Instruction Book

for

SEARS MOTOR CARS

Always Carry This Book in Your Pocket

Sears, Roebuck and Co., Chicago

F8010

INTRODUCTORY

LET it be understood in the beginning that the Sears Motor Car is not a complicated mass of machinery which requires a practical engineer to understand and operate. Let it also be understood that in order to get the best results from the Sears Motor Car or any automobile, the operator must study the different parts and learn by tests and experience just how they work and the results obtained when they are working. Study the different parts of the Sears Motor Car, learn their functions, but do not change them or tamper with them.

What little trouble the owners of Sears Motor Cars have experienced has always been traced back to the fact that the operator thought he could better the machine by changing or experimenting with some part, overlooking the fact that we have spent years in experimenting and testing out the proper parts and the proper arrangement to give the most satisfactory results; or he took the advice of the local man who represented himself to be an expert in automobile engineering. Such men often advocate changes on the car, stating that the car is not right. Do not forget that these men are not the best automobile authorities you can get. If they were, they would be employed in some of the big manufacturing plants. We have automobile experts in our employ, men who are mechanical engineers and know the automobile business, and know what is right when it comes to the matter of construction. Therefore, do not take the advice of any outsider, but come direct to us if you require any information. If the plain and simple instructions in this little booklet are followed, anyone will be able to operate and run a Sears Motor Car successfully and have practically no trouble.

It must be remembered, however, that the Sears Motor Car contains an engine, a commutator or timer, a spark coil, spark plugs, carburetor, gasoline tank, switch and other parts which, combined, put it under the head of a machine; it cannot, therefore, be handled without some care and thought. It is really wonderful how easily some people operate this Sears Motor Car, but when you realize that every Sears Motor Car is run and given road tests and service before it is shipped, you will be willing to admit that if a car fails to run it is the fault of the operator and not of the car. There is a great difference in operators, however, and when handling the Sears Motor Car and watching others handle it, the writer is reminded very much of the managing of a nervous horse. Anyone who has had any experience with horses (and most of us have) knows that certain drivers will take a spirited, nervous horse and drive him at a good swift gait for a number of miles and bring him up perfectly calm with hardly a hair turned, whereas another man can take the same horse and before he has gone half the distance will have the horse nervous, worried and wringing wet with sweat. The handling of the motor or engine in the Sears Motor Car, or in fact any automobile, by different parties is very much like handling a horse. If you will take the time to notice different drivers of cars, you will find some drivers will send their cars along over routes, up and down hill, without very much effort or very much stir, while other drivers will have their engine spouting, puffing, kicking, and even then don't accomplish the same amount of work. It is necessary to study and understand your motor just the same as it is necessary for a driver to study and understand his horse if he wants to get the best results.

It is no more difficult to learn to operate a Sears Motor Car than it is to learn to drive a horse. It is necessary, however, to know your car and your motor and become thoroughly acquainted with them before you can get the best results, the same as it is necessary to find out by experience the kind of a horse you are driving.

Remember, each motor car gets a thorough and rigid road test before delivery and is in perfect condition before we ship it to the customer, and if properly handled it should work perfectly when received. Study the instructions carefully and study the construction and operation of the car. Your success will depend on how well you understand the machine. Remember, it is only a machine, without life or senses, and will perform faithfully only the work you make it do. It takes practice to run a car successfully, and practice will make anyone master of a Sears Car. It is all very easy after you know how, but you can't expect to learn all about your car the first day, and you will learn something good every day for a while after you start to drive an automobile.

This instruction book is gotten up to cover all the troubles an automobile is subject to, in a way so simple that any owner can locate the cause of his own trouble. By all means try to keep your car out of the hands of repair men in local garages, especially in small towns, as there are more cars ruined by them than there are by all the owners of cars put together, regardless of make. Nine times out of ten you will get far better results by reading these instructions carefully, and systematically examining your car and correcting the trouble yourself. After a little experience and time, studying different parts of your car and their relations to one another, you will be surprised how practical and simple an automobile is. In case of serious trouble in the motor, or should the necessity for general overhauling arise, it is far more economical to send it to the factory to be repaired and it will be returned in first class running order.

UNCRATING AND SETTING UP.

To points at great distances the Sears Motor Car is crated for shipment in order to secure the lowest possible freight rate, and in order to do this the wheels are removed from the axles. After uncrating the Sears Motor Car, put the wheels on the same as you would put on any regular buggy wheels, tightening up the nuts and turning the wheels around to see that they work perfectly free. When this is done, unpack the chains, slipping them over the rear wheels, or slip the chains on the axles before putting on the rear wheels; then disconnect the front end of the pull rod, which is the rod that connects to the cross shaft and the foot pedal rod, put the chain on the front or small sprockets first, pull this front shaft and sprocket back as far as it will go, and then put the chain on the rear sprocket, beginning at the bottom. Do not turn the wheel when doing this, but lift the chain over the sprocket teeth. When this is done, connect up the pull rod where you first disconnected it from the front pedal shaft. Now attach the fenders, which you will find packed in the body with all the supports attached ready to fasten to the car.

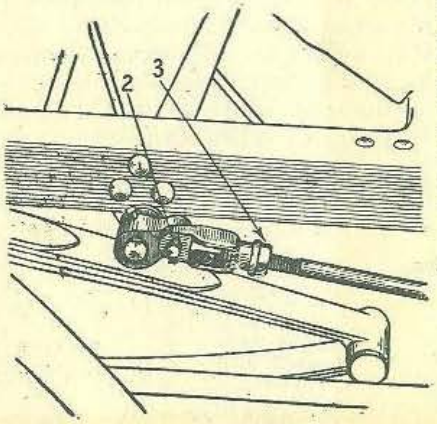


Fig. 14

CAUTION—Right at this point a great many mistakes are made, because the operator is overanxious to run the car to see whether the engine will start, and before following the balance of our instructions, which are very important, they do something that they regret later on. Please be careful and do everything we say, and then go over the whole matter again to be sure that every instruction has been carried out before attempting to run the car.

HOW TO PREPARE THE CAR FOR RUNNING.

Take out the loose boards in the front floor of the body, remove the cap from the automatic oiler (Figure 2), which you will find on the right hand side of the car, and fill this oiler with lubricating oil from the can you will find packed in the car (the oiler holds about ½ gallon). Be sure to put the cap on the oiler by screwing it down tightly after the oiler is filled. Next remove the pipe plug in the top of the crank case (Figure 4, Arrow 1), which is the center of the engine between the two cylinders, and put about ½ pint of oil in the crank case through the hole; then be sure to put the pipe plug back and tighten it up.

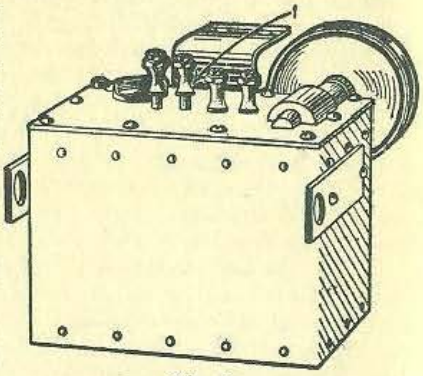


Fig. 2

Open pet cocks on top of cylinders, fill each cup with oil four times and let it run into the cylinders. Go to the front of the car and crank the engine, turning it over three or four times, so that the inside of the engine will take up the oil. See that the belt that runs from the engine shaft to the oiler pulley operates or turns the oiler pulley when you crank the engine. Put a little oil on the drive chains. The next thing to do is to fill the oil reservoirs in the cross drive shaft bearings. You will find these bearings hanging from the frame on each side supporting the cross shaft (Figure 5, Arrow 3), with the two small sprockets on each end; fill these bearings full of oil, using the small oil can. **Do not put oil in the small holes which are in the plate to which the small sprockets is attached.**

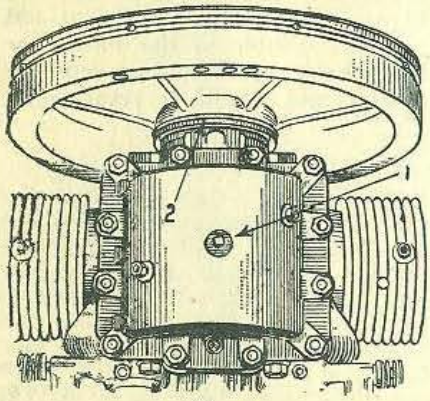


Fig. 4

NOTICE—Be sure these bearings are filled with oil, as they are very important.

Now oil the cross drive shaft. You will notice that the wheel on this shaft (Figure 6), which comes in contact with the fly wheel when the car is running, slides from one side to the other when the speed lever (Figure 13, Arrow 2) is operated. Put oil on this shaft (Figure 6, Arrow 4), sliding the wheel backward and forward several times, by operating the speed lever, so that it works easily. Put oil in the oil cap on the brass collar you will find on the hub of this wheel (Figure 6, Arrow 5).

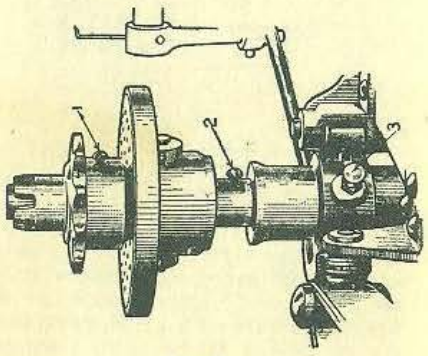


Fig. 5

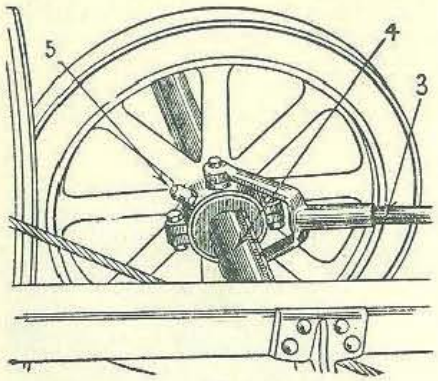


Fig. 6

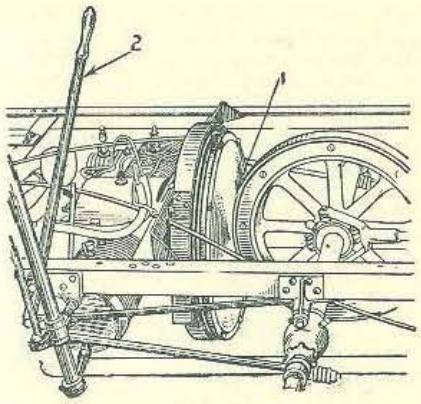
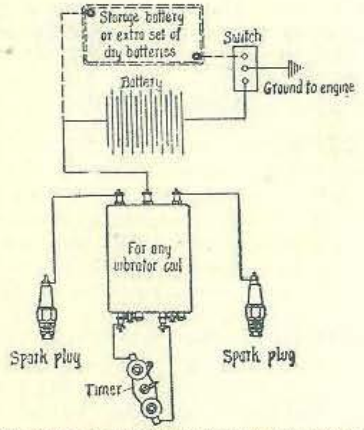


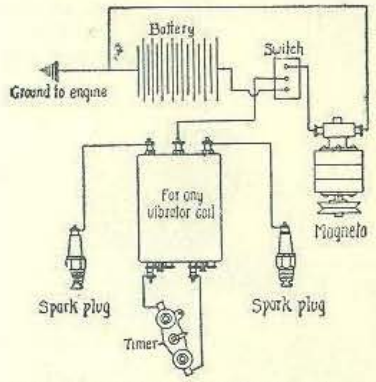
Fig. 13

THE CAR IS NOW READY FOR THE GASOLINE. HOW TO PROCEED.

