of the rear wheels), and, with the hand lever thrown forward, the releasing of this pedal (letting it come back all the way) engages the high-speed clutch. The center pedal operates the reverse gears. The right-hand pedal operates the transmission brake. (See Cuts Nos. 2 and 3.)

*What function does  
Hand Lever perform?*

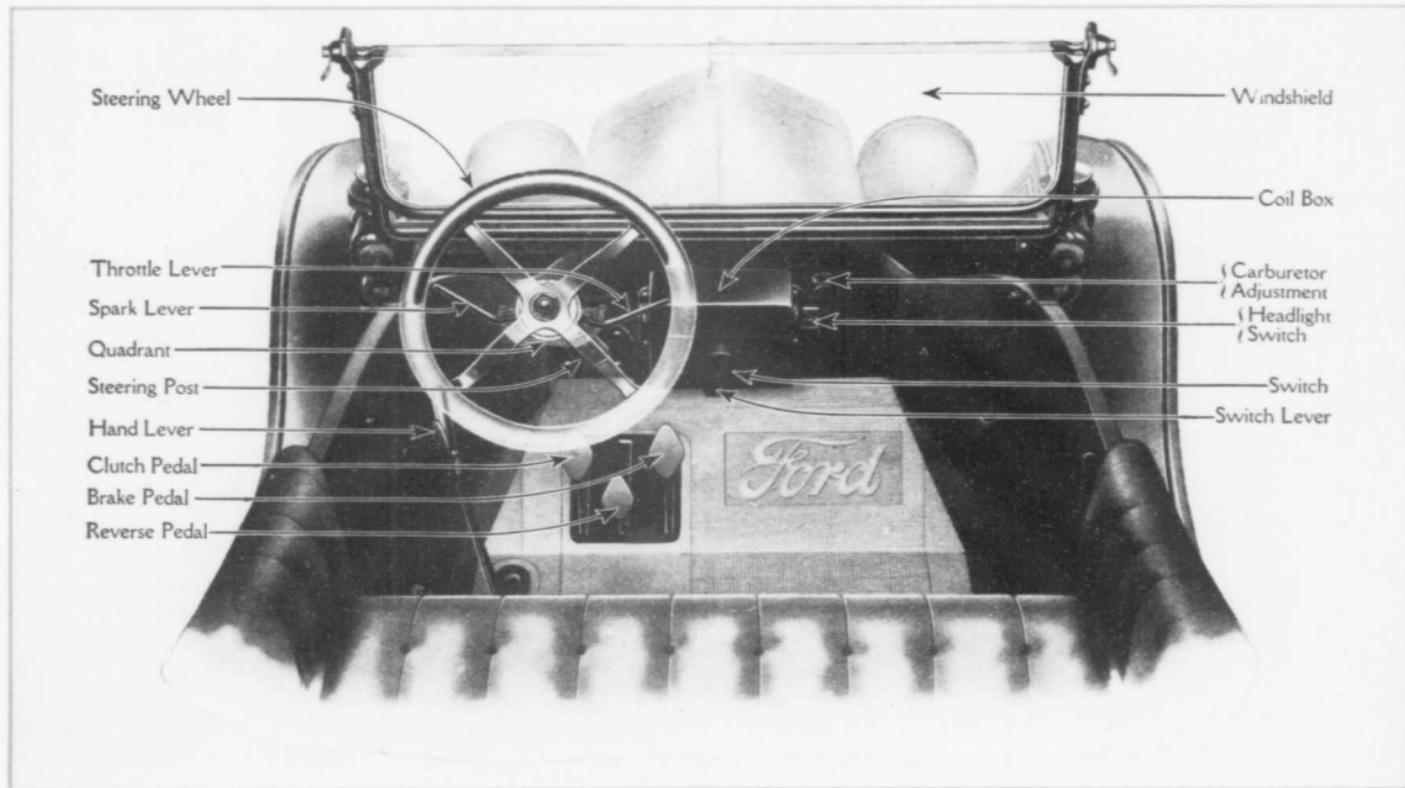
### *Answer No. 10*

When pulled back part way (to a vertical position) it holds the clutch in neutral. If it were not for this lever the driver would have to stop the engine whenever he left the driver's seat. He would also be unable to crank the engine without the car starting forward with the first explosion. When pulled back as far as it will go, the hand lever sets the emergency brakes on the rear wheels, by expanding the brake shoes in the rear wheel drums. Therefore the hand lever should be back as far as it will go when cranking the engine or when the car is at rest. When the car is to be reversed this lever should be only in a vertical position, and not far enough backward to set the brakes on the rear wheels. When the car is operating in high or low speed the hand lever should be all the way forward.

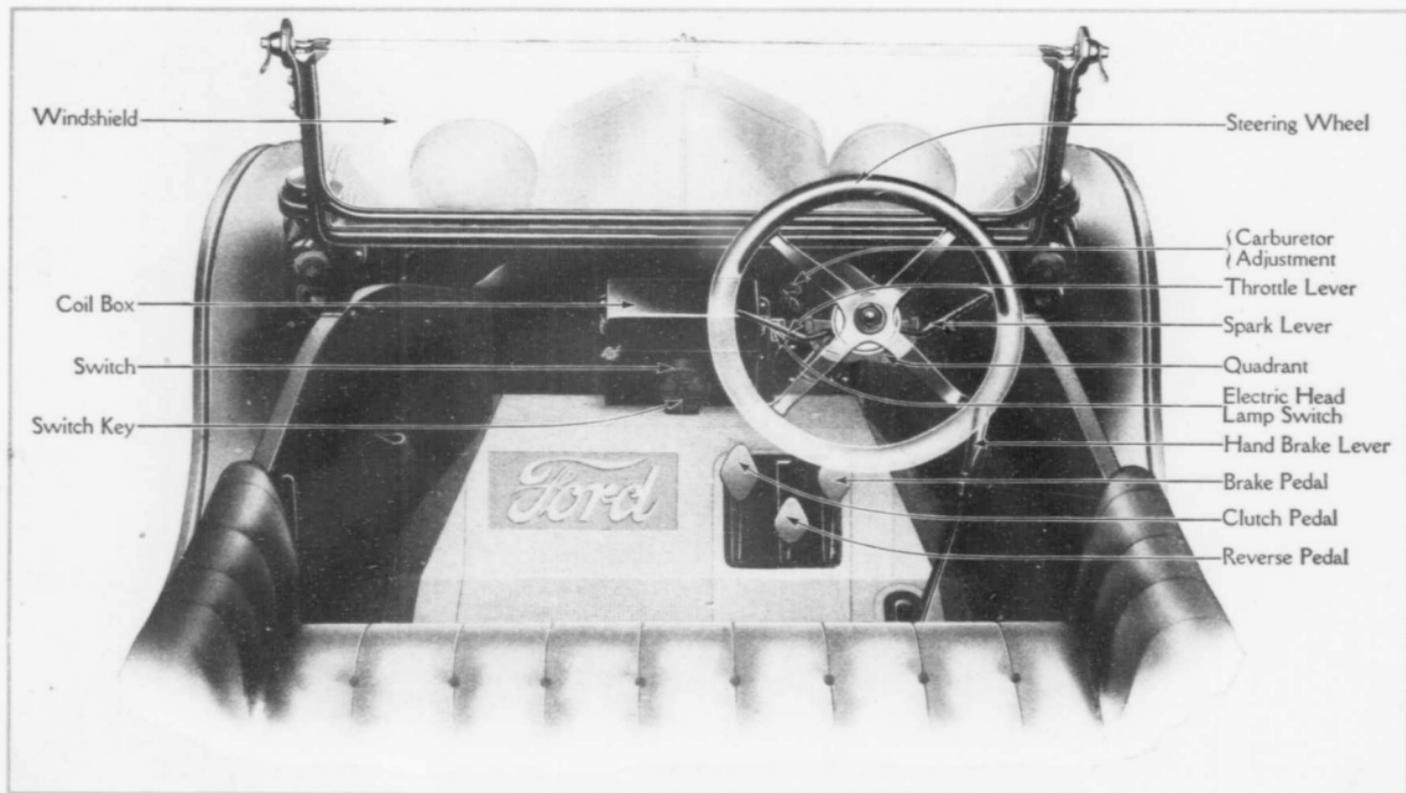
*How is the Car  
started?*

### *Answer No. 11*

Slightly accelerate the engine by opening the throttle two or three notches, place the left foot on the clutch pedal, and thereby hold the gears in a neutral position while throwing the hand lever forward; then to start the car in motion, press the pedal forward into slow speed and when under sufficient headway (20 to 30 feet), allow the pedal to drop back quickly but smoothly into high speed, at the same time partially closing the throttle, which will allow the engine to pick



Ford Left Hand Control. (Cut No. 2)



Ford Right Hand Control. (Cut No. 3)

up its load easily. With a little practice the change of speeds will be easily accomplished, and without any appreciable effect on the smooth running of the car.

*How is the Car stopped?*

### *Answer No. 12*

Partially close the throttle; release the high speed by pressing the clutch pedal forward into neutral (but not far enough to engage slow speed) and hold in that position; apply the foot brake slowly but firmly until the car comes to a dead stop. Do not remove foot from the clutch pedal without first pulling the hand lever back to neutral position, or the engine will stall. To stop the motor, open the throttle a trifle to accelerate the motor and then throw off the switch. The engine will then stop with the cylinders full of explosive gas, which will naturally facilitate starting. Endeavor to so familiarize yourself with the operation of the car that to disengage the clutch and apply the brake becomes practically automatic—the natural thing to do in case of emergency.

*How is the Car reversed?*

### *Answer No. 13*

It must be brought to a dead stop. With the engine running, disengage the clutch with the hand lever and press the reverse pedal forward with the left foot, the right foot being free to use on the brake pedal if needed. Do not bring the hand lever back too far or you will set the brakes on rear wheels. Experienced drivers ordinarily reverse the car by simply holding the clutch pedal in neutral with the left foot, and operating the reverse pedal (or the brake, as required) with the right.

*How is the Spark controlled?*

### *Answer No. 14*

On left drive cars, by the left-hand lever under the steering wheel. On right drive cars, by the right-hand lever. 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 engine has completed its compression stroke. The best results are obtained when the spark occurs just at the time that piston reaches its highest point of travel—the gas being then at its highest point of compression. The spark should only be retarded when the engine slows down on a heavy road or steep grade, but care should be exercised 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. Learn to operate the spark as the occasion demands. The greatest economy in gasoline consumption is obtained by driving with the spark advanced sufficiently to obtain the maximum speed.

IMPORTANT—Read carefully chapter on Lubrication, page 53

*How is speed of  
Car controlled?*

### *Answer No. 15*

The different speeds required to meet road conditions are obtained by opening or closing the throttle. Practically all the running speeds needed for ordinary travel are obtained on high gear, and it is seldom necessary to use the low gear except to give the car momentum in starting. The speed of the car may be temporarily slackened in driving through crowded traffic, turning corners, etc., by "slipping the clutch," i. e., pressing the clutch pedal forward into neutral and letting it slip back into high speed again before the car has lost too much headway.

*Is it advisable for owners to make  
their own adjustments?*

### *Answer No. 16*

The Ford is the simplest of all cars. Most of the ordinary adjustments an owner will soon learn to make for himself. But we most strongly recommend that when it becomes necessary to employ the services of a mechanic, the car be taken to a Ford mechanic—one of our own representatives who thoroughly understands the car—and who will have no motive for running up useless repair bills. The entire Ford organization is interested in keeping every individual Ford car in constant operation—at the lowest possible cost. We have known of much damage done to cars by unskilled repair men.

*What attention  
does the Car need?*

### *Answer No. 17*

Remember that a new machine requires more careful attention during the first few days it is being driven than after the parts have become thoroughly "worked in." The car which is driven slowly and carefully when new usually gives the most satisfactory service in the end. Never start out with your car until you are sure that it has plenty of oil and water. Frequently inspect the running gear. See that no unnecessary play exists in either front or rear wheels, and that all bolts and nuts are tight. Make a practice of taking care of every repair or adjustment as soon as its necessity is discovered. This attention requires but little time and may avoid delay or possible accident on the road.

We aim to deliver the car in proper mechanical adjustment. Afterwards it is plainly the duty of the driver to keep it in that condition if he expects satisfactory service from the car. No one else can possibly keep a car in proper adjustment as well as the driver—he is in the best position to know what attention and adjustments are required.

IMPORTANT—Read carefully chapter on Lubrication, page 53

## The Ford Engine

*What is the principle of the gasoline-driven Engine?*

*Answer No. 18*

Gasoline when mixed with air and compressed is highly explosive. An explosion is a violent expansion caused by instantaneous combustion of confined gases. In the gasoline engine the 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 violently downward, and through the connecting rod imparts a rotary motion to the crank shaft. (See Cut No. 5).

*What are the functions of the Pistons?*

*Answer No. 19*

On the downward stroke the suction of the piston draws the fresh gas from the carburetor, through the inlet 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 exert a pressure of approximately 60 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 to the muffler. The accompanying cut (No. 5) shows clearly the relative positions of the pistons and valves during the different strokes.

*Connecting Rod—how removed?*

*Answer No. 20*

It is a Vanadium steel rod, connecting piston and crank shaft. Should the babbitt bearing become worn, or burned out through lack of oil, a knocking in the engine will result—in which case the entire connecting rod should be replaced. To make this replacement, (1) drain oil from crank case; (2) drain water out of radiator; (3) take off cylinder head; (4) remove detachable plate on bottom of crank case; (5) disconnect connecting rod from crank shaft; (6) take piston and rod out through top of cylinder.

*What is the Valve Arrangement?*

*Answer No. 21*

One intake and one exhaust valve are located in each cylinder. The former admits the fresh gas drawn from the carburetor through the inlet pipe—the latter permits the exploded gas to be driven out through the exhaust pipe. The valves are alternately opened and closed (see Cut No. 5) by the cams on the cam shaft striking against push rods which in turn lift the valves from their seats.



*What about  
Valve timing?*

## *Answer No. 22*

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 at the factory the necessity for retiming would occur only when such parts as the cam shaft, time gears, or valves were 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 a direction opposite to the zero mark (see Cut No. 5). The time gears must also mesh so that the tooth marked zero (0) 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 valves being in the position indicated in Cut No. 5. The opening and closing of the valves being as follows: The exhaust valve opens when the piston reaches  $\frac{5}{16}$ " of bottom center, the distance from the top of the piston head to the top of the cylinder casting measuring  $3\frac{3}{8}$ ". The exhaust valve will close on top center, the piston being  $\frac{5}{16}$ " above the cylinder casting. The intake valve opens  $\frac{1}{8}$ " after top center (the piston then being  $\frac{1}{4}$ " above the top of the cylinder) and closes  $\frac{9}{16}$ " after bottom center, the distance from the top of the piston to the top of the cylinder casting measuring  $3\frac{1}{8}$ ".

The clearance between the push rod and valve stem should never be greater than  $\frac{1}{32}$ " nor less than  $\frac{1}{64}$ ". The correct clearance is naturally half way between these two measurements. The gap should be measured when the push rod is on the heel of the cam.

