

# How to Run The FORD

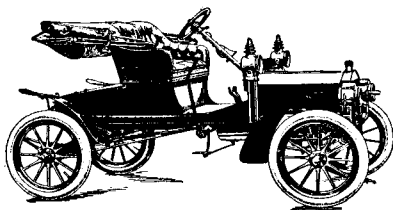


Models "N" and "R"

**Ford Motor Company**

Detroit, Michigan

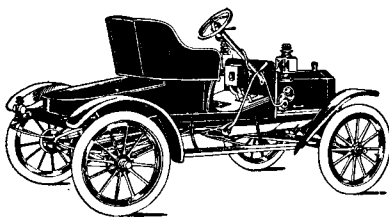
**INSTRUCTIONS**  
**FOR**  
**OPERATION AND CARE**  
**OF**



**Model N**

**FORD RUNABOUTS**

---

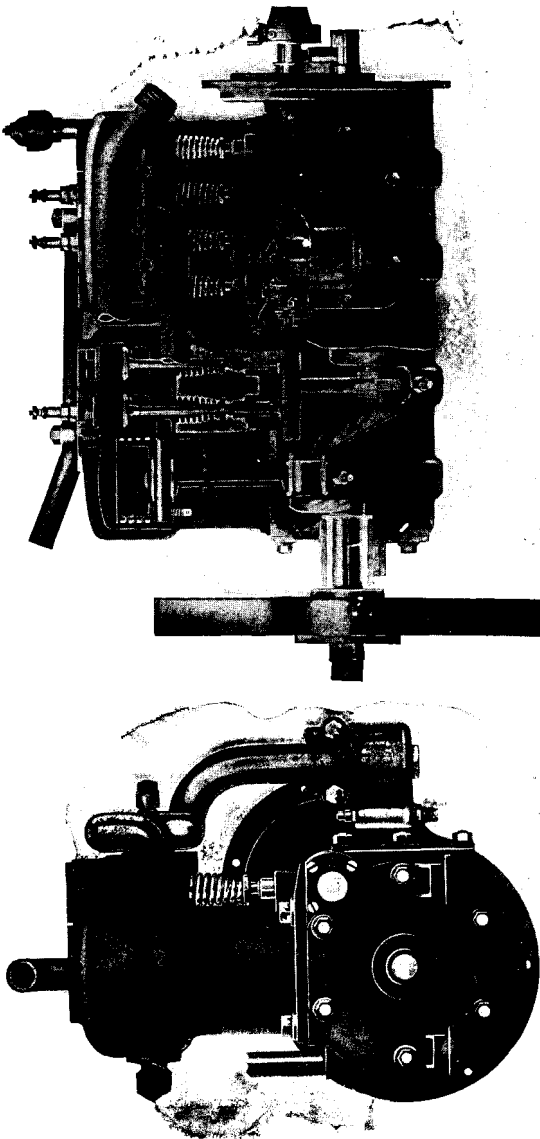


**Model R**

---

**Issued by**  
**The Ford Motor Co.**  
**Detroit, Mich., U. S. A.**  
**1907**

**Catalogs and Price List of Parts and full line of  
Accessories for the asking.**



End and Sectional Views 4-Cylinder Ford Motor

## INTRODUCTION.

This Instruction Book is calculated to inform the buyer as to the various special points of the Ford Runabouts so as to enable him to make the necessary adjustments properly and to get the best service out of the car.

We have endeavored to make it cover the ground so thoroughly that not only those who, by previous experience, are familiar with the various features of standard Automobile construction may more readily become acquainted with the latest Ford product, but we have tried to make it sufficiently comprehensive to enable the tyro, living, maybe, far from the motoring centers, to take his car in hand on the day of receiving it and with a little care and practice, get all there is in it.

### "IT'S UP TO YOU."

Infinite thought, consideration and discrimination, have been exercised in the design, selection of material and in the construction of the Ford Runabouts to the end that there shall not develop a weak link in the chain of their excellence.

It has been our ambition to make Ford cars the best in the world at the price. All the years of experience at our command—an experience enriched by a knowledge of the weakness as well as the strength of over six thousand cars manufactured by ourselves, beside that which we have gained from closely observing the successes and errors of contemporary makers.

Every Ford Car goes to its owner in as good condition as to final adjustment and "ready for work" as this experience enables us to make it.

But after all it is a machine. A machine possessing all the vital parts as one might say, heart, lungs, good legs and power of direction—but not brains. These must be supplied by the driver.

## GOOD DRIVER—GOOD CAR.

The man who appreciates that an automobile is a machine—a very highly developed, highly automatic and “fool-proof” machine but still a machine; that it needs care; must have fuel and oil; must be kept clean and in proper adjustment at all times to secure satisfactory results—that man will be found driving the same machine year in and year out, seldom changing to other models, even though the one he has may not be one of the best. You will find such a man enthusiastic over the pleasures and possibilities of motoring, and he will tell you that his repair bills are so small as to be out of all proportion to the satisfaction he derives from his machine.

On the other hand it is noticeable that the man who is constantly changing from one car to another and then is never satisfied—never has a good word to say for the car he is driving—is one who fails utterly to appreciate the fact that lack of oil results in wear and more serious injury; that wear calls for immediate and careful adjustment; that batteries become exhausted and water evaporates when heated; and that careless driving invariably results in an expense account. Such a person will have trouble with any car he drives until he learns these simple lessons, if indeed he ever does.

The locomotive driver must first spend two years mastering the art of wiping and oiling the machine, and wherever you see the engine standing you see him still wiping and oiling. Another year is spent in learning how to feed fuel at the proper rate, at the end of which time, if he is more than usually apt, he may be permitted to take hold of the lever.

The skilled stationary engineer is always found with oil can in one hand and oily waste in the other—that is why his engine never stops.

Automobiles are built to withstand abuse that no other machine could endure. All the brains that the designer possesses and all the experience at his command he has incorporated in the Ford car to the end that it may be as positive, reliable and simple in its control as human ingenuity can make it; beyond this point he cannot go; and so it is that care and a fair amount of attention on your part will yield big dividends in pleasure and eliminate 95 per cent. of the expense account you might otherwise incur.

## VIGILANCE AND—OIL.

The first rule in motoring is to see that every part has, at all times, plenty of oil—then more oil. The second is to see that every adjustment is made immediately the necessity for such adjustment is discovered; and the third rule is—exercise common sense—that's what they drive horses with.

The liability of trouble and the consequent marring of pleasure trips through neglect to make adjustments promptly, increases by the square of the time they are neglected.

Permitting any part to run for even a brief period without proper lubrication will certainly result in serious injury to the machine and expense to the owner; and the results of reckless driving, while they may not show up immediately, will none the less certainly appear later, for all that.