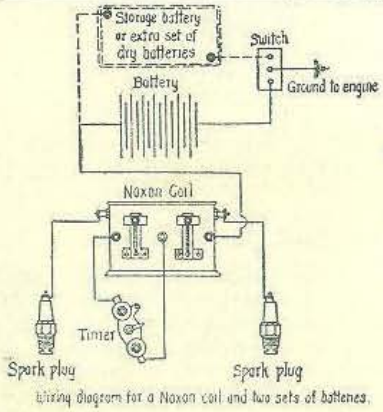
FIRST—Fill the gasoline tank with gasoline; it holds about 6 gallons. Use 74-degree test gasoline, the kind used in all automobiles and carried by all garages. You can get at the gasoline tank by removing the cushion, lifting out the seat bottom and unscrewing the cap. It is well to strain the gasoline through a chamois skin, as this takes out any little particles of foreign matter or water that might afterward give trouble by clogging the carburetor. When the tank is filled be sure to tighten down the cap in the top, then open up the small valve that you



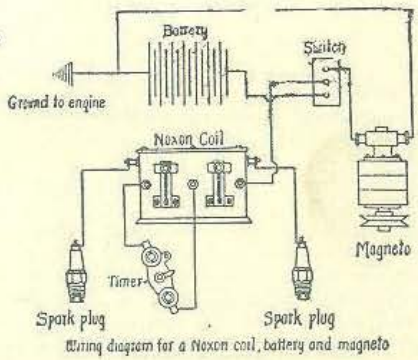
Wiring diagram for any vibrator coil and two sets of batteries.



Wiring diagram for any vibrator coil, battery and magneto.



Wiring diagram for a Noxon coil and two sets of batteries.

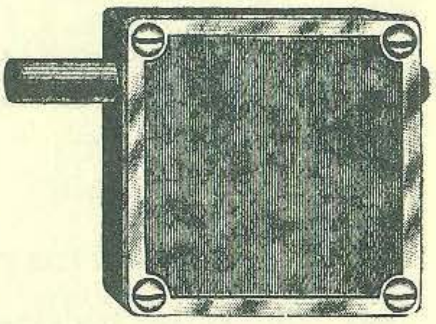


Wiring diagram for a Noxon coil, battery and magneto

will find in the pipe right beneath the tank; this valve should be turned so that the handles point up and down. The valve is closed when the handles point crosswise or at right angles to the pipe. This allows the gasoline to flow down into the carburetor.

SECOND—See that the batteries are connected up properly, that all nuts that hold the wires are tightened, and that the wires are attached to their proper places, according to illustration.

THIRD—Insert the plug or key in the switch. You will find the switch on the left hand side of the body beneath the outer edge of the seat; batteries are connected to forward terminals of switch. Slip plug forward so end is even with back of switch block and sticking through in front. See illustration.



FOURTH—See that the control levers, both the spark and the throttle (the throttle is marked "T," and controls the mixture from the carburetor; the spark lever is marked "S") are closed; that is, that they are in as far as they will go toward the seat. In other words, when sitting in the seat running the car the levers should be pulled in toward you. You will find these levers on the steering post.

FIFTH—Raise the front flap of the cushion so you can see the spark coil, then crank the engine slowly, and if the spark coil is operating properly you will notice the two vibrators on the front of the spark coil snap or throw a spark at different intervals. If these vibrators operate when you crank the engine, you are getting the sparks properly and the car is ready for the engine to be started.

HOW TO START THE ENGINE.

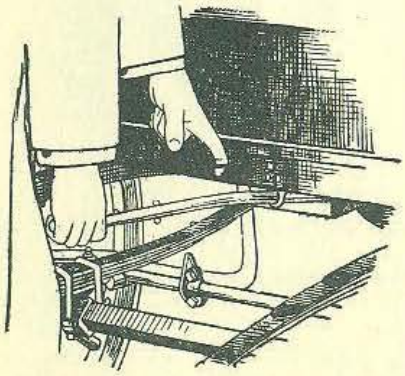


Fig. 1

FIRST—Open the throttle gas lever, which you will find on the steering post, about ½ inch. Leave the spark lever retarded, or in as far as it will go, when starting. An advanced spark may injure you by a back fire. Be sure **not** to advance the spark lever before cranking the engine.

SECOND—See that the brake is set on the car by pushing the right foot pedal and catching it in the ratchet.

THIRD—Prime the carburetor by pulling the small wire which you will find extending through the frame on the front of the body near the starting crank. Hold this wire out with left hand while you crank. As soon as engine explodes, release the wire. (Figure 1.)

FOURTH—Run the motor for about fifteen minutes with spark lever pushed forward and a closed throttle to fill the oil veins before starting to drive the car.

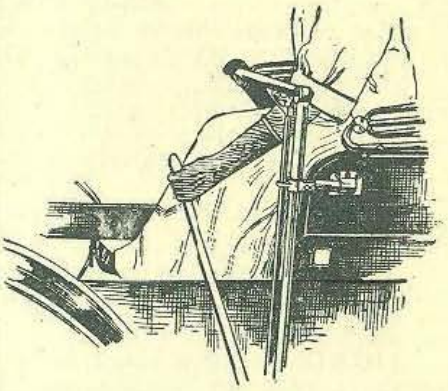
HOW TO START THE CAR RUNNING.

CAUTION—Unless you have run a car before and know something about automobiles it is well for you to familiarize yourself thoroughly with the different levers and controls before trying to run the car. You can do this by sitting in the seat for a few minutes and operating all the levers, excepting the contact foot pedal or the left foot pedal, which, as you will see afterward, starts the car.

FIRST—See that the speed lever or the lever on the side of the body is a little forward of perpendicular, as in this position it is set for the lowest speed. If you pull it back of the perpendicular position it is set for reverse motion or to run the car backward.

SECOND—Advance the spark lever and have throttle partly open so that the engine is running at a good rate of speed. Do not allow the engine to run away with itself or race, as this does it harm.

THIRD—Be sure that the right foot pedal is released from the ratchet; in other words, see that the brake is not set.



FOURTH—Press your left foot gently on the left foot pedal and at the same time open the throttle slowly. Be sure not to push heavily, as a very slight pressure will start the car. This pedal is geared so that a very slight foot pressure throws the contact wheel against the power or fly wheel with sufficient force. Do not, therefore, think you must push with all your strength on the foot pedal. You will soon become accustomed to this by practice. Keep your heel firmly on the floor in starting so the car will start off steadily.

FIFTH—The car should now be moving forward at the slowest speed, and it is well to run it for some little time at this speed before trying to go faster. Throttle the engine by pulling in slowly the throttle or lever marked "T." Do not, however, pull this in so far that it will stop or kill the engine. This is something you must learn by experience after you have thoroughly familiarized yourself with the car and have run it slowly for some distance. You can then release your foot and shove the speed lever forward about halfway down. Now by speeding up the engine and pressing the left foot pedal you will gather speed. To run on high speed, push the speed lever forward as far as it will go. It is not well, however, for you to try to speed the car, if you have never before operated an automobile, until you become perfectly familiar with it.

When you have the engine and car running smoothly, advance or push the spark lever to the left as far as it will go. In other words, give the engine an early spark. Control the speed of the engine by the throttle or lever marked "T."

CAUTION—Don't try to start right out driving your car up steep hills or through deep sand and mud. You will need practice running the car on good level roads before you can attempt to make such tests. The car will do it, but you must learn to drive it properly first.

HOW TO BACK THE CAR.

It is often necessary in turning around on a narrow street or to get out of a bad place to back the car. To do this pull the speed lever back against the seat and then by pressing the left pedal the car will back up.

What is commonly called running on spark is accomplished by having the spark lever out as far as it will go, and the throttle or lever marked "T" in as far as you can keep it and still keep the car going along. This method of running on spark is economy, as you use the least possible amount of gasoline. To get power when climbing a hill or starting, however, you must open up the throttle so as to give the engine enough mixture from the carburetor.

You will be surprised after you have mastered the car, which should take but a very short time, how simple you find everything on the Sears Motor Car, and no matter what your expectations are you will be surprised at its simplicity.

RULES FOR STARTING.

Four rules to observe before starting:

FIRST—See that all moving parts are well oiled.

SECOND—Be sure the oiler is full of oil or that there is enough oil for the trip. The glass gauge in one corner of the oil reservoir will enable you to see how much oil there is.

THIRD—See that battery connections are tight. These sometimes jar loose.

FOURTH—Always see how much gasoline there is in the gasoline tank.

SEVEN RULES FOR STARTING THE MOTOR.

FIRST—Open gasoline valve under gasoline tank.

SECOND—Insert switch plug.

THIRD—See that spark lever (marked "S") is away back (late spark). Look twice to make sure. It will save you from a "back kick" from starting crank.

FOURTH—Open throttle lever just a little; this differs a little on different cars. You will find just the right position of throttle lever to start promptly.

FIFTH—Pull out priming wire and hold out while cranking. This is not always necessary.

SIXTH—Crank the engine.

SEVENTH—After motor is running, get into the car; have side speed lever standing a little forward of perpendicular, which is slow speed forward, and advance spark lever. Wave a goodby to the folks standing around to see you start, press left foot pedal and car will move slowly forward. After you are started you can control speed of car with "gas" throttle, favoring the car where roads are bad, and speeding along where roads will permit.

IF ENGINE WON'T START, ASK YOURSELF THESE QUESTIONS:

FIRST—Is the plug in the switch?

SECOND—Does the spark coil click?

THIRD—Is gasoline valve open?

FOURTH—Is switch plug clean?

FIFTH—Is there gasoline in tank?

SIXTH—Are spark and throttle levers set right for start?

All of the above little things are so easily overlooked that one must form a habit to overcome neglect. It will happen to anyone, and often you will find yourself cranking the engine when there is no gasoline in the supply tank or you have not inserted switch plug.

LEARN TO OPERATE THE CAR WHERE THERE IS PLENTY OF ROOM.

It is always well to start the car where you will have plenty of room to operate it. Starting a car and becoming accustomed to working the foot both on the contact pedal and the brake pedal is like learning anything else. If you have never run a car you will naturally be a little timid at first, and in case you become confused and push the wrong pedal at any time, if you have plenty of room there will not be any accident. Like other things, it is very easy once you master it. The Sears Motor Car is the easiest car on the market to operate and is the only car so simple in construction of its operating parts that it can be sent to a purchaser without the aid of an expert to demonstrate it.

A bicycle is easy to ride after you have learned how; but it takes practice. The Sears Motor Car is not as hard to master as a bicycle. There is no balancing to be done to hold your seat but, like learning to ride a bicycle, practice will make you proficient. In fact, after you have practiced a few times you will find it comes as natural to push this pedal and that pedal, pull this lever and that lever, as it is for you to put one foot before the other when walking.

ADVICE.

Now don't expect to do it all in a day when you start out with your motor car. We all have to learn. You can't expect to start right out and do everything that every other person has done with a motor car. Have patience. You may have difficulties while you are learning, but you will overcome all of these. Perhaps the reader is as well informed on automobiles as the writer, but we are saying this for the benefit of the beginner. An automobile is only a machine, and its success depends entirely upon the operator. Remember, we don't ship a machine from our factory until it is in perfect condition. Each car gets a severe road test and is in perfect running order up to the time the gasoline tank is drained and the machine crated for shipment, and should continue in that same perfect condition unless put out of adjustment in some way.

See that the oiler delivers a liberal supply of oil to the cylinders, especially if you are using the motor hard on severe roads, climbing steep hills, going through deep sand, or driving at a steady high speed. With the cylinders well oiled you will get full power from the motor, and an air cooled motor should have plenty of oil; this will prevent overheating of the motor.

After you understand the operation of the machine it will be a continuous source of pleasure. Do not abuse the car. Drive it as carefully as you would a nice buggy, and your expense for repairs will be practically nothing. Rough handling will increase your repair bills and shorten the life of the car.

Go over the car frequently and look for loose wires, loose nuts or bolts. Look over the steering connections. Keep all nuts tight to prevent rattle. Don't let fenders work loose. It's only a moment's work to tighten a nut, and it will keep the car running smoothly and quietly.

Use good automobile lubricating oil in the oiler.

Strain the gasoline through a chamois skin; it will save you trouble from dirt or water getting into the carburetor.

EXPLANATION OF TWO-CYCLE AND FOUR-CYCLE MOTORS.