*What about the  
care of the Valves?*

## *Answer No. 23*

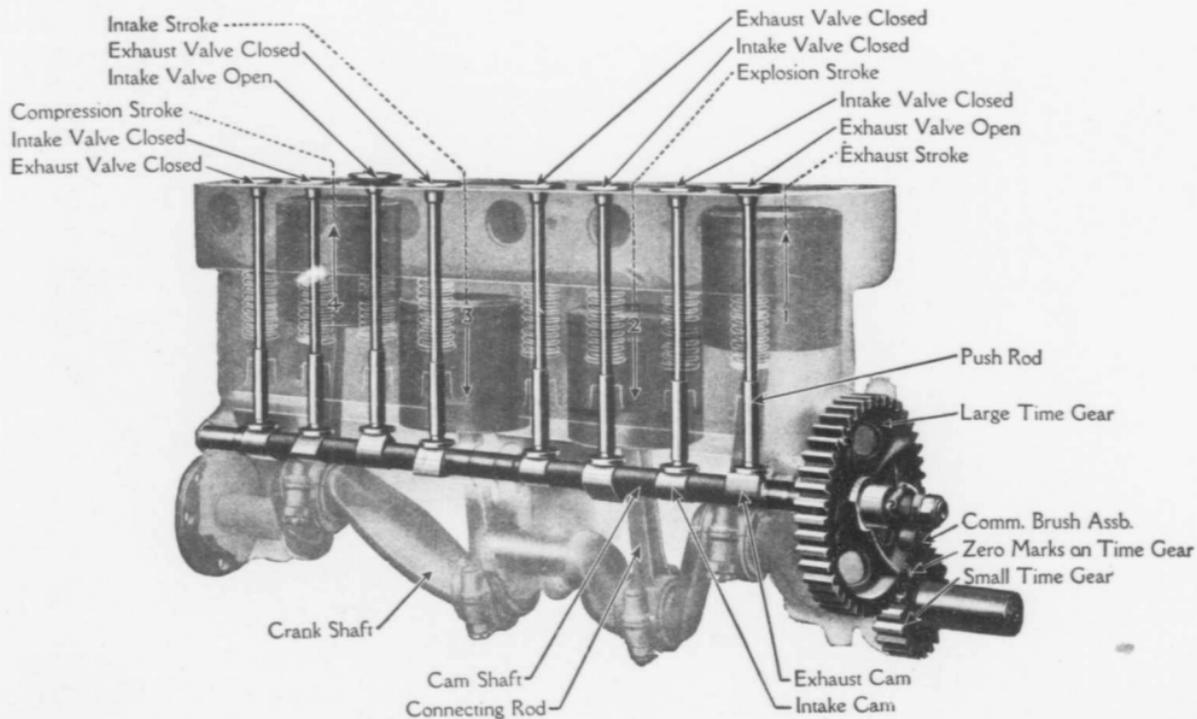
They seldom get out of order—but they may get dirty, as a result of carbon collecting on the valve seats. These carbon deposits, by preventing proper closing of the valves, permit the gases under compression to escape, resulting in loss of power and uneven running of the motor. If, when turning the engine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

*How are the Valves  
removed for grinding?*

## *Answer No. 24*

(1) Drain radiator; (2) remove cylinder head; (3) remove the two valve covers on the right side of engine; (4) raise the valve spring with lifting tool (see Cut No. 6) and pull out the little pin under the valve seat. The valve may then be lifted out by the head—preparatory to grinding.

IMPORTANT—Read carefully chapter on Lubrication, page 53



Cylinder Assembly, showing the correct position of the valves with time gears properly set according to punch marks on the gears, also the relative position of the pistons in their strokes as indicated above. The firing order of the cylinders is 1, 2, 4, 3. (Cut No. 5)

*How are Valves ground?*

### *Answer No. 25*

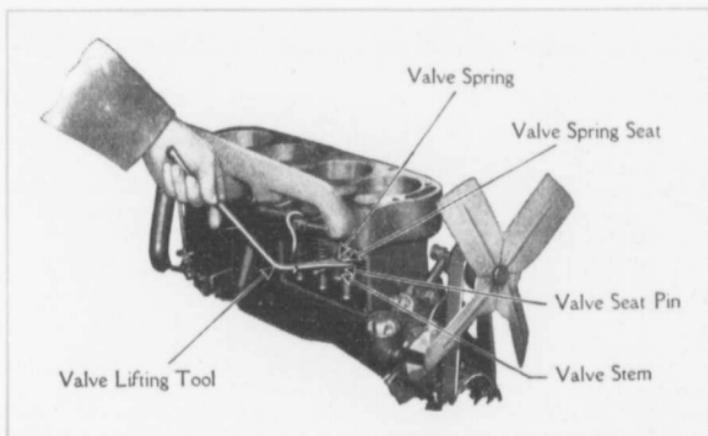
For this work use a good grinding paste of ground glass and oil—procurable from auto supply houses. A convenient way is to put a small amount in a suitable dish, adding a spoonful or two of kerosene and a few drops of lubricating oil to make a thin paste.

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 turn) a few times, with a Ford grinding tool. Then lift slightly from 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 around 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. This 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 valve.

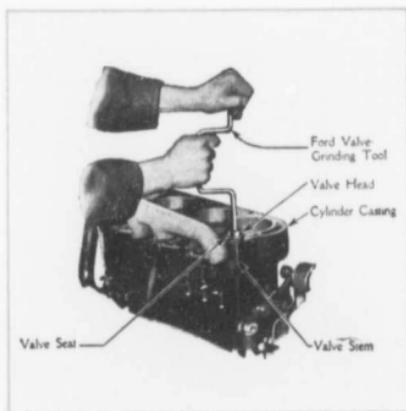
*When the Valves and Push Rods are worn—what?*

### *Answer No. 26*

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 dimin-



How the valve lifting tool should be used. (Cut No. 6)



Method of grinding valve. (Cut No. 7)

ishing the power of the motor, it is best to replace the push rods with new ones. The clearance between the push rod and the valve stem should never be greater than  $\frac{1}{32}$ " nor less than  $\frac{1}{64}$ ". 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  $\frac{1}{64}$ " there is danger of the valve remaining partially open all the time. If replacing the push rod does not give the proper clearance, the valve should also be replaced. We do not recommend drawing out the valve stem, as the operation requires experience and the price of the new part does not warrant the time and expense necessary to properly do the work.

*What about the  
Valve Springs?*

## *Answer No. 27*

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 effect 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 exhaust or burned gas is drawn back into the cylinder on the next (intake) stroke, reducing the amount of fresh gas drawn in on the same stroke, and thus greatly diminishing the force of the next explosion. Weakness in a valve spring can usually be detected by the following method: Remove the valve cover plate 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.

IMPORTANT—Read carefully chapter on Lubrication, page 53

*What causes "Knocking" in the engine?*

### *Answer No. 28*

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 a too advanced 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 the piston striking the cylinder head gasket. When the engine knocks from any cause whatsoever, the matter should be promptly investigated by an experienced mechanic and the difficulty corrected.

*How may the different Knocks be distinguished?*

### *Answer No. 29*

(1) The carbon knock is a clear, hollow sound, most noticeable in climbing sharp grades, 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 motor. (3) The connecting rod knock sounds like the distant tapping of steel with a small hammer, and is readily distinguished when the car is allowed to run idly down grade—or upon speeding the car to twenty-five miles an hour, then suddenly closing the throttle, the tapping will be very distinct. (4) The crank shaft main bearing knock can be distinguished when the car is going uphill, as a dull stud. (5) The loose piston knock is heard only 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. 30*

First, drain the water off by opening the pet cock at the bottom of the radiator; then disconnect the wires at the top of the motor and also the radiator connection attached to the cylinder head. Remove the 15 cap screws which hold the cylinder head in place. Take off the cylinder head and, 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. In replacing the cylinder head gasket turn the motor 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 bolts down evenly (i. e., give each bolt a few turns at a time); do not tighten them on one end before drawing them up at the other.

*Connecting Rod Bearings—how adjusted?*

### *Answer No. 31*

Connecting rod bearings may be adjusted, without taking out the engine, by the following method: (1) drain off the oil; (2) remove plate on bottom of crank case—exposing connecting rods; (3) take off first connecting rod cap, and draw-file the ends,—a very little at

IMPORTANT—Read carefully chapter on Lubrication, page 53

a time; do not under any circumstances raise the upper half of the connecting rod off the crank shaft—the piston might drop down too far, allowing the rings to expand below the lower edge of the cylinder walls; it would be extremely difficult to remove. (4) replace cap, being careful to see that punch marks correspond, and tighten bolts until it fits shaft snugly; (5) test tightness of bearings by turning engine over by the starting handle. Experienced mechanics usually determine when the 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—then tighten the cap bolts, put in all the cotter keys and replace the crank-case bottom plate and the work is finished. Be sure to put plenty of oil in the crank case before starting the motor.

Remember, there is a possibility of getting the bearings too tight, and under such conditions the babbitt is apt to cut out quickly, unless precaution is taken to run the motor slowly at the start. It is a good plan after adjusting the bearings to jack up the rear wheels and let the motor run slowly for about two hours (keeping it well supplied with water and oil) before taking it out on the road. Whenever possible these bearings should be fitted by an expert Ford mechanic. Worn connecting rods may be returned, prepaid, to the nearest dealer or branch house for exchange at a price of 75 cents each to cover the cost of reabbtting.

The constant tapping of a loose connecting rod on the crank shaft will eventually produce crystallization of the steel—result, broken crank shaft and possibly other parts of the engine damaged.

It is not advisable for any owner or repair shop to attempt the reabbtting of connecting rods or main bearings, for without a special jig in which to form the bearings, satisfactory results will not be obtained.

*How is the Power Plant removed from the Car?*

### *Answer No. 32*

- (1) Drain the water out of the radiator and disconnect the radiator hose, both upper and lower (or disconnect the top and side water connections);
- (2) disconnect the radiator stay rod which holds it to the dash;
- (3) remove the two stud nuts which hold the radiator to the frame, take out the connection plugs in the head lamps, disconnect feed wire on right head lamp, take out the carburetor priming wire and take off radiator shell and radiator;
- (4) remove the commutator (or spark advance) pull rod and the carburetor throttle pull rod altogether;
- (5) disconnect the four spark plug wires at the plugs, the magneto to coil wire at the magneto contact, and remove the commutator case without disconnecting the wires attached to it;
- (6) remove the stud nuts, springs and cap holding the front radius rod in the socket underneath the crank case;
- (7) remove the four bolts holding the universal ball cap to the rear end of the motor;

IMPORTANT—Read carefully chapter on Lubrication, page 53

(8) remove pans on either side of cylinder casting; turn off gasoline under tank and disconnect feed pipe from carburetor;

(9) disconnect long exhaust pipe from exhaust manifold by unscrewing large pack nut, and remove the long exhaust pipe;

(10) take out the two cap screws and bearing cap which hold the crank case to the front frame bearing;

(11) remove the bolts which hold the crank case arms to the frame at the sides. Then pass a rope through the opening between the two middle cylinders and tie in a loose knot or loop. Through the rope pass a "2 x 4" or a stout iron bar about ten feet long, and let a man hold each end; let a third man take hold of the starting crank; raise the motor an inch or two till the crank case side arms clear the bolts in the frame, hold the front radius rods down, move the motor forward and lower it onto the frame again, then slide it forward under the dash; it can then be lifted from the car to the work bench for adjustment.

Note,—on 1916 and earlier cars the dash and steering gear assembly must be removed before the motor can be lifted out. After (9) proceed as follows,—disconnect the dash at the two supporting brackets which rest on the frame, and remove all bolts holding the dash to the body; remove the bolts holding the steering gear bracket to the frame, and remove the steering ball arm from the lower end of the steering post; lift off the dash with the steering gear, coil, spark plug wires, commutator wiring and case, etc. attached to it.

*Crank Shaft Main Bearings—  
how adjusted?*

### *Answer No. 33*

Should the stationary bearings in which the crank shaft revolves become worn (evidenced by a pounding in the motor) and need replacing or adjusting, proceed as follows:

(1) After the engine has been taken out of the car, remove transmission cover, crank case, fly wheel and transmission assembly, magneto coil, cylinder head, pistons, and connecting rods. Punch-mark the front end of each crank shaft bearing cap so you can always replace each cap in the proper position. Take off the three babbitted caps and clean the bearing surfaces with gasoline. Apply Persian blue or red lead to the crank shaft bearing surfaces, which will enable you, in fitting the caps, to determine whether a perfect bearing surface is obtained.

(2) Place the rear cap in position (with the punch marked end towards the front) and tighten it up as much as possible without stripping the bolt threads. When the bearing has been properly fitted, the crank shaft will permit moving with one hand. If the crank shaft cannot be turned with one hand, the contact between the bearing surfaces is evidently too close, and the cap requires shimming up, one or two brass liners usually being sufficient. In case the crank shaft moves too easily with one hand, the shims should be removed and the steel surface of the cap filed off, permitting it to set closer.

(3) After removing the cap, observe whether the blue or red "spottings" indicate a full bearing the length of the cap. If

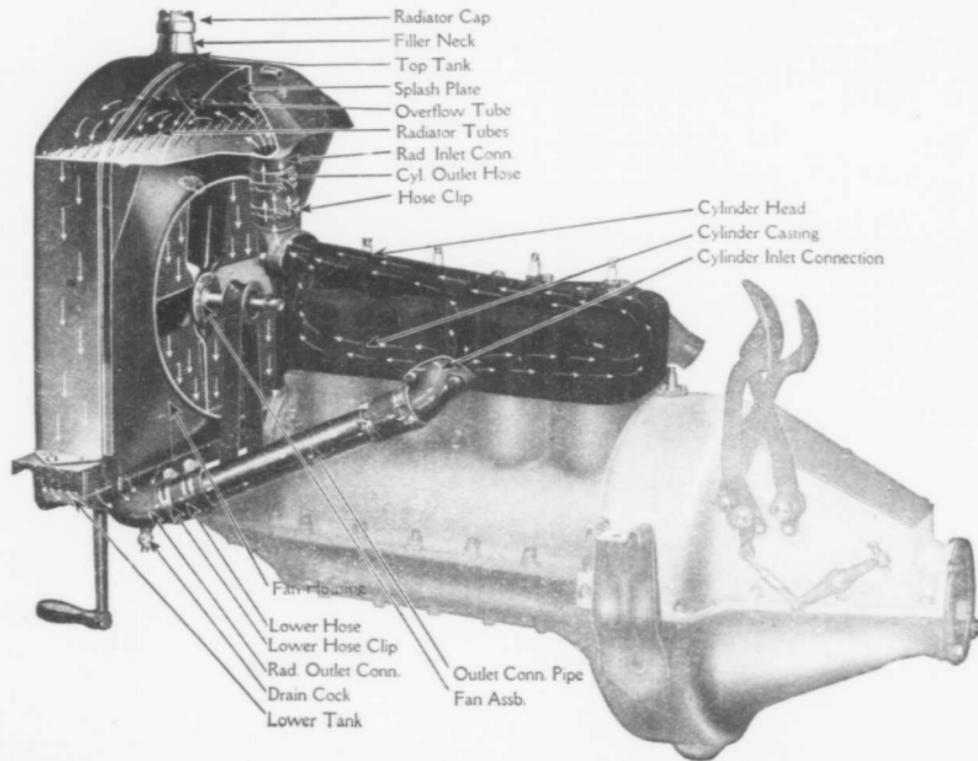
IMPORTANT—Read carefully chapter on Lubrication, page 53

"spottings" do not show a true bearing, the babbitt should be scraped and the cap refitted until the proper results are obtained.

(4) Lay the rear cap aside and proceed to adjust the center bearing in the same manner. Repeat the operation with the front bearing, with the other two bearings laid aside.

(5) When the proper adjustment of each bearing has been obtained, clean the babbitt surfaces carefully and 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 shim under the cap and the oil between the bearing surface will prevent the metal being drawn into too close contact. If oil is not put on the bearing surfaces, the babbitt is apt to cut out when the motor is started up before the oil in the crank case can get into the bearings. In replacing the crank case and transmission cover on the motor, it is advisable to use a new set of felt gaskets to prevent oil leaks.

IMPORTANT—Read carefully chapter on Lubrication, page 53



The Thermo-Syphon Cooling System of the Ford has no pump or complicated mechanism. Arrows show course of water through water passages. (Cut No. 8)

## The Ford Cooling System

*How is the Engine cooled?*

### *Answer No. 34*

The heat generated by the constant explosions in the engine would soon overheat and ruin the engine, were it not cooled by some artificial means. The Ford engine is cooled by the circulation of water in jackets around the cylinders. The heat is extracted from the water by its passage through the thin metal tubing of the radiator—to which are attached scientifically worked out fins, which assist in the rapid radiation of the heat. The fan, just back of the radiator, sucks the air around the tubing—through which the air is also driven by the forward movement of the car. The fan belt should be inspected frequently and tightened when necessary—not too tight, however—by means of the adjusting screw in the fan bracket. Take up the slack till the fan starts to bind when turned by hand.

*How does the Water circulate?*

### *Answer No. 35*

The cooling apparatus of the Ford car is known as the Thermo-Syphon system. It acts on the principle that hot water seeks a higher level than cold water—consequently when the water reaches a certain heat, approximately 180 degrees Fahrenheit, circulation commences and the water flows from the lower radiator outlet pipe up through the water jackets, into the upper radiator water tank, and down through the tubes to the lower tank, to repeat the process (see cut No. 8).

*What are the causes of Overheating?*

### *Answer No. 36*

(1) carbonized cylinders; (2) too much driving on low speed; (3) spark retarded too far; (4) poor ignition (see chapter on Ignition); (5) not enough or poor grade oil; (6) racing motor; (7) clogged muffler; (8) improper carburetor adjustment; (9) fan not working properly on account of broken or slipping belt; (10) improper circulation of water due to clogged radiator tubes, leaky connections or low water.

