FORD CARE and Home Repair

donated by the author Murray Fahnestock

HOW TO ENJOY YOUR FORD CAR

1922 Edition

Preface

THE purpose of this book is to explain in a simple way how Ford owners can make some of the necessary repairs and adjustments of various parts of the Ford car. It is not intended to be a complete manual of car repair, but a valuable handbook on car economy, telling the driver how to operate his car at a saving and with the least probability of trouble. When complicated repairs are required, the car owner will always find it most economical and satisfactory to go to a first class repairman.

The several chapters in this book are reprinted from articles which have appeared in FORD OWNER and DEALER and reveal the character of the technical material which has made this magazine one of the most valuable and authoritative motor publications ever known.

While this book is confined exclusively to repair subjects, the monthly magazine, FORD OWNER and DEALER, covers many other departments of value and entertainment to anyone interested in the Ford car. Each issue contains more than two hundred pages full of features of interest including accounts of Ford tours, new Ford ideas and activities of the Ford Motor Co., short stories, helpful hints to Ford owners, "Questions and Answers," Fordson tractor articles, Ford speedster building, racing, etc., with many splendid illustrations.

If this little book proves interesting and instructive then you will surely find the big illustrated magazine, FORD OWNER and DEALER, a hundred times more valuable.

Practically all of these article were written by our own Technical Editor, Murray Fahnestock, who writes exclusively for the FORD OWNER and DEALER.

Regular subscribers may obtain a copy of "Ford Care and Home Repairs" for ten cents.

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Radiator Repairs

By Murray Fahnestock.

In this particular article, we shall attempt to describe the location of leaks and the repair of Ford radiators from the point of view of the individual car owner, who has but few tools, still less equipment, and but limited knowledge and experience of radiator repairing.

In some future article we hope to describe the repairing of radiator with tools, equipment, knowledge and skill from the point of view of the Ford car repairman, who makes a specialty of the quick and profitable repair of Ford and Fordson tractor radiators.

Of course, the repairman will get all the more DIFFICULT kinds of radiator repairing, for which he will charge accordingly. While the majority of repairs, to be described in this article, are those which are most easily and most simply made, without the necessity of taking the entire radiator apart.

THERE is always more radiator repairing to be done in the spring and early summer for two chief reasons. The first of these reasons being the bursting of radiators, due to the freezing and the expansion of the water. The second reason is due to the fact that the use of some anti-freeze solutions has a corrosive effect on the tubes and tanks of the radiator and these leaks become most noticeable when the radiator is put into service in the early spring months.

The repair of radiators is particularly interesting in the spring, as that is the time when radiators are most frequently overhauled in putting the car into condition for a summer of pleasant use. And, as overheating is most prevalent during the hot summer months, it is necessary that these leaks be eliminated for summer driving. Otherwise, leakage of the water will result in lowering the cooling solution to such an extent that the engine will overheat and cause trouble on long summer drives.

The spring is also a good time for the car owner to test and, if possible, repair the radiator of his own car. If he cannot repair the radiator, then the spring months, when the repairmen are not quite so busy as later in the summer, is a good time to take the radiator to be completely overhauled, if the inspection by the car owner finds this to be desirable and necessary.

As some anti-freeze solutions leave more or less of a deposit or scale on the inside of the radiator and tubes, it is also a good plan to have the radiator cleaned out, if trouble from this source is suspected.

Some of the causes of radiator troubles are due to the **unequal distribution** of the anti-freeze solution, when the calcium-chloride solutions are mixed up. If the solution is stronger at one part than at another, this concentrated solution may have a tendency to corrode the radiator tubes and cause trouble.

Another cause of radiator troubles is the clogging of the overflow pipe of the radiator by either dirt or sediment, or perhaps by freezing. If this overflow pipe becomes clogged and the radiator cap fits tightly, then a frozen radiator, or even the steam developed in the top part of the cylinder head during hard driving, may cause a considerable pressure on the inside of the cooling system.

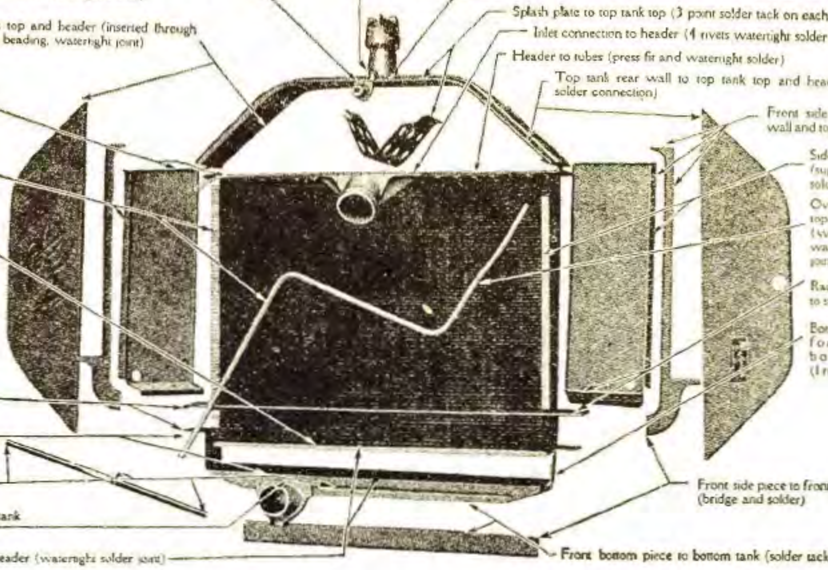
If this pressure exceeds 10 or 15 pounds to the square inch, it is quite easily possible that this may find some leaks in the cooling system at soldered joints which are not overly strong, or may split or burst some of the tubes.

Clogged Tubes.

Another cause of bursting radiators is the clogging of one or more of the tubes. When this occurs, the water ceases to circulate in that particular tube. And it is possible that the anti-freeze solution may not replace the water in that particular tube. Or, if the radiator is drained, it is probable that the water may not be drained from that particular tube. Consequently, a cold spell may cause the bursting of one or more clogged tubes, and for this reason it is particularly desirable to have a clean radiator for use during the winter months.

There are 95 vertical tubes in the radiator of the Ford car. These tubes are of copper. As these tubes are in five layers, from front to rear, that means that there are nine rows of tubes across the front of the radiator, and that the tubes are five rows deep in the radiator.

The important fact about this is, that if the leakage should occur in one of the inner rows of tubes, then it is very difficult to reach these inner tubes for soldering and repairing. When troubles develop in one of the inner rows of tubes, it is quite frequently necessary to take the radiator to a skilled repairman to have this leaking tube either soldered or replaced. In fact, even the repairman will usually replace the tube, rather than attempt to solder a tube in one of the inner rows.



1916 and Earlier Ford Radiator.

As the clogging of one or two tubes will only restrict the efficiency of the cooling system by about 1% per tube, it follows that, if it were easy to plug the tops and bottoms of these tubes, this would be a good method for repairing the tubes for temporary use during the summer.

However, as it is necessary to unsolder the top and bottom tanks of the radiator, in order to obtain access to the ends of the tubes, this makes a rather difficult repair and it is far more easy to describe the manner in which the tubes can be plugged, than to actually do the work.

Cleaning Radiator.

One of the methods which tends to lengthen the life of the radiator in general use, when no anti-freeze solution is used, is to drain the radiator occasionally to remove the sediment which accumulates from the water. This will also remove bits of metal, and rust and scale, which come from the water packets of the cylinder head. It is sometimes advisable to wash out the radiator, including the cooling system of the engine, by means of a solution composed of a half pound of lye dissolved in about five gallons of water.

The radiator should first be drained. And then filled with this solution. And the engine driven for about five minutes with a retarded spark in order to heat the cooling solution. The heat hastens the chemical activity of the lye, and enables the radiator to be cleaned out more quickly.

After this, the radiator and the cooling system should be drained and refilled with clean, fresh water, and then the engine should be again run for a few minutes and this water drained out. Finally, the radiator can be filled, with the expectation that no further corrosion of the cooling system from the lye will take place.

It is a good plan to examine the radiator tubes occasionally to make sure that none of the radiator tubes are dented or pinched, as this will cause the easy clogging of the tubes by mud or sediment, or by the freezing of the water in cold weather.

Paint Restricts Radiation.

It is important that the tubes and fins of the radiator be not covered with a heavy coat of paint, as paint seriously interferes with the free and easy radiation of the heat. If the tubes and fins of the radiator are painted at all, this should only be done by using a thin, dead-black paint; such as is made by mixing lampblack and turpentine.

Enamel, or light-colored paints interfere with the radiation of the heat, and should never be used. The practice of painting the core of the radiator with an aluminum or gold paint seriously interferes with the cooling of the radiator, and the efficiency of the engine.

The manner in which the removable radiator shell of the 1917 and later radiators is painted does not make any particular difference, as this shell is insulated by an air space from the core of the radiator, and does not have any practical effect on the cooling of the radiator and the radiation of heat.

On the 1916 and earlier radiators, the manner in which the tanks are painted, does have some effect on the cooling, as the side and top tanks on these earlier radiators were in close metallic contact with the radiator tanks and core.

The horizontal fins, between the radiator tubes, should be kept clean and evenly spaced, so as to allow the air to pass freely through the core of the radiator. If these fins become bent, they can be straightened by the use of wide, flat-nose plyers, or by the use of a special tool which is made for just this purpose, and consists of a number of flat strips of metal, placed at a particular distance.

1916 Ford Radiators.

There are two types of radiators in general use on Ford cars. The earlier type of radiator, of the "angular" design, was used on 1916 and earlier Ford cars. Most of these radiators have been replaced by the 1917 and later type radiator of the stream line type, as used on Ford cars of 1917 and later models. However, there are still many of these old brass radiators in use on Ford trucks and commercial cars, so that it is necessary to know how to repair them, as well as to know how to repair the later models.

Referring to the picture of the 1916 type radiator, showing the parts dissembled; it will be found that the radiator filler spout is fastened to the top tank of the radiator, and the bracket which holds the front end of the radiator to dash rod is also soldered and riveted to the same plate.

Beneath this top plate of the radiator is the "splash" plate, which is soldered to the top plate of the radiator. This splash plate is to prevent, to some extent, the splashing of the water from one side of the radiator to the other, and to distribute the water from the inlet hose connection to all the tubes more equally.

This splash plate sometimes becomes loose from its soldered connections in the radiator, and then tends to rattle around in the radiator when the water level is low. This will do no particular harm, except for the fact that a loose splash plate is apt to cut through the radiator overflow pipe, down where the radiator pipe passes through the bottom plate of the top tank of the radiator. If this occurs, then it will be impossible to keep the water level in the radiator higher than this leak in the overflow pipe, as all the water will tend to run out through the overflow pipe as soon as this level is reached.

To prevent this trouble with splash plates, it has been suggested that the splash plate be doubled up by means of pliers, and pulled out through the top filler opening of the radiator. This suggestion is only offered for what it is worth, and is usually more easily said than done.

In order to obtain access to the top of the tubes of the radiator for repairing, it is necessary to remove the plate from the back of the top tank of the radiator. This allows access to the entire interior of the top tank, and also to the top ends of the tubes. For a complete overhauling, when some of the tubes are to be replaced by new ones, then it is desirable to remove the entire tank from the radiator. But this is usually beyond the ability of the individual car owner. And if such repairs are necessary, the radiator should be taken to a competent repairman.

When making repairs at the bottom of the radiator, it is only necessary to remove the front plate from the bottom tank, but this does not give much space in which to work, so that it is rather difficult to solder or repair the bottom ends of the tubes.

In the 1917 and later radiators, the repairing is sometimes a little easier to accomplish because there is a radiator shell which is easy to remove, and which permits access to the tubes and fins of the radiators, and covers up any rough soldering of the different parts.

Radiator Nomenclature.

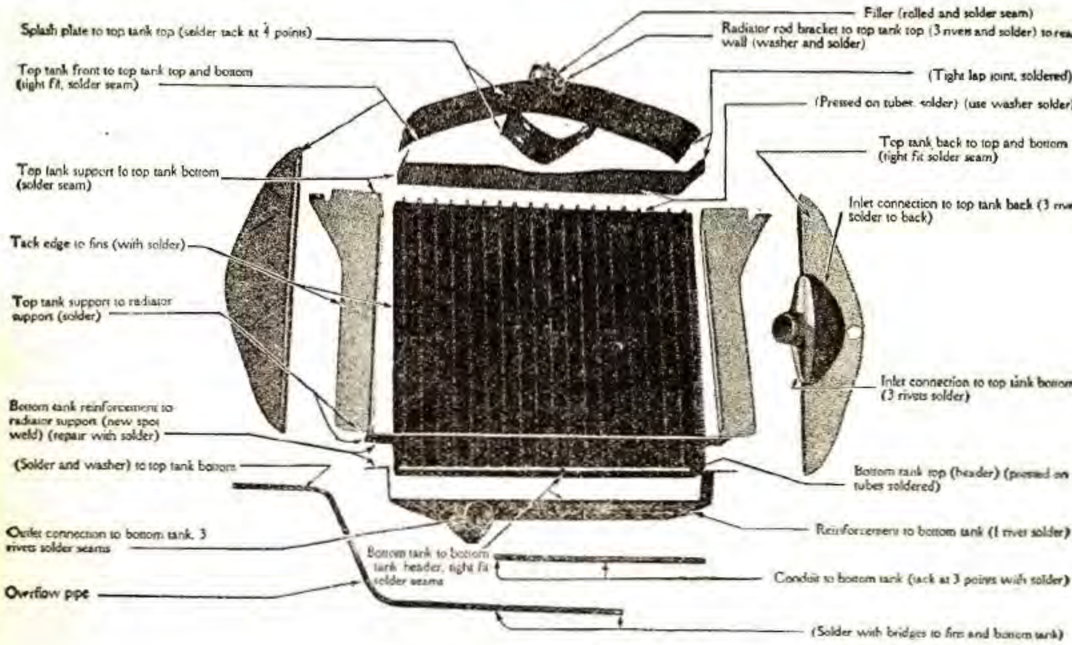
As it is necessary to know the names of the different parts, so that one can order parts intelligently; or understand directions for radiator repairing; we have shown a page of illustrations of parts so that one can call a bracket by its rightful name, and not refer to as a "dewhicky" or "thingamajig."

No. 622—Brace (side)..............1909-16
623—Bracket (rod on rad).....1909-21
624—Bottom (up. tank).......1909-16
625—Bottom (up. tank).......1917-21
626—Clasp (hood on rad)......1909-21
627—Core 1909-16
628—Core 1917-21
629—Con. (inlet).............1909-16
630—Con. (inlet).............1917-21
631—Con. (outlet)............1909-21
632—Cover (lower tank).......1909-21
633—Fin 1909-21
634—Flange (filler)..........1909-16
635—Flange (filler)..........1917-21
636—Nut (hose clip)..........1909-21
637—Piece (fro. bot.)........1909-16
638—Piece (fro. side) R......1909-16
639—Piece (fro. side) L......1909-16
640—Pipe (overflow)..........1909-16
641—Pipe (overflow)..........1917-21
642—Plate (splash)...........1917-21
643—Screw and nut............1909-21
644—Screw and Nut............1909-21
645—Support 1909-21
646—Support (lower tank).....1909-21
647—Support (up. tank) R.....1917-21
648—Support (up. tank) L.....1917-21
649—Tank complete (top)......1909-16
650—Tank complete (top)......1917-21
651—Tank (lower).............1909-19
652—Top (up. tank) less filler flange 1909-16
653—Top (up. tank) less filler flange 1917-21
654—Tube 1909-16
655—Tube 1917-21
656—Wall (L).................1909-16
657—Wall (R).................1909-16
658—Wall (up. tank front)....1909-16
659—Wall (up. tank front)....1917-21
660—Wall (up. tank rear).....1909-16
661—Wall (up. tank rear).....1917-21
662—Wall assem. (rear).......1917-21

Testing for Leaks.

When testing the radiator **on the car**, one of the easiest ways to test the radiator for leaks, after having filled the radiator to the top, and dried off the outer surface of the radiator, so that leaks can be discovered, is to race the engine at high speed. A radiator will frequently develop leaks, when the engine is running at high speed and vibrating considerably, while it may seem to be almost leak-proof when the engine is running idly at slow speeds.

Of course this racing of the engine should not be overdone, as it is perfectly possible to shake a good radiator to pieces by undue racing of the engine.