For the benefit of those who are not familiar with motor construction we will explain that there are two classes of motors, one known as the two-cycle motor, the other known as the four-cycle motor.

The two-cycle motor is commonly called the valveless motor, and the piston is utilized to open and close the passages through which the gas enters the cylinder and through which it leaves the cylinder; in other words, it opens and closes the intake port and the exhaust port. This type of motor has not proven to be absolutely successful in every respect, consequently it has not been adopted by the majority of manufacturers.

The four-cycle motor is the one that is in universal use, and its operation is in four cycles as follows: The first cycle is the first outward stroke of the piston. This stroke is sometimes called the suction stroke, as it draws the mixture into the cylinder. The second cycle is commonly called the compression stroke. This is when the piston travels in the cylinder toward the head and compresses the gases which have been drawn in on the first stroke. The third cycle is called the power stroke, as this is the stroke that is caused by the explosion of the compressed gases. The fourth cycle, called the exhaust stroke, expels the burnt gases from the cylinder through the exhaust outlets.

INSTRUCTIONS FOR REMOVING MOTOR FROM CAR.

Secure a box at least 18 inches wide (longer if possible), and just high enough to slide under the fly wheel. When it is in this position, put a block of wood on each end of the motor between the box and the muffler pipe elbows.

Disconnect all the parts that run from the motor to the running gear or frame, such as oiler and gasoline pipes, oiler belt, timer wire at the coil, ground wire on the cover of crank case, spark and throttle control rods, muffler hangers, etc. Also disconnect the two front motor

supports and the rear motor support. Having done all this, the motor is free from the car. With the assistance of men at both front wheels, have them lift the front end of the car high enough to clear the motor, and at the same time shove the car backward over the motor. Replace the motor in the same way. It will require only about fifteen minutes to do this work, and it is advisable to take the motor out of the car when you wish to give it a general overhauling and general cleaning.

NOTE OF EXPLANATION.

The following pages are compiled in paragraphs and each paragraph given a different number. The last few pages of the book consist of an index alphabetically arranged to assist you in locating the car trouble. Look in this index for the symptom which corresponds with the trouble you are having with the car. There you will find given the various things which might cause the trouble, and reference to paragraphs. Refer to the paragraph or paragraphs given for a remedy. For example, if the clutches of the car slip, look in the index under the heading of "Clutches Slipping." You will find this indicated by their not being properly adjusted, or they are too oily. You are then referred to Paragraph 29, which gives you complete instructions for remedying this trouble.

PARAGRAPH A.

OILING. We cannot emphasize too strongly the matter of lubrication, and wish to warn you against the local garage man or dealer who sells you oil on the representation that it is fit for your motor. Nothing but the highest grade of oil should be used, and this must be a high fire test, air cooled engine oil. Do not be deceived by the statement that the oil you are buying is strictly high grade. This may be true, but there are strictly high grade oils that are only fit for water cooled engines and cannot be used successfully in air cooled engines. Do not use machine oil or any cheap lubricating oil. The life of the machinery depends upon its proper lubrication. If poor oil is used the motor will overheat, the power will be decreased, the cylinders will get dirty, and you run a great risk of having the bearings burn out. We furnish with each car 1 gallon of lubricating oil of the kind that should be used in our motors. We can supply this oil in any quantity. This is the only oil we guarantee. If you do not care to buy from us, we recommend the following oil, and that you do not use any other: "Monogram," medium, made by New York Lubricating Oil Co., New York City, or Mobiloil "B" in summer and Mobiloil "E" in winter. This oil is made by the Vacuum Oil Co., New York City.

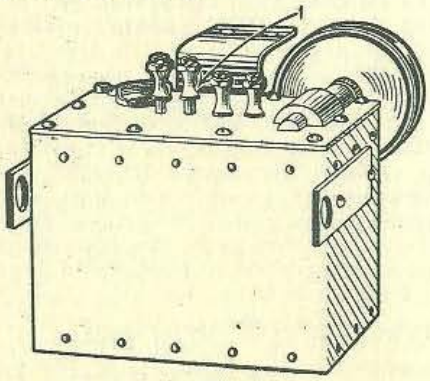


Fig. 2

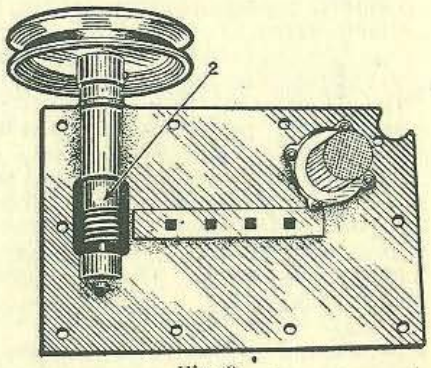


Fig. 3

Before starting out on a trip be sure that the oiler is full, that the oiler belt is on and that the oiler is working properly. Start the motor and watch the operation of the oiler and if it is working properly the pumps will rise about ⅜ of an inch (Figure 2, Arrow 1) and snap back in place suddenly. If they do not snap back the oiler is not working properly, and an examination must immediately be made of the oiler to

determine the cause. This might be caused by tne set screw (Figure 3, Arrow 2) coming out of place on worm gear on pulley shaft. If it has come out you will probably find it in the bottom of the oiler. In replacing it screw it down tight and hold it in place with a drop of solder.

PARAGRAPH B.

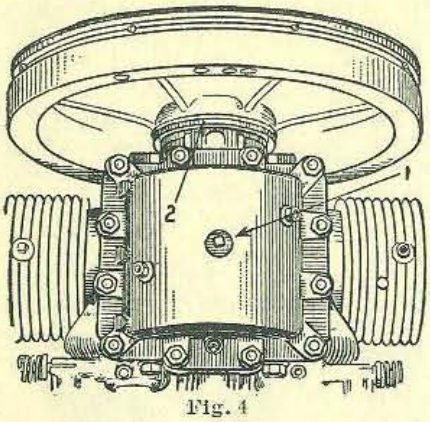


Fig. 4

OILING. When you first receive the car be sure to put oil in the crank case before starting. This can be done by removing the pipe plug in the top of the crank case (Figure 4, Arrow 1). One-half pint of oil should be used for this purpose. This should be replenished from time to time and a careful watch kept to see that there is a bath of oil 5/8 of an inch deep in the bottom of the crank case at all times. Another point which needs oiling is the thrust bearing (Figure 4, Arrow 2). This oiling can be done by means of an oil can.

PARAGRAPH C.

OILING. On each end of the jack shaft you will find three places, indicated by arrows in the drawing, which need oiling. Once a week should be sufficient for the point on the external half of the clutch (Figure 5, Arrow 1) and the point between the clutch and the jack shaft bearing boxes (Figure 5, Arrow 2). Special attention should be given to oiling the jack shaft bearing (Figure 5, Arrow 3). This should be taken care of after every 100 or 150 miles. Special attention should also be given to oiling the

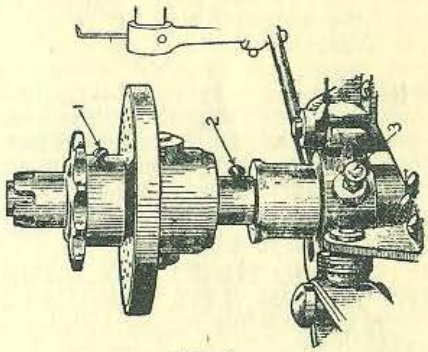


Fig. 5

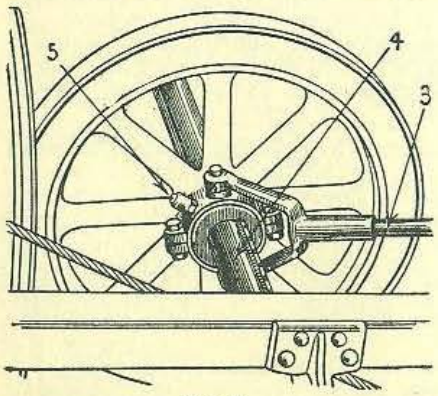


Fig. 6

jack shaft where the friction wheel slides backward and forward (Figure 6, Arrow 4), and plenty of oil should be put in the oiler (Figure 6, Arrow 5). This should be done every 100 or 150 miles. Another point which should receive careful attention in regard to lubrication is at the end of the bell crank where it fits into socket on yoke (Figure 6, Arrow 3). We advise looking at the axles at least once a month, and, if necessary, oil them. Put a small amount of oil on each chain every few days.

PARAGRAPH 1.

FAILURE TO START CAR EASILY IN COLD WEATHER is due to slow vaporization of gasoline, especially if poor grade of gasoline is being used. In this event, prime motor through pet cocks with about

one teaspoonful of gasoline, or wrap a hot cloth around carburetor until gasoline warms up, which never fails to start car.

PARAGRAPH 2.

IF IN RUNNING THROUGH A HARD PLACE, such as sand or mud, or up a steep hill, the engine develops a knock, it indicates that the throttle is too wide open or that the speed lever is too far forward. To overcome this, close the throttle slightly until the knocking ceases, or move the speed lever back.

PARAGRAPH 3

WHEN THE STARTING CRANK SLIPS OFF THE STARTING RATCHET when you are cranking the car it indicates that the slot in which the pin on the end of the starting crank fits is worn so badly that the pin will not hold. To remedy this take a round file and file the slot deeper.

PARAGRAPH 4.

IF TOO LITTLE GASOLINE IS BEING FED BY THE CARBURETOR, make carburetor adjustment by opening up the needle valve indicated (Figure 7, Arrow 1). Just a slight opening will be sufficient. Make sure that the gasoline is running freely from the tank to the carburetor. This can be determined by disconnecting the gasoline feed pipe at the point where it connects with the carburetor.

Water or dirt in gasoline is a very common source of trouble which causes the motor to run very irregularly, and if in any quantity it will stop the motor entirely. In very cold weather the water in gasoline will freeze, blocking the outlet from tank and also the gasoline feed pipe and carburetor. Strain all gasoline through a chamois skin.

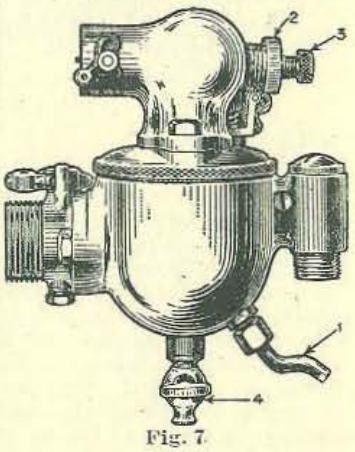


Fig. 7

PARAGRAPH 5.

IF TOO MUCH GASOLINE IS BEING FED BY THE CARBURETOR, cut down the gasoline supply by turning up the needle valve (Figure 7, Arrow 1). About one-half turn open on needle valve will usually give proper mixture. See that the air valve spring is not adjusted too tight. This valve can be adjusted in the following manner: Loosen locknut (Figure 7, Arrow 2) and then relieve the tension on the air valve spring by unscrewing the knurled nut (Figure 7, Arrow 3) until there is only a light pressure on the seat. This pressure can be tried with a nail or anything small enough to enter the mouth of the air intake.

NOTE—As water and dirt will get into the gasoline in spite of what precautions you may take to prevent it, we advise that the carburetor and gasoline pipe be occasionally flushed. The carburetor can be flushed by opening the pet cocks at the bottom and letting the gasoline run out. The feed pipe can be flushed by disconnecting it from the carburetor and then turning the gasoline on at the tank and letting about 1 quart run through. Do this while the gasoline tank is full, for then the pressure will be greater and the particles of dirt that have lodged in the gasoline pipe will be washed out.

PARAGRAPH 6.

IF THE CARBURETOR LEAKS it is probably caused by dirt getting on the seat of the needle valve and preventing the valve from closing. Shut off gasoline at tank and drain carburetor through the pet cock on the bottom (Figure 7, Arrow 4), then turn on gasoline at tank and fill the carburetor with a new supply of gasoline. This simple operation will usually wash out any dirt that has settled on the float valve seat.

PARAGRAPH 7.