If the history of all the joyously anticipated pleasure trips that have ended disastrously could be written, it would be shown that in 90 per cent. of the cases the humiliation and disappointment might have been avoided by making a certain repair or adjustment, the necessity of which was known before starting, instead of trusting to luck and a crippled part.

In the flush of enthusiasm just after receiving your car remember a new machine should have better care until she “finds herself” than she will need later when the parts have become better adjusted to each other, limbered up and more thoroughly lubricated by long running.

You have more speed at your command than you can safely use on the average roads, or even on the best roads save under exceptional conditions, and a great deal more than you ought to attempt to use until you have become thoroughly familiar with your machine and the manipulation of levers and brakes has become practically automatic.

Your Ford car will climb any climbable grade. Do not, in your anxiety to prove it to every one, climb everything in sight. A good rule is, if you crave the fame, climb the steepest grade in your neighborhood once, then let others take your word for it or the word of those who witnessed the performance, for the deed thereafter.

Extraordinary conditions must be met when they present themselves—they should not be made a part of the every day routine.

## WHEN YOUR CAR IS SHIPPED.

The tires are inflated, the emergency brake set, gasoline tank and radiator drained and the valve in pipe leading from gasoline tank to carburetor is closed, the switch on the coil box open and wires disconnected from batteries under the seat so as to prevent meddlesome persons closing the electrical circuit and causing the batteries to run down. The oil is left in the engine base and lubricator and finally, the wheels are carefully blocked to prevent the car getting away and thereby sustaining injury in transit.

Remove the blocks carefully with a pinch bar and draw out, or drive down, all nails so as to avoid injury to the tires. Release the emergency brake and take the automobile out of the car, being careful not to scratch or mar the body.

## WATER.

On receiving your car, and before starting the motor, fill the water tank, which is incorporated in the radiator, with clean fresh water, preferably straining it through muslin or other similar material to prevent foreign matter getting into the small tubes.

It is important that the car should not even be run out of the freight car under its own power unless the water tank is full. The tank may appear to be full before all parts of the circulation system have been supplied. It will, therefore, be necessary to turn the motor over a few times by hand so that the pump will force water into the cylinder jackets. This will lower it in the radiator. Pour in the water until you are sure both radiator and jacket have been filled and the water runs out of the over-flow pipe. During the first few hours that the engine is running it is a good plan to examine the radiator frequently and see that it is full and the water circulating properly. Soft rain water when it is to be had in a clean state is superior to water which may contain alkalis and other salts which are injurious, or which tend to deposit sediment and clog up the radiator.

## GASOLINE.

The gasoline tank is under the seat. See that it is supplied with gasoline. Always strain through chamomis skin to prevent water and other foreign matter getting into the carburetor. When filling the gasoline tank extinguish all lamps, throw away your cigar and be sure that there is no naked flame 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 atmosphere within a radius of several feet is permeated with highly explosive vapor.

Unless it has been tampered with, the carburetor adjustment is right, having been set by the head tester, so do not meddle with it until you are certain it needs adjusting.

## OIL.

See that the oiler contains a supply of oil. We recommend Monogram, medium fire test, Gas Engine Oil for all motor lubrication, but there are numerous good grades of gas engine oil on the market. There are several good semi-fluid greases suitable for differential oil and transmission gear lubrication—we recommend Standard Oil Number Three Grease, or dope, for this purpose. It is false economy to use poor or cheap oils. The axles and transmission gears are well supplied with lubrication when they leave the factory, but it is well to examine them frequently.

The engine crank case contains a supply of oil when the car is shipped from the factory, but for the first few hundred miles oil should be used liberally on all parts of the car and particularly around the engine. There is a drain cock in the engine base and there should be sufficient oil at all times to run out when this is opened. Should this test indicate insufficient oil, add more. Pour the oil through the "breather tube" at the right side of the crank chamber.

## WIRING.

See that all wires leading from the batteries and commutator to coils, plugs and "grounds" are intact.

## CONTROL.

Familiarize yourself with the functions of the various operating and control levers, which are as follows: The hand lever at the side of the car operates the high and low speeds. The lever is in the "neutral" position when almost vertical—leaning slightly forward. Pull it back for low speed and push forward until you feel it lock, for high. Of the foot levers, the one at the extreme left operates the reverse. The one at the right is the emergency brake, and the middle one operates the brake on the transmission gear. To lock the emergency brake push the lever forward and then, with the other foot, press down the button in the floor just at the left of the slot. To release emergency brake push foot lever forward, when the button will spring back, thus disengaging the ratchet. Of the two smaller levers below the steering wheel, the one at the right controls the spark advance and the one at the left, the throttle. The forward position of these two levers is low spark, and closed throttle, respectively, while the extreme rearward position gives the extreme spark-advance and open throttle.

One and one-half turns of the steering wheel gives the full sweep from right to left, or vice versa, of the front road wheels. The Ford steering reduction gears furnish ideal steering qualities, the wheel being easily turned by the left hand with almost no effort.

## IGNITION.

The Model "N" Ford Runabout is equipped with two sets of dry-cell batteries—five cells to the set. Model R equipment consists of one six-volt storage battery and one set of dry cells. A four unit coil is located on the dash and a switch on the front of the coil serves to "cut in" either set of batteries. The switch should always be open when the engine is not running as otherwise the batteries may run down in a short time. The batteries are under the seat, just back of the gasoline tank. The commutator is on the rear end of the cam-shaft and access may be had to it by raising the front floor board.

**After making sure** that your water, gasoline and oil tanks are filled; the valve between the gasoline tank and carburetor open; emergency brake set; speed change lever in neutral position; spark retarded; throttle about half open; battery wires connected and switch closed—you are ready.

**TO START THE MOTOR.** Grasp the starting crank and turning it until its position corresponds with the position "7:30" on a clock dial, push it on the crank until it engages with the crank shaft; pull up sharply. Do not jerk, but on the other hand the pull should not be too sluggish. If the motor is cold it may be necessary to turn it over three or four times briskly. In extreme cases it may be necessary to close the carburetor air intake by holding your hand or a glove over it till motor starts, when it should at once be withdrawn. If warm it ought to go on a quarter turn.

**Do not wear yourself out cranking** a motor that won't start after three or four turns—there is something wrong—a switch open—a faulty electric connection—a short circuit—weak batteries—foul plugs—lack of gasoline in the carburetor—a closed throttle or imperfect mixture. Search for trouble in the above order. Do not monkey with the carburetor or coil trembler adjustments until you are sure the trouble is not elsewhere; unless it has been tampered with in transit, the carburetor adjustment is correct as is also the trembler adjustment unless the battery has been run down by short circuiting in transit.

There is no guess work about a gasoline motor—a popular superstition to the contrary notwithstanding—if every thing is as it should be the motor will start on the first turn. Atmospheric temperature affects the vaporizing qualities of gasoline—but that is all. There is no excuse for a person suffering a back-kick from a gasoline engine except absent-mindedness in setting the spark.