*What should be done when the Radiator Overheats?*

### *Answer No. 37*

Keep the radiator full. Don't get alarmed if it boils occasionally—especially in driving through mud and deep sand or up long hills in extremely warm weather. Remember that the engine develops the greatest efficiency when the water is heated nearly to the boiling point. But if there is persistent overheating when the motor 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. Perhaps twisting the fan blades at a greater angle to produce more suction may bring desired results. 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—providing the water system is not entirely empty—in which case motor should be allowed to cool before cold water is introduced.

*How about cleaning the Radiator?* **Answer No. 38**

The entire circulating system should be thoroughly flushed out occasionally. To do this properly, the radiator inlet and outlet hose should be disconnected, and the radiator flushed out by allowing the water to enter the filler neck at ordinary pressure, from whence it will flow down through the tubes and out at the drain cock and hose. The water jackets can be flushed out in the same manner. Simply allow the water to enter into the cylinder head connection and to flow through the water jackets and out at the side inlet connection.

*Will the Radiator freeze in winter?* **Answer No. 39**

Yes, unless an anti-freezing solution is used in the circulating system, you are bound to experience trouble. As the circulation does not commence until the water becomes heated, it is advisable to use an anti-freezing solution in winter, otherwise at low temperature the water is apt to freeze before it commences to circulate. 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 or denatured alcohol can be used to good advantage. The following table gives the freezing point of solutions containing different percentages of alcohol: 20 per cent solution freezes at 15 degrees above zero; 30 per cent solution freezes at 8 degrees below zero; 50 per cent solution freezes at 15 degrees below zero. A solution composed of 60 per cent water, 10 per cent glycerine and 30 per cent alcohol is commonly used; its freezing point is about 8 degrees below zero.

*Is it advisable to use Calcium chloride, oil or kerosene in anti-freezing solutions?*

**Answer No. 40**

No. Alcohol and glycerine are the only safe ingredients to use. Calcium chloride injures the radiator tubes; oil does not carry off the heat properly, but transmits it to the outside cylinder walls; it is, moreover, very sluggish in action, and therefore causes overheating troubles; it also rots rubber hose connections very rapidly. Kerosene is very poor as a cooling medium and gives off dangerous gases when heated.

*How are leaks and jams in the Radiator repaired?*

**Answer No. 41**

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. Cut the tube an inch above and below the jam and insert a new piece, soldering the connections. If the entire radiator is badly jammed or broken it would probably be advisable to install a new one.

## The Gasoline System

*How does the  
Carburetor work?*

*Answer No. 42*

The carburetor is of the automatic float feed type, having but one adjustment—the gasoline needle valve. The cross section diagram of carburetor on next page is not a detail drawing but simply shows how the gasoline enters the carburetor, is vaporized by a current of air, and passes through the inlet pipe to the engine in the form of an explosive mixture. The gasoline, entering the bowl of the carburetor, gradually raises the float to a point where it closes the inlet needle valve, thus cutting off the flow of gasoline. As the gasoline in the bowl recedes, the float lowers and lifts the needle from its seat and the flow of gasoline is resumed. It is plain to see that a constant level of gasoline is maintained in the carburetor by the automatic action of float and needle. The quantity of gasoline entering into the mixture is governed by the needle valve (see Ans. No. 45). The volume of gas mixture entering the intake pipe is controlled by opening and closing the throttle, according to the speed desired by the driver.

*Why is Carburetor adjustment  
placed on dash?*

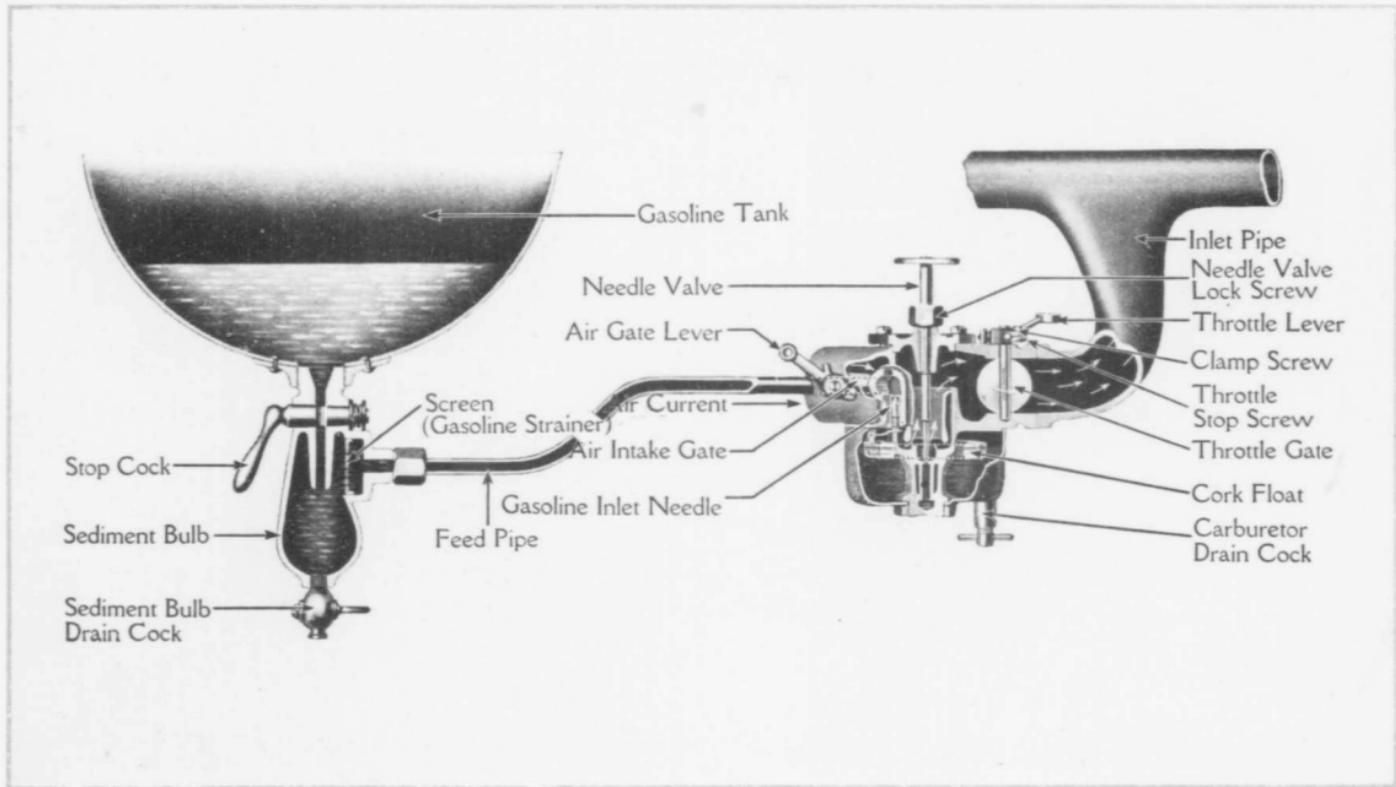
*Answer No. 43*

For the convenience of the driver in adjusting the carburetor. After the new car has become thoroughly worked in, find out what position of the carburetor adjusting rod handle seems to give the best results, and endeavor to keep it in that position to indicate the point at which the engine runs most satisfactorily. In cold weather it will probably be found necessary to turn the carburetor adjustment one-quarter turn to the left (see Cut No. 10, Figure "B") particularly in starting a cold engine. As gasoline vaporizes readily in warm weather, the driver will find it economical to reduce the quantity of gasoline in the mixture by turning the carburetor adjustment to the right (as far as possible without reducing speed) as indicated by Figure "C." This is particularly true when taking long drives where conditions permit a fair rate of speed being maintained, and accounts in part for the excellent gasoline mileage obtained by good drivers.

*What is meant by a "lean"  
and a "rich" mixture?*

*Answer No. 44*

A lean mixture has too much air and not enough gasoline. A rich mixture has too much gasoline and not enough air. A rich mixture will not only quickly cover the cylinders, pistons and valves with soot, but will tend to overheat the cylinders, and is likewise wasteful of the fuel. It will often choke the engine and cause mis-firing at slow speeds, although at high speeds the machine may run fairly well, but with a "heavy" feel. The mixture should be kept as lean as possible without the sacrifice of any of the power of the motor. Too



This cut illustrates the principle of Ford Carburetion. (Cut No. 9)

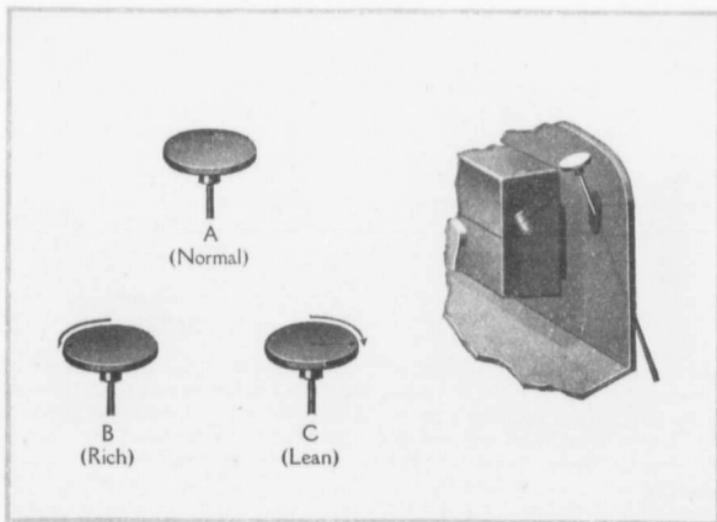
lean a mixture will result in back-firing through the carburetor, for the reason that the gas burns slowly in the cylinder, and is still burning when the inlet valve opens again, which causes the gas in the intake to ignite. A rich mixture is shown by heavy, black exhaust smoke with a disagreeable smell. Proper mixture will cause very little smoke or odor.

*How is the Carburetor adjusted?*

### *Answer No. 45*

If the carburetor adjustment is known to be absolutely incorrect, turn the adjusting needle down (to the right) until it seats (do not screw it down so hard as to damage the seat) then turn it up (to the left) about one full turn or one and an eighth turns; this position is close enough to enable you to start the motor.

After starting the motor, advance the throttle lever to about the sixth notch, with the spark retarded to about the fourth notch. The flow of gasoline should now be cut off by screwing the needle valve down (to the right) until the engine begins to mis-fire; then gradually increase the gasoline feed by opening the needle valve until the motor picks up and reaches its highest speed—and until no trace of black smoke comes from the exhaust. Having determined the point where the motor runs at its maximum speed, the needle valve binding screw should be tightened to prevent the adjustment being disturbed. For average running a lean mixture will give better results than a rich one.



Carburetor Dash Adjustment. (Cut No. 10)

*Would water clog  
the Carburetor?*

### *Answer No. 46*

The presence of water in the carburetor or gasoline tank, even in small amounts, will prevent easy starting and the motor will mis-fire and stop. As water is heavier than gasoline it settles to the bottom of the tank and into the sediment bulb along with other foreign matter. As it is difficult nowadays to get gasoline absolutely free from impurities, especially water, it is advisable to frequently drain the sediment bulb under the gasoline tank. During cold weather any water which accumulates in the sediment bulb is likely to freeze and prevent the flow of gasoline through the pipe leading to the carburetor. Should anything of this kind happen it is possible to open the gasoline line by wrapping a cloth around the sediment bulb and keeping it saturated with hot water for a short time. Then the water should be drained off. In event the water gets down into the carburetor and freezes, the same treatment may be applied.

*What would make the  
Carburetor leak?*

### *Answer No. 47*

The flow of gasoline entering the carburetor through the feed pipe is automatically regulated by the float needle raising and lowering in its seat. Should any particle of dirt become lodged in the seat, which prevents the needle from closing, the gasoline will overflow in the bowl of the carburetor and leak out upon the ground. If the cork float is too high, that will also cause the carburetor to flood and leak.

*If there is dirt in the  
Carburetor—what?*

### *Answer No. 48*

The spraying nozzle of the carburetor having a very small opening, a minute particle of grit or other foreign matter will clog up the orifice, and result: motor will begin to mis-fire and slow down as soon as it has attained any considerable speed. This is accounted for by the fact that at high speeds the increased suction will draw the particles of dust, etc., into the nozzle. By opening the needle valve half a turn and giving the throttle lever two or three quick pulls the dirt or sediment will often be drawn through, when the needle may be turned back to its original place. If this does not accomplish the purpose, the carburetor should be drained. Be careful not to screw the needle valve down too tight or you will groove the needle and the valve seat.

*If Engine runs too fast or chokes  
with throttle closed—what?*

### *Answer No. 49*

If the engine runs too fast with throttle fully closed unscrew the carburetor throttle lever adjusting screw until the engine idles at suitable speed. If the motor chokes and stops when the throttle is fully closed, 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.

*What is the purpose of the Hot Air Pipe?*

### *Answer No. 50*

It takes the hot air from around the exhaust pipe and conducts it to the carburetor—where the heat facilitates the vaporizing of the gasoline. It is usually advisable to remove this pipe in the hot season—but it is an absolutely necessary feature during cold weather.

*What is the purpose of the Cork Float?*

### *Answer No. 51*

It automatically controls the flow of the gasoline into the carburetor. If it floats too low, starting will be difficult; if too high, the carburetor will flood and leak. To correct the float setting bend the float lever arm up or down slightly, but do not attempt this unless you are positive the float needs readjusting.

A cork float which has become fuel soaked should be removed and replaced by a new one or thoroughly dried and then given a couple of coats of shellac varnish to make it waterproof.

*Should the Priming Rod be used in cranking when the Motor is warm?*

### *Answer No. 52*

No. The carburetor does not ordinarily require priming when the motor is warm, and cranking with the rod pulled out is apt to "flood" the engine with an over-rich mixture of gas, which does not readily explode. This naturally causes difficulty in starting. If you should accidentally flood the engine, turn the carburetor adjusting needle down (to the right) until it seats; then turn the engine over a few times with the starting crank in order to exhaust the rich gas. As soon as the motor starts, turn back the needle (to the left) and readjust the carburetor.

IMPORTANT—Read carefully chapter on Lubrication, page 53

## The Ford Ignition System

*What is the purpose of the Ignition System?*

*Answer No. 53*

It furnishes the electric spark which explodes the charge in the combustion chamber, thus producing the power which runs the engine. It is important that the charge be correctly ignited at the proper time, in order to obtain satisfactory results in running the car. In the Ford car the ignition system is as simple as it is possible for human invention to make it.

*How does the Magneto generate current?*

*Answer No. 54*

Magnets mounted on the motor flywheel, and revolving with it, pass stationary coil spools mounted on a support attached to the rear of the cylinder, creating an alternating low tension electric current in the windings of the stationary coil spools. This current is carried from the magneto coil spools to the magneto connection (wire) leading to the coil box on the dash.

*Should the coil Vibrator Adjustment be disturbed?*

*Answer No. 55*

Every coil unit is properly adjusted when it leaves the factory and this adjustment should not be disturbed unless to install new points or to reduce the gap between the points which may have increased from wear. When adjustments are necessary they should, whenever possible, be made by one of our service stations who have special equipment for testing and adjusting units and will gladly furnish expert service. If the points are pitted they should be filed flat with a fine double-faced file and the adjusting thumb nut turned down so that, with the spring held down, the gap between the points will be a trifle less than  $\frac{1}{32}$  of an inch. Then set the lock nut so that the adjustment can not be disturbed. Do not bend or hammer on the vibrators, as this would affect the operation of the cushion spring of the vibrator bridge and reduce the efficiency of the unit.