IF THE CARBURETOR IS CLOGGED screw up on the needle valve as far as it will go. This will have a tendency to mash any dirt that may be obstructing the passage. Then open needle valve again to the proper adjustment. Also drain the carburetor through the pet cocks at the bottom. This will remove whatever water is in the carburetor.

PARAGRAPH 8.

IF CARBURETOR WORKS ONLY WHEN FLOODED it indicates that you are not feeding enough gasoline. Open needle valve by unscrewing until the motor runs properly. Or it may be that the air intake valve opens too easily and does not give enough suction to draw up the gasoline through the nozzle in the proper proportion. To overcome this, tighten the tension on the air valve spring by first loosening the locknut (Figure 7, Arrow 2) and then screw up on the knurled nut (Figure 7, Arrow 3) until there is a light pressure on the seat. This pressure can be tried with a nail or anything small enough to enter the mouth of air intake.

PARAGRAPH 9.

WHEN GASOLINE DOES NOT RUN FREELY INTO CARBURETOR it indicates that there is a stoppage somewhere in the gasoline feed. Remove the gasoline feed pipe at the carburetor and blow through it. If the stoppage is at the point where the gasoline leaves the tank this will usually remove the dirt, but if this fails to work, remove the pipe entirely from the tank, see that it is clean, and with a small wire or nail remove dirt that has accumulated around the opening inside the tank by pushing the wire or nail through this opening

PARAGRAPH 10.

WEAK BATTERIES. The only sure way to determine this and correct it is by the use of an ammeter, and while the coil we furnish will enable you to use batteries with an amperage as low as three or four, we would advise against letting the batteries get this weak. We would prefer that you use a battery that tests not below five or six. In testing batteries, test each one separately, and if you find a weak one throw it out and use the remaining batteries until you have replaced the whole set. Examine the wiring to see that the fastenings are perfectly tight, and also that the battery connections are tight. If you have occasion to replace the batteries be sure to get the battery connections on in the proper manner. In other words, connect the carbon on one battery to the zinc of the other, and follow this throughout the entire set. When the batteries become weak it will be indicated by misfiring and explosions in the muffler.

PARAGRAPH 11.

TIMER NOT MAKING CONTACT FOR EACH CYLINDER. To determine this, turn the engine with the crank the same as you would in starting, and watch the timer pin (Figure 8, Arrow 1) to see that it makes a clean contact between the discs on both halves of the timer, **especially the bottom half.** If you find the contact is not good, loosen the set screw (Figure 8, Arrow 2) and pull the timer pin through a sufficient distance to cause it to make a good contact. If the timer pin is worn too much, reverse it and use the new end. If for any reason the arm on which the timer discs are assembled should become bent so far as to make it impossible for the timer pin to make a contact, it will be necessary to straighten it. The timer discs must always be in line with the timer pin. This adjustment can be made by removing the

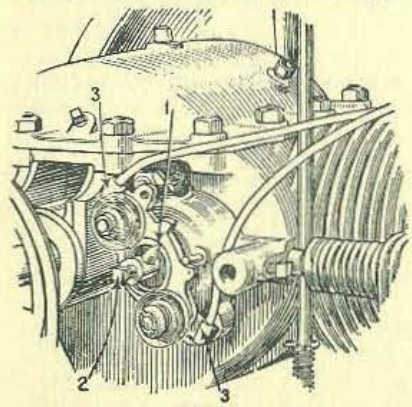


Fig. 8

cotter pin, and loosening or tightening the nut on the end of the shaft holding the timer discs. Be sure that the terminals on the timer (Figure 8, Arrow 3), to which the wires are attached, are not bent so that they come in contact with the timer at any point. If they do it will cause a short circuit and the coil will fail to work, and this will prevent the engine from working properly.

PARAGRAPH 12.

WHEN THE TIMER PIN COMES IN CONTACT WITH THE TIMER and causes a shower of sparks, it indicates that the timer is too dry and dirty. This should be washed off with kerosene oil and a drop of lubricating oil put on. It also indicates that the contact points of your coil are dirty and not properly adjusted, or vibrator spring is broken.

PARAGRAPH 13.

SHOULD PLATINUM CONTACTS (Figure 9, Arrow 4) **BECOME ROUGHENED OR DIRTY,** smooth the same by means of a fine file or emery cloth, being careful not to alter the tension of contact spring.

PARAGRAPH 14.

TO ADJUST COIL, press down vibrator lightly (Figure 9, Arrow 1) until it comes in contact with magnets underneath (Figure 9, Arrow 2); screw down adjusting screw (Figure 9, Arrow 3) until contact points meet, then unscrew one-half turn.

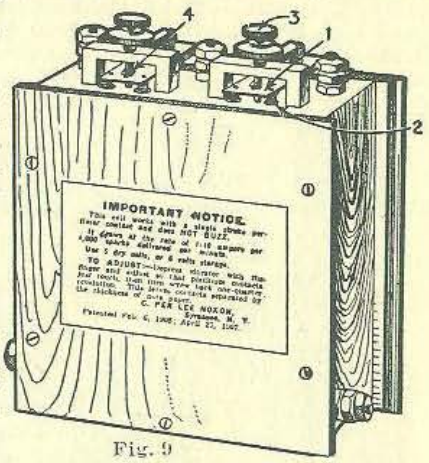


Fig. 9

PARAGRAPH 15.

TESTING COIL. To determine if the coil is working properly, remove the secondary wires from the spark plugs and place the terminals so they will be about 1-16 inch away from the engine. Then crank the engine very slowly and watch closely to see if the spark jumps from the end of the secondary wires when the spark coil clicks. If it does not, the secondary wires are leaking current on account of broken or oil soaked insulation, or the coil is in all probability broken down on the inside of the secondary winding and must be replaced by a new coil.

PARAGRAPH 16.

IF THE VIBRATORS STICK ON THE COIL it is usually caused by a short circuit between the timer and the primary terminals on the timer; or the insulation between the vibrator spring and the coil core, which acts as a magnet, being broken off or worn out; or the insulation on the timer wires being broken and coming in contact with some metal part, causing a short circuit.

PARAGRAPH 17.

IF SHORT CIRCUITED, straighten terminal and examine timer wiring to see that insulation is not broken and coming in contact with some metal part and short circuiting.

PARAGRAPH 18.

IF INSULATION OR VIBRATOR IS BROKEN OFF, glue a thin piece of cardboard on under side of vibrator.

PARAGRAPH 19.

IF COIL BUZZES it indicates weak batteries. If you know that the batteries are not weak by actual test, the trouble is probably due to the coil. Try remedy covered by instructions in Paragraph 15.

PARAGRAPH 20.

IF COIL IS DEAD it is probably due to the batteries being dead. But if you find by actual test that the batteries are not dead, examine the timer to see if there is a short circuit caused by the terminals being bent and coming in contact with the timer; also examine the vibrators to see

that the contact points are clean. Examine the vibrator spring to see that it is not broken; also see that the little coil spring on the vibrator is not broken or out of place; and see that timer is making good contact.

PARAGRAPH 21.

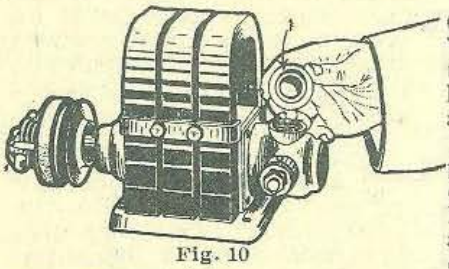


Fig. 10

MAGNETO FAILS TO RUN CAR WELL, BUT BATTERIES WORK O. K. If belt is slipping, tighten it by cutting off one end and linking it together again. To clean armature, remove the round cap (Figure 10, Arrow 1). This will expose to view the armature. As the engine runs and armature revolves, hold a piece of fine emery cloth against the armature. This will clean it off and brighten it up.

PARAGRAPH 22.

TO DETERMINE WHEN FRICTION AND CLUTCHES ARE HOLDING PROPERLY, drive the car on level road, and when the car is under headway release the power pedal, speed up the motor and press on the power pedal. If car does not show an immediate response it indicates that there is a slippage. See Paragraphs 27 and 28.

PARAGRAPH 23.

USING TOO MUCH PRESSURE ON POWER PEDAL will waste power and cause friction fiber ring to flatten out. When friction wheel and disc are free from grease and adjusted properly, and speed lever is in proper place for pulling, a slight pressure will carry the car up the steepest hill.

PARAGRAPH 24.

IF FRICTION RING IS WORN DOWN TO IRON RING it will cause the iron flange on the friction wheel to come in contact with the aluminum disc on the fly wheel and cut it badly, make a rumbling noise and fail to make proper friction contact. The motor will develop its full power, but the car will have a noticeable drag. The only remedy is to replace the fiber ring. If it has cut your friction disc very badly you will have to turn it over and use the other side, or replace it with a new one.

PARAGRAPH 25.

IF FRICTION WHEEL OR PLATE IS GLAZED TOO SMOOTH it can be remedied by taking a file and roughening the surface of the friction plate by scratching it from the center to the outer edge in a way that will resemble spokes radiating from a hub. Wash off all traces of oil with gasoline.

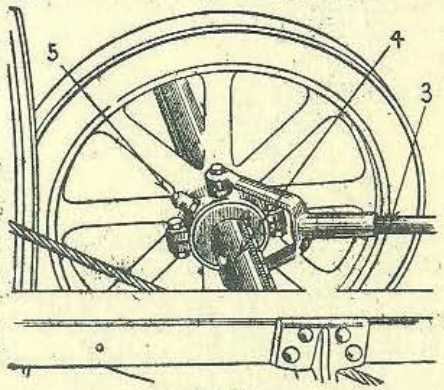


Fig. 6

PARAGRAPH 26.

WHEN SPEED LEVER DOES NOT TRAVEL FREELY it indicates that the jack shaft on which the friction wheel slides is too dry; also that the end of bell crank which fits into the slot on friction wheel shifting yoke is too dry. Oil at points indicated in Figure 6, Arrows 3, 4 and 5.

PARAGRAPH 27.

WHEN KNOCK OCCURS WHILE THE CAR IS RUNNING ON THE ROAD, BUT DOES NOT KNOCK WHEN STANDING IDLE, it is due to a flat spot on the friction wheel; or the cap screw which acts as a stop to prevent the friction wheel from sliding too far either way on the shaft is broken off and is allowing the wheel to run over top of cap screws which hold the friction plate to the fly wheel.

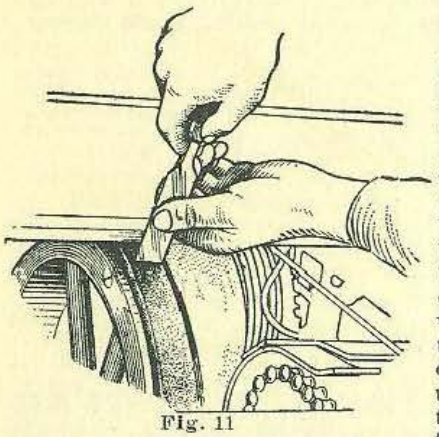


Fig. 11

WHEN THE KNOCK IS DUE TO A FLAT SPOT IN THE FRICTION WHEEL it can be remedied in the following manner: Jack the rear axle up free from the floor, open the floor boards in the rear of the car, have somebody turn the wheels, and then take a sharp carpenters' chisel, hold it vertical, brace it against the floor of the car (Figure 11) and, while the fiber ring is revolving, push the sharp edge of the chisel against the fiber ring until it just comes in contact with the high spots on the wheel. As the fiber ring revolves, the chisel will scrape off the surface of the wheel. Continue this operation until the chisel makes an even contact with all parts of the wheel. If flat spot is not bad, another remedy would be to run the car on the level road and have the pressure on the power pedal very light. This will permit a certain amount of slippage and will gradually wear the flat spot off. But if you employ this means of removing the flat spot, we want to caution you against having the pressure too great. If the pressure is too great it will simply increase rather than decrease the flat spot. Another remedy which has been tried and proven successful is to throw the fiber ring in the reverse position, and with pressure light and the engine going, drive down hill. Do not run the car with a bad flat spot. It is not only annoying, but it is detrimental to the motor. The best thing to do would be to remove the friction wheel immediately and have it trued up on a lathe, or order a new one and have the old friction wheel trued up at your own convenience.