Present Type of Ford Radiator.

If this does not show up the leak, then it is possible to hold one's finger over the radiator overflow pipe, while the engine is run at a fairly good speed with a retarded spark. And perhaps with the radiator covered over with a blanket, so as to develop steam in the cylinder head and subject the radiator to considerable pressure. Care should be taken not to develop more than about 15 pounds pressure in the radiator, as too much pressure might blow up a perfectly good radiator.

Another method of testing the radiator in the car is to connect a tire filling hose, from an air pressure system, to the overflow pipe of the radiator. Take care that a good gasket is fitted into the radiator filler cap, so that no leakage of air will occur at this point.

If one has an old radiator filling cap available, the tire valve from an old tire tube can be fitted into a hole drilled through a radiator cap. This will form a convenient way of pumping air pressure into the radiator or of using a tire gauge to measure the air pressure to which the radiator has been subjected —being sure, of course, that the tire gauge is capable of correctly measuring pressures as low as 10 or 15 pounds to the square inch. Some tire gauges are not accurate, until pressures of 40 and 50 pounds and upwards are reached.

When the tire pump is attached to the valve in the radiator cap, and the air pumped into the top part of the radiator, then it is necessary to plug up the radiator overflow pipe with a wooden plug, while using this method of testing, for leaks.

Another method of plugging the radiator overflow pipe, while making tests, is to slip a piece of heavy walled rubber tubing over the radiator overflow pipe, and then doubling over the end of this rubber tube to prevent the escape of air.

Removing the Radiator.

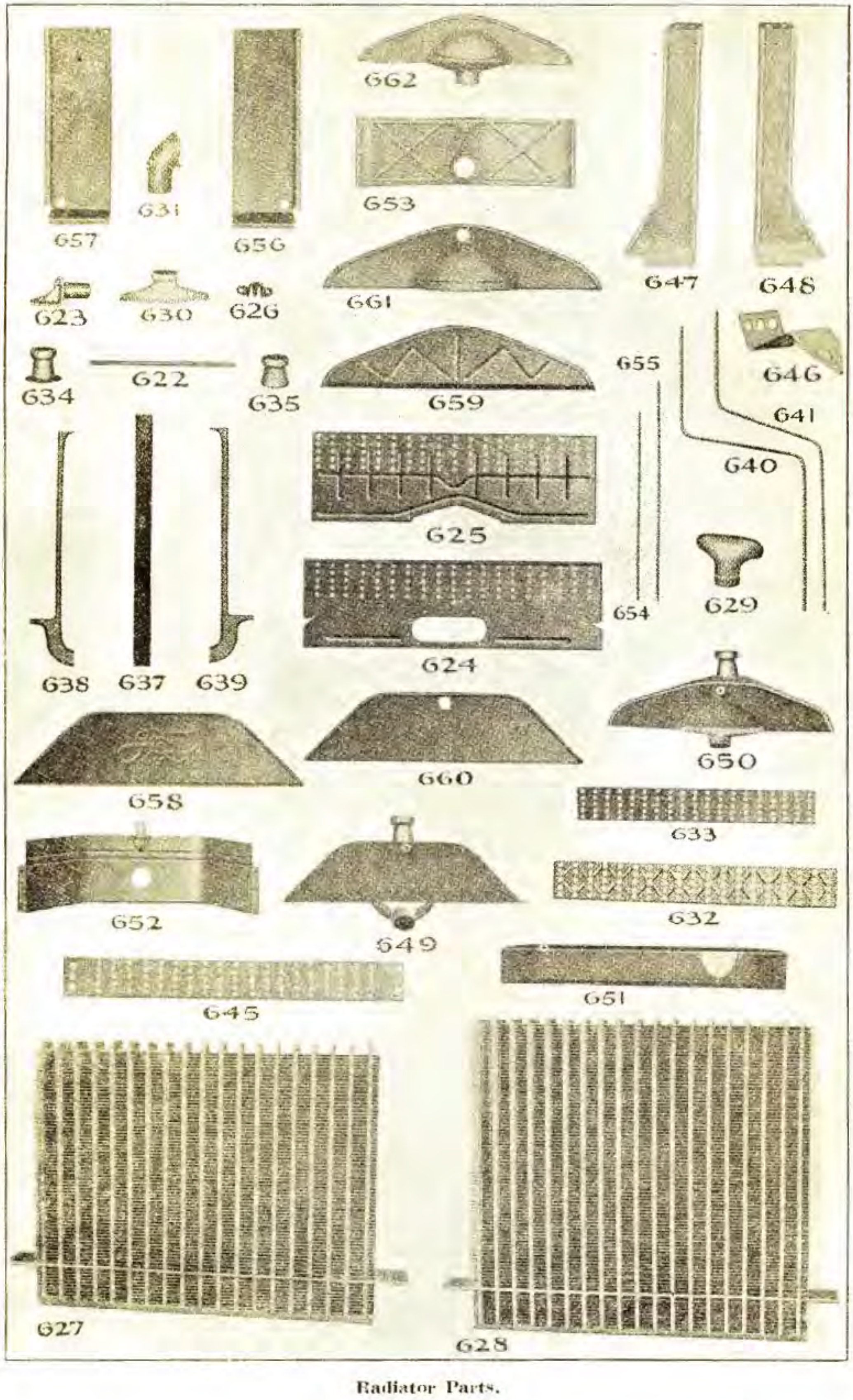
To remove and replace the Ford radiator is supposed to occupy about 45 minutes of the time of a fairly skillful repairman. It is not to be supposed that the individual owner of a Ford car will be able to do the work as rapidly as this. The individual owner of a car usually finds, when he is repairing the radiator, that other parts can be given attention. And these little "touches in time" which may save trouble on the road, will increase the time required for removing and replacing the radiator.

In replacing the Ford radiator, the first operation is to open the radiator drain cock and drain the radiator, saving the non-freezing solution, if one has been used. As the radiator drain cock is usually clogged with mud and sediment, it is often necessary to use a wire to clean out this mud, in order to drain the radiator.

We are now ready to lift off the hood and to place it in some convenient location, say on the left-hand running board. It is well to make a practice of placing the different parts in the same place each time, in order that one may form habits, which will be conducive to more rapid work.

We are now ready to loosen the top hose connection, between the radiator and the cylinder head. And there are two possible methods in which this work can be done; the preferable method depending upon the condition of the top water outlet hose.

If the water outlet hose appears to be in good condition and you do not think it will be necessary to replace the rubber hose, then the quickest and best method of procedure is



Radiator Parts.

to use the cylinder head bolt nut wrench to loosen the two cap screws, holding the water outlet hose connection to the cylinder head, and to remove the water outlet hose casting with the radiator hose and radiator.

This eliminates the necessity of loosening the joints between the rubber hose and the cast iron fittings. And, as it is sometimes difficult to obtain a water-tight connection when replacing the hose, it is better to make the disconnection between the cast iron flanges if possible.

However, if the top water outlet hose connection appears to have become rotted and to require replacement, then it will be better to loosen one of the clamps holding the rubber hose in place. And to pull out the radiator hose connection from the rubber hose. This will give an opportunity for examining the condition of the rubber hose, and for replacing it more easily if necessary. By using one's head, instead of one's hands, much time can be saved.

After removing the two cap screws, holding the top water hose connection, pull out the gasket. Clean this copper-asbestos gasket before placing it on one of the front fender aprons.

Now use the same cylinder head bolt wrench for loosening and removing the two cap screws which hold the side water inlet hose connection to the side of the cylinder block. Then remove and clean the copper-asbestos gasket which was between this side water hose connection and the side of the cylinder block.

As a rule, the rubber hose connections, at the two ends of the outlet connection pipe, do not become worn and rotted nearly as quickly as the top water outlet hose for two good and sufficient reasons.

One of these reasons is that the top water outlet hose is exposed to the action of much hotter water than the lower hose connection. Also, it is sometimes exposed to the action of the oil which floats on the top of the water. Another good reason is that there is always considerable **vibration**, between the top of the radiator and the cylinder block. Thus this top water outlet hose is twisted and stretched, to a much greater extent than the side water connections.

There is no economy in replacing defective rubber hose on the water outlet hose connections of the radiator. The cost of the hose connections is only about one-third of the cost of installing them, so that, if it becomes necessary to change the hose at a later date, the probable expense of changing these hose will be greater than if these hose had been replaced when the radiator was off the car for other repairs.

We are now ready to loosen and remove the headlight wires from the lamps, if the car is one of the older types of Fords. In later type Fords, it is not necessary to remove the headlight wires when removing or replacing the radiator, though it may be necessary to disconnect and remove the cross wire running between the two headlights.

We are now ready to straighten the end of the carburetor pull rod, and to remove this pull rod from the carburetor choker arm. And to pull out this rod from the front of the radiator. Be careful, when removing this pull rod, not to damage the tubes of the radiator, as the tubes are made of comparatively thin copper and are easily damaged. Place this radiator pull rod also on the left-hand running board.

Now pull out the cotter pins from the nuts which hold the radiator to the chassis. If this is an old-style Ford, having brass nuts and brass cotter pins, save the brass cotter pins. But if the cotter pins are of steel, throw them away and use new ones.

We are now ready to use a speed wrench or an s-wrench, for removing the nuts holding the sides of the radiator to the chassis frame. It often happens, when one attempts to turn these nuts, that the stud turns inside of the chassis frame. The bottom end of this stud goes through a small metal plate and is fastened by another cotter pin through the bottom end of the stud.

If the plate assembly twists around inside of the chassis frame, it may be necessary to use a tire iron or a screwdriver blade, and wedge between the edge of this flat plate and the side of the chassis frame, to keep the plate holding the stud from turning, while the nut is being removed from the top of the stud.

Now loosen the lock nut on the radiator-to-dash rod. This nut is adjacent to the dash board of the car. Then a pair of pliers, or a pipe wrench of say the six-inch size, can be used to unscrew the radiator-to-dash rod from the socket in the radiator.

We are now ready to stand in front of the radiator and, by grasping one side of the radiator in each hand, to lift the radiator off the car—using care not to scratch the radiator, or the headlamps, any more than is absolutely necessary.

If this is one of the late model Ford cars of 1917 or later date, one should remove the radiator shell, before attempting to remove the radiator core and tanks

Replacing the Radiator.

Before replacing the radiator, one should examine the fabric gaskets on the side members of the chassis frame, to make sure that these gaskets are in good condition and properly placed over the radiator studs, before putting the radiator back in place.

It is also a good plan to clean the flanges of the cylinder block, where the hose connections are bolted on, as it is necessary to have clean surfaces for the gaskets, if a water-tight joint is to be secured.

Before replacing the radiator on the car, close the radiator drain cock, and make sure that it is screwed tightly into the bottom tank of the radiator.

We are now ready to place the radiator core and tanks in place. And, after this has been done, the radiator shell can be dropped down, using care not to bend the fins between the tubes or to scratch the headlamps.

After the radiator has been placed in position, we can bolt up the gasket, between the top water outlet hose connections and the flange at the front end of the cylinder head. Before putting the gaskets in place, it is a good plan to smear these gaskets with heavy cup grease. This cup grease helps the gaskets to settle properly into place, so that they will bed down more firmly and make a water-tight joint.

While some car owners use shellac for making these joints, the trouble with shellac is that, when the parts are being removed, it is necessary to scrape off the shellac. And very frequently the gaskets are injured when this is done, thus making it necessary to use new gaskets each time. And also making it necessary to scrape off the flanges each time the work is done.

If the flanges are scraped clean and smooth, and if the cap screws are tightened down **evenly**, no trouble should be secured in making a water-tight joint at both of the water connections. While it is **sometimes** necessary to use a new gasket, it is the general rule that such gaskets only need to be replaced by new ones after the radiator has been removed three or four times, or after one or two years of service.

After water-tight joints have been secured between the rubber hose connections and the cylinder head, and cylinder block; we can then bolt the radiator down into place on the side members of the chassis frame.

When tightening the nuts holding the sides of the radiator to the chassis, these nuts should not be tightened too firmly, because if they are, the springs inside of the chassis frame will be drawn down so solidly that there will not be any "give" or yield and an undue strain will be put on the radiator, when the car is driven over rough roads and the chassis frame twists and bends. These springs were put in with a definite purpose of affording a "yielding" support at this point. And the radiator stud nuts should only be pulled down enough to allow the cotter pin to slip through the holes in the studs, and through the notches of the nuts, so that a yielding and flexible support will be secured.

The final part of the work is to tighten the radiator-to-dash rod, fastening this rod into the front end of the radiator, and using care to make the **distance**, between the radiator and dash of the proper length, so that the hood will just fit between the dash board of the car and the radiator shell.

By turning to radiator-to-dash rod farther into the socket in the radiator, the adjustment between the radiator and the dash is changed, and the appearance of the car will be improved by paying attention to secure the correct distance between the radiator and the dash, so that the hood fits snugly and evenly at both the dash board and the radiator.

Removing Transmission

To remove the Ford transmission for repairs, without taking the engine out of the car, proceed as follows.

Unbolt universal point housing and take out rear end.

Remove transmission cover.

Remove all bolts that hold cylinder block to the crank case. But do not remove the two bolts nearest the front end. Merely loosen them.

Attach a chain block to the rear of cylinder block, and lift the cylinder block about ⅜ inch. (The two bolts left in place in the front end will prevent the cylinder block from sliding forward and dislodging the gasket.)

The driving plate, part No. 3321 can now be removed by taking out the six cap screws which hold it. The clutch disc drum, part No. 3332, and the thrust plates can now be removed. Then the transmission drum assembly and the triple gears. This method is much quicker than "pulling the motor".

Windshield Clear in Rain

Driving a car during a rain storm, without some device for keeping the windshield clear, is sure suicide and murder. I have found the following method for preventing the rain from collecting in globules on the shield to be very effective and practical. One cleaning will last from one to two hours during storm.

Purchase from any garage one piece of felt gasket stock ½ inch thick by three inches square. This pad will fit nicely into a thin chewing tobacco pocket box, obtainable at any drug store.

Place pad in dish and pour over it a solution of Glycerine and Witch Hazel—water could be used instead of Witch Hazel, but it sours. About three ounces Glycerine, one ounce Witch Hazel. Let pad soak over night and gently press out surplus, by squeezing in hand.

When windshield is thoroughly wet; rub pad over glass evenly, up-and-down—never lengthwise—thus leaving thin coating of Glycerine, on which the rain will "flatten-out" giving clear view ahead. Keep pad in tin box when not in use, it stays clean.

Care and Adjustment of The Timer

WHEN we first started to write this article, we intended to illustrate and discuss the leading makes or types of timers, but it did not take long for us to realize that the "leading" types of timers "lead" in every direction, and that it would take a "master mind" of the Darwin type to properly classify the different types and do them justice.

Timers—thy name is legion, and then some! There are good timers, old-timers, new timers, poor timers and punk timers. The infinite variety includes roller-brush timers, wipe-contact timers, magneto-contact type t i m e r s, porcelain timers, flat-spring timers, coil-spring timers, ball-contact timers, knife-contact timers, end-contact timers, carbon-brush timers, ball-bearing timers, oil-less timers, grease-filled timers—and twice as many other kinds, too numerous to mention.

In the present article, it is the intention to describe theory and practice in the care and repair of the **regular** Ford dirt-and-grease covered timer, that comes with the car. Because it is usually such a filthy mess, most of us leave the timer alone as much as possible, and few of us understand it as well as we should.

If we understand the care of the regular, roller brush type of timer, it will be easy to understand the correct method of handling most of the special types of timers, though some special instructions, on the installation and care of special timers will also be given.

Parts of Timer

In order that there may be no mixup in regard to the names of the different parts, we have shown the working parts of the standard timer assembled.

It will be noticed that the cast bronze "hub" has a slot in one side. This "notch" is for straight steel pin which extends through the end of the cam shaft, and "locates" the roller brush assembly in the proper relative position on the cam shaft, thus timing the spark.

On the older timers, made several years ago, this hub was "notched' 'on both sides, and the cotter pin engaged both sides of the hub. On present timers, this notch is only cut on one side of the hub. And so it is necessary to cut off about one-eighth of an inch from an old pin, or to use a new pin, with a new-style roller brush assembly.

As the only force tending to shift the position of the roller brush assembly on the cam shaft is the slight friction of the roller against the contact segments, this means that the cotter pin through one side of the hub is amply sufficient to hold the hub roller brush assembly firmly in place.