Here is what is called the safety method of starting a 4 or 6 cylinder motor—it's a good plan for a lady driver.

Having prepared as above but with battery switch open, turn the motor over once or twice, letting it come to rest by "balancing between compressions." Throw on the battery switch and, nine times out of ten, it will start—unless very cold—on the spark.

As soon as the motor starts push forward the throttle lever to prevent racing. The spark may be advanced a few notches as it is better practice to retard the motor speed by throttling the charge of gas than to leave the throttle open and slacken the speed of the engine by a slow spark.

A retarded spark with full gasoline charge tends to over heating of the cylinders and should be avoided at all times.

## TO START THE CAR.

Having seated yourself, grasp the steering wheel lightly but surely with the left hand, release the emergency brake; then, slightly accelerating the motor by opening the throttle, draw the change speed lever back gently until you feel the low speed clutch take hold—pressing harder as the car gets under way. Then push the lever forward—unhesitatingly and firmly—until you feel the high speed clutch lock. The FORD Clutch is of the multiple-disc type and takes hold very gently, no matter how quickly engaged.

The function of the low speed gear is to start the car and give it sufficient momentum so that the high speed clutch may be thrown in without “stalling” the motor. Experience and practice only can teach one what degree of momentum is required. If the motor is running at about normal speed when the low speed clutch is engaged the Model N or R will attain sufficient headway in twice or three times its own length (15 to 25 feet) to take the “high” easily, the motor slowing down slightly until it gets the load and then speeding up again without effort.

Should you inadvertently stall the motor, release the clutch, set the emergency brake and start over again. Once under way, manipulate the spark and throttle levers, until you obtain the desired speed and the best results in smooth running.

## TO STOP THE CAR.

First pull the change speed lever into “neutral” position, **being sure not to draw it too far back, and thereby apply the low speed** (90 per cent. of accidents to beginners occur through applying the low speed in a moment of excitement instead of stopping at neutral position when disengaging the high speed clutch). Apply the brake—not too quickly at first, but firmly until the car comes to a dead stop.

## TO REVERSE THE CAR.

Presuming that you have first stopped as above, release the brake; leave change speed lever in neutral; with motor running at moderate speed, apply the reverse lever with the left foot, at first gently then more firmly, as the car moves backward. To stop, release the reverse lever and apply brake as before.

## TO STOP THE MOTOR.

Open the throttle so that the cylinders will take full charge of gasoline; this will accelerate the engine, when the switch may be thrown off. The motor will then stop with cylinders full of explosive gas and ready to start on the spark.

## A DULL KNOCK IN THE MOTOR

Is an indication that the spark is advanced too far; retard it gradually until the knock ceases. In ascending grades, as the speed decreases, a knock will sometimes develop; it is an effect of the same cause and calls for the same treatment—slightly retard the spark.

Should one or more cylinders seem to be missing accelerate and retard the motor speed two or three times by disengaging the clutch and opening and closing the throttle. This will usually result in bringing them all in, as such missing is frequently caused by a drop of water, or oil, or carbon particles having lodged between the spark points of the plugs. If the above treatment does not effect a cure, you may have a foul plug, in which case take it out and clean it. See that the plug points are separated about 1-32 inch.

## SUGGESTIONS.

**You will not realize** the fullest pleasure from driving until you become so familiar with your car, its moods, peculiarities, its sensitiveness to the throttle and spark control—separately and in combination—and the way it “likes” to take grades, hard roads and heavy roads, that you can instinctively feel whether it is working to the best advantage or laboring because of improper handling—in other words until sympathy has been established between the car and driver you have not realized to the full the exhilarating sense of having at your control a machine that is as a living thing in its responsiveness to your slightest wish and its adaptability to all manner of conditions. Just as no two musical instruments have exactly the same tone, so every automobile while apparently an inanimate machine, differs in its action from every other machine even of the same make. Each driver, too, has his peculiarities and, by the way he makes adjustments and handles the car, lends to it some of his own individuality.

**Endeavor** to so familiarize yourself with the operation of the machine that to disengage a clutch and apply the brake becomes practically automatic—the natural thing to do in case of an emergency. For the same reason accustom yourself to frequent use of the emergency brake. In moments of excitement the driver invariably performs that operation which has become most natural to him.

**The best brakes** can be easily and quickly ruined by slipping them until they burn out. Negotiating long down grades in this way will necessitate frequent adjustment of the brakes.

The skillful driver seldom uses his brake—having his car always under control and checking speeds by throttling.

**Always be sure** that one clutch is disengaged before engaging another. In climbing very steep grades you will find it necessary to drive with spark a little slower and throttle well open.

**In Turning Corners**, it is unnecessary to disengage the clutch or to apply the brake; as you approach the corner check the speed of the car by throttling—opening up when about half way round. Not, however, until you have ascertained that the coast is clear.

**Do not rush hills**—take them at a moderate pace, but “open up” just as you strike the grade so as to give the motor the “benefit of the doubt.”

**You will have a feeling at first** that you must hang on the steering wheel “like grim death”; this is unnecessary and the feeling will wear away after a few days’ driving, when you will find that a slight touch is sufficient to turn the car in any direction.

**It is a good practice** to use the left hand for steering only—the throttle lever may very easily be manipulated with the index finger for opening and the thumb for closing. This leaves the right hand free to operate the change speed lever.

**Learn to control** the speed of the car with the spark and throttle as much as possible releasing the high speed clutch only when absolutely necessary and resorting to the low gear only in extreme cases. It is hard to explain just how to use the spark and throttle so that the beginner will understand, but the rule is “use the spark for speed and the throttle for power.”

## ENGINE LUBRICATION.

The motor is lubricated by the most reliable system that has ever been devised for this purpose, i. e., splash lubrication. The oil is forced from the reservoir, which is attached to the engine, by the pressure of the engine exhaust. One tube leads to the engine base and the other to the ball and socket connection between the rear axle and the transmission gear. The amount of oil feed may be regulated by the adjustment device on top of the reservoir. Loosen the lock nut with a wrench and with a screw driver turn the cone valve up or down according to the amount required, more or less. If the engine smokes, it is getting too much oil; there is a pet cock in the bottom of the engine base and there should at all times be sufficient oil to run out of this pet cock and yet not smoke at the muffler.

A great deal of patience may be required at first to get the oil regulated exactly right, but once it is regulated you will have no trouble with it. The engine is always better for having too much oil than too little.

## TO ADJUST CRANK SHAFT BEARINGS.

To adjust the central crank shaft bearing remove the aluminum side plates and then, with a socket wrench, remove the nuts from the bolts which project up through the aluminum base between the two sets of cylinders. This will allow the lower half of the bearing to come off; remove the fibre shim and file down until the bearing is a close fit on the shaft. The two end bearings of the crank shaft are not adjustable. They are of babbitt and if the engine runs dry and they become too loose, the better and cheaper plan is to send to the factory for new ones to replace them. The hole in the aluminum case is reamed to absolute accuracy and the babbitt bushings are interchangeable.