If friction ring should flatten out so it comes over the flanges of the wheel it will kill power. The edges should be beveled off with a chisel as the wheel revolves (Figure 12). This is usually caused by too much oil accumulating on the friction ring.

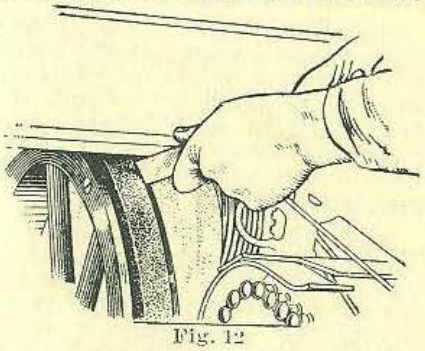


Fig. 12

PARAGRAPH 28.

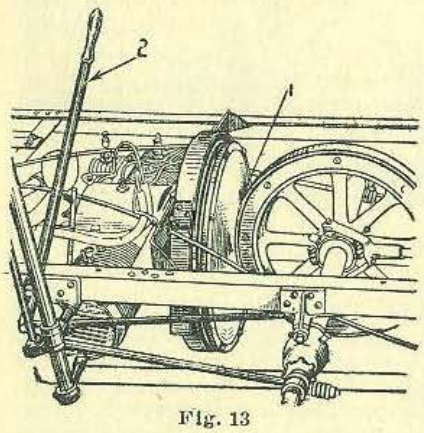


Fig. 13

WRONG ADJUSTMENT OF FRICTION WHEEL AND FRICTION PLATE. The distance between the friction disc and fiber ring (Figure 13, Arrow 1) should not be greater than 1-16 inch. If it is, it must be adjusted in the following manner: Remove cotter pin in pull rod (Figure 14, Arrow 2) and slip pull rod off the end of shaft; loosen locknut (Figure 14, Arrow 3), and turn turnbuckle a sufficient number of turns to bring friction wheel up to within 1-16 inch of the friction disc. This should be done on both pull rods. Tighten up locknuts and slip pull rods on shaft. After doing this see that the distance between friction wheel and friction disc is the same

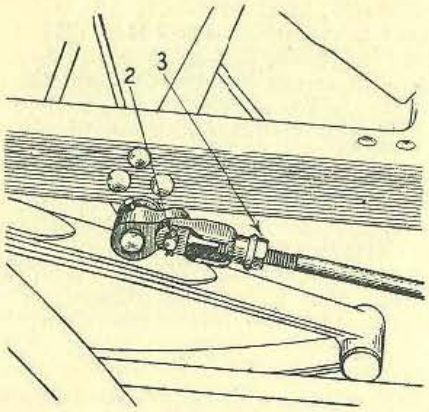


Fig. 14

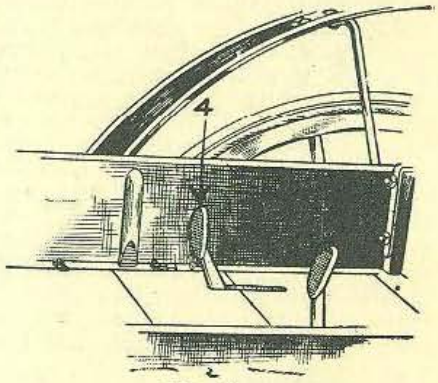


Fig. 15

when the shifting lever is in the reverse position, and also in position for high speed. If there is any variance adjust the pull rod on the side of the car on which the variance occurs until the distance is equal on both reverse and high when the power pedal is back in position (Figure 15, Arrow 4). Replace cotter pins in pull rods. Now adjust chains in the following manner: Put the shifting lever in a vertical position and force the power pedal far enough forward to make a contact between the fiber ring and the friction disc sufficient to run the car over an ordinary

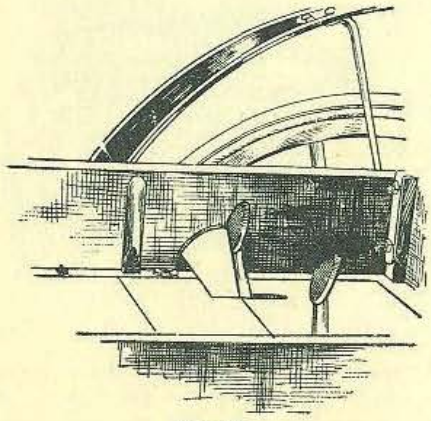


Fig. 16

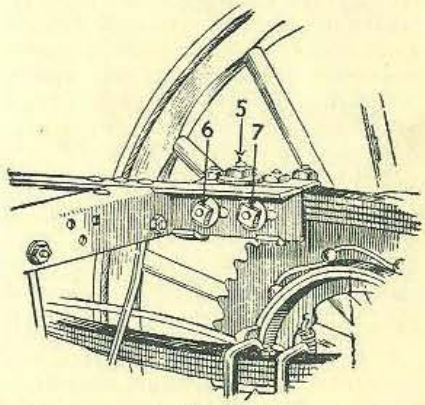


Fig. 17

road. Then block the power pedal in this position with a wedge (Figure 16). With the pedal in this position, the chains should be a little slack. If it is necessary to adjust the chains on account of their being either too loose or too tight, loosen the three nuts on each sliding pad (Figure 17, Arrows 5, 6 and 7) and force the spring pad either back or forward until the chains are properly adjusted on both sides. Then tighten all nuts and remove wedge.

PARAGRAPH 29.

CLUTCHES NOT PROPERLY ADJUSTED. To adjust, remove pull rods to allow jack shaft to swing backward a sufficient distance to permit the removal of chains; take out cotter pin (Figure 18, Arrow 1) and unscrew slotted nut (Figure 18, Arrow 2). Then remove internal and external differential plates. This will expose the end of the jack shaft and show the internal pin protruding through slot in the jack shaft (Figure 19, Arrow 3). See that this pin is in place in both ends of the shaft and that it moves freely back and forth.

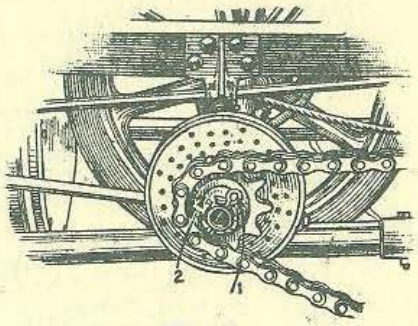


Fig. 18

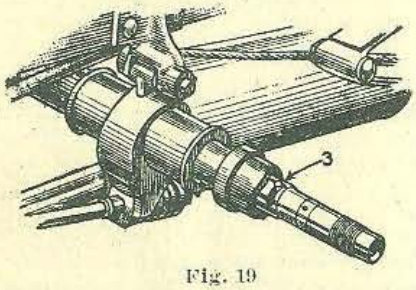


Fig. 19

Before replacing clutch see that the pad on the inside half (Figure 20, Arrow 4) is washed free from all grease and that the inner edge of the clutch member (Figure 20, Arrow 5) is also free from grease and dirt accumulation; also see that the perforations in the outer member of clutch are free from grease and dirt accumulation. **The inner surfaces of these clutch plates should always be kept free from oil.** In replacing the clutch see that there is plenty of oil in the slot through which the internal pin protrudes. First, replace the spring; second, the internal half of the clutch, and see that the internal pin works freely in the key way (Figure 20, Arrow 6); third, put on perforated plates and see that all work back and forth freely on the shaft; fourth, replace the slotted nut, **turn up as tight as possible, and then turn back this nut four notches;** fifth, insert cotter pin. Make this same adjustment on both ends of the shaft. If chain has a tendency to jump on either side, tighten up the slotted nut on this side one notch, or back off one notch on the other side.

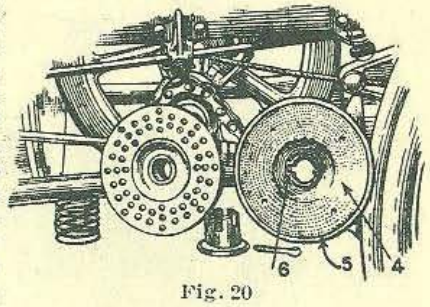


Fig. 20

AFTER ADJUSTING CLUTCHES in accordance with the above instructions you should test the adjustment to see that it is right. It may be that in driving through mud or up hill the clutches will slip. If this is the case they have not been adjusted tight enough, and it will be necessary to tighten the slotted nut up another notch. If you find that the clutches stick and do not release freely it will be necessary to loosen the slotted nut until the sticking is overcome.

CLUTCHES SHOULD NOT BE SCREWED UP TIGHT. If they are the differential will not work, and this will make the car act as though it lacked power. **Do not put oil in the holes in outside clutch member.**

PARAGRAPH 30.

IF SPEED LEVER TRAVELS FORWARD it indicates that the motor is too low; if speed lever travels backward the motor is too high. This can be remedied in the following manner: On the cross member of frame and front of fly wheel is the rear motor support (Figure 21, Arrow 1). Underneath this cross member at a point indicated by Arrow 2 are two

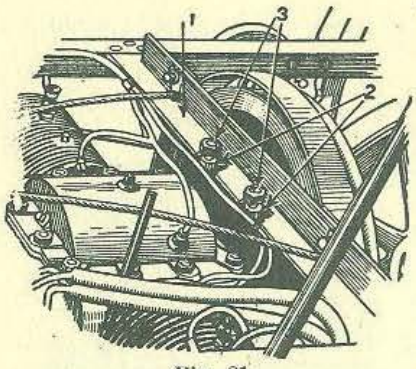


Fig. 21

locknuts. When the lever travels forward unscrew the two lower nuts one-half turn and tighten up on the two nuts that show on top of the cross member and which are indicated by Arrow 3. If this does not remedy the trouble repeat the operation until you have raised the motor a sufficient height to overcome the traveling of the speed lever. If the speed lever travels backward loosen the top nuts a half turn and tighten up on the under nuts. Repeat this operation until the motor is lowered a sufficient distance to overcome the traveling of the lever.

PARAGRAPH 31.

TO DETERMINE IF BOTH CYLINDERS ARE WORKING REGULARLY hold down the vibrators on the coil alternately. If when holding down the vibrator on the left hand side of the coil the motor stops, it indicates that the right cylinder is not working properly; if when holding down the vibrator on the right side the motor stops, it indicates that the left hand cylinder is not working properly.

PARAGRAPH 32.

MISFIRING. The meaning of this is that the engine fails to explode its charge on either one or both of the cylinders. It can be determined by listening to the motor exhaust. If the engine is firing regularly you will hear an even and continuous exhaust, but if the engine is not firing regularly you will hear an uneven exhaust.

FOUL SPARK PLUG OR PLUGS. Remove spark plugs from the cylinders and clean them carefully, being sure to take off all carbon and all oil. Examine the porcelains to see that they are not broken. This break usually occurs inside the plug and can only be determined by taking the plug apart for examination. If you find the porcelain broken the only remedy is to replace it with a new plug. Be sure that the gap between the sparking points on the plug is not more or less than 1-32 inch. Be sure that the wire that runs through the center of the spark plug is tight. This can be tightened and held in place by means of the little locknut on top of the plug next to the porcelain (Figure 22, Arrow 1).

Fig. 22

PARAGRAPH 33.

TOO MUCH SPACE BETWEEN EXHAUST VALVE STEM AND PUSH ROD. The space between the end of the exhaust valve stem and the red fiber plug on the end of the push rod (Figure 23, Arrow 1) should not be greater than the thickness of an ordinary postal card. If it is worn so that this space is greater than 1-16 inch it must be adjusted in the following manner: Remove the two nuts on the cam box (Figure 23, Arrow 2); also remove timer pin, and then remove the cam box a sufficient distance to allow you to pull out the push rod. When the push rod has been removed take out the fiber plug and either replace with a new fiber plug or cut off the worn part, and insert in the push rod a piece of hard cardboard the thickness of the amount removed from the fiber plug; then insert plug and replace timer.