The "roller arm" is also a bronze casting and, being a "casting," it is **not** well to treat it too roughly, or it may break suddenly. However, in a later part of this article, we shall show how it is sometimes necessary to **bend** this roller arm a wee bit, in order to obtain better contact between the roller and the contact segments.

The "hub cap" of pressed steel, fits over the end of the bronze hub, and its function is to keep the steel cotter pin from dropping out of its place in the end of the cam shaft. If the nut, on the end of the cam shaft is allowed to become too loose, then this washer will shift, the cotter pin will fall out, and then the roller brush assembly will turn on the cam shaft. This will throw the timing of the spark, for all four cylinders, badly out of kilter, and will stop the engine if the roller brush assembly slips much.

If the engine stops suddenly, and the sparks seem "all mixed up," and occur in the wrong cylinders, then the possibility of a "shifted" roller brush assembly should be investigated.

The fibre insulating washer surrounds the steel screw or stud of the contact segment, and keeps it from making contact with the steel or aluminum case of the timer. These insulating washers should be kept fairly clean, and free of bits of metal, or fragments of wire, which might cause a "short" betwen the contact screw and the shell, or case.

The "hexagon brass nut" should be kept fairly tight. If allowed to become loose, the end of the contact segment can tilt up. This will tend to cause "jumping" of he roller, and uneven wear of the raceway on which the roller runs. It is a good plan to tighten all four of these hexagon brass nuts, when overhauling the timer, as the fibre shrinks with use, and wear tends to loosen the contacts—unless these nuts are given a half-turn or so to tighten them, every now and then.

The "contact segment" of tool steel, is one of the vital parts of the timer. When this crescent-shaped piece of steel becomes rough and worn, then poor contact will be made and the engine will run badly. Sometimes the screw becomes loose in the contact and, when this occurs, the screw should be rivetted more tightly into the contact segment.

The "arm pin" of cold-rolled steel, on which the roller arm oscillates slightly in or out, to compensate for inequalities in the distance between the cam shaft and the roller raceway, as the roller brush assembly rotates, re-

Timer Components.

ceives but little wear, as the movement on this large pin is comparatively slight and slow. In checking over this part of the timer, the fit should not be "shabby" but the roller arm should swing in or out freely and easily, without binding, yet without undue looseness.

The cam "cam pin" is a straight piece of cold-rolled steel, though a pin can be cut off from a wire nail, if the regular pin is lost—as any kind of steel is amply strong for the slight strain in this particular part. However, the pin should be a good "fit," as the fit of this pin determines the "timing" of the spark advance, and too small a pin will allow the hub to shift on the cam shaft and out of the correct position.

The "coil spring" is made of spring steel, and should be replaced if it has become stretched or broken. Fortunately, these springs are stretched such a very short distance that their elastic limit is seldom exceeded, and so they very seldom break. But, difficulty in starting the engine—though it might run after once being started owing to the centrifugal force holding the roller brush in contact with the segments—may cause the timer to be suspected of having a broken spring in the roller brush assembly.

The "roller pin" is of cold-rolled steel and needs to be hard, as this is one of the points that receives most wear, owing to the high speed at which the roller revolves on this pin. When examining the timer, make sure that this pin is firmly rivetted in place in the roller arm. If not, rivet the pin securely into the roller arm, as there should be no looseness or play, between the roller pin and arm, to cause poor contact, and wabbling of the roller.

As practically all the wear is concentrated on one side of the roller pin, the turning of the roller pin will tend to equalize the wear, and will help somewhat, if the pin is given just a half-turn, so that the opposite, and less worn side, is brought outside to support the roller against he race-way.

We now come to the last—but by no means least—vital part of the Ford timer. In fact, this "roller" is usually the chief source and chief sufferer from trouble. The roller is made from high-grade steel, and is heat treated and tempered, to make it wear as long as possible, in spite of the rough traveling at high speeds that it does over the steel contacts and the fibre insulation of the race-way of the timer shell.

When this roller is case hardened, it sometimes happens that the hardening is not uniform over the entire surface, and the roller may be harder or softer towards the ends, with a ring of differently hardened steel around the center. This may cause rings or "grooves" to wear in the race-way on the inside of the timer shell.

Function of Timer

While some people may think that we are needlessly "fussy" in regard to the timer, it is necessary to understand the functions of the timer, in order that we may more fully realize the importance of this vital part of the engine. A large percentage of the Fords, that one encounters on city streets and country roads, could be greatly improved by the installation of a new timer—or by taking better care of the old one.

The name "timer" means that this device **times** the spark, thus firing the charge at **precisely** the proper instant—and not a fraction of a second too early, or a little too late. In spite of its comparatively simple appearance and outwardly rough workmanship, the timer is—or should be—an instrument of precision, making the contact at precisely the proper instant, and **accurately** timing the spark.

Most car owners wait until the timer fails to fire the charge in one or more cylinders—before cleaning or replacing the worn parts. Few of us realize that the efficiency of the engine may be greatly impaired, and that the power may be reduced by several horse power, by an inaccurately timed spark, and by what we might call "partial" misfiring.

Those of us who have followed the glorious career of Man-O-War, the fastest racehorse in the world, may not have realized that one of the factors of the speed of this horse is due to the fact that his steps have been timed with wonderful accuracy. Other horses may have had the muscles, but Man-O-War had the nerve development that enabled him to time his strides accurately.

If Man-O-War should lose this gift of accurate timing—he would then be only a horse, capable of pulling the family buggy and worth a couple of hundreds of dollars perhaps, as compared with the hundreds of thousands of dollars which have been offered and refused for this magnificent horse.

If the Ford engine is to develop the full measure of speed and power that has been "built into" it, then the explosions of the four cylinders must be as accurately timed as the strides of the race horse. The Ford engine makes 2442 revolutions in high gear, while the car is traveling one mile. Since there are two working strokes in the engine, for each revolution, this means that there are 4884 working strokes per mile. As there are 5280 feet in a mile, then each "shot," or working stroke in the engine propels the car a distance of about 13 inches.

When we consider what short "steps" the Ford engine takes, even when the car is running in high gear, we begin to realize how quickly those steps must be made, and how accurately they must be timed, when the car is traveling at the reasonable speed of 30 miles an hour.

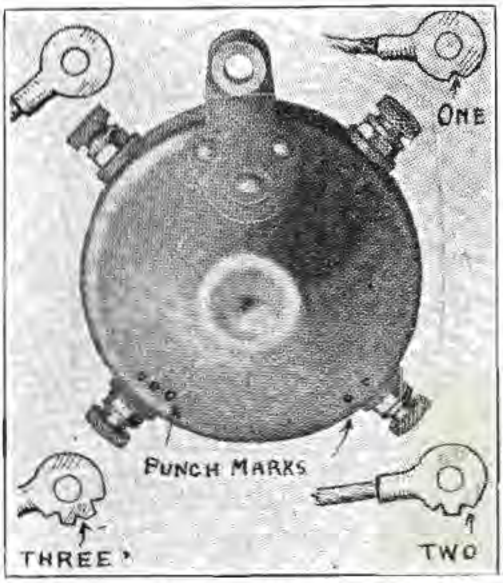
At this speed, there are 2442 "shots" per minute, or about 40 shots per second. This means that if the timer "hesitates" or delays, for even 1/40 of a second, that the engine will not fire at all. Even a delay of 1/100 of a second will mean that the engine will hardly run at all—to say nothing of running well. So, for really good running of the engine, it is necessary that the spark be accurately timed, within a limit of about 1/1000 of a second.

The blurred buzz of a hummingbird's wing is probably not so rapid as this, and it is hard to visualize so fine a measurement. As the thickness of th magazine page on which this is written is several thousands of an inch, we can compare this page with an inch board, and then we can begin to realize what a small fraction of a second the one-thousandth of a second really is.

Keeping in mind the necessity for accurate timing, so that the working strokes of all four cylinders shall push in harmony to ensure the steady rhythm of power of a smooth-running, powerful engine; we realize how important it is that there be no looseness or "play" in the bearings and parts of the roller brush assembly, and that the raceway on which the roller runs be kept clean and smooth, and free from "bumps."

Good Contact Needed

There are two kinds of electric current in the Ford ignition system. There is the "high-tension" current, flowing from the coil units to the spark plugs. This "high-tension" current, with its voltage of from 5,000 to 15,000 volts, thinks nothing of jumping across a little dirt, or a poor contact, or even through a half-inch or so of air. But, in the timer circuit, there is only the voltage of the Ford magneto. Theoretically, this is about 18 volts. Practically, we only get from 6 to 8 volts, or even less, when the engine is turned at slow cranking speeds.

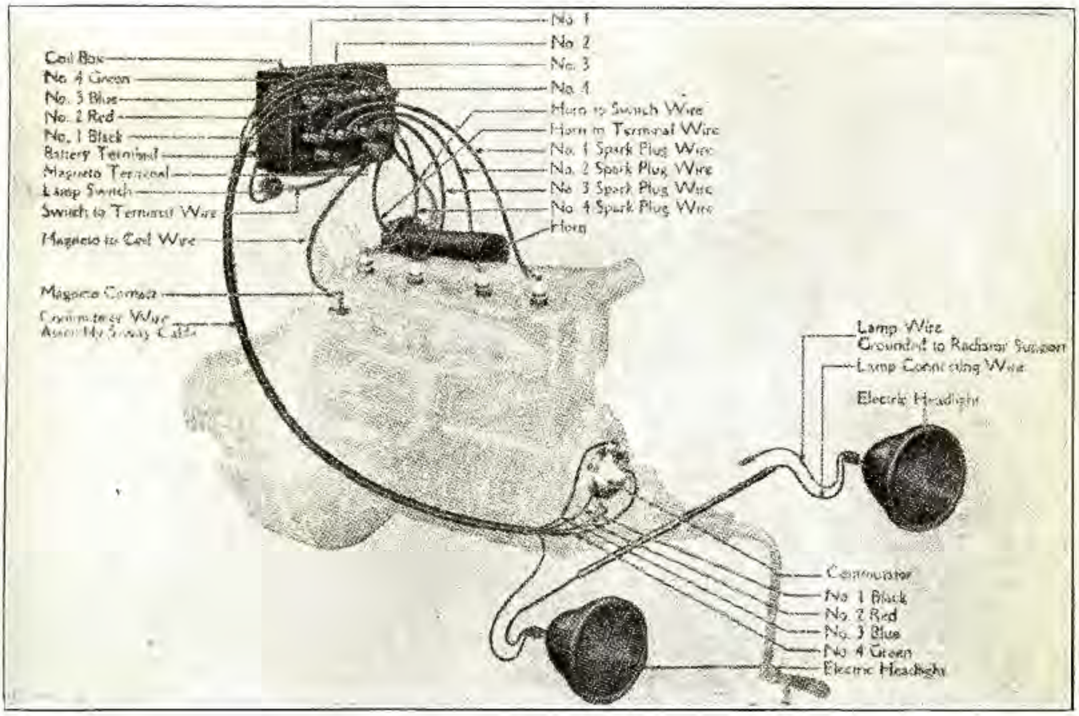


Identifies Wires.

Now, this 6 to 8 volts is barely sufficient to buzz the vibrators of the coil at best. But, if this current is impeded by a poor contact, between the roller and the segments, or by a poor contact between one of the wires and its binding post; then this weak current may be so decreased that the coils will not buzz at all, and so the engine will altogether fail to start.

The reason that the poor contact between the roller and the sgments is the chief cause of timer troubles in starting, is that trouble in one of the wires will only interfere with the firing of one cylinder. And if the other connections are right, the engine will start on the other three cylinders.

Since oil is an insulator of electric current, the presence of a film of oil or grease, betwen the contact segments and the roller, may keep the roller from making the absolutely essential "metal-to-metal" contact, which is needed to allow the current to flow through. Some forms of timers restrict the area of the contacting surfaces, so as to enable the roller to cut through more readily. Others use some form of whiping contacts, to wipe off the oil, while other timers are so built that no oil is needed for the lubrication of the working parts.



Wiring Diagram.

While oil-soaked commutator wires are often said to be the cause of "shorts" in the timer wiring, the statement is not precisely accurate. The fact is that oil tends to rot rubber, as we all know; and, when the rubber insulation is rotted, then it is easy for the metallic strands of wire to touch some part of the timer case and cause a "short."

To Oil, or Not to Oil.

The problem of oiling the timer is to lubricate the timer so that the parts may not wear too rapidly, and yet to keep the oil **off** the contact surfaces, so that good electrical contact will be secured. This means that the oil should be placed on the axle of the roller and on the pivot of the roller arm, and kept off the **surface** of the roller, if possible.

However, as all of these working parts are in the **same** case, it is not usually feasible to exercise any discrimination in oiling any particular parts. The custom is to just oil the timer in general, with the hope that the oil will reach the "working" parts, without insulating the roller from contact with the metal segments.

If a timer is properly lubricated, as directed in the Ford Manual, at least every two hundred miles or so, it is probable that the timer will last for several years before wearing out. However, owing to the inaccessibility of the oil cup on the timer shell, few car owners give the timer as frequent lubrication as it should receive, so that the average timer has to be replaced every year, and usually oftener, in order to make the engine run fairly smoothly and regularly.

Some car owners believe that the use of heavier oil makes starting so difficult that it is better to eliminate the use of oil **entirely,** and to replace the timer by a new one every four months or so. For winter use this practice has something to recommend it. But in the summer, the oil does not congeal in gum so easily, and it is generally better to give the timer more frequent lubrication, so that the timer will last a much longer time before requiring replacement.

Even under the best average circumstances, it will probably be advisable to replace the timer every five thousand miles, or for about six months of use. As it is foolish to mar the performance of an engine by a timer that is not in as good conditions as it should be.

For summer use, it is possible to use a **very** light or **thin** engine oil for lubricating the timer, provided that too much oil is not put in at one time. The oil already in the timer is usually so thin that it dilutes the fresh oil poured in, and so the oil does not prevent good contact from being secured.

If one pours in too much clean, fresh oil into the timer, after overhauling the timer, it is quite possible that trouble will be experienced in **starting** the engine, as this thick, heavy oil will prevent the roller from making contact with the segments, until a fairly high speed is reached. Then the **centrifugal** force will **aid** the spring in pushing the roller against the segments and securing better contact. But, as soon as the engine slows down, it is apt to misfire and stop. For this reason it is often better to add a little bit of kerosene to the cylinder oil when refilling the timer, after having the timer off the engine for an overhauling and cleaning.

For the winter lubrication of the timer, we have our choice of using no oil at all, or else of using a fifty-fifty mixture of kerosene and light engine oil. This kerosene thinned oil will not gum up so readily, and it is not so apt to prevent the roller from making good contact with the segments.

A good practice for winter lubrication is the use of 3-in-One oil, or of light, sewing-machine oil for the lubricttion of the timer. These oils are so thin and light that they are not apt to interfere with good electrical contact. Also, it might be added they are not apt to make as effective a lubricant as a heavier bodied oil.

Another method of timer lubrication involves packing the entire timer case with light grease. The reason that this grease does not seem to prevent easy starting in cold weather is that the roller brush assembly cuts a groove through the grease, and so the roller makes good contact even in the coldest weather. Some of our readers have recommended this practice, while our own experience with this method has not been altogether satisfactory.

Wiring Connections

The wiring connections of the Ford timer are a puzzle to many car owners, and even to some repairmen. The four wires leading from the coil box to the timer case, are differently colored, and this is intended as an aid in more easily **identifying** the wires and making the proper connections. However, as the **ends** of the wires near the timer soon become dirty and oil-soaked, so that they all have the same, dirty-black color, it is often difficult to tell "which-is-which" of the four wires near the commutator shell.

One way of making it easier to identify these different wires near the commutator, is to wrap thees wires for about an inch, where they project through the end of the loom, with insulating tape. This insulating tape keeps the oil and dirt off the wires, so that the true colors of the wires may be more readily distinguished. By removing this tape, one can see which-is-which of the different timing wires connected to the binding posts on the timer shell.

We suggest to timer manufacturers that they **paint** different colored marks on the timer shell, **adjacent** to the binding posts, so that the car owner may more readily determine which wire goes to a particular contact. In one particular make of timer, the names of the colors of the different wires are stamped on the timer shell. This is very good practice indeed, when the timer shell is a casting, and when it is possible to stamp, or cast these names of the different colors in place.