## TO LUBRICATE TRANSMISSION GEAR.

In the transmission case between the low speed clutch band and the reverse, there is a threaded plug, another is located in the conical rear end section of the case. Remove these plugs and fill the case with Albany grease and replace the plugs, being careful to screw them up tight so that they will not work out. In the high speed clutch disc there is a hole drilled for oiling. The inner discs of the clutch are lubricated automatically from the inside of the case.



## TO REMOVE TRANSMISSION GEAR.

The engine base and aluminum transmission support are bolted together, forming a unit power plant. Should it be necessary to disconnect the transmission gear it is simpler to take the unit-plant out of the frame. Stand the motor on end—placing two 2x4 blocks for the fly wheel to rest on, with the end of the crank-shaft between the blocks—Remove the bolts which hold the two aluminum sections together. Draw the aluminum transmission frame away from the engine base, being careful to support the transmission gear meantime. The squared rear end of the engine crank-shaft slips into a squared hole in the front end of transmission-gear shaft—the latter may be withdrawn. It is unnecessary to remove the bands to dis-assemble the gear.

## TO REMOVE CRANK-SHAFT.

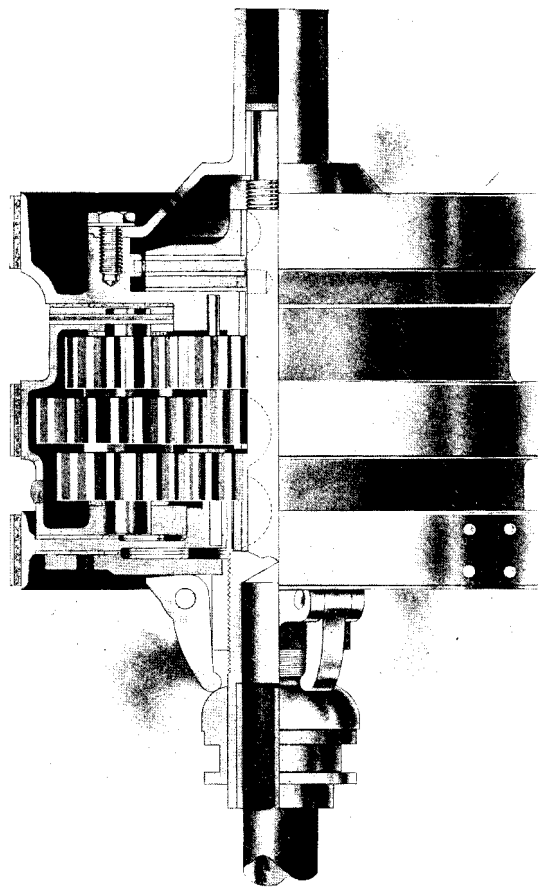
Disconnect engine base from transmission frame; disconnect connecting rods; remove middle bearing; draw off steel gear; disconnect front end-piece of crank case and draw the shaft out through that aperture.

## TO REMOVE CAM-SHAFT.

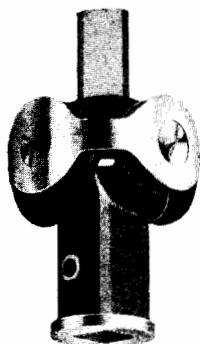
The cam-shaft is a one-piece drop forging with all cams integral; the cams cannot, therefore, become displaced; consequently, it should never be necessary to remove it. But should you wish to do so, first disconnect the transmission gear; take off the commutator; loosen the set screws which pierce the side of engine case and hold the cam-shaft bearings in place. The shaft may then be withdrawn. To replace it, reverse the operation, being careful to mesh the gears as they were before. The gears are marked, one mark being on a tooth and another between the two teeth into which the first one meshes.

## TO DISCONNECT COMMUTATOR.

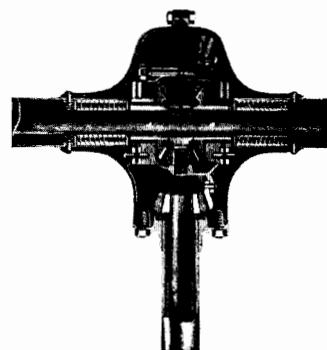
Remove the grass cap; unscrew lock-nut; with draw the steel cap which is held in place by the lock nut; this exposes the retaining pin, drive out the pin and the commutator may be removed from the cam-shaft. To replace, reverse the operation, being careful to get each part in its proper place. It is impossible to get the commutator on in a wrong position.



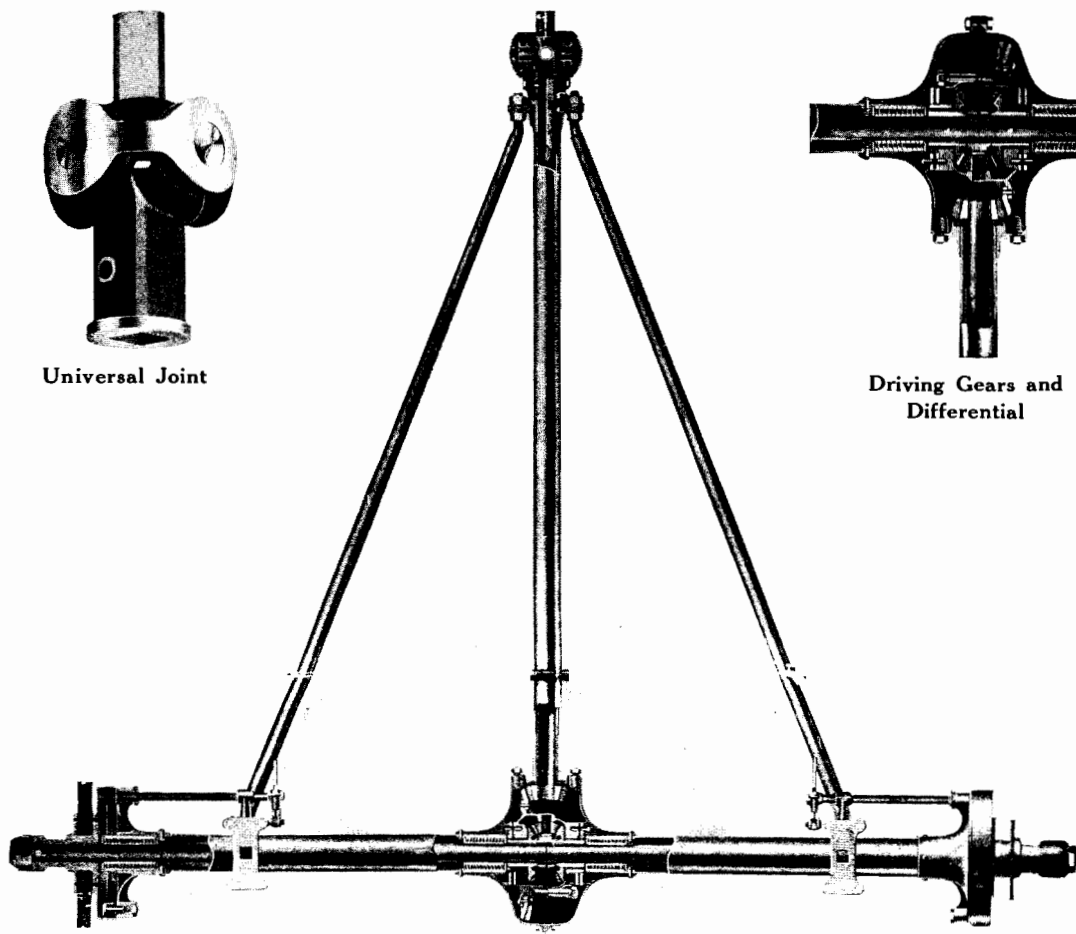
Ford Spur-Planetary Transmission Gear. (Model N and R.)