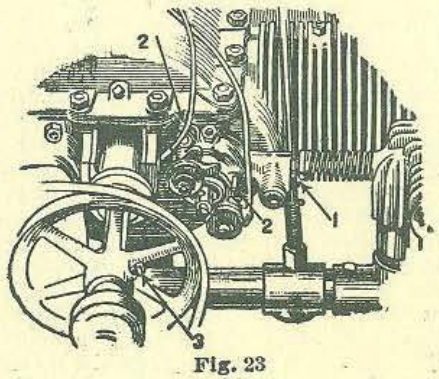


Fig. 23

PARAGRAPH 34.

CARBON DEPOSIT. The use of poor lubricating oil and irregular running of the motor will cause a carbon deposit to form in the cylinders, and this carbon deposit if allowed to remain and retain heat will cause premature explosions and lack of power. Therefore, in order to clean it out, remove the cylinder head (Figure 24, Arrow 3). This can be done by means of a short punch and a hammer, tapping the cylinder head on the two lugs that form part of the cylinder head casting. If you find it difficult to remove the cylinder head, a little kerosene put on around the threads will loosen it. After it has been removed, as shown in the illustration, carefully scrape off all carbon deposit from the cylinder walls, the head of the piston and the cylinder head (Figure 24, Arrows 1, 2 and 3), and be very careful not to allow any of this carbon to get into the exhaust valve opening, which is also shown in the illustration (Figure 24, Arrow 4). In repracing the cylinder head put a light coat of powdered graphite and oil around the threads.

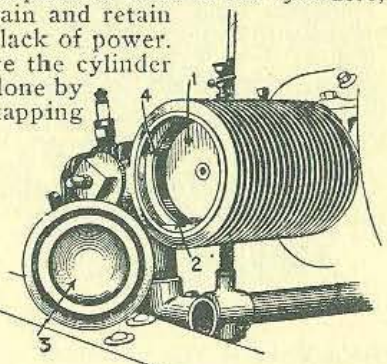


Fig. 24

PARAGRAPH 35.

LOOSE CONNECTING ROD. The adjustment of the connecting rod is made in the following manner: Remove the cotter pin and nuts (Figure 25, Arrow 2), then remove the connecting rod cap (Figure 25, Arrow 1). When this is done remove the bearing from the cap and file the cap at the two points indicated by Figure 26, Arrows 1 and 2. Do not file the bearing. It will be impossible for us to tell you just how much to file off. This will have to be judged by yourself by noting the amount of wear there is in the bearing before you remove the cap. This can be determined quite accurately by grasping the fly wheel and moving crank back and forth slightly. If you should happen to file off too much and can't turn crank shaft freely, don't loosen up nuts and leave it that way. Take connecting rod off again and put a thin sheet of hard paper between connecting rod and cap, and then tighten up. Always be sure to leave nuts perfectly tight or else connecting rod is liable to break cylinder and bend crank shaft.

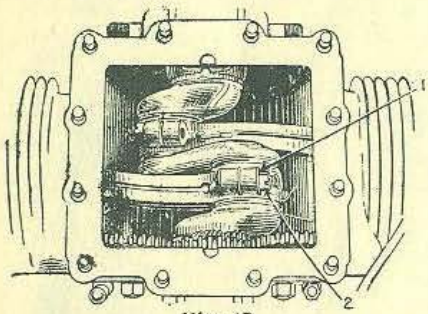


Fig. 25

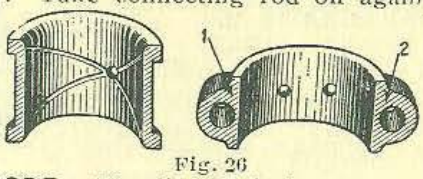


Fig. 26

PARAGRAPH 36.

LEAK IN THE INLET MANIFOLD. Usually this leak occurs at the point where the inlet manifold is connected with the cylinder. It can be overcome by merely tightening the manifold nut. If the leak is at any other place it will be necessary to solder it. The manifold nut and other connections are indicated by Figure 27, Arrows 1, 2 and 3. If for any reason you have occasion to remove the manifold in replacing it, be sure to get the threads started straight. If you are careful of this you can then very easily turn the nut up all the way and this will cause the intake manifold to be drawn up tight against the seat.

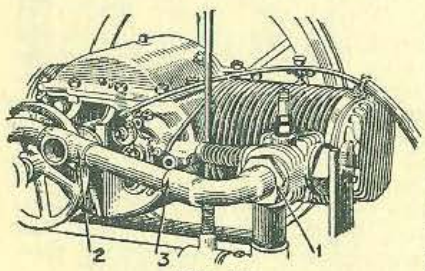


Fig. 27

PARAGRAPH 37.

WEAK INTAKE VALVE SPRING. To remedy this trouble tighten the tension on the spring by turning up the nut on the end of the valve stem (Figure 28, Arrow 1).

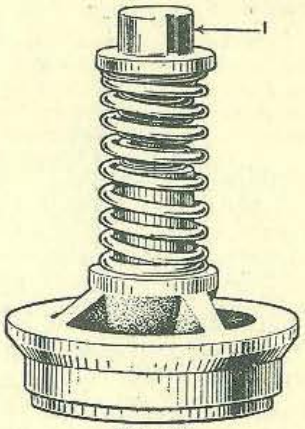


Fig. 28

PARAGRAPH 38.

LOSS OF COMPRESSION, CAUSED BY LEAK where inlet manifold is connected with the cylinder, around spark plugs, around cylinder heads or around exhaust valve seats. To determine whether or not you have loss of compression, that is, whether one or both cylinders offer little or no resistance on the compression stroke, crank the engine the same as for starting. If one cylinder turns over hard and the other easy, the easy one has lost compression. After having determined this, make certain that the manifold nut is tight, and then with an oil can pour oil around the cylinder heads where they screw into the cylinders and around spark plugs, and then crank the engine again. If the leak is around either of these two points the oil will bubble. If the leak is not in these places it will be necessary to examine the exhaust valve. In order to do this it will be necessary to remove the two motor straps which support motor in front, then remove the square cap (Figure 29, Arrow 2), next remove the small pin in the end of the exhaust valve stem and push out the exhaust valve as shown in Figure 29. This will enable you to examine the beveled edge on the valve head and also the valve seat. If the leak has occurred at this point it will be indicated by little holes in the beveled edge or in the seat, which are called "pits;" or you will be able to see on the beveled edge of the valve head the point where it comes in contact with the valve seat, and if the valve is warped this contact will only show on part of the beveled edge. The rest of this beveled edge will probably be blackened by soot. To overcome this trouble it will be necessary to grind in the valve. This can be done in the following manner: On the beveled edge of the valve (Figure 29, Arrow 3) put a mixture of emery flour and oil mixed to a consistency of thin paste, or some valve grinding compound. Then with a screwdriver inserted in the small slot on the head of the valve press the valve into its seat. When you do this be sure that the push rod is way back so that the end of the valve stem will not come in contact with it. Then with the screwdriver still inserted in the slot, rotate the valve back and forth in its seat with a slight pressure, and at every four or five rotations remove the valve from the seat a small distance. This is done for the purpose of allowing the valve grinding mixture to distribute itself evenly over the seat, otherwise a continual grinding without removing it from the seat will cut grooves in both the seat and the valve, and if this is done you would not be able to retain compression until they had been removed. After having ground the valve into a perfect seat, that is, where every part of the beveled edge comes in contact with the seat, wash off carefully with gasoline all traces of the compound, leaving the valve and its seat perfectly clean. If motor has been run for a long period without lubrication, which may result in cylinders being cut and compression blowing past pistons, motor should be shipped to factory for repairs.

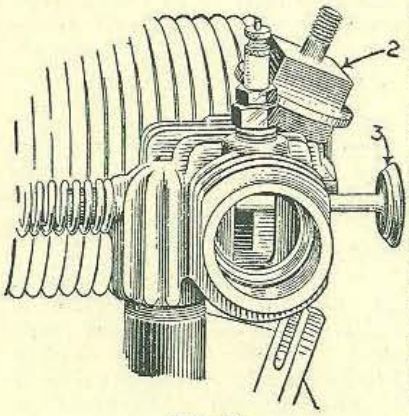


Fig. 29

PARAGRAPH 39.

NO OIL IN THE ENGINE. Pour oil through the pet cocks in the top of the cylinders; also put some in the crank case and examine the feed pipes of the oiler to see that they are not clogged. This can best be done by removing the connections at the engine end, starting the engine and looking to see that the oil is pumped out of each vein.

PARAGRAPH 40.

MAIN CRANK SHAFT BEARINGS can be taken up by putting a small sheet of paper between crank case cover and main bearing cap and screwing cover down tight. Be sure not to have bearings too tight or they will run dry and stick.

PARAGRAPH 41.

WHEN MOTOR DEVELOPS A SUDDEN KNOCK ON THE ROAD IT IS IN ALL PROBABILITY DUE TO BURNT OUT BEARINGS. In this case we want to caution you against driving another foot. **Stop immediately.** Take off the crank case cover and examine the connecting rods. If you find the bearing has burnt out it is in all probability due to a lack of lubrication, the use of poor lubricating oil, fan belt being lost off or large fan pulley being loose on shaft. There is no remedy for this except replacing with a new bearing, but a temporary remedy can often be applied which will enable you to get home or get to the nearest town where you can have a bearing fitted. Proceed in the following manner: First, loosen the cap and take the connecting rod away from the shaft; remove from the shaft all traces of any melted bearing; use fine emery paper or scrape it with a knife; be sure that the shaft is perfectly smooth. Next, drain all oil out of the crank case through the plug in the bottom of the case; be sure that the crank case is clean and free from all oil and parts of the burnt out bearing. Next, make a temporary bearing out of a piece of wood if you can find a piece large enough to whittle into the shape of a bearing. If you cannot, take small pieces, whittle them smooth, and lay them aroung the crank where the connecting rod joins. Then replace the connecting rod and cap and tighten them up; replace the plug in the bottom of the crank case, pour in some fresh oil, replace crank case cover, and drive carefully to the nearest point where it will be convenient for you to replace the bearing. **When the bearing is replaced be sure that all traces of roughness are removed from the crank shaft, and polish off the shaft perfectly smooth with the very finest emery cloth. If this is not done the bearing will be destroyed as fast as it is put in.**

WHEN EXHAUST VALVE FAILS TO OPEN ON EITHER CYLINDER when motor is running it indicates that one or more teeth are broken out of the cam gear, or the cam is loose on shaft, or shaft is loose in the timing gear. You can determine if the exhaust valve is opening by watching the operation of the push rod while the motor is running. If the push rod does not work back and forth in the cam box and strike the end of the valve stem, you may be sure that one of the above three troubles is the cause.

If cam is loose replace the taper pin and rivet over the head to keep it from coming out again. If the cam gear is loose on the shaft or there are teeth broken out of the gear it will be necessary to replace with new ones. Note the following:

INSTRUCTIONS FOR SETTING EXHAUST VALVES FOR No. 1 CYLINDER.

The right hand cylinder as you are sitting in the car.

Set the pistons so that they are in the position as shown in Figure 1. This position is called the out stroke.

On the right hand cam gear, marked "A," is stamped Figure 1.