It is also possible for the individual car owner, by using dabs of black, red, blue and green paint, adjacent to the terminals of the timer, to identify the timer terminals, so that the "clack" wire can be attached to the contact point marked with "black" paint, and the "red" wire can be attached to the contact point marked with "red" paint, etc.

Another method of identifying the Ford timer connections is to file a notch in the **edge** of one of the wire loom **terminals**, and then to file or make **two** cuts with the hacksaw blade, in the next terminal, and three cuts in the third terminal, and either four cuts, or none, in the fourth terminal.

A center punch is now used to make one center-punch mark adjacent to the first terminal, and **two** center punch marks adjacent to the **second** terminal, etc. The wire terminal, with **one** notch, can be attached to the binding post which is marked with **one** center-punch mark and so on around the timer shell.

Instead of using center-punch marks, one could file nicks in the case, or make marks with the hacksaw. In using a center-punch, in marking the timer, one should use care in using the center punch, and not use so much force that the timer case is bent out of round. It is possible to make these marks effectual, yet without using enough force to destroy the timer case.

The advantage of these **cuts**, in marking the terminal and the timer shell, is that it is possible for one to distinguish the different terminals and to make the proper connections in the **dark**, in case that one has trouble with the timer on the road and no light is available.

Another method of identifying the wires at the timer end of the wire loom assembly, is to slip a short section of rubber hose, say an inch or two long, over the ends of the wires, where they project from the ends of the wire loom. By slipping this rubber sleeve forward a little, it is easy to uncover a clean section of the wires, and to distinguish which-is-which in the differently colored wires.

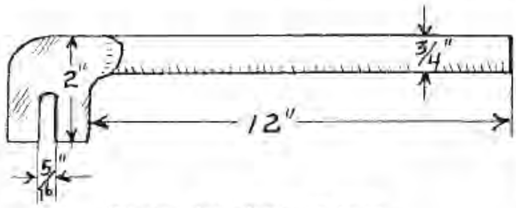
In case the wires are so dirty that one cannot tell the different colors, it is sometimes possible to **cut back** the **loom** covering for half an inch or so, or to pull the wires out of the loom for a short distance, so that the different colored wires can be distinguished.

If there are any short-circuits in these wires around the contact terminals, or where they come out of the end of the wire loom and rub against the chassis frame or against the carburetor priming rod, this is apt to cause one of the coil units to "buzz" all of the time, or whenever the contact is made. This will cause one or more of the cylinders to fire out of its proper order, and may cause that cylinder to back fire. Or, if the inlet valve is open, the flame will pass down through the inlet manifold and cause explosions in the carburetor.

When the engine "backfires" through the carburetor, short-circuit in the wire loom assembly, or somewhere around the timer connections, can be usually suspected, provided of course that the mixture supplied by the carburetor is not too weak, as that is another possible cause of "backfiring" through the carburetor.

In making the connections around the timer terminals, be careful that there are no **stray** strands of wire, or broken connections, which might touch against the timer shell or against the cylinder front cover plate, or even against the commutator pull rod. Not only must these wires and contacts be fully insulated in one position of the timer, but one must make certain that they will not touch any adjacent metal parts when the timer shell is moved to the fully advanced or fully retarded position.

Some careful car owners wrap **insulating tape** around both binding posts and the ends of the wire, after the connections have been made. But this precaution is hardly necessary, and requires longer time for replacing or repairing the timer, when this work becomes necessary. It is necessary, however, to tighten the knurled nuts sufficiently, so that



Timer Rod Bending Iron.

the timer terminals will not turn on the binding post, and touch against adjacent metal parts. In order to tighten these thumb nuts sufficiently, it is generally necessary to use pliers, as it is almost impossible to tighten them sufficiently with one's fingers.

Wiring Diagram

In the wiring diagram, which we show herewith, and which we suggest that you cut out of the magazine and paste under one of the seat cushions of the car, if you are not familiar with the Ford wiring system, it will be noticed that the right-hand side of the coil box is connected to the front or number one cylinder, the spark plug. Running from right to left, the second coil unit is connected to the second spark plug, the third coil unit to the third spark plug, and the coil unit at the extreme left-hand side is connected to the fourth cylinder, the cylinder which is towards the rear. This means that the four coil units are connected in 1-2-3-4 order to the four cylinders of the engine.

However, as the Ford engine fires in 1-4-3-2 order, this means that it is necessary to make a change in the primary wires so that the four cylinders of the engine will fire in the proper order, and that is why so much difficulty is experienced in connecting up the Ford timer case.

Referring to the Ford timer itself, we know that, when one faces the radiator, the starting crank and crank shaft rotate in a **closewise** direction. As the crank shaft is geared to the cam shaft, this means that the cam shaft rotates in the **opposite**, or in a counter-clockwise direction.

If we take the lug on the timer shell, to which the commutator pull rod is attached, as a "point of location;" then the binding post to the left of this lug is usually considered as a number one binding post, which has the "black" wire and is connected to No. 1 coil unit, and to the spark plug to the front or No. 1 cylinder.

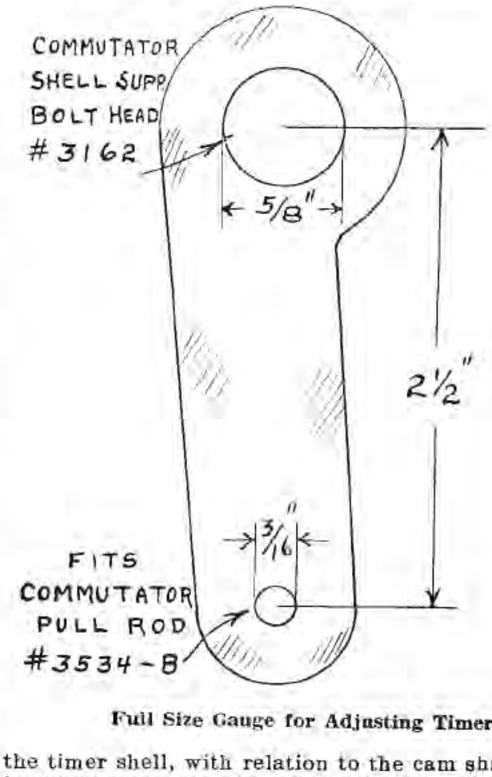
Proceeding around the commutator shell, as the roller brush assembly revolves, it will next touch the contact segment connected to the lower terminal, on the **carburetor** side of the engine. This is No. 2, or "red" wire of the commutator wire loom assembly. Proceeding around further, the next lower binding post, on the steering post side of the car, is No. 4 wire which is a "green" wire. Last of all, we come to the upper binding post, on the steering post side, which is the "blue" wire and fires the fourth or rear cylinder.

We thus discover that the **transposed wires** are those connected for the two rear cylinders. And this is the part to be careful with, when making the connections at the commutator end of the wiring assembly. At the coil box end of the wire loom assembly, the wires are connected in regular 1-2-3-4 order.

Another method, of replacing the timer shell assembly, is to remove but one wire at a time from the old time case, and to replace the wires on the newtimer shell in precisely the same order as the wires were removed.

Setting the Spark Advance

If the spark advance is not correctly set, or in other words if the angular position of



Full Size Gauge for Adjusting Timer.

the timer shell, with relation to the cam shaft is not correct, then the spark will occur either too late or too early, with regard to a certain position of the spark lever control on the steering column.

While it might be thought that any inaccuracy of the timer setting could be corrected by moving the spark lever more or less, still this is not good practice. The Ford timer requires **all** the spark advance and retard which can be obtained when the timer case is set in **precisely** the correct position, so that if the timer is not set in the correct position, it will not be possible to secure all the advance or retard which is sometimes needed for the **best** operation of the engine.

Furthermore, it is desirable to have the timer set in a certain **standard** position, so that when repairmen or others, not familiar with a particular car, are driving or testing the engine; then they will be able to start the engine without breaking an arm or doing damage to the electric starting system. For this reason, a **standardized** spark advance has been adopted, and should be used by each and every individual car owner and repairman.

Setting Timer.

The **standard** spark advance, or commutator setting, as adopted by the Ford Motor Company, is now 2½ inches. This is the center-to-center distance between the end of the commutator pull rod, where it projects through the lug on the timer shell, and the head of the bolt, which holds the commutator retaining spring in place.

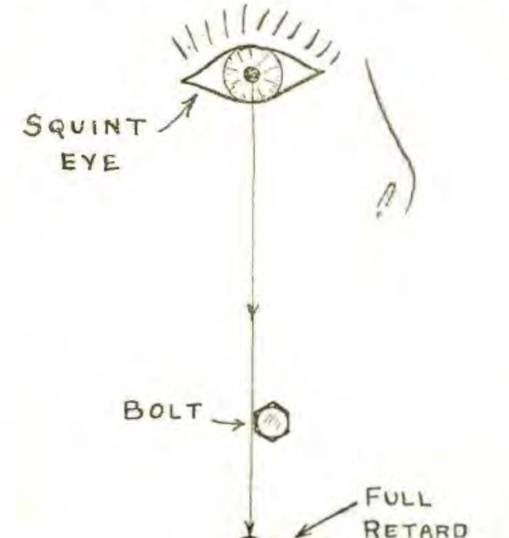
Several years ago, in an earlier article on this subject, we advocated the use of a standard distance of 2⅝ inches. But with the installation of the Ford electric starting and lighting system, it was found that 2⅝ inches sometimes caused the engine to kick back when starting on battery current. And so for safety's sake, this 2⅝ inch has been reduced to 2½ inches and we **now** recommend that this distance be used.

When making this adjustment, the timer case should be set by the spark lever on the steering column, so that "end-play" or lost motion in the different connections be taken out.

Some of the results of a poorly adjusted spark, are an overheated engine, burned valves, a knocking engine, or perhaps a broken arm or damage to the electric starting motor.

Before adjusting the spark advance, one should turn the socket of the universal ball joint, on the end of the commutator pull rod, as tightly as possible. While some car owners try to adjust the length of the commutator pull rod by **partially** unscrewing the ball joint from the end of the rod, we do not advocate this practice, as this is apt to result in a loose and "wobbly" connection between the ball joint and the threaded end of the rod.

When the ball joint is only held on the end of the rod by a few threads, then this is apt to wear the threads on the end of the rod and in the socket, so that a wobbly connection and looseness and "play" will exist at this point. Then the driver does not have as accurate control of the spark advance as he should. Also, the threads are apt to wear, and the ball joint may pull off the end of the rod, leaving the spark advanced, so that the motor will back fire, and possibly injure the driver, the next time the engine is cranked.



Squint Eye Method.

We advise securing this socket as firmly on the end of the rod as possible, thus making a practically solid joint at this point. And then making the adjustment in the **variation** of the length of the commutator pull rod by **bending** the commutator pull rod. The commutator pull rod can be **bent** by the careful use of a monkey wrench, and this method is advised for the use of individual car owners. Repairmen usually find it advisable to make a special bending bar, of the dimensions given in our sketch, as this allows the commutator pull rod to be bent more quickly and correctly. This tool is usually called a bending iron.

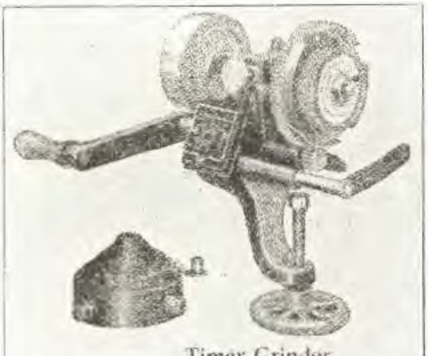
Timer Adjusting Gauge

In order to make a gauge for adjusting the timer, a sheet metal gauge can be cut from thin piece of steel. Our sketch shows the dimensions, and can be used as paper pattern, and pasted on the sheet metal, and then the gauge cut out. For the **occasional** use of a car owner, such a gauge can be made of heavy cardboard, and will be sufficiently accurate for the purpose if a new gauge is made each time the timer is adjusted. However, for regular use, the sheet metal gauge is far better.

Inland Timer Refacer.

The actual dimensions of this gauge are given,so that the gauge can be laid out directly on the metal, if one does not wish to mutilate the pages of this magazine. Many car owners and dealers keep this magazine for permanent reference, and to preserve an article of this kind, without destroying the pages of the magazine.

The commutator retaining spring is held in place by a long ⅜ inch diameter bolt, which passes through the oil filler opening of the cylinder front cover plate. The large opening in the gauge is intended to fit over the hexagonal head of the bolt, so that it is not necessary to even loosen the bolt when applying the gauge.



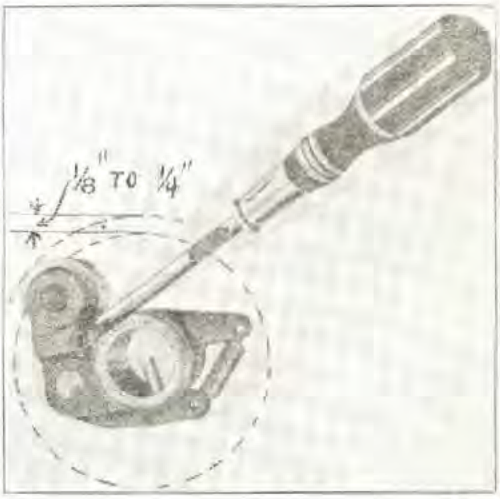
Timer Grinder

This gauge is intended to be used with the spark lever in the **fully** retarded position, the commutator being placed in this position by moving the spark lever on the steering column. With the large opening slipped over the head of the bolt, the **small** opening in the other end of the gauge just slips over the end of the commutator pull rod—or else the commutator pull rod should be bent until it does.

Squint-Eye Method

A rough-and-ready method of verifying the setting of the timer is used by one good repairman and which he calls the "Squint-Eye" method. It will be noticed, by referring to the sketch, that the object which might be taken for the rising sun, at the top of the drawing is supposed to represent the human eye. As there is only one eye shown, this eye is not cross-eyed, and the eye may be either black, or blue, or green, or yellow, and almost anything but closed, and still give very good results.

In using this method, the operator stands boldly in front of the radiator, with the hood removed from over the engine, and glares down past the bolt on which the fan bracket arm is pivoted. By looking **vertically** down past the edge of this bolt, at the end of the commutator pull rod, with the spark lever in the **fully retarded** position, these parts should line up exactly. This method is useful to the foreman of a repair shop, in checking over the adjustment of every car, before it goes out of the shop. It is also a useful method for use on the road, when more elaborate methods are not available.



Bends Roller Arm.

Repairing Worn Timers

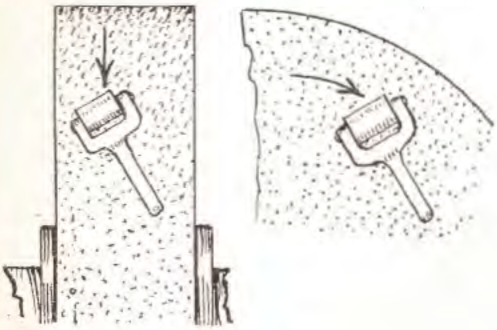
While it is the custom of most car owners and repairmen to simply discard all worn timers and parts which show signs of wear, it seems to us that this is a rather wasteful custom, which worked well enough in the hurry and scurry of war time rush, but will not be used so much now that things are settling back to normal, and more time is available for saving parts. When time was everything, it paid to discard parts, but now that time is not so precious—better service will be obtained by salvaging perfectly good parts.

If the race-way or path on which the commutator roller runs is not smooth and level, then the roller will vibrate and jump. This jumpy action of the roller will cause **partial** misfiring of the engine, even though it does not cause the engine to misfire altogether.

Or maybe cause the engine to fire **late** at times, and then the engine will not develop its full power and speed. Trouble with a **rough** commutator shell is usually most in evidence in **higher** speeds of the engine, and means wasted gasoline and more carbon in the cylinders, and an overheating engine as well as lack of speed and power.

A slight improvement can sometimes be made in a worn timer shell by **tightening** the nuts which hold the steel contact segments in place, thus drawing these segments farther down into the insulation and making them come more evenly with the insulation. The softer fibre insulation usually wears more rapidly than the hardened steel of the contact segments.

Some skillful mechanics can place a timer shell on the lathe and true out the inside surface of the timer, and make the inside of the timer practically as smooth and true as when new. But it requires a good mechanic to center the timer shell accurately and to obtain good results, because if the work is not skillfully done, the cutting tool is apt to catch and chatter, while working on the uneven surface. The lathe tool tends to catch on the edges of the steel segments and then chatters and digs into the softer fibre insulating material, thus making a rough and sagged cut.