**Universal Joint**



**Driving Gears and  
Differential**



### **Famous Ford "Three Point Drive" Rear Axle.**

(Broadly covered by letters Patent in all countries of the World.)

#### **REAR AXLE.**

The rear axle runs on Hyatt roller bearings. End thrust tendencies of the large bevel gear are taken by fibre discs between hardened and ground steel discs—the best possible construction for this service. The propeller shaft runs in babbitt bearings at both ends. The entire axle is lubricated by a copper tube which leads from the pressure feed oiler and enters at the ball joint. The oil flows down through the tubular torsion lever to the gears and finally to the Hyatt roller axle-bearings. These bearings are spiral rollers and each alternate spiral is reversed so that they distribute the oil automatically over all parts of the bearing surface.

#### **TO DETACH THE REAR AXLE.**

Jack up the frame, disconnect the springs from the spring blocks by removing nuts and spring clips. Remove the bolts which hold the two sections of the aluminum ball-socket together. This allows the ball to be drawn back and out of the socket; disconnect the brake connections and the axle may be removed from under the car.

## CLUTCHES.

Transmission clutches should never be too tight, nor on the other hand, should they be so loose as to permit of slipping between every stroke of the motor. The low forward speed and reverse clutch are steel bands, fibre lined. These will wear indefinitely if kept just slightly oiled; they will also hold better in this condition than when dry. They are adjusted by screwing up the nuts on the ends of the draw rods. See that the bands do not drag on the drums when open, as this constitutes a break effect which not only consumes power in large quantities, but tends to over-heat the motor.

The high speed clutch is of the Ford multiple disc construction—alternate discs of iron and fibre. It is adjusted by turning the threaded sleeve, which carries the three dogs, a fraction of a turn to the right. In order to do this it is necessary first to loosen the set screw in the sleeve. This should be carefully tightened after the proper adjustment is secured. If the transmission case is kept well filled with grease the high speed clutch will automatically lubricate. The fibre discs will rapidly wear away if allowed to run dry, but if lubricated are of long life and furnish ideal friction qualities.

## CONNECTING ROD BEARINGS.

To adjust connecting rod bearings, remove the plates which cover the hand-holes at the left side of the engine base; there is a fiber shim between the jaws of the hinged bearing cap and main section of the connecting rod; remove this shim and file it down until, when the cap is drawn up tight by the connecting bolt it is a close fit on the crank shaft.

To adjust piston pin bearing, remove the side plates as above, turn the crank shaft over until the piston is in the most accessible position and the connecting rod out of the way of the hand; with a socket wrench tighten up the set screw in the upper end of the connecting rod. The bearing section is split, and by tightening this set screw, the ends are pinched together. Be careful to get a close fit and yet not make the bearing bind.

## TO REMOVE THE DIFFERENTIAL GEAR.

Remove the rear wheels by unscrewing the hub cap and driving out the retaining pin—the wheel may then be withdrawn; disconnect the axle as previously explained. In the steel casting and just back of the ball there are two threaded plugs; remove these and revolve the axle until the steel pin which secures the squared end of the propeller shaft in the female section of the universal joint comes opposite the holes; drive out the pin; remove the lock nuts from the front end of the tapered distance rods and also the six nuts which hold the torsion tube to the differential housing. The torsion tube that encloses the drive shaft may then be drawn away from the axle. If it binds do not drive with a hammer but place a block of wood at the back of the collar and drive carefully so as not to injure the parts.

Next, remove the seven bolts which hold the two halves of the differential housing together; draw them part. To replace, reverse both operations, being careful to get all parts such as fibre and steel discs, roller bearings, keys and pins in their proper places.

Gear noises in the differential case are likely to be due to the bevel gear having gotten out of true mesh through wear of the fibre discs. This will not occur if these parts are kept properly lubricated, but if it does, of course, the remedy is to send to the factory for new discs to replace the old ones. Do not try to make discs yourself, for the difference in thickness will throw the gear out of mesh, causing loss of power and uneven wearing of the gears.

## TO GRIND A VALVE SEAT.

This operation requires care and skill. Place on the valve a small quantity of very fine ground glass, or, if this is not obtainable, very fine emery powder. Use sufficient oil to make a very thin paste, being careful not to allow the paste to run into the cylinder. The valve is then rotated, being firmly pressed down against its seat at the same time.

The valves are accurately timed at the factory. If the cam shaft should be removed for any reason, care must be taken to replace it so that the gear on crank shaft and the gear on cam shaft mesh according to the factory marks, one gear bearing a mark on one tooth, the other gears having a mark between the teeth that straddle that of the first gear.

## TO REMOVE A VALVE.

Unscrew the threaded plug. Press up the washer which holds the end of the valve spring, and take out the pin, push the valve up and draw it out.

## DISARRANGEMENTS IN VALVES.

If the motor gets in the habit of missing a little every day when nothing seems wrong, it is well to look for a clogged muffler (which causes back pressure), weak valve springs, insufficient clearance between valve stem and tappet rod, leaky valves, leaky inlet pipe, weak batteries, vibrator points worn off, spark coil broken down in the insulation, insufficient time of contact in the commutator or badly worn valve gear.

The clearance between the valve stem and tappet rod should be not less than one-thirty-second of an inch. Leaky valves can easily be found by trying the compression with the inlet and exhaust pipes detached. If the inlet pipe leaks the motor will start hard and will require carburetor priming, and when the throttle is opened the engine will choke and emit black smoke from the muffler.