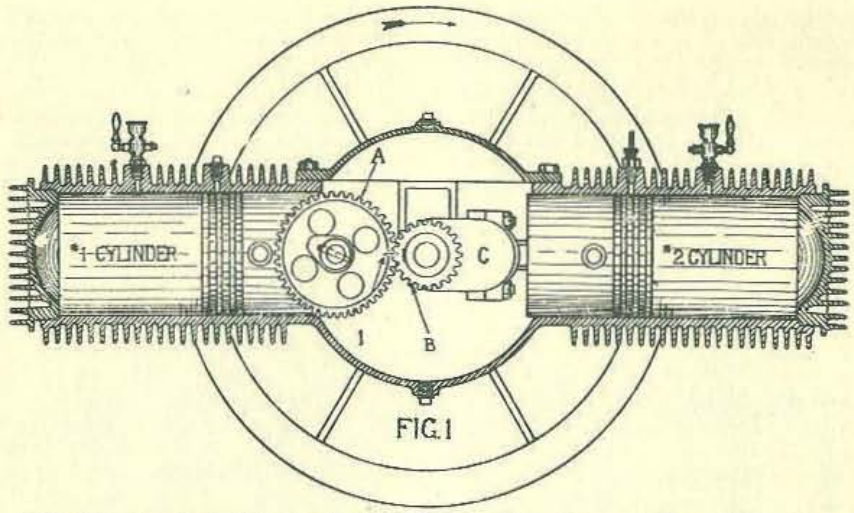


FIG. 1

On the crank shaft, marked "C," is a flat place, and on this place is a line cut which points between two teeth on the small crank shaft gear, which is marked "B."

Set the tooth on the cam gear which is marked No. 1 in the space indicated between the two teeth on the small crank shaft gear.

INSTRUCTIONS FOR SETTING EXHAUST VALVES FOR No. 2 CYLINDER.

The left hand cylinder as you are sitting in the car.

After having set the gears in the No. 1 cylinder, turn the fly wheel one-half turn in the opposite direction from which the motor usually runs. This will place the pistons on dead center, as shown in Figure 2. This position of the pistons is known as the inner stroke.

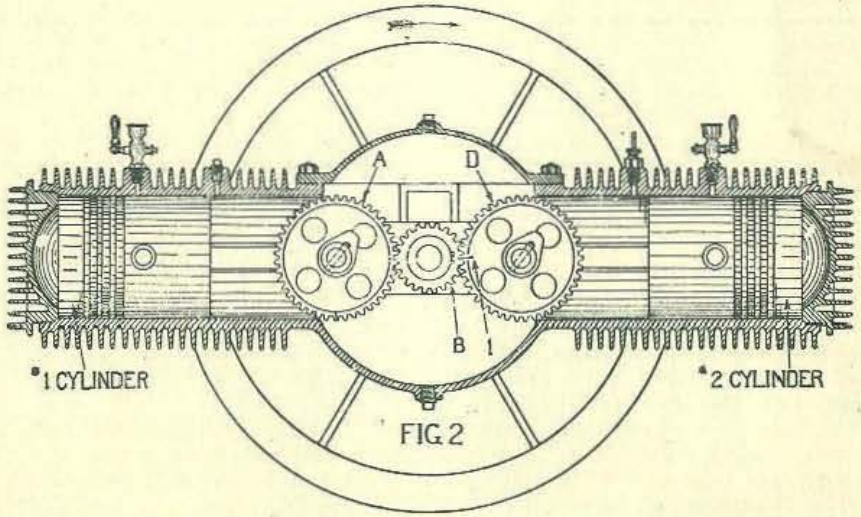


FIG. 2

Set the tooth marked No. 1 on the left cam gear in the space indicated by the line on the small crank shaft gear.

After you have set the valves it will be necessary to see that the timer pin projects on the proper side of the cam shaft to make the contact at the right time, and the following instructions will enable you to do this:

First, see that the wires are connected as shown in the wiring diagram. Now remove the cylinder head from the No. 1 cylinder, which

is the right hand cylinder as you are sitting in the car. Advance the timer, which is indicated by "F" in the illustration, as far as possible, as shown in the illustration; then set the timer pin "G" so that it makes a contact with the upper timer disc, indicated by "H."

When this contact is made the piston must be on the compression stroke, that is, the stroke toward the head of the cylinder and immediately after the exhaust stroke, and when the piston is about 2⅜ inches from the end of the cylinder, as shown in the illustration.

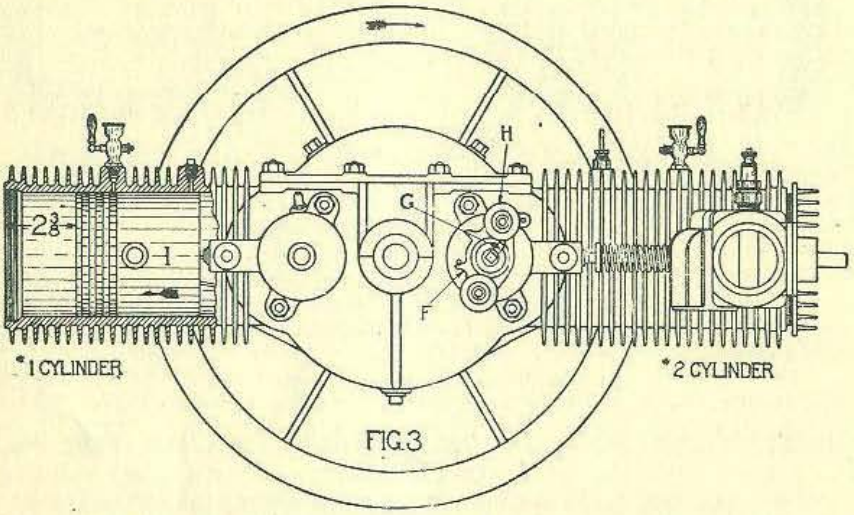


FIG.3

You will be able to determine if the pin projects from the proper side of the cam shaft by watching the exhaust valve in the No. 1 cylinder at the point where the push rod comes in contact with the valve stem. The push rod will begin to push the valve open when the crank shaft has made about one-quarter of a revolution, after the timer pin has made contact with the timer disc. In other words, after you have set the timer pin to make contact with the disc, as described above, turn the engine one-quarter of a turn and then ascertain if the exhaust valve in the No. 1 cylinder is starting to open.

When the timer pin makes a contact with the discs these discs should spread apart from 1-32 inch to 1-16 inch as the timer pin passes between them. When this contact is made it is called "closing the circuit," and it is at this time that the vibrator on the coil clicks.

When looking at the motor you will be able to see where the push rod from the cam box comes in contact with the end of the exhaust valve stem.

When these valves are closed there should be a space between the end of the push rod and the exhaust valve stem about the thickness of an ordinary postal card, and if upon investigation you find that there is not, you must either put in a new fiber plug or adjust the old plug.

This can be done by removing it, cutting off the worn part, and before inserting the fiber plug again put in the hole a packing of sufficient thickness to hold the fiber plug out the distance necessary to allow the proper clearance between the plug and the valve stem. See Paragraph 33.

When the push rod comes in contact with the end of the stem you will know that the exhaust valves are beginning to open, and this opening should take place 7-16 inch before dead center on the outward or expansion stroke, and they should close after the piston has traveled from 1-64 to 1-16 inch past dead center on the inward stroke.

In attaching the cam box to the cylinder care should be taken to draw it down tight to its seat to prevent the cam shaft binding in its bearings.

In tightening the cam box **do not** tighten up on one bolt as far as you can, then on the other, but tighten slightly on first one and then the other, and keep this operation up until the cam box is firmly seated.

If you have occasion to remove the cam box, in replacing it be sure to replace the spider spring on the inside. This should be replaced in such a way that the three projections on the spring come in contact with the inside of the cam box.

PARAGRAPH 43.

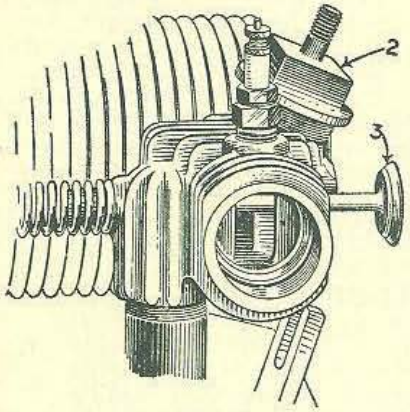


Fig. 29

IF EXHAUST VALVES ARE GUMMED UP WITH SOOT remove valve in the following manner: Remove the two motor straps which form front motor support, and the square cap (Figure 29, Arrow 2). Remove also the small pin in the end of the exhaust valve and push the exhaust valve out as shown in the illustration. Now clean valve stem and bearing through which stem passes into valve chamber.

PARAGRAPH 44.

INTAKE VALVE BROKEN. The only remedy for this is to replace with a new intake valve. This can be done in the following manner: Disconnect intake manifold from engine by loosening the manifold nut, remove all the broken parts, insert a new one, and in replacing manifold be sure that the threads are started straight. You will then be able to screw the manifold nut all the way in and draw the manifold up against its seat, thus preventing a leak.

PARAGRAPH 45.

DO NOT RACE MOTOR. We want to warn you against the practice of racing the motor. This is a practice that is followed invariably by every man when he first gets an automobile. There is nothing that can do a motor greater harm. When the motor is not pulling its load, throttle it down so that it runs slowly, and at all times endeavor to keep the speed of the motor at the same speed of the car. In other words, don't let the motor run at a rate of speed that would carry a car at the rate of 30 miles an hour while the car is only going 8 or 10 miles an hour. When you stop the car stop the motor.

PARAGRAPH 46.

MOTOR VIBRATES BADLY WHEN RUNNING ON HIGH SPEED. Examine the motor support straps on the front end of motor, and if loose, tighten; if broken, replace. No specific instructions are needed for this. Also examine the rear motor supports (Figure 21, Arrow 3), and if loose, tighten by the use of the nuts which fasten these supports to the cross member of the frame; if broken, remove and replace with new ones.

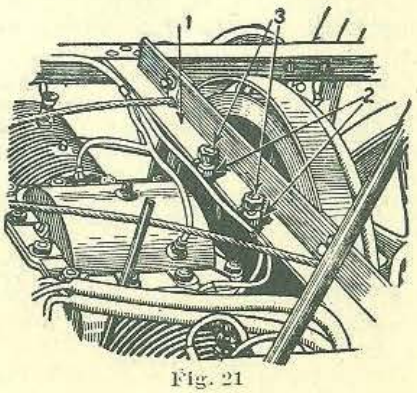


Fig. 21

PARAGRAPH 47.

OVERHEATING. An accumulation of mud on cylinders will cause them to become overheated, which naturally reduces the efficiency of the motor. Clean off and keep clean. Keep spark lever well advanced while running. Follow Oiling Instructions.

PARAGRAPH 48.

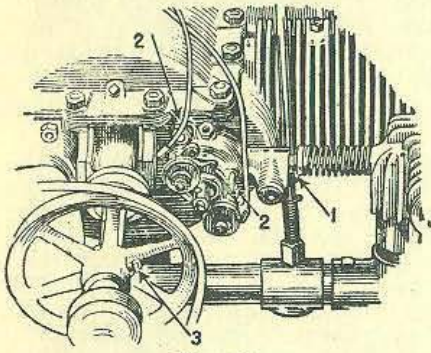


Fig. 23

IF PULLEY WHEEL RUNNING BELT THAT OPERATES FANS BECOMES LOOSE ON SHAFT it will cause the motor to heat, and it will begin to knock as well as lose its power. If not caught in time it will damage the motor on the inside. This should be watched carefully, as well as the oiler belt and pumps. Be sure that set screw in pulley that drives fans is always tight (Figure 23, Arrow 3). See that fan belt is tight enough to prevent slipping or coming off. If upon examination you find that the fan or oiler belt has been lost, a temporary replacement can be made by the use of a shoe string or a piece of rope.

PARAGRAPH 49.

IF BOXES BECOME LOOSE IN WHEELS they can be tightened up in the following manner:

Take wire nails 2 inches long and drive them in the wood surrounding the box half way between the box and the outside of hub at intervals of about every ½ inch, and if this does not tighten them sufficiently drive other nails in between the first ones. This is a very simple and effective repair and can be done most any place.

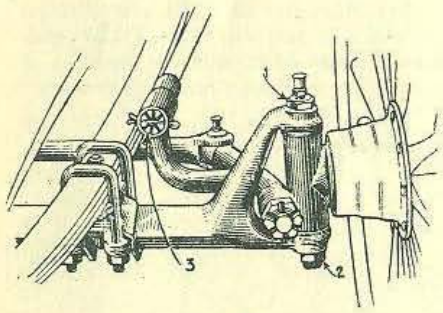


Fig. 30

PARAGRAPH 50.