Grinding the Roller.

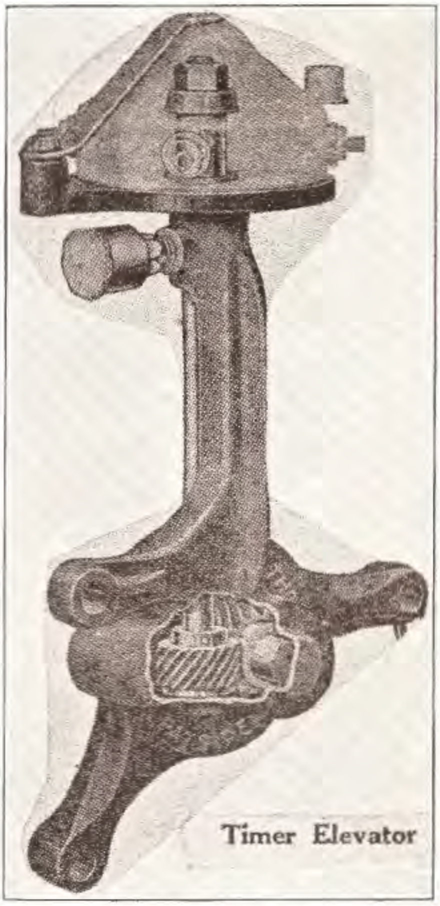
The trouble with this method is that the lathe is not often used in Ford repair shops, as most of Ford repair shop work is **replacement** work, and so a lathe is not generally available.

A satisfactory tool for this work of refacing timers is called the Inland timer refacing tool and is, in a sense, a small portable lathe, specially adopted for this particular work. With such a tool, the timer shell can be refaced rapidly, insuring perfect roller contact at all times.

This tool is provided with an **automatic** feed, which means that the race-way will be cut true and even, across the entire surface. The automatic feed is provided with a quick return, to save the time of the repairman when truing up timers. And there is a sensitive cutting adjustment, which makes it possible to finish the surface smoothly, without removing the timer shell from the tool.

There are few details in the handling of this tool which require attention, in order that the best results may be secured, the first detail being to tighten the nuts holding the metal contact segments to the shell, so that these contact segments will not jump and chatter as the edge of the cutting tool digs into them.

The high spots of the metal and fiber are "roughed" by using a light cut, and finally a "finishing" cut is taken by just turning the adjusting screw about ⅛ of a turn. These operations are repeated, until the cutting tool is found to cut smoothly around the entire circumference of the race-way. Then the cutter should be run through again, **without** changing the adjustment of the cutting edge. This forms a finishing cut, for surfacing the timer shell.



Timer Elevator

If the race-way is unusually rough, it is sometimes advisable to remove the timer case and dump out the metal chips, before making the finishing cut, as otherwise these metal chips may dig into, and roughen up the surface of the race-way. A liberal supply of oil, inserted through the oil hole in the body of the cutting bar, assists the cutting edge in applying a fine "machine-finish' 'on the race-way of the commutator shell.

After this race-way has been "machine-finished," it should be polished with fine emery cloth or sandpaper. Care should be taken to wipe out all metal chips from the timing shell, before replacing the timer on the engine.

Timer Grinder.

Another method of refacing the commutator shell consists in a special timer **grinder**, having an emery wheel somewhat smaller than the inside of the Ford commutator shell. This timer grinder is fitted with a special chuck which requires no skill in centering the commutator shell on the grinder. When this grinding tool is in use, the grinding wheel revolves inside of the timer shell at a high rate of speed, while the chuck and timer are slowly and steadily rotated round the grinding wheel equally and smoothly, so that even a badly worn timer can usually be trued up as good as new in a very few minutes.

Grinding the Roller.

It is equally important to have a smooth and accurately finished roller on the roller brush assembly, as it is to have a smooth, true surface on the timer shell itself. When the timer case becomes rough, the roller usually becomes badly worn also, as the wear on the roller is concentrated over a smaller surface than the inside of the timer itself.

This generally means that the roller brush assembly has to be more frequently replaced than the timer shell. As the roller brush assembly only costs about one third as much as the timer shell, this is not a catastrophe. But there is no necessity, in many cases, for purchasing a new roller brush assembly, when a worn brush is the only defect.

As one of our readers so cleverly suggested in our Hints Department, it is comparatively easy to true up the rollers by holding the roller brush assembly at an angle with the oil stone, and showing the roller slantiwise so that roller grinds as it turns on the oil stone. Of course, the roller brush assembly can be smoothed more rapidly on the surface of an emery wheel or grindstone. But then it may be advisable to give the roller surface a final fiinsh and polish, on a fine oil stone, or on a fine grade of sandpaper.

This truing and grinding of the roller can be accomplished on either the face, or the side of the emery wheel. In many cases, the rim or edge, of the emery wheel is grooved and rough, so that better results can often be obtained by holding the roller brush assembly against the side of the revolving wheel, at a slight angle as shown in our drawing. Under these conditions the roller will revolve rapidly as it is scraped and ground on the surface of the stone, and a good, true result can easily be secured in this manner.

If Ford car owners would true up their timers every month or two, both roller brush assembly and timer shells, they would obtain much better results, both as to smoothness and power of thb engine and efficiency of fuel, than they now do.

The question has been raised as to whether refacing these timers will so **increase** the inside diameter of the timer shell that the roller brush assembly will no longer make good contact with the contact segments. This objection can be easily overcome by inserting the blade of a screw driver between the roller and the hub of the roller brush assembly, and prying **outwardly**, thus bending at the arm for 1-16 to ⅛ of an inch, and securing **ample** range of contact for even the most badly worn timers, after they have been refaced.

As a matter of fact, Ford cars sometimes give trouble with poor contact, even with brand new timer shells. Then this same method of bending out the roller arm can be used. In one case, where a Ford car gave persistent trouble with **overheating**, this trouble was finally located as being due to poor contact between the roller and the contact segments, and the trouble was overcome by bending out the arm of the roller brush assembly in the manner in which we have described.

Timer Elevators.

Another improvement, in Ford timer accessories, is the Ford timer elevator to bring the Ford timer up out of the dirt-and-darkness, between the front end of the engine and the radiator, into the broad light of day. There are about five different makes of these timer elevators now on the market, these elevators differing in details of construction and design.

In the Thomas timer elevator, there is a set of spiral gears at right angles to each other, which transmit the driving power from the cam shaft to the vertical shaft, at the top end of which the timer assembly is placed. As the only friction tending to hold back the roller brush assembly is that existing between the roller and the race-way of the timer shell, there is very little power indeed transmitted through these gears. And they should last almost indifferently without wearing or causing trouble. As more or less oil usually leaks out into the casing surrounding these gears from the front end of the camshaft, these gears are adequately lubricated and due to their spiral construction they will cause practically no noise when in action.

The use of one of these timer elevators protects the timer itself from oil and dirt and water, and is effective in securing easier starting, because the vertical position of the raceway of the timer makes the oil run off more easily, so that the oil does not collect between the roller brush assembly and the contact segments. The use of one of these timer elevators allows an overhead wiring system running along the radiator to dash rod to be used.

Ford Facts & Figures

Motor Numbers Tell When Each Ford Car and Truck Was Made. Also Includes Canadian Fords and General Specifications.

By Ed. Technical

As we are continually adding to our new readers, the subject of "motor numbers" and when Ford cars were made, becomes of keen interest when buying or selling Fords, or when applying for licenses. And as the Ford Motor Company keeps "grinding them out" at the rate of a million a year; we have found it necessary to publish a new and revised birthday list, together with extensive additions.

As the material in our previous Ford Birthday Party was copied into several books and by several magazines; we have realized our responsibility as the "recognized authority, and have checked over these motor numbers very carefully indeed.

Our first list of Ford motor numbers, as published in the May 1918 issue, has stood the test of many years of use by Ford car owners and agents everywhere. Questions have arisen— but have been satisfactorily answered—and the list has stood pat.

We give the complete lists, for the convenience of those who buy and sell Fords, as well as for the use of those who sometimes need to know the exact age of a Ford, when ordering parts. As every owner of a Ford sells his car at some time or other, this makes the list valuable to almost anybody.

Save This Issue.

We advise you to save this issue, because you are apt to need it at some future time. If you have occasion to sell your Ford car or Fordson tractor, this list will make it easy to convince the prospective buyer as to when the car was actually built. If you ever have an opportunity of buying a used Ford or tractor, this list will be even more valuable, as it will make it easy to ascertain just when the car or tractor was actually built. Thus verifying the seller's veracity, as well as obtaining exact data.

The "motor number" is stamped onto the side of the cylinder block, right over the side water inlet hose connection. On some of the very early Fords, made in 1910 or so; the motor numbers were stamped down near the breather, or oil filler pipe. But nearly all these very early Fords have had the cylinder blocks replaced by this time, so nearly every Ford now in use carries the number in the same place, right over the side hose connection.

When the cylinder block is replaced by a new one, the same motor number should be stamped on the new cylinder block as was stamped on the old block. Thus each car retains the same motor number, from the assembly line to the junk-yard, irrespective of how often the different components of the car have been replaced.

As one can buy a complete Ford engine and transmission assembly for $125 in exchange change for the old engine; some owners of old Fords install new engines. And the new engine should have the same number stamped on the block that appeared on the old engine.

The Ford Motor Company does not have any spare motor numbers so that the only safe way is to use the same motor number right along, and so keep out of trouble. If you build up a Ford out of "scrapped" parts, as some repairmen do; then this car should be listed as a "special", under the name of the repairman as manufacturer. It should not be given a Ford motor number, as it has no factory birth-right.

If the same motor number is not stamped on the new block or new engine, then one may have difficulty in selling the car at some future time. No intelligent buyer will take a car without a "motor number", as he knows that he will have difficulty in securing a state license; and that he may get into trouble with the police, who may think the car a stolen one.

Replacing the engine may seem like replacing the car, but it is the car and not the engine which is licensed by the state. The motor number is also the "car number", and is the only number that distinguishes one Ford from another, as far as the factory is concerned.

Car Serial Numbers.

Some of the earlier Ford cars, made from 1912 to 1915, had a "serial", or car number, stamped on a metal plate attached to the dash. But most of these old-style bodies have now been changed, and little attention is now paid to these car numbers. However, for insurance adjusters or police departments who need this additional "check-up" on stolen Fords, we give this serial list.

Date	Car Number
Oct. 1, 1912-Sept. 30, 1913	150,001-332,500
Oct. 1, 1913-July 31, 1914	332,501-539,000
Aug. 1, 1914-April 30, 1915	539,001-742,313

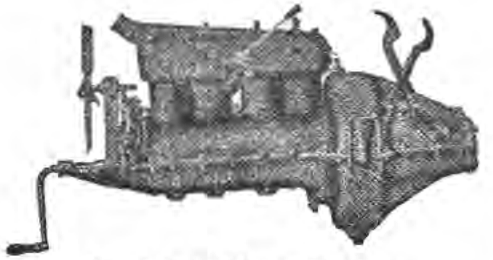
On some Ford engine numbers, a letter is prefixed to the motor number. When the "C-numbers" are used, this means that the Ford car was built in Canada. These are the "overseas" Fords, that are shipped to foreign countries in all parts of the world.

B-Numbers.

The "B-numbers" Fords, were built at the factory in Detroit, and Ford cars with motor numbers B-1 to B-12,247 were built between October 1, 1912 and September 30, 1913.

A little more care in looking up the "past" of used Fords, that are offered for sale at bargain prices or by strangers, would do much to reduce the stealing of Ford cars from which we all suffer, either directly, or by paying higher premiums for theft insurance.

Do not "make up" fictitious motor number, as this is dishonest and steals the number



Location of Motor Number

belonging to some other Ford car owner. If a Ford with an incorrect motor is sold, then the buyer has a fine chance to make a fool out of the one who sold it, as the evidence will tend to indicate that the motor number was altered with fraudulent intent to deceive.

Early Ford Cars.

The famous Model T. Fords are the ones on which production has been concentrated since October 1, 1908. But before the Model T. was built, there were several early models, beginning with the 2-cylinder, chain-drive Model A, up to the better known Models N. S. and R, concerning which we sometimes hear from our readers.

While in 1908, the Ford factory only built 6,398 cars, it now builds over 4,000 per day —which is almost as many per day now as were formerly built in a year. Yet the owners of these early Fords are still being taken care of, and it is still possible to purchase parts for these early Fords. That's Henry Ford's idea of service!

The fact that there are no "orphans" in the Ford family now, is splendid evidence that those who buy new Fords will be just as faithfully taken care of. Past performance is a fine guarantee of future good faith.

Dates on Castings.

Like a woman's "No!", the dates on such castings as the cylinder head and cylinder block do not mean much. These dates only show when the block is cast. Since a cylinder block is improved by "ageing" or being allowed to settle for several months to allow the casting strains to become equalized before machining; this means that an engine is even better, if the casting date is several months earlier than the motor number.

When the car is a "used" Ford, it is not safe to pay much attention to the date cast on the cylinder block. The cylinder block of an early Ford may have been replaced by a 1919 or 1920 block. Then the cast iron figures will indicate that the car is much newer than it really is, as proven by the honest motor number.

If the motor number does not agree with this list, it is possible that the motor number may have been changed by placing a "1" or some other digit in front of the true motor number; thus making the car appear to be much newer than it really is. Or a "6" is sometimes changed to an "8", or the numbers may be filled up and new numbers stamped on.

Do not place too much reliance on the motor number, for, while it is good evidence, still it is not conclusive evidence. If there is any suspicion that the "motor number" has been altered, we suggest that the seller be asked to produce the "Buyer's Order and Agreement" showing the date of purchase from the Ford Motor Company. Or else you should write to the State Highway Commissioner, asking for facts concerning the car. Or refer to the records of the local Ford Agent or Factory Branch. Honest sellers of used Fords are glad to be investigated—it is the rascals who cannot stand it. An altered motor number makes the car an outcast and its owner an object of suspicion wherever he goes.

Production of Ford Cars.

The Ford Motor Company was organized June 16, 1903. The list below includes the earlier Ford models; as well as the present Model T Fords, made since 1908.

	Ford cars		
1903	1,708	1913	168,220
1905	1,695	1914	248,307
1906	1,599	1915	308,213
1907	8,423	1916	533,921
1908	6,398	1917	751,287
1909	10,607	1918	642,750
1910	18,664	1919	521,600
1911	34,528	1920	945,500
1912	78,440	1921	989,785

NOTE—The above production figures refer to the Ford fiscal year, commencing August first. And while the Ford Motor Company has not produced a million in a fiscal year—still the million-a-year mark was actually passed in 1920 when 1,038,450 cars were built from January 1, 1920 to December 31, 1920.

Made in Millions.

The Ford car is the only automobile that has ever been "made in millions." It is interesting to notice that Ford with motor number 1,000,000 was made on December 10, 1915. Ford with motor number 2,000,000 was made on June 14, 1917. While the Ford with motor number 3,000,000 was started on "the long trail" in April 1919. The motor number of 4,000,000 was given to a Ford car built in May 1920. While Edsel Ford has retained for his own use the Ford with 5,000,000 motor number, as built in May 1921. By the time this article is published, the 6,000,000 Ford will be "passing them on the hills."

Our list of motor numbers only gives the numbers of the Model T. Fords.

1908

	Motor Number			Cars Built
Oct. 1-31	1	to	11	11
Nov. 1-30	11	to	101	90
Dec. 1-31	101	to	309	208

1909

Jan. 1-31	309	to	646	335
Feb. 1-28	646	to	1052	406
Mar. 1-31	1052	to	2025	973
Apr. 1-30	2025	to	2691	666
May 1-31	2691	to	4036	1345
June --30	4036	to	5980	1944
July 1-31	5980	to	8107	2127
Aug. 1-31	8107	to	9840	1733
Sept. 1-30	9840	to	11148	1308
Oct. 1-31	11148	to	12405	1257
Nov. 1-30	12405	to	13132	727
Dec. 1-31	13132	to	14161	1029

1910.