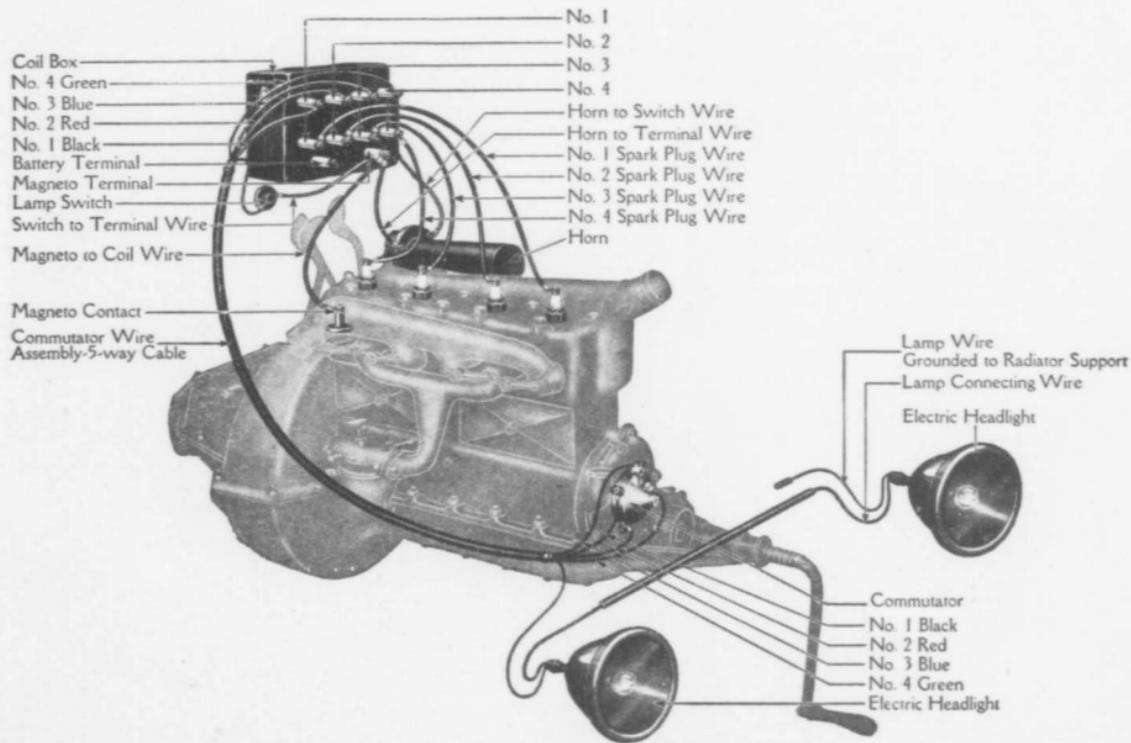
*How is a Weak Unit detected?*

*Answer No. 56*

With the vibrators properly adjusted, if any particular cylinder fails or seems to develop only a weak action, change the unit with others to determine if the fault is actually in the unit.

If the vibrators do not buzz, regardless of the position of the unit in the coil box, the unit itself is probably at fault (vibrators badly worn or improperly adjusted).

If the vibrators buzz with the unit in one position but not in another the fault will probably be found in the commutator or wiring corresponding to the position of the unit when it does not buzz. For instance if the vibrators buzz when the unit is in No. 1 position (right end of the coil box) but do not buzz in No. 4 position (left end of coil



Wiring of the Ford Ignition System, also Electric Horn and Headlamps. (Cut No. 11)

box) look for a break, short circuit or loose connection in No. 4 commutator wire or a worn contact point (No. 4) in the commutator. If the vibrators buzz regardless of the position of the unit in the coil box, and still no spark occurs at one certain spark plug, the latter may be dirty or short circuited or the porcelain may be cracked.

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

*Answer No. 57*

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 engine pan or other metal parts is made. A steady buzzing of one of the coil units will indicate a "short" in the wiring. When driving the car the engine will suddenly lag and pound on account of the premature explosion. Be careful not to crank the engine downward against compression when the car is in this condition, as the "short" is apt to cause a vigorous kick back.

*Does Coil Adjustment affect starting?*

*Answer No. 58*

Yes. When the vibrators are not properly adjusted more current is required to make and break the contact between the points, and, as a result, at cranking speeds you would 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 are apt to produce an occasional "miss" in the engine.

*What is the purpose of the Commutator?*

*Answer No. 59*

The commutator (or timer) determines the instant at which the spark plugs must fire. The grounded wire in 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.

*What about the Spark Plugs?*

*Answer No. 60*

One is located at the top of each cylinder and can easily be taken out with the spark plug wrench included with every car, after the wire connection is removed. The high voltage current flows out of the secondary coils in the coil box and on reaching the contact points in each spark plug it is forced to jump a  $\frac{1}{16}$ " gap, thereby forming a spark which ignites the gasoline charge in the cylinders.

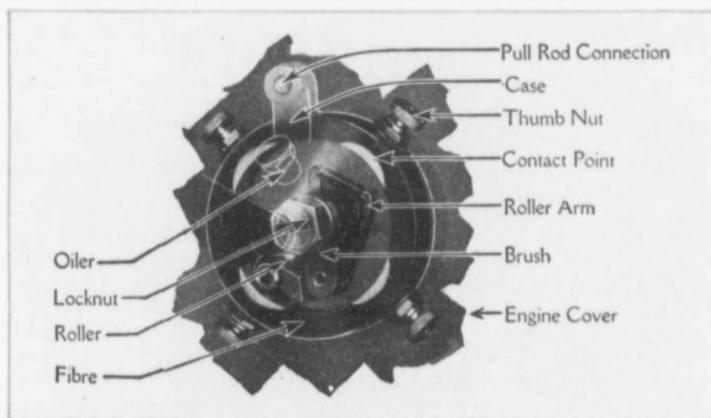
IMPORTANT—Read carefully chapter on Lubrication, page 53

The spark plugs should be kept clean (i. e., free from carbon) and should be replaced if they persist in not working properly. There is nothing to be gained by experimenting with different makes of plugs. The make of plugs with which Ford engines are equipped when they leave the factory are best adapted to the requirements of our motor, notwithstanding the opinion of various garage men to the contrary. All wire connections to spark plugs, coil box and commutator should, of course, at all times be kept in perfect contact. (See Answer No. 63 on cleaning Spark Plugs.)

*What are the indications of Ignition trouble?*

### Answer No. 61

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



The Ford Commutator. (Cut No. 12)

*How can you tell which Cylinder is misfiring?*

### Answer No. 62

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 down the two outside vibrators, No. 1 and No. 4, with the fingers, so 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 in either 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 mis-firing is in No. 1.

IMPORTANT—Read carefully chapter on Lubrication, page 53

In this manner all of the cylinders in turn can be tested until the trouble is located. Examine both the spark plug and the vibrator of the mis-firing cylinder.

*How are Spark  
plugs cleaned?*

### *Answer No. 63*

After removing the plug 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 plug should be taken apart by securing the large hexagon steel shell in a vise and loosening the pack nut which holds the porcelain in place. The carbon deposits can then be easily removed from the porcelain and shell with 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. The porcelain and other parts should finally be washed in gasoline and wiped dry with a cloth.

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, and the distance between the sparking points should be  $\frac{1}{32}$ " , about the thickness of a smooth dime.

Dirty plugs usually result from an excess of oil being carried in the crank case—or from using oil of poor quality.

*If the Coil and  
Plug are right—what?*

### *Answer No. 64*

The trouble is probably due to an improperly seated valve, worn commutator, or short circuit in the commutator wiring. Weakness in the valves may be easily 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 gasket (packing) becomes 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 (with the motor running, of course) and noticing whether bubbles appear or not.

*Would a worn Commutator  
cause misfiring?*

### *Answer No. 65*

Yes. If misfiring occurs when running at high speed, inspect the commutator. The surface of the circle around which roller (see Cut No. 12) travels 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. Possibly the trouble is caused by short-circuited commutator wires. The spring should be strong enough to make a firm contact between the roller and the points if they are worn or dirty.

*How is the  
Commutator removed?*

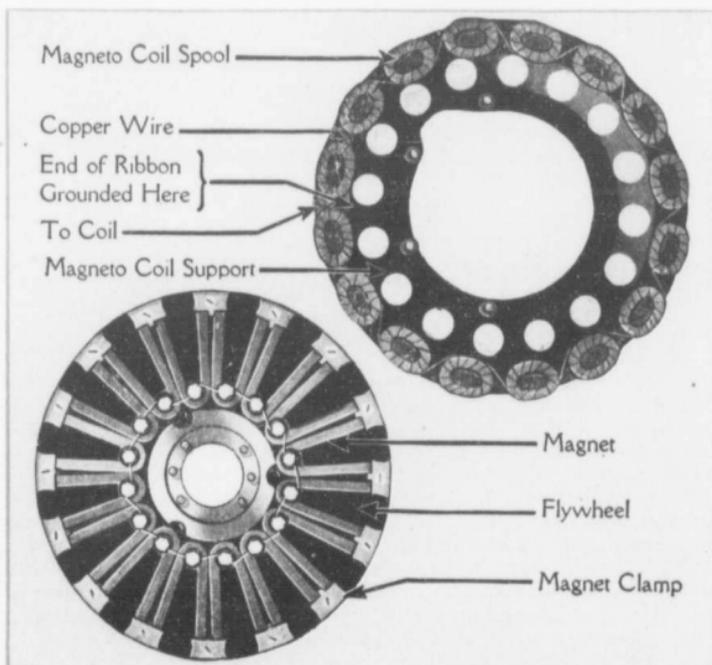
### *Answer No. 66*

Remove cotter pin from spark rod and detach latter from commutator. Loosen the cap screw which goes through breather pipe on top of time gear cover. This will release the spring which holds the commutator case in place and this part can be readily removed. Unscrew lock nut; withdraw steel brush cap and drive out the retaining pin. The brush can then be removed from the cam shaft. In replacing the brush, care must be exercised to see that it is reinstated so that the exhaust valve on the first cylinder is closed when the brush points upward. This may be ascertained by removing the front valve door and observing the operation of No. 1 valve. (See Cut No. 5.)

*Does cold weather affect  
the Commutator?*

### *Answer No. 67*

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 very apt to prevent the roller from making



The Ford Magneto. The flywheel with magnets revolves with the engine, while magneto coils remain stationary. (Cut No. 13)

perfect contact with the contact points imbedded 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 with the contact points. To overcome this, as well as any liability of the contact points to rust, we recommend a mixture of 25% kerosene with the commutator lubricating oil, which will thin it sufficiently to prevent congealing, or freezing, as it is commonly called. You have probably noticed in starting your car in cold weather that perhaps 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 terminals.

*How is the  
Magneto removed?*

### *Answer No. 68*

It is necessary to take the power plant out of the car (see Answer No. 32) in order to remove the magneto. Then remove crank case and transmission cover—take out the four cap screws that hold the flywheel to the crank shaft. You will then have access to the magnets and entire magneto mechanism. In taking out these parts—or any parts of the car—the utmost care should be taken to make sure that the parts are so marked that they may be replaced properly.

*If the Magneto gets  
out of order—what?*

### *Answer No. 69*

The Ford 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 magnets. If anything like this happens, it is not advisable to try to recharge them, but rather install a complete set of new magnets. The new magnets will be sent from the nearest Dealer or branch house, and will be placed on a board in identically 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 separated from the surface of the coil spool just  $\frac{1}{32}$  of an inch. To take out the old magnets, simply remove the capscrew and bronze screw which holds each in place. The magneto is often blamed when the trouble is a weak current caused by waste or other foreign matter accumulating under the contact spring, which is held in place by the binding post on top of the transmission cover. Remove the three screws which hold the binding post in place, remove binding post and spring and replace after foreign substance has been removed.

IMPORTANT—Read carefully chapter on Lubrication, page 53

## The Ford Transmission

*What is the function of the Transmission?*

### *Answer No. 70*

It is that part of the mechanism of an automobile which lies between the engine shaft and the propeller shaft and by which one is enabled to move at different speeds from the other. It is the speed gear of the car. It sends the car forward at low and high speeds and by it the car is reversed.

*What is meant by the term "Planetary Transmission?"*

### *Answer No. 71*

One in which the groups of gears always remain in mesh and revolve around a main axis. The different sets of gears are brought into action by stopping the revolution of the parts which support the gears. By means of bands (similar to brake bands) the rotation of the different parts is stopped. The planetary transmission is the simplest and most direct means of speed control—and is a distinct advantage of the Ford car.

*What is the purpose of the Clutch?*

### *Answer No. 72*

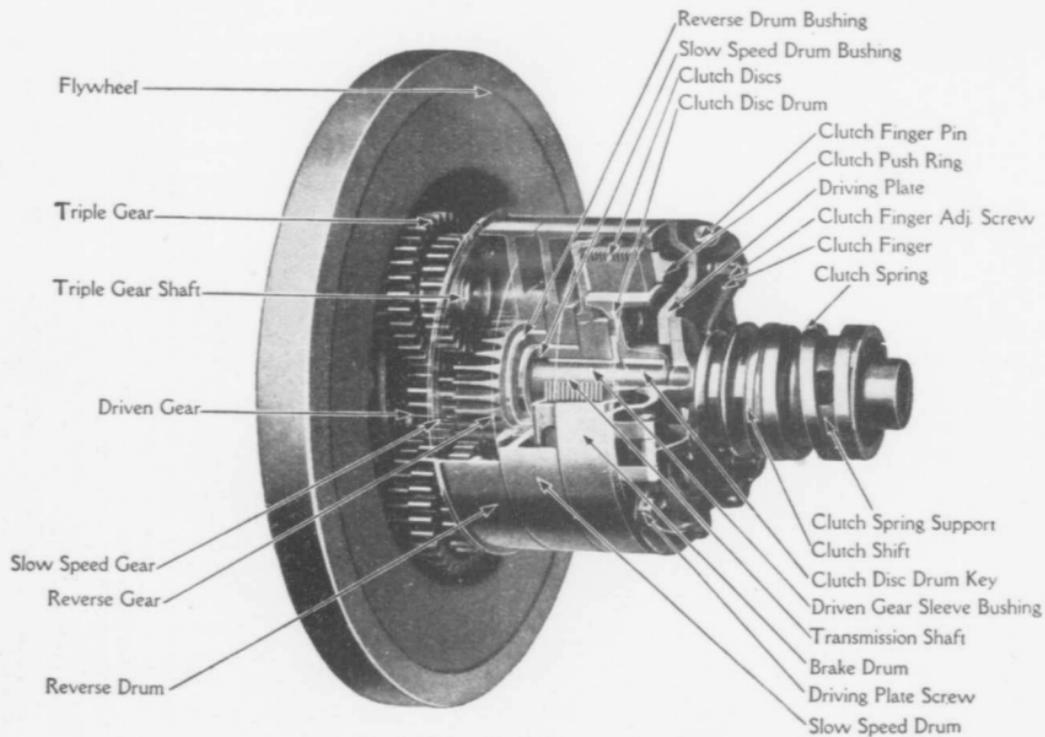
If the crank shaft of the engine ran without break straight through to the differential—and through it applied its power direct to the rear wheels—the car would start forward immediately upon the starting of the engine (were it possible to get it started under such conditions). To overcome this difficulty the shaft is divided and by means of the clutch the part of the shaft to which the running engine is delivering its power is enabled to take hold of the unmoving part gradually and start the car without a jolt or jar. The forward part of the shaft is referred to as the crank shaft, the rear part as the drive shaft.

*How is the Clutch controlled?*

### *Answer No. 73*

By the left pedal at the driver's feet (see Answer No. 9). If the clutch pedal, when pushed forward into slow speed, has a tendency to stick and not come back readily into high, tighten up the slow speed band as directed in Answer No. 76. Should the machine have an inclination to creep forward when cranking, it is probable that the clutch lever screw which bears on the clutch lever cam has worn, and requires an extra turn to hold the clutch in neutral position. When the clutch is released by pulling back the hand lever the pedal should move forward a distance of  $1\frac{3}{4}$ " in passing from high speed to neutral.

See that the hub brake shoes and connections are in proper order so that the brakes will act sufficiently to prevent the car creeping very far ahead. Also be sure the slow speed band does not bind on



Transmission, showing all gears in mesh. (Cut No. 14)

account of being adjusted too tight. Don't use too heavy a grade of oil in cold weather, as it will have a tendency to congeal between the clutch discs and prevent proper action of the clutch.

*What would cause  
the Clutch to slip?*

### *Answer No. 74*

The clutch fingers may need tightening (see Answer No. 75) or possibly the clutch lever adjusting screw, which bears on the cam or speed lever on the controller shaft, may be screwed down too far, preventing the high speed clutch from engaging when the hand brake lever is all the way forward; or the hub brakes may be adjusted too tightly so that the brake operating cams go past center when the brake lever is all the way forward, and the reverse pressure of the hub brake shoes on the cams tends to force the hand brake lever back, thus raising the clutch lever slightly.