## STARTING ON SPARK.

The ability of a 4 or 6-cylinder motor to start "on the spark" is largely dependent upon atmospheric conditions—and in cold weather—the temperature of the cylinders.

If the cylinders are either too hot or too cold, the gasoline will rapidly precipitate so that the mixture in the cylinders is no longer of explosive consistency.

Under ideal conditions a motor will sometimes start on the spark after having stood 12 to 18 hours.

Of course, it cannot start on the spark unless it has stopped with an open throttle so that there is a charge of gas in the cylinders. With regard to starting on the spark generally; many authorities consider this bad practice; the sudden explosion behind the stationary piston unavoidably transmits a severe wrench to the connecting rods and crank shaft; while this may not show up immediately, it is asserted that it finally results in crystalization and a broken crank shaft.

Ford shafts are made extra heavy to meet this condition and we have little apprehension—it is a matter for the driver to settle with himself.

## CARE OF THE COMMUTATOR.

The commutator should be kept filled with non-fluid oil which will take care of the lubrication and yet will not interfere with the passage of the electric current.

## COIL TROUBLES.

If the vibrator points are worn off, considerable sparking at the vibrator will be noticed. When everything else is right in the sparking system the coil should give a spark at least one-half inch long in the air. Sometimes a broken down coil can be restored to good working order by putting it in a dry, warm place for a few days, so as to melt the wax inside and fill up the break in the insulation. Too much battery will break down a coil. The time of contact in the commutator should be not less than one-twelfth of a revolution of the flywheel, and a little more is better. Excessive battery consumption sometimes results from incorrect adjustment of tremblers; from incipient "shorts" on the lines, and occasionally a coil unit may be found in which the core is too far away from vibrator.

## TESTING SPARK PLUG.

If the operator has occasion to suspect that a spark plug is not operating satisfactorily it can be tested by removing it from the cylinder without disconnecting the wire terminal and laying the metal part of the plug on the engine. By turning the latter over slowly the electrical circuit will then be completed by the commutator, and if the spark plug is in working condition a spark will jump between its two points. If not, it is a good indication that the spark plug is foul and needs cleaning or else is short-circuited and worthless.

## COMMON SOURCES OF TROUBLE.

There are a few common sources of trouble which may affect the operation of a gasoline-driven carriage and which we have mentioned in the order of their possible occurrence. Following these will be noted the remedy. In dealing with common sources of trouble the operator should remember that the difference between a comprehensive understanding of his automobile and the superficial knowledge possessed by many owners is the difference between success and failure. Familiarity with an automobile does not call for special mechanical ability; only a careful study of the directions and explanations contained in this book and a common-sense application of them to your car.

### **(1) INADEQUATE LUBRICATION.**

The remedy for this trouble is obvious and if the directions given pertaining to lubrication are carefully followed very rarely should there be trouble of this character. This difficulty can always be easily determined by feeling the different bearings for any indication of heating. In case of an overheated bearing of any kind the obvious remedy is to dose it copiously with good oil, allowing it to cool and then running the machine very cautiously until the trouble is overcome. Only in severe cases is it necessary to take the bearings apart.

### **(2) IMPERFECT VIBRATOR ACTION.**

The vibrator can be seen by opening the top of the spark coil box; and this trouble can generally be corrected by changing the position of the adjusting screw on the top of the coil or by cleaning the platinum points. The indications of this trouble are uncertainty in starting, skipping of explosions and irregular action when running.

### **(3) DIRTY SPARK PLUG.**

This trouble can be corrected by removing the spark plug with an ordinary monkey wrench. The plug can then be cleaned, using brush or emery cloth together with some clean gasoline. If the spark plug points are badly burned, they may be cleaned with very fine emery paper or cloth, or fine sandpaper. The points on the spark plug should be 1-64 to 1-32 of an inch apart.

### **(4) EXHAUSTED BATTERIES.**

The remedy is obvious.

### **(5) LOOSE OR BROKEN WIRES.**

Troubles Nos. 4 and 5 must be discovered by inspection. In an engine well cared for and properly adjusted so as to turn easily, nearly all failures to start promptly and run regularly are electrical, easily found and quickly remedied. Do not waste time and patience in cranking an engine, for, if in proper condition, it will start as surely and run as regularly as a locomotive. One of the most annoying troubles to locate is a wire which is broken in the insulation. This can only be discovered by taking the cable in each hand between the forefingers and thumbs, and going over the wiring inch by inch.

### **(6) A WEAK COMMUTATOR SPRING.**

This will give all the symptoms of No. 2. That is, uncertainty in starting, skipping of explosions, and irregular action when running. It is the least liable to occur and the easiest to discover. If this trouble is suspected remove the cover on the commutator, when it can be easily located.

### **(7) WORN COMMUTATOR.**

Worn commutator; the symptoms of this are similar to Nos. 2 and 6. It results from failure to keep a supply of lubricant in the commutator. The arc formed by the break in the current as the roller leaves the bronze segments, gradually burns the metal away, causing uncertainty of conduct and hence weak or uneven explosions. Take off the commutator, put it in a lathe and turn about 1-64 inch or less off from the inside—being careful to turn it evenly.

### **(8) IMPERFECT ADJUSTMENTS.**

An engine, which, when turned over for starting, shows good compression, gives one explosion, and fails to go far enough to obtain a second explosion shows that there is friction somewhere, usually in the adjustments.

### **(9) WATER OR DIRT IN GASOLINE.**

A globular trap is provided below the gasoline tank to catch sediment or water and prevent it getting into the carburetor. This will arrest a limited amount of water or sediment, but it should be drained frequently. This should never happen if the gasoline is strained through a chamois skin. The remedy is to open the pet cock at bottom of the carburetor and drain thoroughly, flushing two or three times with gasoline to make sure all foreign matter has been removed. It may be well to completely drain the tank and refill with fresh clear gasoline.

### **(10) FROZEN WATER IN CIRCULATING PIPES AND PUMPS.**

This must never be permitted to occur as the operator should use an anti-freezing mixture in cold weather, or else drain the tanks and water system after the return from every run. No attempt

should be made to run the engine when in a frozen condition as it is liable to break the pump and damage the engine beyond repair. The water cooling system must be thawed out by the use of warm water.

#### **(11) POOR WATER CIRCULATION.**

There are three ways in which this trouble can occur; lack of sufficient water, stoppage of the pipes, or breaking of the pump or its driving device. For each of these three troubles the remedy is obvious.

#### **(12) STICKY VALVE STEMS.**

One of the most annoying troubles and sometimes one difficult for the amateur to locate is a sticky valve stem, causing the valve to stay off its seat and thus lose compression, or else seat itself so slowly that the engine will not run up to speed. This trouble can be remedied by removing the plug over the valve. The valve will then be exposed. Use plenty of gasoline or kerosene to wash the thick oil off the stem, turning the valve by hand. In most cases it can be cleaned sufficiently without dismantling it. This seldom occurs unless a great excess of oil has been used, causing it to work back through the combustion chamber and burn on the exhaust valve stem.