Jan. 1-31	14161	to	15500	1339
Feb. 1-28	15500	to	16600	1100
Mar. 1-31	16600	to	19700	3100
Apr. 1-30	19700	to	23100	3400
May 1-31	23100	to	26500	3400
June 1-30	26500	to	29500	3000
July 1-31	29500	to	30200	700
Aug. 1-31	30200	to	31000	800
Sept. 1-30	31000	to	31900	900
Oct. 1-31	31900	to	32500	600
Nov. 1-30	32500	to	33700	1200
Dec. 1-31	33700	to	34900	1200

1911

Jan.1-31	34900	to	37000	2100
Feb. 1-28	37000	to	40000	3000
Mar. 1-31	40000	to	45000	5000
Apr. 1-30	45000	to	50800	5800
May 1-31	50800	to	57200	6400
June 1-30	57200	to	60500	3300
July 1-31	60500	to	62100	1600
Aug. 1-31	62100	to	66700	4100
Sept. 1-30	66700	to	70500	3800
Oct. 1-31	70500	to	83100	12600
Nov. 1-30	83100	to	86300	3200
Dec. 1-31	86300	to	88900	2600

1912

Jan. 1-31	88900	to	92000	3100
Feb. 1-29	92000	to	95900	3900
Mar. 1-31	95900	to	103800	7900
Apr. 1-30	103800	to	112900	9100
May 1-31	112900	to	123800	10900
June 1-30	123800	to	132000	8200
July 1-31	132000	to	139700	7700
Aug. 1-31	139700	to	144500	4800
Sept. 1-30	144500	to	147300	2800
Oct. 1-31	147300	to	156300	9000
Nov. 1-30	156300	to	161200	4900
Dec. 1-31	161200	to	171300	10100

1913

Jan. 1-31	171300	to	186900	15600
Feb. 1-28	186900	to	203300	16400
Mar. 1-31	203300	to	218900	15600
April 1-30	218900	to	242300	23400
May 1-31	242300	to	260000	17700
June 1-30	260000	to	282700	22700
July 1-31	282700	to	298200	5500
Aug. 1-31	298200	to	306800	8600
Sept. 1-30	306800	to	314800	8000
Oct. 1-31	314800	to	324900	10100
Nov. 1-30	324900	to	344900	20000
Dec. 1-31	344900	to	370400	25500

1914

	Motor Number			Cars Built
Jan. 1-31	370400	to	395500	25100
Feb. 1-28	495500	to	419500	24000
Mar. 1-31	419500	to	447600	28100
Apr. 1-30	447600	to	473200	25600
May 1-31	473200	to	490920	17720
June 1-30	490920	to	507102	16182
July 1-31	507102	to	517800	10698
Aug. 1-31	517800	to	538200	20400
Sept. 1-30	538200	to	558300	20100
Oct. 1-31	558300	to	583400	25100
Nov. 1-30	583400	to	599100	15700
Dec. 1-31	599100	to	611100	2100

1915

Jan. 1-31	611100	to	614200	3100
Feb. 1-28	614200	to	630500	16300
Mar. 1-31	630500	to	682400	51900
April 1-30	682400	to	723500	41100
May 1-31	723500	to	805500	82000
June 1-30	805500	to	839700	34200
July 1-31	839700	to	855500	15800
Aug. 1-31	855500	to	881000	2600
Sept. 1-30	881000	to	913000	32000
Oct. 1-31	913000	to	949000	36000
Nov. 1-30	949000	to	985400	36000
Dec. 1-31	985400	to	1029200	43800

Stamps for Motor Numbers

1916

Jan. 1-31	1029200	to	1071800	42600
Feb. 1-29	1071800	to	1119000	47200
Mar. 1-31	1119000	to	1167900	48900
Apr. 1-30	1167900	to	1219400	51500
May 1-31	1219400	to	1272000	52600
June 1-30	1272000	to	1326900	54900
July 1-31	1326900	to	1362213	35313
August 1-31	1362213	to	1400900	38687
Sep. 1-30	1400900	to	1452200	51300
Oct. 1-31	1452200	to	1510500	58300
Nov. 1-30	1510500	to	1570700	60200
Dec. 1-31	1570700	to	1614600	43900

1917

Jan. 1-31	1614600	to	1680000	65400
Feb. 1-28	1680000	to	1739900	49900
Mar. 1-31	1739900	to	1812000	72100
Apr. 1-30	1812000	to	1888000	76000
May 1-31	1888000	to	1968629	80629
June 1-30	1968629	to	2044100	75471

	Motor Number	Cars Built
July 1-31	2044100 to 2113500	69400
Aug. 1-31	2113500 to 2162800	49300
Sept. 1-30	2162800 to 2231000	68200
Oct. 1-31	2231000 to 2310400	79400
Nov. 1-30	2310400 to 2383900	73500
Dec. 1-31	2383900 to 2449100	65200
	1918	
Jan. 1-31	2449100 to 2503200	54100
Feb. 1-28	2503200 to 2558200	55000
Mar. 1-31	2558200 to 2611400	53200
Apr. 1-30	2611400 to 2657500	46100
May 1-31	2657500 to 2700800	43300
June 1-30	2700800 to 2735700	34900
July 1-31	2735700 to 2756251	55451
Aug. 1-31	2756250 to 2774600	18349
Sept. 1-30	2774600 to 2787800	13200
Oct. 1-31	2787800 to 2792300	4500
Nov. 1-30	2792300 to 2805100	12800
Dec. 1-31	2805100 to 2831400	26300
	1919	
Jan. 1-31	2831400 to 2880170	48770
Feb. 1-28	2880170 to 2933000	52830
Mar. 1-31	2933000 to 2997100	64100
Apr. 1-30	2997100 to 3067700	70600
May 1-31	3067700 to 3140000	72300
June 1-30	3140000 to 3210800	70800
July 1-31	3210800 to 3277850	67050

	Motor Number	Cars Built
Apr. 1-30	4810011 to 4907500	97489
May 1-30	4907501 to 5008000	100499
June 1-30	5008001 to 5114530	106530
July 1-31	5114531 to 5223135	108604
Aug. 1-31	5223136 to 5337545	114409
Sept. 1-30	5337546 to 5447816	110270
Oct. 1-31	5447816 to 5529519	81703
Nov. 1-30	5529520 to 5602301	72781
Dec. 1-31	5602302 to 5638071	35769
	1922	
Jan. 1-31	5638072 to 5683808	45736
Feb. 1-28	5684809 to 5737278	52469
Mar. 1-31	5737279 to ?	

Fuel Tank Measurements.

The old "round" gasoline tanks, as used on all Fords for many years, were of approximately 10 gallons capacity. These tanks were used on all touring and roadsters of earlier than 1920 make, and even on some of the 1920 models. With these round tanks, it will be noticed that one gallon, at the bottom of the tank, takes more than twice as much depth as a gallon near the middle.

As the Ford Motor Company wished to fit a new and lower type of body on the Ford

Tractor Motor Number

Aug. 1-31	3277850 to 3346900	69050
Sept. 1-30	3346900 to 3429400	82500
Oct. 1-31	3429400 to 3515430	86030
Nov. 1-30	3515430 to 3588000	72570
Dec. 1-31	3588000 to 3659970	71970
	1920	
Jan. 1-31	3659970 to 3743075	83105
Feb. 1-29	3743075 to 3817430	74355
Mar. 1-31	3817431 to 3910000	92569
Apr. 1-30	3910001 to 3969150	59149
May 1-31	3969151 to 4055280	86129
June 1-30	4055281 to 4141450	86169
July 1-31	4141450 to 4233350	91900
Aug. 1-31	4233351 to 4329900	96549
Sept. 1-30	4329901 to 4426385	96484
Oct. 1-31	4426386 to 4526540	100154
Nov. 1-30	4526541 to 4617925	91384
Dec. 1-31	4617926 to 4698420	80584
	1921	
Jan. 1-31	none	-----
Feb. 1-28	4698416 to 4736431	38,015
Mar. 1-31	4736432 to 4810010	73,578

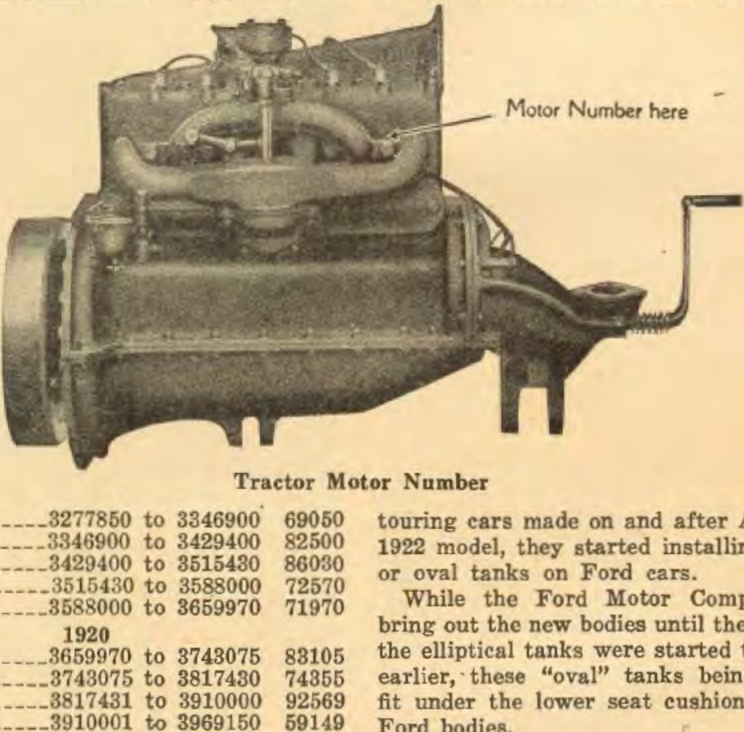
touring cars made on and after August of the 1922 model, they started installing "elliptical" or oval tanks on Ford cars.

While the Ford Motor Company did not bring out the new bodies until the 1922 models; the elliptical tanks were started through much earlier, these "oval" tanks being adopted to fit under the lower seat cushions of the new Ford bodies.

The oval tanks are now used on all Ford models, with the exception of the Sedan. And the capacity of this oval tank may be roughly estimated as 1-½ inches for the first gallon, and ¾ inch for each additional gallon up to nine.

The "square" tank is now used on Ford Sedans, but was also used on many of the earlier Ford Coupes. With the square tank, each ¾ inch represents one gallon.

	Motor Number	Cars Built
July 1-31	2044100 to 2113500	69400
Aug. 1-31	2113500 to 2162800	49300
Sept. 1-30	2162800 to 2231000	68200
Oct. 1-31	2231000 to 2310400	79400
Nov. 1-30	2310400 to 2383900	73500
Dec. 1-31	2383900 to 2449100	65200
	1918	
Jan. 1-31	2449100 to 2503200	54100
Feb. 1-28	2503200 to 2558200	55000
Mar. 1-31	2558200 to 2611400	53200
Apr. 1-30	2611400 to 2657500	46100
May 1-31	2657500 to 2700800	43300
June 1-30	2700800 to 2735700	34900
July 1-31	2735700 to 2756251	55451
Aug. 1-31	2756250 to 2774600	18349
Sept. 1-30	2774600 to 2787800	13200
Oct. 1-31	2787800 to 2792300	4500
Nov. 1-30	2792300 to 2805100	12800
Dec. 1-31	2805100 to 2831400	26300
	1919	
Jan. 1-31	2831400 to 2880170	48770
Feb. 1-28	2880170 to 2933000	52830
Mar. 1-31	2933000 to 2997100	64100
Apr. 1-30	2997100 to 3067700	70600
May 1-31	3067700 to 3140000	72300
June 1-30	3140000 to 3210800	70800
July 1-31	3210800 to 3277850	67050
Aug. 1-31	3277850 to 3346900	69050
Sept. 1-30	3346900 to 3429400	82500
Oct. 1-31	3429400 to 3515430	86030
Nov. 1-30	3515430 to 3588000	72570
Dec. 1-31	3588000 to 3659970	71970
	1920	
Jan. 1-31	3659970 to 3743075	83105
Feb. 1-29	3743075 to 3817430	74355
Mar. 1-31	3817431 to 3910000	92569
Apr. 1-30	3910001 to 3969150	59149
May 1-31	3969151 to 4055280	86129
June 1-30	4055281 to 4141450	86169
July 1-31	4141450 to 4233350	91900
Aug. 1-31	4233351 to 4329900	96549
Sept. 1-30	4329901 to 4426385	96484
Oct. 1-31	4426386 to 4526540	100154
Nov. 1-30	4526541 to 4617925	91384
Dec. 1-31	4617926 to 4698420	80584
	1921	
Jan. 1-31	none	
Feb. 1-28	4698416 to 4736431	38,015
Mar. 1-31	4736432 to 4810010	73,578
Apr. 1-30	4810011 to 4907500	97489
May 1-30	4907501 to 5008000	100499
June 1-30	5008001 to 5114530	106530
July 1-31	5114531 to 5223135	108604
Aug. 1-31	5223136 to 5337545	114409
Sept. 1-30	5337546 to 5447816	110270
Oct. 1-31	5447816 to 5529519	81703
Nov. 1-30	5529520 to 5602301	72781
Dec. 1-31	5602302 to 5638071	35769
	1922	
Jan. 1-31	5638072 to 5683808	45736
Feb. 1-28	5684809 to 5737278	52469
Mar. 1-31	5737279 to ?	



Tractor Motor Number

Fuel Tank Measurements.

The old "round" gasoline tanks, as used on all Fords for many years, were of approximately 10 gallons capacity. These tanks were used on all touring and roadsters of earlier than 1920 make, and even on some of the 1920 models. With these round tanks, it will be noticed that one gallon, at the bottom of the tank, takes more than twice as much depth as a gallon near the middle.

As the Ford Motor Company wished to fit a new and lower type of body on the Ford touring cars made on and after August of the 1922 model, they started installing "elliptical" or oval tanks on Ford cars.

While the Ford Motor Company did not bring out the new bodies until the 1922 models; the elliptical tanks were started through much earlier, these "oval" tanks being adopted to fit under the lower seat cushions of the new Ford bodies.

The oval tanks are now used on all Ford models, with the exception of the Sedan. And the capacity of this oval tank may be roughly estimated as 1-½ inches for the first gallon, and ¾ inch for each additional gallon up to nine.

The "square" tank is now used on Ford Sedans, but was also used on many of the earlier Ford Coupes. With the square tank, each ¾ inch represents one gallon.

Fuel Tank Measurements.

Gallons	Square Tank	Round Tank	Oval Tank
1	3/4"	1 15/32"	1 7/16"
2	1 1/2"	2 9/16"	2 3/16"
3	2 1/4"	3 1/2"	2 13/16"
4	3 "	4 11/32"	3 5/8"
5	3 3/4"	5 1/8"	4 5/16"
6	4 1/2"	5 29/32"	5 "
7	5 1/4"	6 3/4"	5 11/16"
8	6 "	7 11/16"	6 7/16"
9	6 3/4"	8 21/32"	7 3/16"

Engine, Wheel, and Car Speeds.

The gear ratio of the Ford rear axle system is 3.63-to-one, meaning that the Ford engine crank shaft makes 3.63 turns, for each turn of the rear wheels. Now the Ford car is regularly fitted with 30 inch diameter tires, which have a circumference of 94.25 inches.

Since there are 5280 feet in a mile, then 5280 feet multiplied by 12, and divided by 94.25, gives 672.3 turns or revolutions of the Ford rear wheels for each mile of distance covered.

One mile per hour is equivalent to 88 feet per minute, so that at a car speed of 20 miles an hour, the car travels 1760 feet per minute, or one-third of a mile.

Car Speed	Engine Speed	Wheel Speed
1 m. p. h.	41 r. p. m.	11 r. p. m.
5	204	56
10	407	112
15	611	168
20	814	224
25	1018	280
30	1221	336
35	1425	392
40	1628	448
45	1832	505
50	2035	560
55	2239	616
60	2442	672

Overall Dimensions.

Model	Height	Width	Length
Touring	7'-0"	5'-7 1/2"	11'-2 1/2"
Runabout	6'-9"	5'-7 1/2"	11'-2 1/2"
Sedan	6'-9"	5'-7 1/2"	11'-2 1/2"
Coupelet	6'-9"	5'-7 1/2"	11'-2 1/2"
Chassis		5'-7 1/2"	10'-8 "
Truck chassis		5'-7 1/2"	12'-9 "

Ford Car Weights

Year Aug. 1 to July 31	Coupe	Sedan	Runabout
1915 to 1916	1540	1730	1395
1916 to 1917	1540	1730	1380
1917 to 1918	1580	1745	1385
1918 to 1919	1580	1715	1390
1919 to 1920	1580	1750	1390
1920 to 1921	1525	1725	1400
1921 to 1922	*1685	*1875	1380
	Touring	**Chassis**	**Truck Chas.**
1915 to 1916	1510	1200	----
1916 to 1917	1500	980	----
1917 to 1918	1480	980	1450
1918 to 1919	1500	980	1450
1919to 1920	1500	1060	1395
1920 to 1921	1500	1020	1380
1921 to 1922	1485	1070	1430

(*) This weight of Coupe and Sedan includes starter and demountables. Other cars equipped with starter, add 90 pounds.