*How is the  
Clutch adjusted?*

### *Answer No. 75*

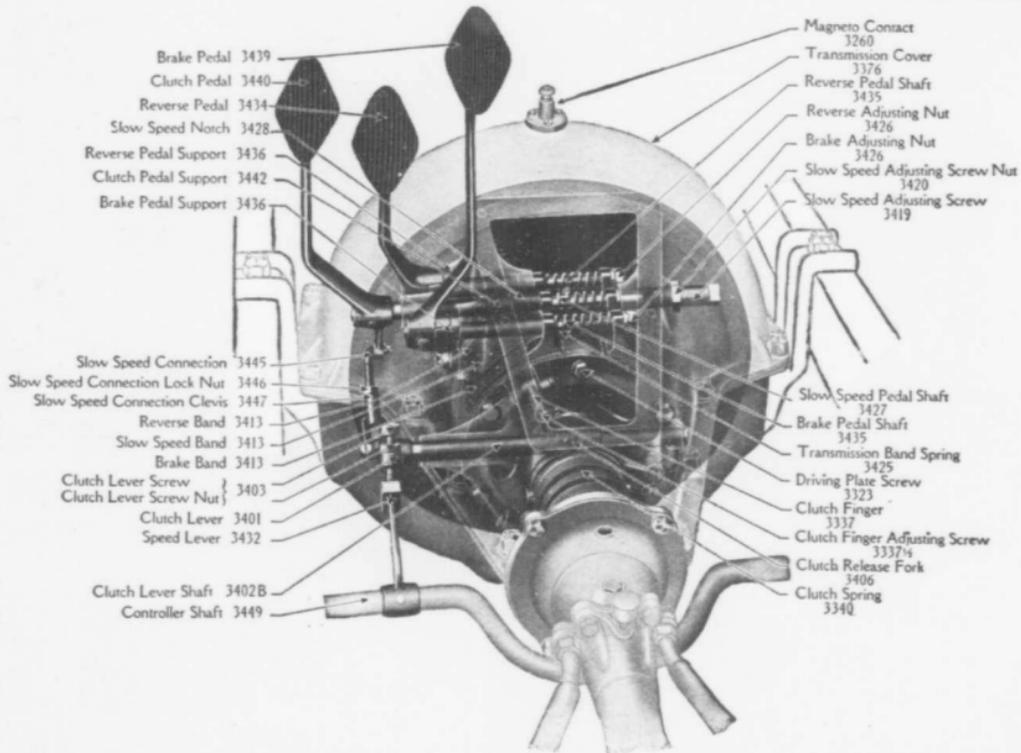
Remove the plate on the transmission cover under the floor boards at the driver's feet. Take out the cotter key on the first clutch finger and give the set screw one-half to one complete turn to the right with a screw driver. Do the same to the other finger set screws. But be sure to give each the same number of turns and don't forget to replace the cotter key. And after a considerable period of service the wear in the clutch may be taken up by installing another pair of clutch discs, rather than by turning the adjusting screws in too far.

**CAUTION:** Let us warn you against placing any small tools or objects over or in the transmission case without a good wire or cord attached to them. It is almost impossible to recover them without taking off the transmission cover.

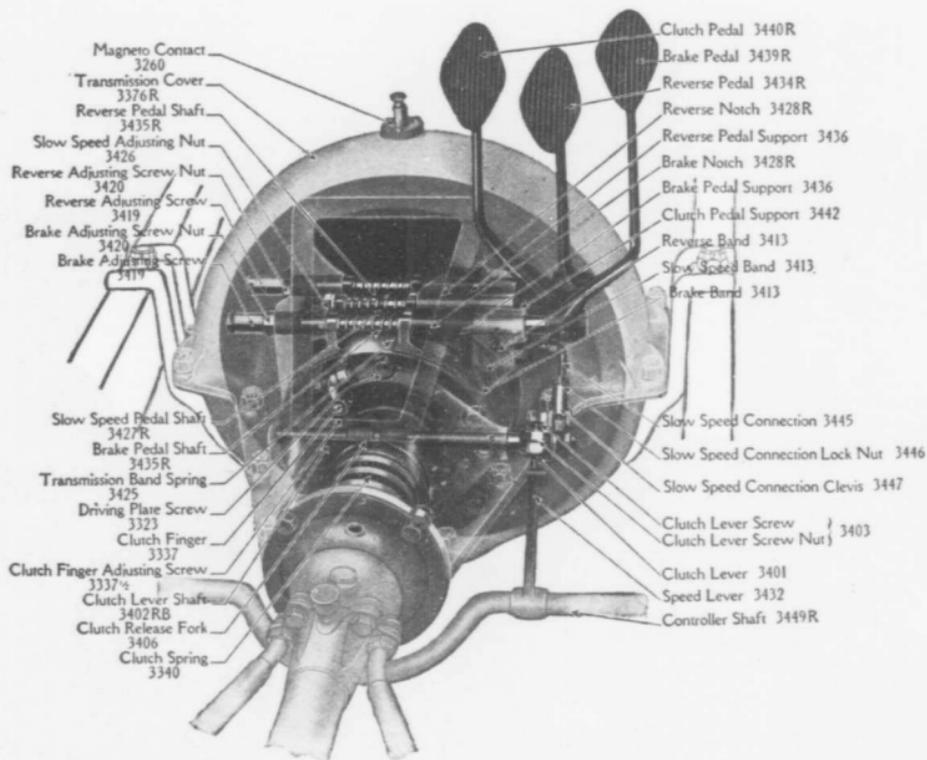
*How are the  
Bands adjusted?*

### *Answer No. 76*

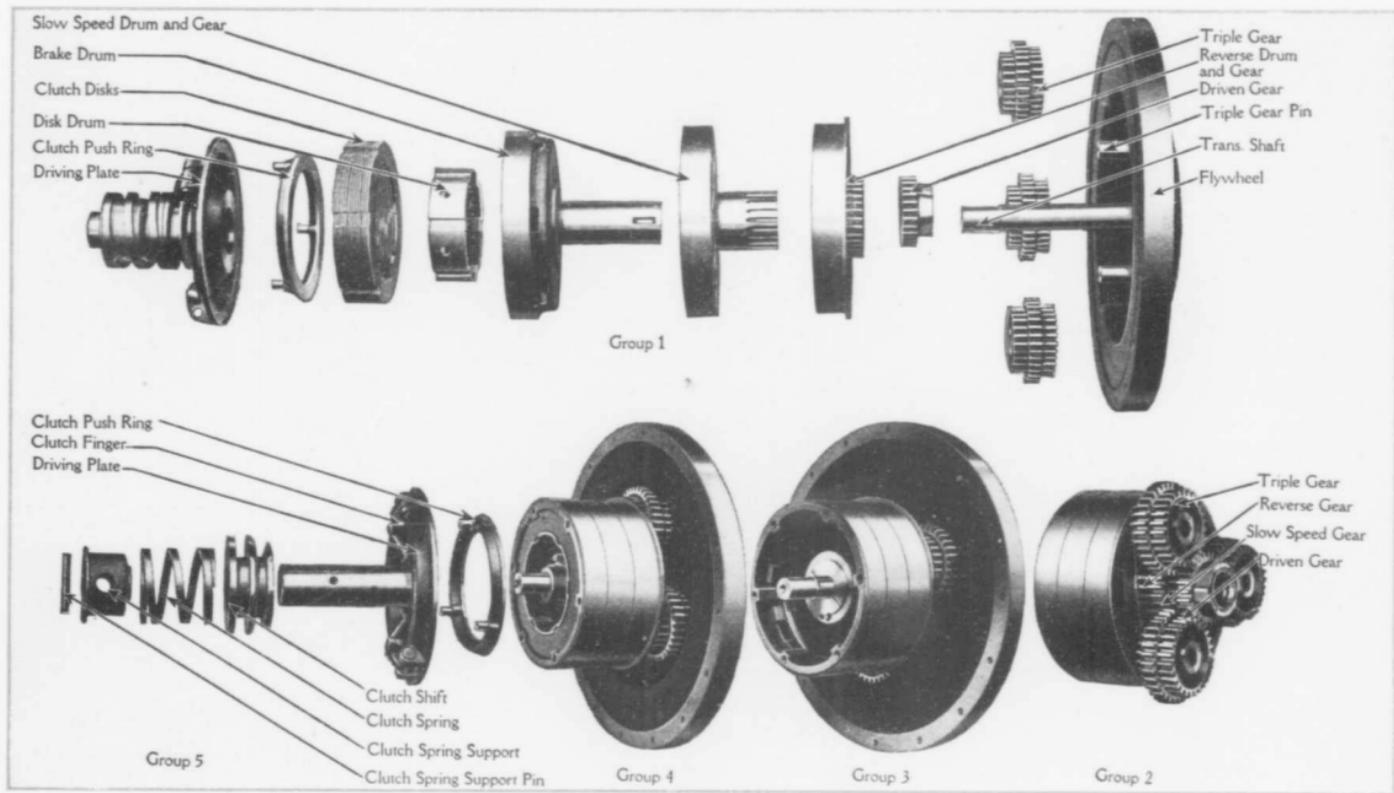
On left control cars—The slow speed band may be tightened by loosening the lock nut at the right side of transmission cover, and turning the adjusting screw (see Cut No. 15) to the right. To tighten the brake and reverse bands remove the transmission case cover door and turn the adjusting nuts on the shafts to the right. On right control cars—The reverse and brake bands are tightened by loosening lock-nuts at the left side of the transmission cover, and turning the adjusting screws to the right. To tighten the slow speed band remove the transmission cover door and turn the adjusting nut on the end of the slow speed shaft to the right. (See Cut No. 16.) See that the bands do not drag on the drums when disengaged, as they exert a brake effect, and tend to overheat the motor. However, the foot brake should be adjusted so that a sudden pressure will stop the car immediately, or slide the rear wheels in case of emergency. The bands, when worn to such an extent that they will not take hold properly, should be relined, so that they will engage smoothly with-



The above drawing shows the operation and adjustments of Clutch, Reverse and Brake Pedals on Left Control Cars. (Cut No. 15)



Clutch, Reverse and Brake Pedals and their Adjustments. Right Control Cars. (Cut No. 16)



Transmission parts in their relative assembling positions. (Cut No. 17)

out causing a jerky movement of the car. The lining is inexpensive and may be had at any of the 6000 Ford service stations at small cost.

*How are the  
Bands removed?*

### *Answer No. 77*

Take off the door on top of transmission cover. Turn the transmission band adjustment nuts (on the ends of the reverse and brake pedal shafts on left control cars—on the end of the slow speed pedal shaft only on right control cars) to the extreme end of the pedal shafts, then remove the slow speed adjusting screw, (reverse and brake adjusting screws on right control cars). Remove the bolts holding the transmission cover to crank case and lift off the cover assembly. Slip the band nearest the flywheel over the first of the triple gears, then turn the band around so that the opening is downward. The band can now be removed by lifting upward. The operation is more easily accomplished if the three sets of triple gears are so placed that one set is about ten degrees to the right of center at top. Each band is removed by the same operation. It is necessary to shove each band forward on to the triple gears as at this point only is there sufficient clearance in the crank case to allow the ears of the transmission bands to be turned downward. By reversing this operation the bands may be installed. After being placed in their upright position on the drums pass a cord around the ears of the three bands holding them in the center so that when putting the transmission cover in place no trouble will be experienced in getting the pedal shafts to rest in the notches in the band ears. The clutch release ring must be placed in the rear groove of the clutch shift. After the cover is in place remove the cord which held the bands in place while the cover was being installed.

*How is the Trans-  
mission assembled?*

### *Answer No. 78*

Cut No. 17 shows the transmission parts in their relative assembling positions and grouped in their different operations of assembling. The first operation is the assembling of group No. 2, which is as follows: Place the brake drum on table with the hub in a vertical position, place the slow speed plate over the hub with gear uppermost. Then place reverse plate over the slow speed plate so that the reverse gear surrounds the slow speed gear. Fit the two driven gear keys in the hub just above the slow speed gear. Put the driven gear in position with the teeth downward so that they will come next to the slow speed gear. Force the driven gear down far enough to prevent end play in the slow speed plate, but not so far as to cause the drums to bind when turned by hand.

Take the three triple gears and mesh them with the gears on the transmission drums, the reverse or smallest section of the triple gear being downward. Each triple gear has one tooth punch-marked; the marked tooth must point directly to the center line of the transmission drums, and the three triple gears must be exactly a third of a circle apart (this may be ascertained by counting the

IMPORTANT—Read carefully chapter on Lubrication, page 53

teeth of the central gears) otherwise the gears will not mesh properly. After making sure that the triple gears are properly meshed tie them in place by passing a cord around the outside of the three gears. Take the flywheel and place it on the table with the face downward and the transmission shaft in a vertical position; then invert the group which you have assembled over the transmission shaft, setting it in position so that the triple gear pins on the flywheel will pass through the triple gears. This will bring the brake drum on top in a position to hold the clutch plates, etc. The next step is to fit the clutch drum key in the transmission shaft. Press the clutch disc drum over the shaft and put the set screw in place to hold the drum.

With old style brake drum with solid web, used on cars below C 65000, put a distance plate over the inner clutch drum first, then a small disc, then a large one and so on, alternating with small and large discs until the entire set, consisting of thirteen small discs and thirteen large ones, are in place, ending up with a large disc on top. With new style brake drum with holes in web, used on cars above C 65000, start with a large disc, then a small one and so on, alternating large and small discs, until the set (consisting in this case of thirteen large discs and twelve small ones, with no distance plate) are in place, and ending up with a large disc on top.

If a small disc is on top it is liable to fall over the clutch drum in changing the speed from high to low and as a result you would be unable to change the speed back into high. Next put the clutch push ring over the clutch drum and on top of the discs with the three pins projecting upward (see group No. 4, Cut No. 17). You will note the remaining parts are placed as they will be assembled. Next bolt the driving plate in position so that the adjusting screws of the clutch fingers will bear against the clutch push ring pins. Before proceeding further it would be a good plan to test the transmission by moving the plates with the hands. If the transmission is properly assembled the flywheel will revolve freely while holding any of the drums stationary. The clutch parts may be assembled on the driving plate hub as follows: Slip the clutch shift over the hub so that the small end rests on the ends of the clutch fingers. Next put on the clutch spring, placing the clutch support inside so that the flange will rest on the upper coil of the spring. Compress the clutch spring and insert the pin in the driving plate hub through the holes in the side of the spring support. Turn the support so the pin will be held between the projections on the inner face of the support; this will prevent the pin working out of place. To facilitate compressing the spring sufficiently to insert the pin loosen the tension of the clutch fingers by means of the adjusting screws. When tightening up the clutch again the spring should be compressed to within a space of two or two and one-sixteenth inches to insure against the clutch slipping. Care should be exercised to see that the screws in the fingers are adjusted so the spring is compressed evenly all around.

**IMPORTANT**—Read carefully chapter on Lubrication, page 53

## The Rear Axle Assembly

*How is the Rear Axle removed?*

### *Answer No. 79*

Jack up car and remove rear wheels as instructed in Ans. No. 93. Take out the four bolts connecting the universal ball cap to the transmission case and cover. Disconnect brake rods at their front ends. Remove nuts holding spring perches to rear axle housing flanges. Raise frame at the rear end, drive spring perches out of axle housing flanges, and the axle can be easily withdrawn.

*How are the Rear Axle and Differential disassembled?*

### *Answer No. 80*

Disconnect drive shaft tube, by removing nuts in front ends of radius rods and the nuts on studs holding drive shaft tube to rear axle housing. Remove bolts which hold the two halves of rear axle housing together, and remove the housings. To disassemble the differential remove the nuts holding the two halves of the case together and lift off the right axle shaft with the small half of the case. See that the two halves of the differential case are marked so that they can be assembled in the same position as before.

*How is the Universal Joint disconnected from the Drive Shaft?*

### *Answer No. 81*

Remove two plugs from top and bottom of ball casting and turn shaft until pin comes opposite hole, drive out pin and the joint can be pulled or forced away from the shaft and out of the housing.