#### **(13) LEAKY VALVES.**

These make themselves manifest by loss of compression, easily discoverable by cranking the engine. When this trouble occurs the valves should be ground to a good seat, using the process described elsewhere.

#### **(14) WEAK VALVE SPRINGS.**

When the valves fail to seat themselves promptly the springs may be weak and should be looked after. A weak inlet valve spring makes itself evident by back-firing through the carburetor. A broken inlet valve key will give much the same indication. Substitution of new springs or parts is the obvious remedy.

#### **CARBON DEPOSIT.**

This is one of the most fruitful sources of trouble in a gas engine. If the cylinders get too much oil a portion of it will work up past the pistons; the intense heat will consume or evaporate the oil, leaving a deposit of carbon; this may be augmented by too rich a mixture, which serves to deposit lamp black or carbon in a film on the inside and top of the compression chamber and on the heads of the pistons. The film thus formed will in time commence to scale and, the projections becoming fused by the heat of explosions, will serve to prematurely ignite the charge.

The symptoms are back-firing and knocking in the cylinders—as if the spark were too far advanced. The cure is to take off the cylinders and scrape off the carbon deposit, being careful not to scratch the cylinder walls. The preventive is to so regulate your oil feed as to give the cylinders plenty, but not too much, oil.

Carbon will also form on the porcelain portion of the spark plugs, thereby furnishing a circuit which the high tension current may travel over rather than jump between the sparking points of the plug. Usually only a part of the circuit will pass by way of the carbon film, still leaving a weak spark at the points. This causes intermittent firing. The symptoms are poor contact in the commutator.

This condition is difficult to detect, for the reason that when the plug is subjected to the usual test of removing from the cylinder and closing the electrical circuit, the spark is seen to jump free and “fat” between the points. This, because the electrical energy which is sufficient to jump between two points  $\frac{1}{2}$  inch apart in the open air will jump less than 1-16 of an inch in the chamber under 60 pounds compression.

#### **(16) BROKEN PUMPS.**

The causes of overheating in motors may be summed up as follows: Poor oil, insufficient oil, bad mixture, weak spark, slow spark, obstructed muffler, broken pump, flat or obstructed water pipe, low water, and valves out of time. The pump may be broken and still circulate the water. The radiator will get hot because slow circulating water does not cool as fast as fast circulating water. Occasionally the pin which holds the pump on shaft may shear off. Remove cover plate and replace pin.

## SOME DRIVING HINTS.

All motorists suffer a degree of unpopularity in rural districts because of the selfishness, carelessness, or thoughtlessness of a few drivers.

When a horse sees a machine ahead of him in a narrow road he naturally wonders how he is going to get by. The driver is probably more timid than the horse. The gentleman motorist will always yield at least a portion of his rights to the man with the horse; drive slowly or stop, giving as much of the road as can safely be yielded to the horse—remember your car will not shy. If the horse seems frightened, stop the motor and if there are ladies in the carriage offer to lead the horse past.

These little courtesies go a long way toward popularizing the motor car in the country.

## HILL CLIMBING.

Every owner takes pride in the ability of his car to climb hills on the "high." The Model "N" or "R" will climb any hill on the high gear that any other car will negotiate, and this does not injure the car so long as the engine does not show any signs of laboring. It is not good practice, however, to force the car to take extremely heavy grades. As soon as the engine begins to labor, it is much better both for the car and the motor to change to the low gear. The low-gear ratio is  $7\frac{1}{2}$  to 1, or about that of the intermediate gears on other cars, so that in the rare cases, when it is necessary to resort to low gear on account of a combination of extremely heavy grades and bad roads, the car will still take them at a 12 to 15 mile an hour gait.

In maneuvering—as in turning around in a narrow street or in close quarters—it is permissible to use the low speed clutch as a brake to stop the backward movement of the car and the reverse to check the forward movement without recourse to the brake in either case. Thus, after releasing the low or reverse clutch (as the case may be) apply the other gently until the car comes forward or backward the desired distance. A little practice will enable one to handle a car equipped with planetary gear very skilfully in this way. It is not possible with the sliding gear of course.

## STUNTS.

Hill climbing and demonstrating over rough roads will eventually show up in the form of strained or fractured parts. Professional demonstrators are prone to perform seemingly impossible feats with an automobile just to show that it will "stand the gaff." While these are perhaps necessary and to an extent do serve to prove to the prospective buyer the qualities of the car, the thoughtful man must realize that no piece of mechanism could for any great length of time live on this kind of treatment as a regular diet. Now that the car is yours, you will naturally desire to prolong its life as much as possible. You can accomplish this to a greater degree by refraining from subjecting it to abuse or working it to its limit except under extraordinary conditions, when such usage is unavoidable. Careful, moderate driving is conducive to long life in an automobile, as is temperate living to the longevity of the owner.

## DRIVING DOWN HILL.

In driving down hill it is permissible to run against the compression of the engine—on high or low gear, according to the steepness of the grade—but in such cases the throttle should be entirely closed; or the switch may be thrown off and the throttle left open, provided care is taken to close the throttle just before the bottom of the grade is reached, so that all explosive gas may be excluded from the muffler before the spark is thrown on again—otherwise an explosion in the exhaust pipe may blow your muffler open.

In descending hills; instead of checking the speed by the use of brakes it is much better practice to throttle the engine clean down so that you are running against the compression of the motor. On slight grades this will be sufficient to govern the car down to a reasonable speed with the high speed clutch in. On very steep hills pull in the slow speed.

## TURNING CORNERS.

In taking corners slow down with the throttle until half way around or until having a good view of the road ahead, then open the throttle gradually. The driver can save tires a great deal by careful driving. One should never try to dodge every pebble or rut in the road, take corners at top speed or stop in the shortest possible distance.

## PERTINENT POINTERS.

It is all right to be a good fellow, but two is a load and three is a crowd in a runabout.

Know your car, but don't tinker unnecessarily. Give the manufacturer credit for knowing his business until the contrary has been demonstrated.

A full chauffeur and a full automobile can result in but one way—the chauffeur gets what is coming to him, but it is too bad about the car.

A mania for making adjustments indiscriminately is responsible for as many motor car troubles as is the habit other drivers have of neglecting needed repairs until the part gives out.

You have the right, inasmuch as it is your car, to experiment in the effort to show how much more you know about it than the original designer—but you do it “for better or for worse” and must accept the consequences.

No two drivers ever agree as to the adjustment of a carburetor, the position of a spark or throttle lever, or the adjustment of clutches or brakes; therefore it is a bad habit to let others drive your car; you will find it out of adjustment invariably.