Power means ability to do work. Consequently, it is the product of the rate and the speed at which the work is done. Torque, or turning power, denotes the rate of work and this "torque" reaches its maximum at speeds of about 900 revolutions. Then the torque gradually decreases with increasing speed, but the maximum horse power is developed at about 1600 revolutions. While tests have shown that Ford engines can develop as much as 22 1/2 horse power, still it will be found that a maximum of 20 horse power, as given below, is more reqresentative of Ford engines with wide open throttle in general use.

R.P.M.	Speed Car	Miles Per Hr. Truck	Lbs.	Horse Power
300	7.5	4.	35	2.
400	10.	5.25	57	4.5
500	12.5	6.55	69	6.5
600	15.	7.9	73	8.5
700	17.5	9.2	78	10.40
800	20.	10.50	81	12.33
900	22.5	11.85	83	14.20
1000	25.	13.15	82	15.60
1100	27.5	14.50	81	16.66
1200	30.	15.80	79	18.20
1300	32.5	17.10	77	19.
1400	35.	18.45	73	19.66
1500	37.5	19.75	70	20.
1600	40.	21.05	65	20.
1700	42.5	22.40	60	19.40
1800	45.	23.75	53	18.20
1900			47	17.

CAR PRICE CHANGES.

	Touring	Runabout	Chassis	Sedan	Coupelet	Truck	Town Car
Aug. 1909	$850	$825			$ 950		$1000
Aug. 1910	950	900			1050		1200
Aug. 1911	780	680			1050		1200
Aug. 1912	690	590					900
Aug. 1913	600	525					740
Aug. 1914	490	440		975	750		690
Aug. 1915	440	390	360	740	590		640
Aug. 1916	360	345	325	640	505		595
Aug. 1917	360	345	325	645	505	600	
Aug. 1918	525	500	475	775	650	550	
Aug. 1919	525	500	475	775	650	550	
Mar. 1920	575	550	525	*975	*850	600	
Aug. 1920	575	550	525	*975	*850	640	
Sept. 1920	440	395	360	*795	*745	545	
June 1921	415	370	345	*760	*695	495	
Sept. 1921	355	325	295	*660	*595	445	
Jan. 1922	348	319	285	*645	*580	430	

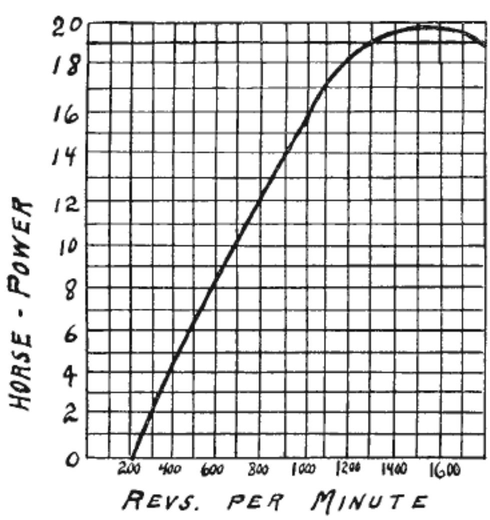
(*) Includes starter and demountable rims.

Canadian Ford Cars.

In Canada, the "Rule of the Road" in some of the provinces has been "Keep to the **left**!" following the old-world customs of Europe. While in other provinces, the new-world rule of "Keep to the **right**!" prevails. Consequently, the Ford in Canada had to become ambidexterous; so that it could keep to the left and be right, or keep to the right and get left, as occasion demanded.

Now this "two-sidedness" of use resulted in the Ford Motor Company of Canada wisely building their Fords to suit Canadian and foreign conditions (many Canadian Fords being exported). As a result of this, we find "port-sided" Fords, with doors on the left-hand side of the Ford touring cars and roadsters.

There is but little difference between the Sedans and Coupes as used in the United States and those built in Canada, because the American enclosed Fords already have doors on both sides. The Canadian Ford roadster does not differ much from the American built roadster, having the same kind of a top and a vertical windshield—but the Canadian Ford roadster has a door on the left-hand side.



POWER CURVE OF FORD

In addition to the door on the left-hand side of the driver's seat, the Canadian touring Ford has a "one-man" top. Also a "slanting" windshield that is so made that the lower glass can be moved to any angle for ventilation, while the upper glass can be moved to a rain-vision position.

Buying Canadian Ford Bodies.

While the Canadian Ford has decided improvements, it also sells for a decidedly higher price. And since Uncle Sam charges an import duty of 50 per cent, this means that by the time a Canadian Ford is brought into the United States, it will cost just about **twice** as much as a Ford bought here.

Some of our readers have considered making their summer tour over into Canada, discarding the American built body and fitting a Canadian built body on the car. Of course, the Canadian built body costs considerably more than the body built in America—not only because of its improvements, but also because Ford prices are higher in Canada on account of much greater government taxation, etc.

One of the Canadian Ford Agents has told us that when driving the Ford into Canada, it would be necessary to pay a duty of practically 35% on the body brought into Canada. Of course, if this was an old junk body, or if only the chassis were driven over, then this 35% duty would be avoided.

After installing the Canadian Ford body on the America chassis, it would be necessary to pay a 50% duty on the Canadian body going into the United States. There would also be a 4% sales tax, and the government would charge duty on the value of the American exchanged involved.

All things considered, the tariff makers seem to have succeeded in their purpose of making it impossible to do business on an international scale. But as the owners of American built Fords can easily purchase the rain-vision, ventilating windshields from American manufacturers; and as there are also a number of one-man tops for Fords on the market; the American Ford car owner can still get what he wants at a reasonable price.

Canadian Ford Weights.

The following weights of Canadian Ford cars do not include water, gasoline or oil.

Without Starter.

Type	Lbs.
Touring car	1570
Runabout	1450
Chassis	1110
Truck	1445

With Starter.

Touring	1655
Runabout	1535
Chassis	1195
Truck	1530
Coupe	1740
Sedan	1910

Canadian Fuel Tank Measurements.

Foreign buyers of American cars sometimes jump to the conclusion that American manufacturers are liars, because, when they attempt to fill the fuel tanks, they find that the fuel tanks will not hold the rated capacity. Likewise Americans are often surprised at the "miles-per-gallon" claimed by those living outside of the United States.

When is a gallon not a gallon? And the answer is that it changes when it crosses an imaginary line between the United States and Canada. In the United States, the Old English Wine Gallon, containing 231 cubic inches is standard. In Canada, the British Imperial gallon, of 277.274 cubic inches, is used. This means that an Imperial gallon is equal to practically 1-1/5 U. S. gallons.

Since the gallons are different, we are giving a table of gasoline tank measurements, showing number of Imperial gallons per inch:

Gallons	Square Tank	Round Tank	Oval Tank
1	6/7″	1-13/16″	1- 3/8″
2	1-5/7″	2-15/16″	2-5/16″
3	2-4/7″	3-15/16″	3-3/16″

4	3-3/7"	4- 7/ 8"	4"
5	4-2/7"	5-13/16"	4-13/16"
6	5-1/7"	6- 7/ 8"	5-11/16"
7	6"	7-15/16"	6-19/32"
8	8-1/8"	9- 5/ 8"	7-15/16"

Canadian Fordson Tractor Fuel Gauge

(Imperial Gallons)

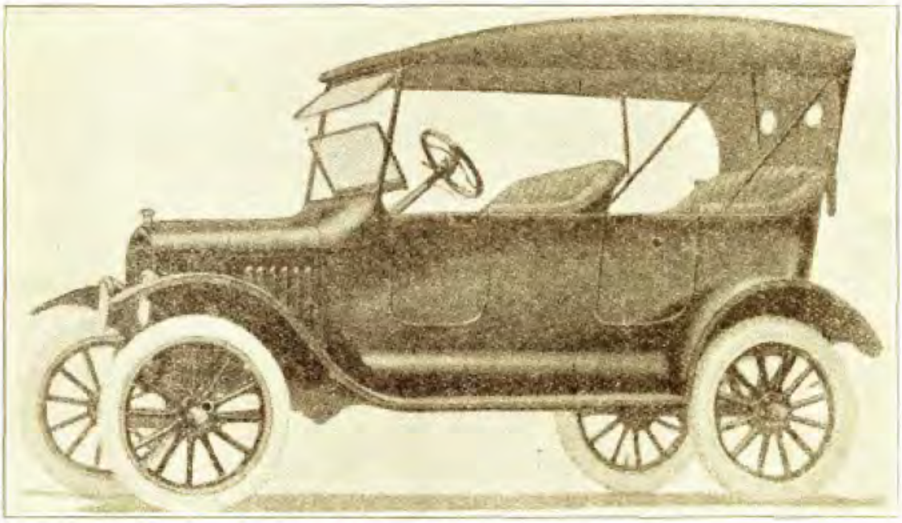
Gallons	1	2	3	4	5
Inches	1-11/64	1-51/64	2-17/64	2-47/64	3-13/64
Gallons	6	7	8	9	10
Inches	3-43/64	4-9/64	8-34/64	4-59/64	5-20/64
Gallons	11	12	13	14	15
Inches	5-35/64	5-60/64	6-21/64	6-46/64	7-12/64
Gallons	16	17	18	19	20
Inches	7-42/64	8-8/64	8-38/64	9-4/64	9-44/64

Canadian Ford Motor Numbers

The letter "C" is prefixed to the cars built by the Ford Motor Company of Canada, located at Ford, Ontario, Canada.

Canadian Ford Motor Numbers

Year	Serial Numbers
May 1, '13 to July 31, '13	C-1 to C-1500
Aug. 1, '13 to July 31, '14	C-1501 to C-16500
Aug. 1, '14 to July 31, '15	C-16501 to C-37500
Aug. 1, '15 to July 31, '16	C-37501 to C-70000
Aug. 1, '16 to July 31, '17	C-70001 to C-121000
Aug. 1, '17 to July 31, '18	C-121001 to C-170000
Aug. 1, '18 to July 31, '19	C-170001 to C-208500
Aug. 1, '19 to Aug. 31, '19	C-208501 to C-212500
Sept. 1, '19 to Sept. 30, '19	C-212501 to C-216500
Oct. 1, '19 to Oct. 31, '19	C-216501 to C-222500
Nov. 1, '19 to Nov. 30, '19	C-222501 to C-227500
Dec. 1, '19 to Dec. 31, '19	C-227501 to C-231000
Jan. 1, '20 to Jan. 31, '20	C-231001 to C-234000
Feb. 1, '20 to Feb. 29, '20	C-234001 to C-237500
Mar. 1, '20 to Mar. 31, '20	C-237501 to C-241500
Apr. 1, '20 to Apr. 30, '20	C-241501 to C-245500
May 1, '20 to May 31, '20	C-245501 to C-251000
June 1, '20 to June 30, '20	C-251001 to C-257000



Canadian Four-Door Touring

Being built in Canada (and not merely assembled there), these Canadian Ford originate within the far-flung limits of the British Empire and so can be shipped to India, New Zealand, Austraila, and other parts of the British Empire, without having to pay the "preferential" tariffs charged against Fords made in the United States.

As some parts of Canada have such deep snow during the winter months that the use of even Ford cars is impractical, there is an "off" season in the sale of Ford Cars in Canada, during which Ford engines are made and stored in the factory. When production is resumed in the spring, then the engines last made and stored are the most accessible, and so are first used for assembly into completed Fords. Consequently, it is impossible to figure quite so closely, within months or weeks, just when a Canadian Ford was built. Though in the long sweep of the yearly production, the results will be found quite accurate.

July 1, '20 to July 31, '20	C-257001 to C-262500
Aug. 1, '20 to Aug. 31, '20	C-262501 to C-266000
Sept. 1, '20 to Sept. 30, '20	C-266001 to C-269500
Oct. 1, '20 to Oct. 31, '20	C-269501 to C-275500
Nov. 1, '20 to Nov. 30, '20	C-275501 to C-278500
Dec. 1, '20 to Dec. 31, '20	C-278501 to C-281000
Dec. 28, '20 to Jan. 17, '21	C-281001 to C-281500
Feb. 16, '21 to Mar. 21, '21	C-282000 to C-282500
Feb. 15, '21 to Feb. 25, '21	C-283000 to C-283500
Feb. 10, '21 to Mar. 4, '21	C-284000 to C-284500
Feb. 15, '21 to Mar. 14, '21	C-285000 to C-285500
Mar. 15, '21 to Mar. 24, '21	C-286000 to C-287000
Mar. 1, '21 to Apr. 11, '21	C-287500 to C-288000
Mar. 3, '21 to Mar. 22, '21	C-288500 to C-289000
Apr. 8, '21 to Apr. 20, '21	C-289500 to C-290000
May 17, '21	C-290500
Mar. 28, '21 to Mar. 31, '21	C-291000 to C-291500
Apr. 23, '21 to Apr. 30, '21	C-292000 to C-293500
May 3, '21 to May 31, '21	C-294000 to C-299500
June 3, '21	C-300000

Tractor Motor Numbers

The motor numbers of Fordson tractors will be found stamped on the right-hand side of the cylinder block near the front end of the engine. But the motor numbers of Fordson tractors do not run in the same smooth sequence as the motor numbers of Ford cars, due to the fact that some of the tractors have been assembled in the "overseas" factory at Cork, Ireland, while other tractors have been assembled at the various branches.

Serial Numbers of Tractors Shipped Each Month from October 1, 1917, to October 31, 1920.

1917	Motors assembled at Home Plant
October	1 to 75
November	
December	76 to 259
1918	
January	260 to 616
February	617 to 1731
March	1732 to 3082
April	3083 to 3900
	6901 to 7608
May	7609 to 9580
June	9581 to 11937
July	11938 to 15225
1919	**Motors assembled at Branches**
July	
August	
September	
October	
November	
December	
1920	
January	100001 to 100192
February	100193 to 102294
March	102295 to 104759
April	104760 to 105000
	120001 to 121591
May	121592 to 124731
June	124732 to 125000
	135001 to 138088
July	138087 to 140000
	150001 to 151504
August	151505 to 145890
September	154891 to 158177
October	158178 to 158322
November	
December	
1921	
January	
February	
March	158312 to 158326
April	158327 to 158970
May	158971 to 159453
June	
July	159454 to 159887
August	159888 to 160000
	170001 to 170243
September	
October	170244 to 170394
November	170395 to 170890
December	170891 to 170957

1918	Motors assembled at Home Plant
August	15226 to 18637
September	18638 to 2224
October	22248 to 26287
November	26288 to 29978
December	29979 to 34426
1919	
January	34427 to 39554
February	39555 to 44782
March	44783 to 50961
April	50962 to 53079
May	53080 to 53110
June	53111 to 55304

Motors assembled at Cork Ireland	Motors assembled at Home Plant
C 1001 to C 1009	55305 to 60864
	60865 to 63000
C 1010 to C 1068	63201 to 65000
	65501 to 68055
C 1069 to C 1080	68056 to 74809
63001 to 63003	
63004 to 63063	74810 to 81363
63064 to 63177	81364 to 88465
63278 to 63200	88466 to 92113
105025 to 105049	92114 to 96973
65001 to 65240	
105050 to 105290	96974 to 100000
105291 to 105704	110001 to 111500
	111501 to 117133
105705 to 105893	117134 to 120000
105894 to 106269	125001 to 125036
	125037 to 129104
106270 to 106635	129105 to 134622
106636 to 106871	134623 to 135000
	140001 to 146097
106872 to 107199	146098 to 150000
107200 to 107303	160001 to 163426
65321 to 65500	163427 to 169258
107304 to 107640	169259 to 169583
107641 to 107954	
107955 to 108229	
108230 to 108243	------ ------
108244 to 108271	169584 to 169840
108272 to 108386	169841 to 170000
108387 to 108456	172001 to 175687
108457 to 108653	175688 to 181313
108654 to 108680	181314 to 187794
108681 to 108744	187795 to 193985
108745 to 108902	193986 to 198363
	198364 to 200018
108903 to 109208	200019 to 200431
109209 to 109397	200432 to 200942
109398 to 109575	200943 to 201025
109576 to 109672	------ ------

Tractor Road Speeds

Approximate engine speed, revolutions of rear wheels, and distance travelled by Fordson tractor, when in high gear. The normal engine speed is 1,000 revolutions per minute, at which engine speed the tractor travels at 6-¾ miles an hour. Traveling at higher speeds than this overloads the engine and will, in time, wear out the bearings or pound them out of round.