*How is the Drive Shaft Pinion removed?*

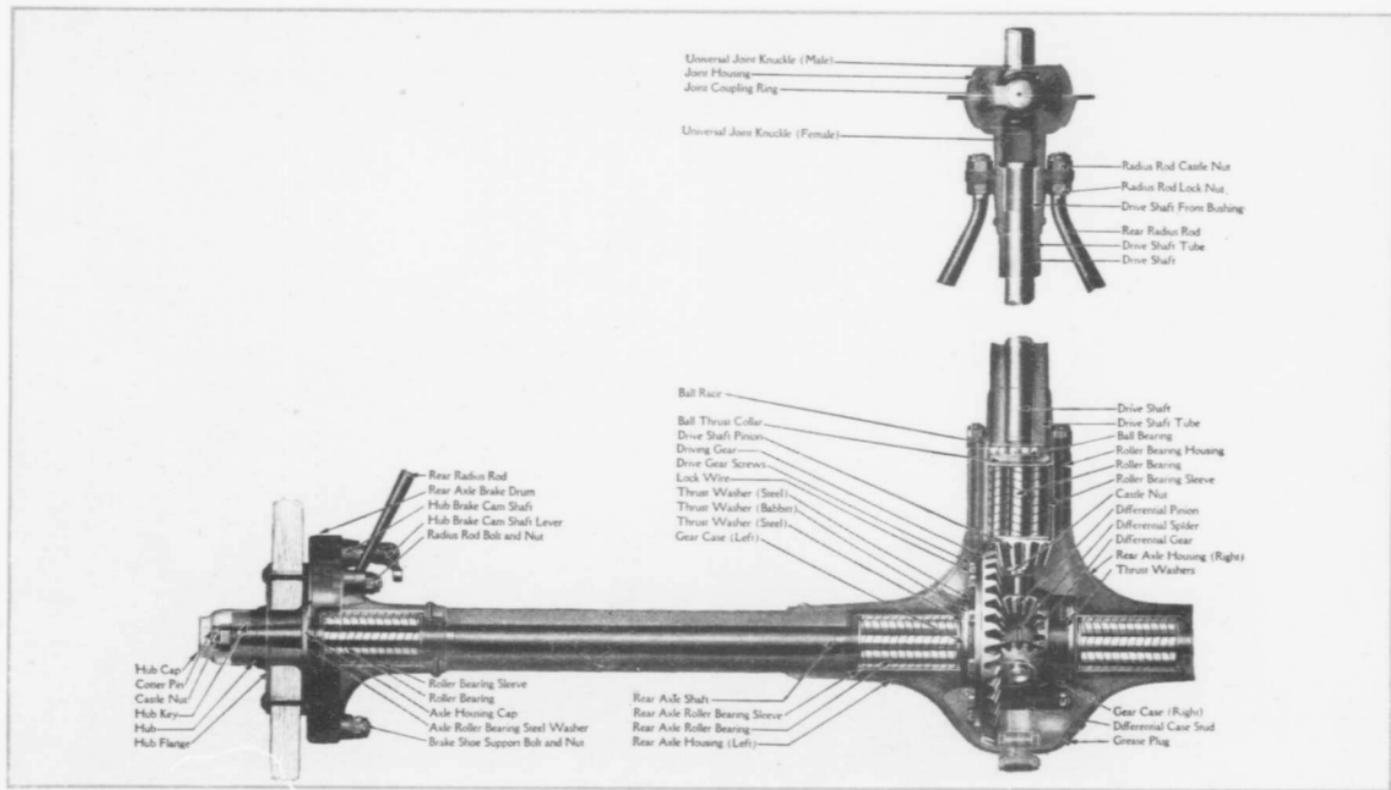
### *Answer No. 82*

The end of the drive shaft, to which the pinion is attached, is tapered to fit the tapered hole in the pinion, which is keyed onto the shaft, and then secured by a cotter-pinned "castle" nut. Remove the castle nut, and drive the pinion off.

*How are the Differential Gears removed?*

### *Answer No. 83*

The compensating gears are attached to the inner ends of the rear axle shafts. They work upon the spider gears when turning a corner, so that the axle shafts revolve at different speeds, but when the car is moving in a straight line the spider gears and compensating gears and axle shafts move as an integral part. If you will examine the rear axle shafts you will notice that the gears are keyed on, and held in position by a ring which is in two halves and fits in a groove in the rear axle shaft. To remove the compensating gears, force them down on the shaft, that is, away from the end to which they are secured, drive out the two halves of ring in the grooves in shaft with screw driver or chisel, then force the gears off the end of the shafts.



The Rear Axle System. (Cut No. 18)

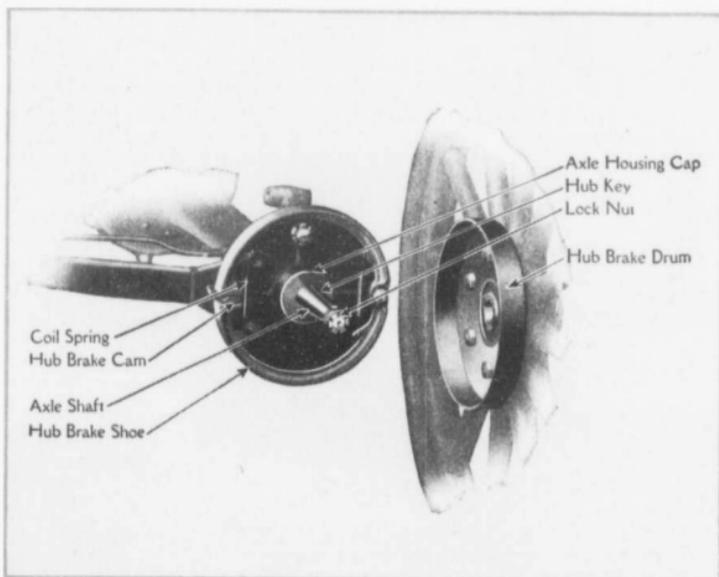
*How is Rear Axle  
Shaft removed?*

## *Answer No. 84*

Disconnect rear axle as directed in Answer No. 79, then unbolt the drive shaft assembly where it joins the rear axle housing at the differential, remove the nuts from the front ends of the rear radius rods and remove the drive shaft assembly. Take out the bolts which hold the two halves of the rear axle housing together at the center and remove the housings. Take the inner differential casing apart and draw the axle shaft through the housing at the center.

After replacing the axle shaft be sure that the rear wheels are firmly wedged on at the outer end of the axle shafts and the keys in proper position. When the car has been driven thirty days or so, make it a point to remove the hub cap and set up the lock nut to overcome any play that might have developed. It is extremely important that the rear wheels are kept tight, otherwise the constant rocking back and forth against the keyway may in time cause serious trouble.

If the rear axle or wheel is sprung by skidding against a curb or other accident, it is false economy to drive the car, as tires, gears and all other parts will suffer. If the axle shaft is bent, it can, with proper facilities, be straightened, but it is best to replace it.



The Ford Emergency Brake. (Cut No 19)

*How are Differential and Rear Axle assembled?*

## *Answer No. 85*

Place one of the axle shafts, with 24 tooth gear attached, through each half of the differential case so that the gears come inside the case. Place the three 12 tooth pinions on the arms of the differential spider with the teeth on the pinions towards the center of the spider, and place the spider in the left or large half of the differential case, meshing the three pinions with the 24 tooth gear. Place the small fiber thrust washer inside the hub of the spider, then attach the small or left half of the differential case, with the other axle shaft in place in it. After bolting the two halves of the differential together, place one of the axle shafts in a vise and turn the differential case once or twice to make sure the gears do not bind.

Place a steel thrust washer on either side of the differential case, making sure that the pin in the case fits in the hole in the thrust washer, then put on a babbitt or composition thrust washer on each side. Place a steel thrust plate on the inner face of each half of the axle housing, making sure that these plates also are held from turning by the pins in the axle housings. (The thrust plates and washers can be held in place temporarily with a daub of fresh grease.)

Put a roller bearing on each axle shaft next to the differential, then place the left half of the differential (the side carrying the large driving gear) in the left axle housing, then put the right axle housing in place on the right axle shaft and bolt the two halves of the housing together. Put the drive shaft and housing assembly in place, with the grease hole in the universal joint housing on top; bolt the radius rods to the drive shaft housing in front, and bolt up the drive shaft roller bearing housing studs. Put in the axle shaft outer roller bearings, then the steel washers, felt washers and dust caps. If possible test the axle for back-lash and quiet operation before installing it in the car. If back-lash exists (looseness between the drive shaft pinion and the driving gear) tighten the drive shaft bearing housing stud nuts. If the axle hums, due to too tight meshing of the driving gears, loosen these stud nuts slightly. Secure all six nuts with wire before replacing the axle in the car.

IMPORTANT—Read carefully chapter on Lubrication, page 53

## The Ford Muffler

*Is the Muffler Necessary?*

*Answer No. 86*

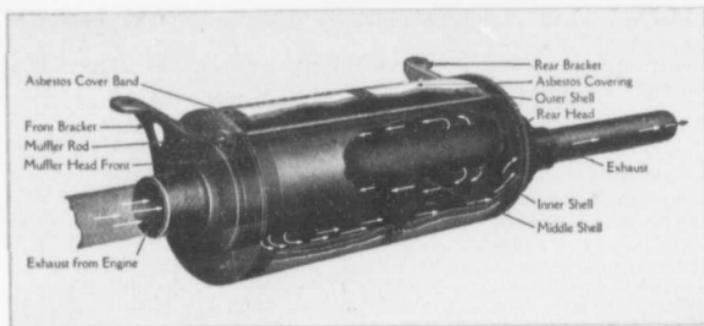
The exhaust as it comes from the engine through the exhaust pipe would create a constant and distracting noise were it not for the muffler. From the comparatively small pipe, the exhaust is liberated into the larger chambers of the muffler, where the force of the exhaust is lessened by expansion and discharged out of the muffler with practically no noise. (See Cut No. 20.) The Ford muffler construction is such that there is very little back pressure of the escaping gases, consequently there is nothing to be gained by putting a cut-out in the exhaust pipe between the engine and the muffler.

*Does the Muffler require any Attention?*

*Answer No. 87*

It should be cleaned occasionally. Remove it (see Answer No. 88) and take off nuts on ends of rods which hold it together—and disassemble.

In reassembling muffler, be careful not to get the holes in the inner shells on the same side or end.



The Ford Muffler. (Cut No. 20)

*How is the Muffler disconnected?*

*Answer No. 88*

To disconnect the muffler it is not necessary to disconnect the exhaust pipe from the motor (although it is a good plan and a simple matter, necessitating only unscrewing the union). To disconnect muffler from frame, remove bolts holding muffler brackets to frame, drop muffler down so it will clear the frame and slip it back off the tube. If the muffler from any cause becomes materially damaged it will probably be cheaper to replace it with a new one than to attempt to repair it.

IMPORTANT—Read carefully chapter on Lubrication, page 53

## The Running Gear

*What care should the Running Gear have?*

### *Answer No. 89*

In the first place it at all times should have proper lubrication (see chapter on Lubrication). Once in every thirty days the front and rear axles should be carefully gone over to see that every moving part, such as the bushings in spring connections, spring hangers, steering knuckles and hub bearings, are thoroughly lubricated, and that all nuts and connections are secured with cotter pins in place. The spring clips, which attach the springs to the frame, should be inspected frequently to see that everything is in perfect order. This is specially important in the case of the front spring clips as looseness here is liable to affect the steering of the car dangerously.

*How is the Front Axle removed?*

### *Answer No. 90*

Jack up front of car so wheels can be removed (see Answer No. 93), disconnect steering gear ball arm from the steering connecting rod, disconnect radius rod at ball joint, and remove two cotter pinned bolts from spring shackle on each side, so detaching front spring. To remove the front radius rod without taking axle out of car, remove nuts and springs and lower ball cap holding rear end of radius in socket under crank case, remove nuts from front ends of radius rod at spring perches and drive ends of rod out of spring perches towards the rear, springing the rear end of radius rod down far enough to clear the crank case.

To install a new radius rod reverse the above procedure. The radius rod can be put in either side up.

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

### *Answer No. 91*

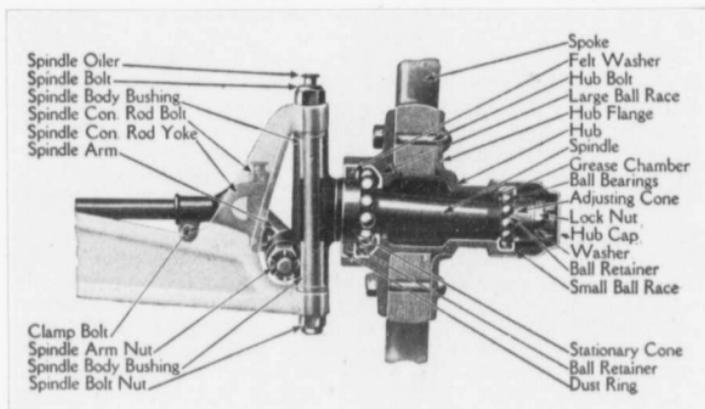
Should the axle or spindle become bent extreme care must be used to straighten the parts accurately. Do not heat the forgings, as this will distemper the steel, but straighten them cold. If convenient, it would be better to return such parts to the nearest branch or dealer, where they may be properly straightened in jigs designed for that purpose. It is very essential that the wheels line up properly (see Answer No. 94). The eye is not sufficiently accurate to determine whether the parts have been properly straightened, and excessive wear of the front tires will occur if everything is not in perfect alignment.

*What about the Wheels?*

### *Answer No. 92*

The wheels should be jacked up periodically and tested, not only for smoothness of running, but for side play as well. If in spinning a front wheel a sharp click occurs now and then and the wheel is momentarily checked, it is probable that there is a chipped or split ball in the bearing which should be removed, otherwise it may necessitate the removal of the entire bearing. A wheel in perfect adjustment should, after spinning, come to rest with the tire valve directly below the hub. Undue wear of the hub bearings, such as

cones, balls and races, is usually caused by lack of lubrication and excessive friction, due to the adjusting cone being screwed up too tight. It is a good plan to clean the bearings frequently and keep the hub well filled with grease.



The Ford Spindle and Front Hub Assembly. (Cut No. 21)

*How are the Wheels removed?*

*Answer No. 93*

**Front wheels:** Take off hub cap, remove cotter pin and unscrew castle nut and spindle washer. The adjustable bearing cone can then be taken out and the wheel removed. Care should be taken to see that the cones and lock nuts are replaced on the same spindle from which they were removed, otherwise there is a liability of stripping the threads which are left on the right spindle and right of the opposite. **Back wheels:** They should not be removed unless absolutely necessary—in which case proceed as above, then with a wheel puller remove the wheel from the tapered shaft to which it is locked with a key. In replacing rear wheels be sure that nut on axle shaft is as tight as possible and cotter pin in place. The hub caps of the rear wheels should be removed occasionally and the lock nuts which hold the hub in place tightened up. If these nuts are allowed to work loose, the resulting play on the hub key may eventually twist off the axle shaft.

*How does the setting of the Front Wheels differ from that of the Rear Wheels?*

*Answer No. 94*

It will be observed that the front wheels are placed at an angle—that is to say, the distance between the tops of the front wheels is about three inches greater than between the bottoms. This is to give perfect steering qualities and to save wear on the tires when turning corners. The front wheels should not, however, "toe in" at the front—at least not more than a quarter of an inch. Lines drawn

IMPORTANT—Read carefully chapter on Lubrication, page 53

along the outside of the wheels when the latter are straight in a forward position should be parallel. All wheels should always be kept in proper alignment, otherwise steering will be difficult and tire wear greatly increased. Adjustment can be made by turning the yoke at the left end of the spindle connecting rod (right end on right control cars) to draw the wheels into a parallel position.

*What care do the Springs need?* **Answer No. 95**

If the springs are somewhat stiff when the car is new take a screw-driver and pry the leaves apart near the end just enough to place a little lubricating oil or graphite between them. You will find that repeating this operation about once a month will add materially to the riding comfort of the car.

*Should Spring Clips be kept tight?* **Answer No. 96**

Yes. If the spring clips are allowed to work loose the entire strain is put on the tie bolt which extends through the center of the spring. This may cause the bolt to be sheared off and allow the frame and body to shift a trifle to one side. If this occurs on the front spring it will seriously affect the steering. It is a good plan to frequently inspect the clips which hold the springs to the frame and see that they are kept tight.

*What about the Steering Apparatus?* **Answer No. 97**

It is exceedingly simple and will need little care—except, of course, proper lubrication. The post gears which are arranged in the "sun and planet" form are located at the top of the post just below the hub of the wheel (see Cut No. 1). By loosening the set screw and unscrewing the brass cap—after having removed the steering wheel—they may readily be inspected and replenished with grease. To remove the steering wheel, unscrew the brass nut on top of the post and drive the wheel off the shaft with a block of wood and hammer.

*How is Steering Gear tightened?* **Answer No. 98**

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 ball arm at the lower end of the steering post and file off the surface until they fit snugly around the ball. If the ball is badly worn it is best to replace it with a new one. Also tighten the ball caps at the other end of the steering gear connecting rod in the same manner. If the bolts in the steering spindle arms appear to be loose, the brass bushings should be replaced with new ones (see Cut No. 21). Excessive play in the front axle may be detected by grasping one of the front wheels by the spokes and jerking the front axle back and forth. After the car has been in service two or three years excessive play in the steering gear may make necessary the renewal of the little pinions, as well as the brass internal gear just underneath the steering wheel spider. It is also advisable to inspect the front spring hangers occasionally to determine whether or not new bushings are necessary to overcome any excessive vibration.