It is not possible to lose control of an automobile, though some drivers do “lose their heads.” You can stop quicker by applying the brakes gradually than by locking them so severely as to slide the wheels; the minute the car begins to slide it is just as liable to go sideways as forward.

Do not expect a set of springs designed to carry two and ride smoothly with that load, to transport three people and still retain their proper form and resiliency.

Skidding is frequently caused by a too severe application of the brakes. When your car skids, as it will sometimes do when turning corners at speed on wet pavements, release the brakes and clutch, throttle down the motor, keep your head and hold the car pointed in the direction you want to go.

Driving on very slippery pavements skidding can be entirely avoided by driving with spark and throttle only instead of using brakes to slow down; to slacken speed, put spark lever as far forward as it will go, close throttle and run against motor. Use brakes only for full stop and then “gingerly.”

## AN OUNCE OF PREVENTION.

The man who would have his car absolutely dependable in emergencies, should always favor it in every way possible, when the emergency arises, all parts will then be ready to properly perform their functions, and not give way from being habitually overstrained.

Never crank a motor by pushing downward—an accidental back-kick might result in a sprained wrist, or a fractured arm or at least an unpleasant jolt. Locate and engage the crank so that the pull will be upward. This affords the greatest leverage and a back-kick will serve only to force your fingers open and release the crank without serious results.

Most drivers take natural pride in their ability to handle a machine. The planetary gear lends itself admirably to performing stunts and spectacular maneuverings with the car—so much so that there is a great temptation to show off. There is no objection to this so long as the driver uses good mechanical judgment and skill. Otherwise the crank shafts may break now and then.

In driving on country roads where pitch holes or bad culverts are likely to be met, extreme care should be exercised. These are fatal to springs and taking them at speed frequently results in serious wrenching of the frame, body and other parts. The same caution is necessary in driving over unfamiliar roads at night.

In tires alone, the driver can make a great difference in the maintenance cost by exercising discretion in driving. The turning of one sharp corner at high speed, so that skidding occurs, will do more damage than twenty-five miles straightaway running by a careful operator, or the running of a tire too soft will result very quickly in its ruin.

Every time the steering wheel is turned there is a severe side strain on the tires, and this causes more tire trouble than anything else. Actual punctures from nails, etc., are seldom the cause of tire failure. Do not pump the tires too hard, just enough so they will stand up full under normal load.



## ANTI-FREEZING MIXTURES.

A satisfactory anti-freezing mixture must offer protection against freezing down to reasonably low temperatures and must not injure any part of the mechanism nor cause any chemical action to take place, neither should it leave any insoluble deposits on the internal parts.

There are several excellent formulae for anti-freezing mixtures and we will be pleased at any time on receipt of request to give the latest information available on this subject. Here is one we can recommend: Equal parts of glycerine, wood alcohol and water. (2) Calcium chloride is a cheaper solution but must be used with caution as too much will injure the radiator and other metal parts. Two and one-half pounds of chloride to 1 gallon of water is about the proper proportion. A little glycerine, about 1 pound, added, will tend to neutralize the injurious effects of the chloride.

## WASHING THE CAR.

For the benefit of owners who care for their own cars we add a few hints on the proper method of washing. As the finish is apt to become ruined by improper care, these suggestions, if followed out, may possibly be the means of saving the owner considerable expense.

If city water pressure is handy the carriage should be thoroughly rinsed off with cold water by means of a hose, being careful not to get water on the ignition apparatus or wires. Until the mud has been thoroughly softened and rinsed off by the water, do not rub it, as the particles of sand and grit will scratch the varnish. After the dirt has been loosened and washed off, the carriage should be gone over with a coarse sponge (a large sponge is essential) and a fair quantity of good, soft automobile body soap. This removes the surplus oil and grease from the running gear and body, and adds a lustre to the finish. The soap should then be washed off with the sponge, together with the hose and cold water, after which the car should be rubbed perfectly dry with a soft, clean chamois.

## A FEW DON'TS.

Don't attempt to start the engine unless the switch is closed.

Don't start your engine unless the spark lever is in a safe position.

Don't try to run without water, gasoline or oil.

Don't crank an engine more than three or four times after priming. If it does not start at once there is something wrong. (See Common Sources of Trouble.)

Don't engage one clutch until another has been released.

Don't drive too fast or attempt to stop quickly on a wet and slippery road or pavement.

Turning corners at high speed should be guarded against.

Don't allow an automobile to stand in cold weather with plain water in the circulating system as it will freeze and burst something. In cold weather a good non-freezing mixture should be used.

Don't run the engine fast when the automobile is standing still; it is liable to overheat.

Don't run too much on the low gear as it is apt to overheat the engine. The car can be run slowly on the high speed by use of the throttle and spark levers.

Don't forget to fill all oil and grease cups at the beginning of every run and to see that these are feeding properly.

Don't fail to use a high grade of lubricants.

Don't apply the hammer-and-cold-chisel combination as a substitute for a wrench in removing a nut that has rusted in place. Pour some kerosene on, then remove the nut so as not to cut off the corners of the nut or break the bolt.

Don't forget to inspect all bolts and nuts frequently to see that they are screwed firmly in place.

Don't forget when putting in new batteries to place the positive carbon ends next to the spark coil.

Don't get any oil on your wire terminals as it may short circuit the batteries.

Don't monkey with carburetor or coil adjustments in your new car till certain the original factory adjustment has been changed.

## PARTS AND REPAIRS.

### To Ford Owners:

To avoid unnecessary delays and useless correspondence, parts and repairs should, wherever possible, be procured through the dealer or agency or Branch from which the car was purchased or through the nearest FORD representative, who is generally in a position to know what is desired and how to order it. (If he is not, we should like to know it.)

With over six thousand Ford cars in use it is obviously impossible for us to deal with all Ford owners direct. We cannot open accounts with or sell at a discount to any except regular agents with whom we make annual contracts. Where conditions are such as to, in our judgment, warrant it, we will fill orders for parts at prices listed in our parts catalog f. o. b. factory **provided cash accompanies the order.**

In all cases we must have motor number and model of machine with correct description, name and number of the part as per catalog of parts. If these are not procurable, return the part properly tagged, **charges prepaid**, (or we cannot accept it) a special letter of instruction written, and return instructions given. Otherwise we cannot promise prompt service or an intelligent fulfillment of the order.

### TO FORD AGENTS AND DEALERS:

Broken parts must in all cases be sent to us transportation charges **prepaid** for examination before any claim will be allowed. The new parts will be charged for and sent C. O. D.; and if any allowance is made credit will be given for old parts if returned within thirty days after defect is discovered.

The practice sometimes resorted to by agents of other concerns, of charging customers for parts which the factory has replaced gratis, is reprehensible and Ford dealers are warned against it.

Above instructions to owners relative to ordering parts must also be followed by dealers.

FORD MOTOR COMPANY,  
Detroit, Mich.