Rev. of Engine per Minute	Rev. of Rear Wheels per Min.	Tractor Speed Ft. per Min.	Tractor Speed Miles per Hour
1000	54	594	6-¾
1185-⅛	64	704	8
1333-⅓	72	792	9
1481-½	80	880	10

As the Fordson tractor has no speedometer, it is convenient to measure speeds by pacing and timing with minute hand of watch. The average man takes 40 paces per hundred feet. It is better to take one's normal stride, and base calculations on it, rather than to strive to take 3 feet per step. Walk beside tractor and count paces. Forty paces per hundred feet is 2-½ feet per step.

Paces Per Minute

2½ feet per step	3 feet Per step	Miles per hour
53	44	1-½
61	51	1-¾
70	58	2
79	66	2-¼
87	73	2-½
96	80	2-¾
106	88	3

Tractor Fuel Tank Gauge

Measurements for stick for gauging fuel in tractor tank.

Gallons	1	2	3	4	5
Inches	15/16	1-7/16	1-13/16	2-3/16	2-9/16
Gallons	6	7	8	9	10
Inches	2-15/16	3-5/16	3-5/8	3-15/16	4-1/4
Gallons	11	12	13	14	15
Inches	4-7/16	4-3/4	5-1/16	5-3/8	5-3/4
Gallons	16	17	18	19	20
Inches	6-⅛	6-½	6-⅞	7-¼	7-¾

Stops Door Rattle

If the rear doors of the Ford rattle and will not stay closed, when the car is driven over rough roads; this is usually caused by the sagging of the back part of the body, tending to pull the doors away from the front part.

The remedy is to see that the two front and the two center body bracket bolts are perfectly tight and then remove the two rear body bracket bolts and have one man use an old Ford drive shaft, or other steel pry bar, and get behind the car and lift the back part of the body up off the frame and as high as possible. And then insert plain steel washers between the rear body brackets and the body sills and replace the bolts. Sometimes, but not often, it is necessary to use longer bolts.

One-Eyed Fords.

Sometimes, when one is driving at night, one bulb is burned out, and this opens the circuit so that the other bulb does not burn either. But, if the driver indulges in such human frailties as chewing gum, or smoking cigarettes, he will have some tin-foil with him. And this tin-foil can be used to advantage to **complete** the circuit across the base of the burned out bulb, and send the current to the remaining good bulb.

Insert a small, thin, round wad of tin-foil in the base of the socket, and then replace the burned out bulb. **And this will give the connection** to the other bulb. Be careful not to **race the engine**, as all the current is now concentrated in one bulb.

Repair Radiator Tubes

Radiator tubes are frequently damaged in accidents and it is valuable to know of a rough-and-ready method of roadside repairs which will get the car home. Pry the fins up and away from the damage sections of the tube, so that leaky parts of the tubes will be accessible.

Now use cord, or common store string, and wrap it around the leaky or split tube, for a distance of half an inch or so above and below the leak. Use two or more layers, if necessary, to completely cover the leak.

Give the string a generous coating of white lead, or iron cement, such as is used for stopping leaks by plumbers and steam fitters. This forms a cheap and often quite lasting repair. Of course, one cannot easily reach the back tubes to wind them. But then it is the front tubes which are most often damaged in collisions. The string may be looped around with a hooked wire or shoe buttoner. And the white lead applied with a match.

Repairs Worn Timer

A temporary repair, for making a worn timer work a while longer and bringing the car home, can be accomplished by removing the four terminals from the shell and then loosening the nuts that hold the segments in place.

Now drive out the four contact segments and place washers, cut from a piece of inner tube rubber, or cardboard, under each timer segment. This forces the contact segments **out**, so that they make better contact with roller. When the nuts are replaced on the segment studs, the washers are pressed down, and the segments drawn down, approximately flush with the fibre raceway.

FORD MOTOR TROUBLE CHART

By G. I. MITCHELL.

The chart has been prepared to outline the various troubles met in the Ford power plant and to enable the owner and mechanic to diagnose and locate these faults.

A general knowledge of power plant troubles is necessary to use the chart, the mechanic must be able to tell if motor is "missing" or running "irregularily," or if it is loosing power or overheating. Recognizing these main divisions permits one to quickly locate the trouble and remedy.

In many cases the trouble will be found in the auxiliary members of the power plant rather than in the motor itself. The chart, however, only undertakes to include the more common troubles of the power plant.

Some time ago the Scientific American published a similar chart for the use of owners of other cars. This chart, especially prepared for Ford owners, should be found very helpful.

I. MISSING OR IRREGULAR ACTION

Part at Fault	Trouble	Effect	Remedy
1. Spark Plug	Binding post loose	No spark	Tighten terminal
	Leak in threads	Low compression	Screw down tight
	Defective gaskets	Low compression	Replace plug
	Cracked insulator	Short circuit	Replace plug
	Points too far apart	No spark	Set points closer
	Points too close	No spark	Set points apart
	Carbon deposits	No spark	Clean plug
	Plug too long	Pre-ignition	Use shorter plug
2. Combustion Chamber	Carbon deposits	Pre-ignition	Remove carbon
3. Piston Head	Carbon deposit	Pre-ignition	Remove carbon
	Crack or blow-hole (Rare)	Low compression	Replace piston
4. Valve Head	Washed or pitted on seat	Poor mixture. Low compression	True up valve head and grind to seat or replace with new valve
5. Valve Stem	Bent or sticks in valve guide	Low compression. Irregular valve action	Straighten stem. Clean guide. Oil
6. Valve Spring	Weak or broken	Irregular valve action	Replace with new spring
7. Exhaust Valve Seat	Scored or warped. Dirty or covered with gummed oil and carbon	Valve will not close. Poor mixture Poor compression	Use reseating reamer. Clean and grind to seat
8. Exhaust Valve Stem Guide	Warped or carbonized	Valve stem sticks	Clean guide
	Worn guide	Low compression Poor seating Poor mixture	Ream out guide and fit valve with oversize stem
9. Valve Stem Clearance	Too little	Valve will not shut	Use valve adjusters. Set inlet gap .020". File off end of stem. Set exhaust gap .025"
	Too much	Valve opens late and closes early	

1. MISSING OR IRREGULAR ACTION—Continued			
Part at Fault	Trouble	Effect	Remedy
10. **Cam Shaft Bearing**	Worn	Valve openings mistimed or valve lift short	Replace cam shaft bushings
11. **Cam**	Worm contour	Valve mistimed Valve lift short	Replace cam shaft
12. **Timing Gears**	Not properly meshed	Valves mistimed	Time properly and fasten to shaft with key
	Worn or broken teeth	Valves do not act	Replace with new gears
13. **Cam Follower Guide or Valve Tappets**	Loose in crank case	Oil leaks and poor valve action	Fasten securely
	Worn in bore		New guide
14. **Inlet Valve**	Opens late Closes early	Back fire in carburetor Motor loses power	Adjust clearance Time properly
15. **Inlet Valve Seat**	Warped or pitted Carbon deposit	Poor compression Back fires in carburetor	Use reseat reamer Clean and grind
16. **Inlet Valve Stem Guide**	Worn	Poor mixture Low compression	Ream out guide and use valve with oversize stem
17. **Carburetor**	Weak mixture	Back fires in carburetor	Adjust carburetor for richer mixture
	Too rich mixture	Carbon deposit Sluggish motor	Adjust carburetor for weaker mixture
18. **Inlet Manifold**	Leak at joints or defective gasket	Poor mixture	Tighten bolts Use new gasket Shellac joints
19. **Piston**	Walls scored	Poor mixture Low compression	Replace with new piston
20. **Piston Rings**	Loss of spring Loose in grooves Worn or broken	Poor compression	Replace with new rings
	Slats in line	Poor compression	Turn rings so slots are staggered
21. **Cylinder Wall**	Scored	Poor compression	Regrind cylinder and use oversize pistons
22. **Valve Spring Collar Key**	Lost or broken	Releases spring Valve stays open	Replace with new key
23. **Cylinder Head Gasket**	Leak	Poor compression Water in cylinder	Draw down tighter Use new gasket

2. LOST POWER AND OVERHEATING			
24. **Inlet Manifold Connections**	Poor mixture in all cylinders, or poor mixture in one set and good mixture in the other set of cylinders	Surging or pulsating	Tighten connections Put in new gaskets
25. **Upper Water Outlet of Cylinder Block**	Loose or defective gasket	Loss of water and overheating	Tighten bolts Use new gasket

2. LOST POWER AND OVERHEATING—Continued			
Part at Fault	Trouble	Effect	Remedy
26. **Radiator**	Tubes stopped up by sediment	Overheating	Clean thoroughly with washing soda solution
27. **Radiator Hose Connections**	Loose or hose rotted	Loss of water Overheating	Tighten hose clamps Replace hose
28. **Combustion Chamber**	Crack or blowhole	Low compression	Weld
	Rough	Pre-ignition	Smooth up
	Carbon deposit	Pre-ignition	Remove carbon
29. **Valve Head**	Warped or pitted	Low compression	Tune up in lathe
	Covered with carbon		Clean and grind
30. **Valve Seat**	Pitted	Low compression	Use reseat reamer
	Covered with carbon		Clean and grind
31. **Wrist Pin**	Loose	Poor compression Scored cylinder	Regrind cylinder and fit oversize piston. Fasten wrist pin securely
32. **Piston Rings**	Loss of spring	Low compression	Peen rings or replace with new
	Loose in grooves	Low compression Overheating	Fit new rings
	Slots in line	Low compression	Turn rings so slots are staggard
	Broken because too tight	Scored cylinder wall. Hot oil in crank case. Low compression	Regrind cylinder, fit oversize pistons and new rings
	Insufficient opening in gap	Excessive friction Overheating Broken rings Poor compression	Replace with new rings, or widen gaps
33. **Piston**	Binds in cylinder Walls scored or worn out of round	Overheating Excessive friction	Lap off excess metal, or Replace with new piston
34. **Cylinder Walls**	Scored	Low compression	Regrind cylindefor oversize piston
	Dry form lack of oil	Excessive friction Overheating	Clean oil tube Replenish oil
35. **Cam Shaft Drive Gears**	Loose on shaft	Irregular valve action	Fasten to shaft
	Not properly meshed	Valves out of time Loss of power Overheating	Time properly
	Worn or broken teeth	No valve action	Replace with new gears
36. **Oil Tube**	Stopped up	No oil on timing gears or in crank case dip troughs	Clean out
37. **Crank Shaft**	Scored or rough at journals	Overheating	Smooth up
	Sprung	Overheating Pounding	Straighten

2. LOST POWER AND OVERHEATING—Continued			
Part at Fault	Trouble	Effect	Remedy
38. **Crank Pin and Main Bearings**	Adjusted too tight	Loss of power Overheating	Adjust to running clearance
	Insufficient oiling		Clean oil hole
39. **Oiling System**	Insufficient oiling	Overheating and burned out bearings Scored cylinder and piston walls	Add more oil
	Poor oil		Use grade recommended by Ford Motor Co.
	Dirty oil		Wash crank case with kerosene Replace with new oil
40. **Water Jacket**	Clogged with sediment	Overheating	Remove sediment
3. NOISY OPERATION			
41. **Spark Plug**	Leaks	Hissing	Tighten or use new plug
42. **Cylinder Wall**	Scored	Knocking	Regrind and fit oversize piston
43. **Manifold Joints**	Leakage	Hissing	Tighten
	Defective gaskets	Hissing	Use new gaskets
44. **Combustion Chamber**	Carbon deposits	Knocking	Remove carbon
45. **Cams**	Worn contour	Metallic knock	Replace
46. **Piston Head**	Carbon deposit	Knock	Remove carbon
47. **Wrist Pin**	Worn, loose in piston	Dull metallic knock	Replace bushings or pin or both
48. **Connecting Rod**	Worn bearings	Distinct sharp knock	Adjust or replace
49. **Main Bearings**	Worn	Dull knock	Adjust
50. **Oil Pan Bolts**	Worn or loose	Rattle	Tighten
51. **Timing Gears**	Loose on shafts	Metallic knock	Tighten
	Worn or broken teeth	Grinding noise	Replace
	Improper meshing	Grinding	Mesh properly
52. **Cam Shaft Bearings**	Worn or loose	Slight knock	Replace
53. **Valve Tappets**	Gap too wide	Sharp clicking	Use valve adjusters or new valves
54. **Magneto**	Magneto striking coils	Grating noise Weak or useless magneto	Adjust magneto air gap to $\frac{1}{32}''$ Recharge magneto Repair coils
55. **Flywheel**	Loose on crank shaft	Heavy dull knock	Tighten holding bolts

3. NOISY OPERATION—Continued			
Part at Fault	Trouble	Effect	Remedy
56. **Transmission Gears**	Worn or loose on pins	Grinding in neutral, low and reverse	Replace with new gears and pins
57. **Transmission Bands**	Worn	Chatter and jerky action in low and reverse also when using foot brake	Replace transmission band linings
	Adjusted too tight	Car creeps forward unless hand brake is set. Excessive friction. Overheating. Loss of power	Loosen tension on bands
58. **High Speed Clutch**	Discs worn rough	Fierce, grabbing clutch	Install new discs
	Weak clutch spring	Slipping clutch	Install new spring
59. **Crank Case Arms**	Broken	Motor loose in frame. Heavy knocking	Weld broken member or use repair bracket or replace crank case
	Loose on frame	Motor loose in frame Heavy knocking	Tighten securely to frame

Starts Stiff Engine.

Here is a little hint for Ford owners, who overhaul their own cars. To start a motor that has been overhauled, is a very difficult task, when there is no battery around. You don't need a battery to start your stiff motor. All you have to do is go to your neighbor and ask him, if you can have his Ford for a few minutes. Your neighbor, probably will say, "Nothing doing. I'll not tow that stiff motor with my car."

But, tell him in advance that you don't want to use his car for towing purposes. Just long enough to use his power plant to get your car started. Then you will have him puzzled, He certainly will want to see what you are going to do with his Ford.

Now, instead of looking around for a tow line, look around for two pieces of wire, about 8 or 10 feet long. Connect one wire, from his magneto terminal to your battery side terminal. And connect the other wire, car-to-car, magneto terminal to your battery side terminal. And connect the other wire, car-to-car, for ground. The best and easiest way to ground it, is to fasten the wire to both radiator rods.

Now, all ready, let's go! Let your neighbor start his engine and keep it running. Retard your spark lever. Throw your switch to battery side, and a few lift ups will start your stiff motor very easily. Because there is plenty of juice there, it has a battery beaten.

This is also a good stunt on cold mornings, when there are a number of Fords with weak magnetos. This is what I have done on cold mornings. I would pick out a car that was an easy starter, with a good, live magneto. Then I would go from car to car, until I had them all started. Remember, cranking one cold car is not so bad; but when it comes to cranking a dozen Fords, it's no fun.

Here is another thing I do. Often I am sent out to start a new driver's car. Generally, when I get out, I find that the new driver cranks and cranks until he has the motor flooded. Of course, after the motor is flooded, no hand cranking will start the motor. All I do is connect the wires. And after a few turns the car will start up fine. I have started many a Ford on the country roads in this manner. Every Ford owner should carry about 8 or 10 feet of wire in his tool box, for emergency.

Leaky Radiators

To stop the radiator from leaking,—put one teaspoonful of bran into it. Start the engine to cause water to circulate. Inside of twenty minutes, the radiator will be tight and will stay tight—even if the holes are $\frac{1}{16}$ of an inch in diameter.

Get the bran that is sold in packages to eat, as it is without flour or gluten, and will not clog radiator tubes. Do not use "shorts," as the flour in it will cook in lumps, plug the tubes and cause boiling.

Do not put the bran in and stand around waiting for leaks to stop—they won't. Get in, ride around twenty minutes, and they will.