IMPORTANT—Read carefully chapter on Lubrication, page 53

## The Ford Lubricating System

*How does the Ford Lubricating System differ from others?*

### *Answer No. 99*

It is simplified—and there are fewer places to oil. Practically all of the parts of the engine and transmission are oiled by the Ford splash system, from the one big oil reservoir in the crank case. Cut No. 22 shows the principal points of lubrication, and specifies when replenishment should be made, according to mileage. This chart should be studied carefully and often. It is a good plan to frequently supply all oil cups with the same oil used in the engine (any good light grade lubricating oil will answer) and the dope cups with good grease. Be sure to see that the commutator is kept freely supplied with oil at all times.

*Which is the best way to fill the "Dope" Cups?*

### *Answer No. 100*

When it is advisable to fill dope cup covers screw them down, refill with grease and repeat the operation two or three times. Always open oil cups by turning to right, as this keeps tightening rather than loosening them. Occasionally remove front wheels and supply dope to wearing surface. A drop of oil now and then in crank handle bearing is necessary, also on fan pulley shaft. Spark and throttle rod joints, controller shaft and brake lever connections should also be given a few drops of oil every week or two. The axles, drive shaft and universal joint are well supplied with lubricant when the car leaves the factory, but it is well to examine and oil them frequently.

*What kind of Oil should be used?* *Answer No. 101*

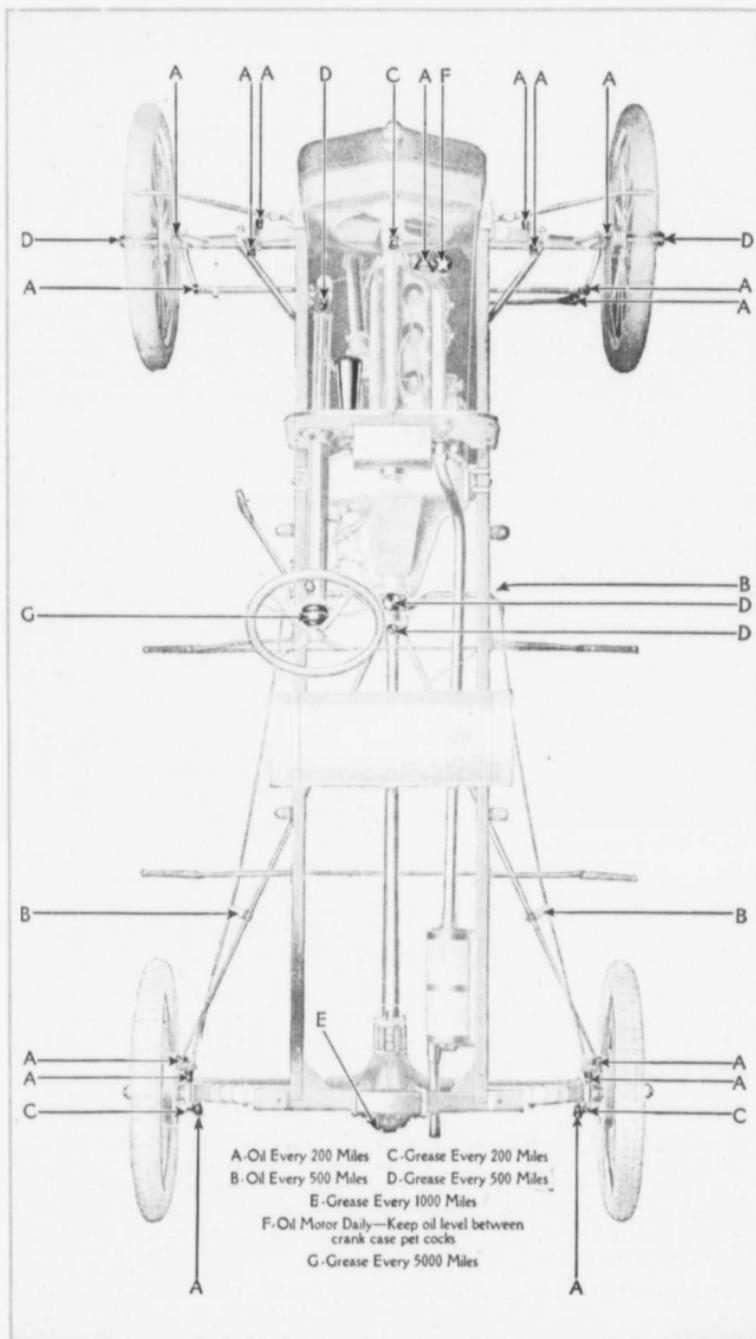
We recommend only light, high-grade gas engine oil for use in the Model T motor. A light grade of oil is preferred, as it will naturally reach the bearing surfaces with greater ease, and, consequently, less heat will develop on account of friction. The oil should, however, have sufficient body so that the pressure between the two bearing surfaces will not force the oil out and allow the metal to come in actual contact. Heavy and inferior oils have a tendency to carbonize quickly, also "gum up" the piston rings, valve stems and bearings. In cold weather a light grade of oil having a low cold test is absolutely essential for the proper lubrication of the car. The nearest Ford Branch will advise you concerning the lubricating oil this Company has found best suited for its cars, both for Summer and Winter weather. Graphite should not be used as a lubricant in the engine or transmission as it will have a tendency to short-circuit the magneto.

*How often should oil be drained from Crank Case?*

### *Answer No. 102*

It is advisable to clean out the crank case by draining off the dirty oil when the new car has been driven four or five hundred miles; thereafter it will only be necessary to repeat this operation about every two thousand miles. Remove plug underneath the flywheel casing and drain off the oil. Replace the plug and pour in a gallon of kerosene (coal oil) through the breather pipe. Turn the engine over

IMPORTANT—Read carefully above chapter on Lubrication



A-Oil Every 200 Miles    C-Grease Every 200 Miles  
 B-Oil Every 500 Miles    D-Grease Every 500 Miles  
 E-Grease Every 1000 Miles  
 F-Oil Motor Daily—Keep oil level between  
 crank case pet cocks  
 G-Grease Every 5000 Miles

Lubrication Chart. (Cut No. 22)

by hand fifteen or twenty times so that the splash from the kerosene will thoroughly cleanse the engine. Remove crank case plug and drain off kerosene oil. In order to get all the kerosene out of the depressions in the crank case the car should be run up a little incline, about the height of the ordinary street curbing. Refill with fresh oil.

*How often should  
Commutator be oiled?*

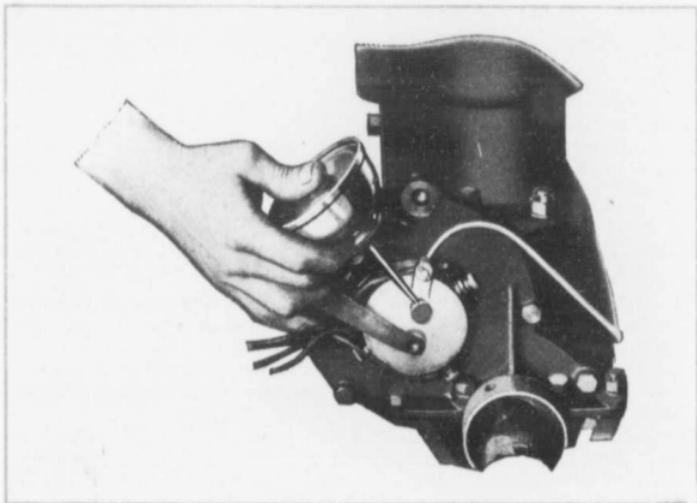
### *Answer No. 103*

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. Don't be afraid to put a little oil into the commutator every other day—at least every 200 miles. 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.

*How is the  
Differential Lubricated?*

### *Answer No. 104*

Imperial Oil Company's Rear Axle Lubricant for Ford cars is regularly used and gives good results both summer and winter. A good grade of cup grease can be used if necessary. The filler plug in the right half of the axle housing is located slightly below the center of the housing; the axle should be kept filled with lubricant to the level of this filler opening. If grease is used regularly it is advisable to use a fairly heavy grade in summer and a lighter grade, possibly mixed with a small quantity of oil to make it flow more freely, in winter.



Oiling the Ford Commutator. (Cut No. 23)

## Care of the Tires

*How are Ford  
Tires removed?*

### *Answer No. 105*

First, jack up the wheel clear of the road. The valve cap should be unscrewed, the lock nut removed and the valve stem pushed into the tire until its head is flush with the rim. This done, loosen up the bead of the shoe in the clinch of the rim by working and pushing with the hands, then insert one of the tire irons or levers under the beads. The tire iron should be pushed in just enough to get a good hold on the underside of the bead, but not so far as to "pinch" the inner tube between the rim and the tool. A second iron should be inserted in the same fashion some seven or eight inches from the first, and a third tool the same distance from the second. As a clincher tire must be pried over the clinch, three or four levers will come in handy in a case of a "one-man job," and the knee of the driver can be used to good advantage to hold down one lever while the other two are being manipulated in working the shoe clear of the rim. After freeing a length of the bead from the clinch, the entire outer edge of the casing may be readily detached with the hands, and the damaged inner tube removed and "patched" or a spare tube inserted. Always use plenty of soapstone in replacing an inner tube.

*How are Casings  
repaired?*

### *Answer No. 106*

Should the casing be cut so there is danger of the inner tube being blown through it, a temporary repair can be made by cementing a canvas patch on the inside of the casing. Before applying the patch the part of the casing affected should be cleaned with gasoline and when dry, rubber cement applied to both casing and patch. This will answer as an emergency repair—but the casing should be vulcanized at the first opportunity.

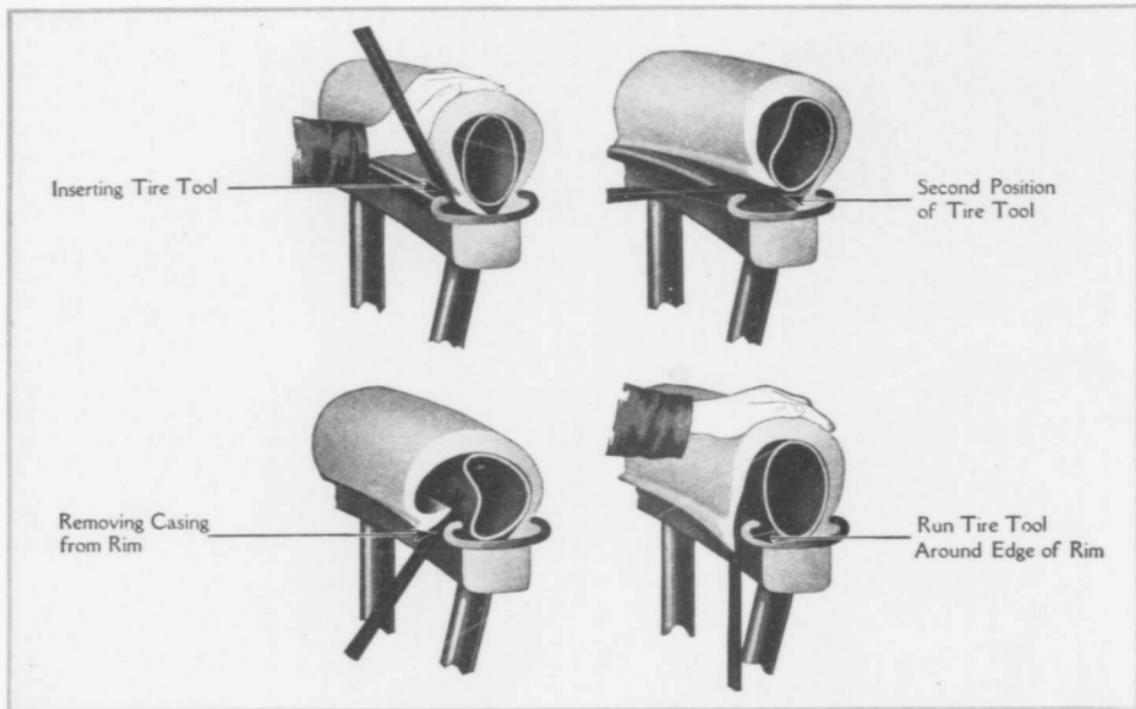
To prolong the life of the tire casings, any small cuts in the tread should be filled with patching cement and a specially prepared "plastic" sold by the tire companies.

*How may Tire Expense  
be reduced?*

### *Answer No. 107*

Tire cost constitutes one of the most important items in the running expenses of an automobile. To get the most service at the least expense, the tires should be inspected frequently and all small cuts or holes properly sealed or repaired—thus preventing dirt and water working in between the rubber tread and the fabric, causing blisters or sand boils.

Tires should never be run partially deflated, as the side walls are unduly bent and the fabric is subject to stresses which cause what is known as rim cutting. The chances of getting a puncture will be greatly reduced by keeping your tires properly inflated, as a hard tire



Method of removing Ford clincher tires. (Cut No. 24)

exposes much less surface to the road than a soft tire, and also deflects sharp objects that would penetrate a soft tire.

Running a tire flat, even for a short distance, is sure to be costly. Better run on the rim, very slowly and carefully, rather than on a flat tire.

Remember that fast driving and skidding shorten the life of the tires. Avoid locking the wheels with the brake—no tire will stand the strain of being dragged over the road in this fashion.

Avoid running in street car tracks, in ruts, or bumping the side of the tire against the curbing.

The wheel rims should be painted each season and kept free from dust.

When a car is idle for any appreciable length of time, it should be jacked up to take the load off the tires. If the car is laid up for many months, it is best to remove the tires, and wrap up the outer casings and inner tubes separately, and store them in a dark room not exposed to extreme temperatures. Remove oil or grease from the tires with gasoline. Remember that heat, light and oil are three natural enemies of rubber.

*How is a puncture in  
the Inner Tube repaired?*

### *Answer*|||No. 108

After locating the puncture, carefully clean the rubber around the leak with benzine or gasoline. Then rough the surface with sandpaper from your tire repair kit to give a hold for the cement. Apply the cement to both patch and tube, allowing it to dry for about five minutes, repeating the application twice with like intervals between for drying. When the cement is dry and sticky press the patch against the tube firmly and thoroughly to remove all air bubbles beneath it and insure proper adherence to the surface—then spread some soapstone or talc powder over the repair so as to prevent the tube sticking to the casing. Before the tube is put back into the casing plenty of talc powder should be sprinkled into the latter. A cement patch is not usually permanent and the tube should be vulcanized as soon as possible. In replacing the tire on the rim be very careful not to pinch the tube.

IMPORTANT—Read carefully chapter on Lubrication, page 53

## Points on Maintenance

*What is the proper way to wash the Car?*

### *Answer No. 109*

Always use cold or lukewarm water—never hot water. If a hose is used, don't turn on the water at full force, as this drives the dirt into the varnish and injures the finish. After the surplus mud and grime have been washed off, take a sponge and clean the body and running gear with a tepid solution of water and ivory or linseed oil soap. Then rinse off with cold water; then rub dry and polish the body with a chamois skin. A body or furniture polish of good quality may be used to add lustre to the car. Grease on the running gear may be removed with a gasoline soaked sponge or rag. The nickel work may be polished with any good metal polish. It should be a point of pride with every Ford owner to keep his car clean—always. By so doing he will lengthen its life and retard its depreciation.

*What care does Top need?*

### *Answer No. 110*

When putting the top down be careful in folding to see that the fabric is not pinched between the bow spacers, as they will chafe a hole through the top very quickly. Always slip the hood over the top when folded to keep out dust and dirt. Applying a good top dressing will greatly improve the appearance of an old top.

*What are the Rules of the Road?*

### *Answer No. 111*

In all Canadian Provinces except British Columbia and the Maritime Provinces—Keep to the right. In passing a car going in your direction, go to the left. In British Columbia and the Maritime Provinces, and in all other British Colonies except Canada—Keep to the left. In passing a car going in your direction, go to the right. Always be prepared to meet emergencies. Don't cut diagonally across the street. Hug the curb in making the "short turn" at the corner. Always go around the center of the street intersection in making the "long turn." Extending the arm to the right or left will indicate to the driver behind the direction in which you expect to turn. Observe the traffic regulations. And always be courteous—it costs nothing and helps a lot.

*How is Skidding best prevented?*

### *Answer No. 112*

Keep off slippery pavements whenever possible. Drive slowly when on them. In wet and snowy weather use chains on rear wheels, and if the mud or snow is very bad, on all wheels. Apply the chains loosely so they will move about and distribute the wear over the entire surface of the casing. Non-skidding tires may help somewhat. When your car starts to skid don't put your foot on the brake pedal, but close the throttle and turn the steering wheel in the direction in which the rear wheels are sliding. This will tend to neutralize the lateral movement of the car.

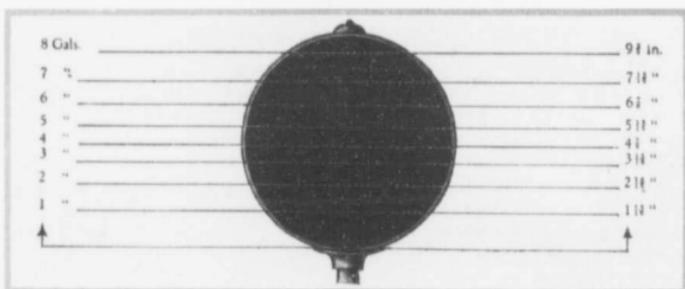
If in the absence of chains, the car becomes mired, or the road is so slippery that the wheels cannot secure sufficient hold to move the car, relief may be obtained by winding ropes around the rear tires and rims, and in and out between the spokes.

IMPORTANT—Read carefully chapter on Lubrication, page 53

*What should be done  
when the Car is stored?*

### *Answer No. 113*

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. Remove cylinder head and clean out any carbon deposits in combustion chamber. Draw off all the gasoline. Drain the dirty oil from the crank case and cleanse the engine with kerosene as directed in Answer No. 102. Refill the crank case with fresh oil and revolve the engine enough to cover the different parts with oil. Remove the tires and store them away as directed in chapter on Care of Tires. Wash up the car, and if possible cover the body with a sheet of muslin to protect the finish. Lamps and other polished parts should be cleaned and wrapped and then packed away.



Gasoline measure for 8-gallon tank. (Cut No. 25)

*How is the amount of  
Gasoline in the tank ascertained?*

### *Answer No. 114*

Diagram No. 25 will show you how to determine the amount of gasoline in your tank. The best measuring medium is a piece of soft pine graduated according to the figures in the diagram and polished with powdered graphite, to give it a metallic-like coating. Those who equip their car with one of these gauges will find they are fully repaid for the trouble taken.

*What is the best way  
to drive Down Hill?*

### *Answer No. 115*

In driving down long, steep hills the speed of the car may be checked by allowing the engine to run against compression, rather than by using the transmission brake. Throw off the switch and close the throttle. If this does not slow your car down sufficiently, throw the clutch into low speed. Upon reaching the bottom of the incline, throw on the switch again and open the throttle. If the throttle is left open while descending the hill fresh gas is apt to work back through the exhaust pipe and cause an explosion in the muffler when the switch is thrown on. Using the engine as a brake should not be undertaken until the driver becomes thoroughly familiar with the car.

IMPORTANT—Read carefully chapter on Lubrication, page 53

*What is the double end wrench (T1917) in the tool kit used for?*

### *Answer No. 116*

This wrench is furnished for use in a couple of places where a standard sized wrench could not be used. The end marked 1 is for use only on the transmission band adjusting nuts (inside the transmission cover). The end marked 2 is for use on the gasoline feed pipe pack nut at the carburetor. This wrench is designed for use only at the two points mentioned, and should not be used at other points where a heavier wrench is needed.

*How are the headlights focussed?*

### *Answer No. 117*

By turning the adjusting screw or focusing screw which projects from the body of the lamp at the rear, just above the wire plug connection. (The doors of the headlamp need not be removed.) It is advisable to place the car so that it faces a plain wall at a distance of about fifteen feet; the doors of the headlamps should be parallel with the wall. With the headlights turned on and the engine running at a moderate speed each lamp should be adjusted so that it shows a clear circle of light with no dark rings. Both lights should be focussed the same.

*How is the headlight door removed?*

### *Answer No. 118*

By pressing the door against the body of the lamp, and at the same time turning to the left. In replacing the door insert the lugs on the inside of the door frame into the slots in the lamp body, then turn to the right until the door snaps into place.

*What size bulbs should be used in the Headlights?*

### *Answer No. 119*

On cars numbered below C-25000 which were fitted with  $\frac{3}{8}$ " magnets, use six volt two ampere bulbs; on cars numbered above C-25000, which were fitted with  $\frac{3}{4}$ " magnets, use nine volt two ampere bulbs.

*How are the reflectors polished?*

### *Answer No. 120*

Use a good grade of silver polish or a paste made of lampblack and water. Don't use anything gritty, as it would scratch the reflectors. Apply the polish with a soft flannel cloth, then clean and polish the reflectors with a clean dry cloth. Always rub lightly.

*What attention does the electric horn require?*

### *Answer No. 121*

It should not require any attention whatever, unless the tone gets weak from any cause. In that case readjust the vibrating diaphragm by means of the adjusting screw in the center of the horn. There is a lock nut under the head of this screw which must be loosened before the adjusting screw can be turned. Be sure to tighten this lock nut, (holding the adjusting screw at the same time) after the horn has been adjusted.

## Summary of Cold Weather Hints

### PREPARATIONS

Before the real cold weather arrives the car should be gone over carefully, any looseness taken up, worn parts replaced, etc. If the motor is running well it should not require overhauling but if it is very loose or knocks it should be gone over carefully. Any looseness will be made far worse by a hard winter's driving. Wheels and their bearings, springs and clips, steering and brake connections require particular attention. (See answers Nos. 92, 96 and 98.)

Drain the old oil from the crank case, flush out with kerosene, and put in a supply of fresh oil, of a lighter grade than you used in the summer. (See answer No. 102.)

At the first approach of cold weather the radiator should be drained and flushed out thoroughly with fresh running water. Then fill it up with a good anti-freezing solution. (See answers Nos. 39 and 40.)

### SPECIAL LUBRICANTS AND SUPPLIES REQUIRED

A lighter grade of oil than used in the summer . . .	See Ans. No. 101
A mixture of 25% kerosene, balance light oil, for commutator . . . . .	} See Ans. No. 67
Anti-freeze solution. Keep the radiator full all the time . . . . .	

### STARTING AND DRIVING

Answer No. 8 gives instructions for starting the motor in cold weather, and overcoming any troubles resulting from gasoline not vaporizing readily with cold air.

Laying a cloth soaked with hot water along the upper horizontal part of the intake pipe, or pouring hot water over the intake pipe and carburetor, will often assist in getting the motor started when very cold. Care must be taken, however, not to let any of the water get into the carburetor where it would cause considerable trouble.

Water or congealed oil in the commutator may sometimes cause trouble in starting. Answer No. 67 tells how to overcome this trouble. Another possible cause of trouble in starting is water in the gasoline. If any water is present in the fuel it will naturally settle in the lowest point in the fuel line and may freeze in the sediment bulb or carburetor. Answer No. 46 gives the most effective remedy for such trouble.

Sometimes oil will congeal on the clutch discs, causing the clutch to stick and making it almost impossible to crank the motor. Placing blocks under the rear axle to raise the wheels off the ground will allow the rear wheels to turn with the motor and cranking will then be easy. As soon as the motor starts, set the emergency brakes tightly before letting the wheels down.

It is a good plan to let the clutch "in" immediately after the motor

is stopped. This prevents oil congealing on the clutch discs and causing trouble. Of course, the clutch must be released and the brakes set tightly before the motor is cranked.

Use chains on the rear wheels when driving through snow or even if it is packed hard on the streets. Hard packed snow is very slippery. If the snow is very deep, chains on the front wheels will aid you in controlling your car.

### CARE OF CAR

Install the hot air pipe and use it throughout the winter.

Keep the car in a warm building whenever possible. If necessary to leave it out in the open, even for a few minutes, throw a robe over the radiator and hood to keep the engine warm.

A padded cover fitting over the radiator and engine hood is a good investment.

If you decide to lay up your car for the winter, the information in Answer No. 113 on this subject will be of value to you.

## Summary of Engine Troubles and Their Causes

### ENGINE FAILS TO START

1. Gas mixture too lean.
2. Water in gasoline.
3. Vibrators adjusted too close.
4. Water or congealed oil in commutator.
5. Magneto contact point (in trans. cover) obstructed with foreign matter.
6. Gasoline supply shut off.
7. Carburetor frozen (in zero weather).
8. Carburetor flooded (in hot weather.)
9. Water frozen in gasoline tank sediment bulb.
10. Coil switch off.
11. Gasoline tank empty.

### ENGINE LACKS POWER— RUNS IRREGULARLY

#### At Low Speeds.

1. Poor compression—account leaky valves.
2. Gas mixture too rich or too lean.
3. Spark plugs dirty.
4. Coil vibrators improperly adjusted.
5. Air leak in intake manifold.
6. Weak exhaust valve spring.
7. Too great clearance between valve stem and push rod.
8. Too close gap between spark plug points.

#### At High Speeds.

1. Commutator contact imperfect.
2. Weak valve spring.
3. Too much gap in spark plug.
4. Imperfect gas mixture.
5. Platinum points dirty or burned.

### ENGINE STOPS SUDDENLY

1. Gasoline tank empty.
2. Water in gasoline.
3. Flooded carburetor.
4. Dirt in carburetor or feed pipe.
5. Magneto wire loose at either terminal.
6. Magneto contact point obstructed.
7. Overheated—account lack of oil or water.
8. Gas mixture too lean.

### ENGINE OVERHEATS

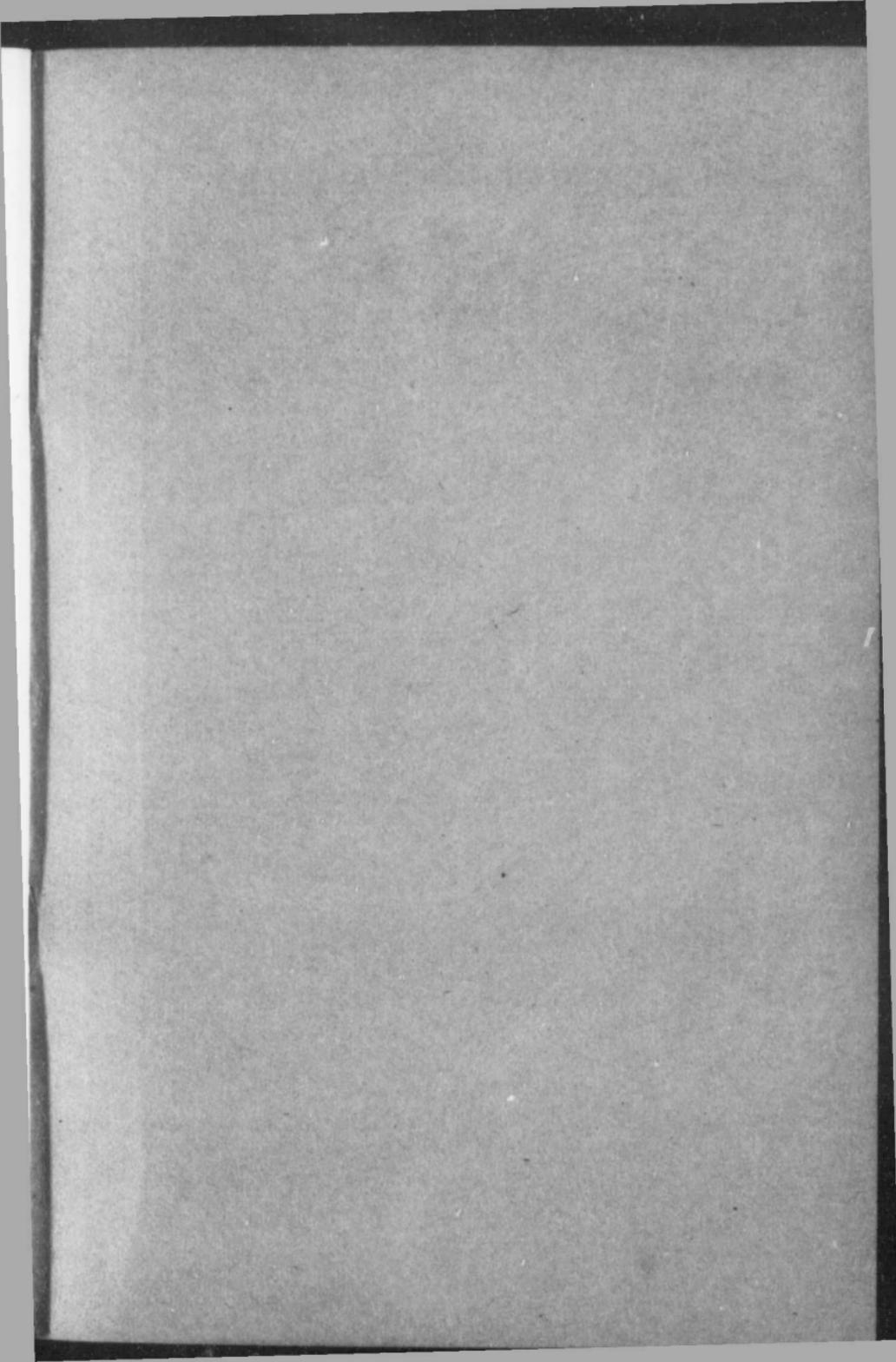
1. Lack of water.
2. Lack of oil.
3. Fan belt broken, loose or slipping.
4. Carbon deposit in combustion chamber.
5. Spark retarded too far.
6. Gas mixture too rich.
7. Water circulation retarded by sediment in radiator.
8. Dirty spark plugs.

### ENGINE KNOCKS

1. Carbon deposit on piston heads.
2. Loose connecting rod bearing.
3. Loose crank shaft bearing.
4. Spark advanced too far.
5. Engine overheated.

## Index

<p><b>Care of Tires</b></p> <p style="text-align: right;">Page</p> <p>Casings—How Repaired . . . 56</p> <p>How to Remove Tires . . . 56</p> <p>Repair Puncture . . . 58</p> <p><b>Cooling System</b></p> <p>Causes of Overheating . . . 23</p> <p>Purpose . . . 23</p> <p>Radiator Care in Winter . . . 24</p> <p>Repairing Radiator . . . 24</p> <p>What to Do When Overheated . . . 23</p> <p><b>Engine</b></p> <p>Carbon—How Removed . . . 18</p> <p>Connecting Rod and Bearings . . . 18</p> <p>Knocking—Causes . . . 18</p> <p>Main Bearing—How Adjusted . . . 20</p> <p>Piston . . . 12</p> <p>Power Plant—How Removed . . . 19</p> <p>Valves . . . 14</p> <p><b>Gasoline System</b></p> <p>Carburetor—How to Adjust . . . 27</p> <p>Carburetor—How Controlled . . . 25</p> <p>Carburetor—Trouble . . . 28</p> <p><b>Ignition System</b></p> <p>Coils . . . 32</p> <p>Commutator—Its Purpose . . . 32</p> <p>Magneto . . . 30</p> <p>Magneto Trouble . . . 36</p> <p>Spark Plugs . . . 32</p> <p>Where to Look for Trouble . . . 33</p> <p><b>Lubricating System</b></p> <p>How It Differs from Others . . . 53</p> <p>Kind of Oil to Use . . . 53</p> <p>To Fill "Dope" Cups . . . 53</p>	<p><b>Maintenance</b></p> <p style="text-align: right;">Page</p> <p>Care of Top . . . 59</p> <p>Gasoline in Tank . . . 60</p> <p>Storing Cars . . . 60</p> <p>To Keep Car Clean . . . 59</p> <p>To Focus Headlights . . . 61</p> <p>Electric Horn . . . 61</p> <p><b>Muffler</b></p> <p>What It Is For . . . 49</p> <p>How to Disconnect . . . 49</p> <p><b>Operation</b></p> <p>Adjustments—What to Do . . . 11</p> <p>Cranking . . . 5</p> <p>Gasoline . . . 3</p> <p>Getting Ready to Start . . . 3</p> <p>Hand Lever . . . 7</p> <p>Oiling . . . 3</p> <p>Spark—How Controlled . . . 10</p> <p>Speed—How Controlled . . . 11</p> <p>Starting . . . 7</p> <p>Starting in Cold Weather . . . 6</p> <p>Stopping and Reversing . . . 10</p> <p><b>Rear Axle</b></p> <p>Rear Axle—How to Remove</p> <p style="padding-left: 20px;">Parts . . . 45</p> <p>Universal Joint . . . 45</p> <p><b>Running Gear</b></p> <p>About Wheels . . . 50</p> <p>Care of Springs . . . 52</p> <p>Its Care . . . 50</p> <p>Remove Front Axle . . . 50</p> <p>Steering Apparatus . . . 52</p> <p><b>Transmission</b></p> <p>Bands . . . 39</p> <p>Clutch . . . 37</p> <p>Planetary Transmission—</p> <p style="padding-left: 20px;">What It Is . . . 37</p> <p>Transmission—How Assembled . . . 43</p>
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# Ford Manual

CANADIAN EDITION