STEERING KNUCKLES LOOSE. To adjust steering knuckles, tighten bolt on top of steering knuckles (Figure 30, Arrow 1) and lock in place by means of locknut and cotter pin on the lower end (Figure 30, Arrow 2). To adjust the ball and socket connection on the steering gear, remove the cotter pin and tighten up on the screw (Figure 30, Arrow 3) two or three turns, and replace cotter pin.

PARAGRAPH 51.

TIRES OPEN AT JOINTS. If the solid rubber tires open at the joints and the wires are not too loose, clean off the channel thoroughly, and then with a wooden mallet begin about 1½ feet back from the end of the tire and drive toward the opening with glancing blows until the two ends are driven up in place and meet. Then with a screwdriver pry underneath the tire and pour in some shellac about 2 feet each way from the joint on both sides of the tire, and let the tire set for two or three hours. Another remedy is to reverse the wheels by putting the right wheel on left side and the left wheel on right side.

PARAGRAPH 52.

BADLY WORN TIRES. Do not allow the tires to become worn too close to channels before replacing. This is not economy. If you do this you run the risk of cracking the channels, and the vibration will be so great that you will eventually spoil the running gear of the car. We can furnish new tires promptly.

PARAGRAPH 53.

WHEN WHEEL BEARINGS ARE DRY it will cause the wheels to turn hard, thereby consuming power and having a tendency to over-

heat the engine. Remove the wheels, clean out the boxes, bearings and spindle with gasoline until they are perfectly clean; then lubricate well with lubricating oil, Boston coach oil or medium hard grease. Do not use common axle grease.

PARAGRAPH 54.

BRAKES BINDING. This is usually caused by the brake cam shaft (Figure 31, Arrow 1) being dry or rusted and binding in the brake bracket. Loosen this by soaking well with kerosene oil; then see that it is kept lubricated. Another cause is fiber pad on the brake band being worn off (Figure 31, Arrow 2), allowing the cam (Figure 31, Arrow 3) which operates the two halves of the brake to travel too far and get on dead center when the brake pedal is applied. This in turn will prevent the brakes coming back in the natural position when the power pedal is released. Adjust brakes in the following manner: When the distance between the brake bands and the brake drum is more than ⅛ inch, disconnect the spring, which will allow you to spread the two halves of the brake; then remove the brake cam pads (Figure 31, Arrow 4) and on each one put a washer about 1-16 inch in thickness, replace pads and spring, slip the wheel on the axle, and revolve it by hand to determine if the wheel travels freely.

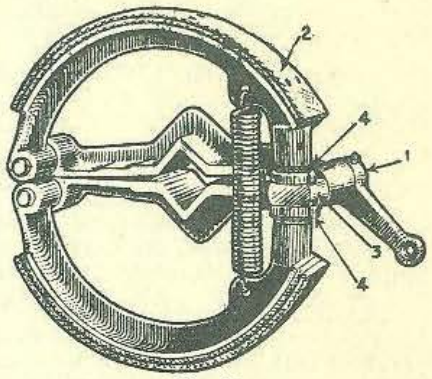


Fig. 31

BATTERIES WEAK. Indicated by misfiring, explosions in muffler motor hard to start, coil buzzing, coil dead. Follow instructions in Paragraph 10.

BATTERY TERMINALS LOOSE. Indicated by misfiring, motor hard to start, coil dead. Follow instructions in Paragraph 10.

BEARINGS TIGHT. Indicates no oil in the engine, use of poor lubricating oil, oiler or fan belt too loose or lost off. Read Paragraphs A and B, Oiling Instructions, and follow instructions in Paragraph 39.

BLACK SMOKE COMING OUT OF MUFFLER. Indicates feeding too much gasoline. Follow instructions in Paragraph 5.

BOXES COMING LOOSE IN WHEELS AND HOW TO TIGHTEN THEM. Follow instructions in Paragraph 49.

CAR WILL NOT TURN CORNERS FREELY. Indicates a broken internal pin, clutches adjusted too tight. Follow instructions in Paragraph 29.

CAR FAILS TO ROLL FREELY ON ORDINARY FLOOR WITH A LIGHT PULL. Indicates wheel bearings being dry, brakes binding, clutches adjusted too tight or dry, one of the internal pins on jack shaft being sheared off. Follow instructions in Paragraphs 53, 54 and 29.

CARBURETOR LEAKS. Indicates that there is dirt on the seat of the needle valve, which prevents the valve from closing. Follow instructions in Paragraph 6.

CARBURETOR CLOGGED. Indicated by misfiring, lack of power, motor hard to start, motor dies down and then picks up, overheating. Follow instructions in Paragraphs 7 and 9.

CARBURETOR WORKS ONLY WHEN FLOODED. Indicates that too little gasoline is being fed, that the gasoline does not run freely to carburetor, leak in intake manifold. Follow instructions in Paragraphs 8, 9 and 36.

CARBURETOR KEEPS FLOODING WHEN STANDING IDLE. Indicates that some foreign substance is preventing the float valve from seating properly, and shutting off the gasoline. Follow instructions in Paragraph 6.

CHAINS JUMPING. Indicates that clutches are too loose, too tight, or not adjusted the same on both sides; that the friction wheel is too far away from the fly wheel, internal pin is sheared off, chains are too loose. Follow instructions in Paragraphs 28 and 29.

CHAINS TOO TIGHT. Indicated by being obliged to push too hard on power pedal to make contact between friction wheel and friction disc. Follow instructions in Paragraph 28.

CLUTCHES SLIPPING. Indicates that they are not properly adjusted or are too oily. Follow instructions in Paragraph 29.

CLUTCHES TOO OILY. Indicated by clutches slipping, locknut on end of jack shaft cutting out, car fails to start easily when power is applied. Follow instructions in Paragraph 29.

CLUTCHES ADJUSTED TOO TIGHT. Indicated by power pedal jerking, chains jumping off, differential binding, which will cause a seeming lack of power. Follow instructions in **Paragraph 29.**

CLUTCHES ADJUSTED TOO LOOSE. Indicated by jerking of power pedal, chains jumping off. Follow instructions in Paragraph 29.

COIL NOT CLICKING ON EITHER OR BOTH SIDES. Indicates weak batteries, loose battery connections, poor timer contact, loose or broken timer wire, small vibrator spring being broken, timer wires short circuited, contact points rough or dry. Follow instructions in Paragraphs 10, 11, 13 and 14.

CONNECTING ROD BEARINGS BURNT OUT. Indicates insufficient oil, poor lubricating oil, oiler not working, poor carburetor adjustment, racing motor. Read Paragraphs A, B and C, Oiling Instructions, and Paragraphs 41, 4, 5 and 45.

CYLINDERS FILLED WITH CARBON DEPOSIT. Indicates use of poor lubricating oil, too much oil, irregular running of motor, poor carburetor adjustment. Read Paragraph A., Oiling Instructions, and Paragraphs 34, 4 and 5.

EXHAUST VALVE STEMS GUMMED UP WITH SOOT. Indicated by misfiring, motor hard to start, loss of power. Follow instructions in Paragraph 43.

EXHAUST VALVES PITTED OR WARPED SO THEY WILL NOT SEAT. Indicated by loss of compression, loss of power, misfiring, overheating, motor hard to start. Follow instructions in Paragraph 38.

EXHAUST VALVE FAILS TO OPEN ON RIGHT OR LEFT CYLINDER WHEN MOTOR IS RUNNING. Indicates that the cam is loose on the shaft, that one or more teeth are broken out of the cam gear, that shaft is loose in the timing gear. Follow instructions in Paragraph 42.

EXPLOSIONS IN MUFFLER. Indicate weak batteries, loose battery connections, loose primary wires, poor contact on timer, coil fails to work, vibrators not adjusted properly, platinum points pitted, switch key dirty. Follow instructions in Paragraphs 10, 11, 12, 13, 14 and 15.

EXPLOSIONS POP BACK IN CARBURETOR. Indicate a weak mixture caused by too little gasoline or too much air, weak inlet valve springs. Follow instructions in Paragraphs 4, 8 and 37.

FIBER PLUG IN END OF PUSH ROD WORN SHORT. Indicated by loss of power, misfiring, overheating, noisy valves, motor hard to start. Follow instructions in Paragraph 33.

FRICTION RING WORN DOWN TO IRON RING. Indicated by drag in car while motor seems to be developing its full power; a dull rumbling noise. Follow instructions in Paragraph 24.

FRICTION WHEEL OR PLATE BEING GLAZED TOO SMOOTH. Indicated by slipping between the friction disc and the fiber ring. Follow instructions in Paragraph 25.

FRICTION WHEEL HAS FLAT SPOT. Indicated by a knocking sound when power pedal is applied, which stops when power pedal is released and engine is running idle. Follow instructions in Paragraph 27.

FRICTION WHEEL TOO FAR AWAY FROM FLY WHEEL. Indicated by being obliged to push the power pedal too far forward before you make a contact, chains jumping off when you release the power pedal. Follow instructions in Paragraph 28.

GASOLINE NOT RUNNING FREELY TO CARBURETOR. Indicated by motor running well, then dying down and suddenly picking up again; dying down while running and coming to a stop, and after standing runs O. K. for a while longer. Follow instructions in Paragraph 9.

INTAKE VALVE BROKEN. Indicated by motor being hard to start, misfiring, loss of compression, engine works on only one cylinder. Follow instructions in Paragraph 44.

LOUD VIBRATING NOISE COMING ON ALL AT ONCE WHILE RUNNING ON ROAD. Indicates yoke that operates friction wheel is too dry, thrust bearings are too dry. Read Paragraphs B and C, Oiling Instructions.

LUBRICATOR RUNNING DRY. Indicated by hot motor, burnt out bearings, pistons seizing. Read Paragraphs A, B, and C, Oiling Instructions.

MAGNETO FAILS TO RUN CAR WELL, BUT BATTERIES WORK O. K. Indicates that armature is dirty, belt is slipping. Follow instructions in Paragraph 21.

MANIFOLD LOOSE OR LEAK IN MANIFOLD. Indicated by misfiring, overheating, engine being hard to start; when car is running on the road engine will die down and car act as though it were going to stop, and suddenly pick up again. Follow instructions in Paragraph 36.

MISFIRING. Indicates foul spark plug or plugs, too little gasoline being fet by carburetor, gasoline not running freely to carburetor, weak batteries, timer not making contact, timer dry and dirty, platinum contact points rough or dirty, coil not properly adjusted, vibrators on coil sticking, short circuit at timer, insulation on coil vibrator broken off or worn out. Follow instructions in Paragraphs 32, 4, 9, 10 11, 12, 13, 14, 15, 16, 17 and 18.

MOTOR DEVELOPS SUDDEN KNOCK ON THE ROAD. Indicates burnt out bearings. Follow instructions in Paragraph 41.

MOTOR SEEMS TO RUN RIGHT, BUT FAILS TO PULL THROUGH HEAVY ROADS OR UP HILLS. Indicates jack shaft not properly adjusted, making the distance between the fiber ring and the friction plate too great; clutches slipping, clutches too tight, too much pressure on power pedal. Follow instructions in Paragraphs 23, 28 and 29.

MOTOR KNOCKS WHEN CAR IS RUNNING ON ROAD, BUT DOES NOT KNOCK WHEN STANDING IDLE. Indicates flat spot in friction wheel. Follow instructions in Paragraph 27.

MOTOR RUNS STRONG, BUT CAR FAILS TO MOVE EASILY. Indicates clutches slipping, jack shaft not properly adjusted, leaving too much space between fiber ring and friction disc; brakes binding, wheel bearings tight or dry, chains too tight, fiber ring and friction disc oily or glazed. Follow instructions in Paragraphs 28, 29, 53, 54, 25 and 24.

MOTOR OFFERS NO RESISTANCE WHEN CRANKING. Indicates loss of compression. Follow instructions in Paragraphs 38 and 44.

MOTOR FAILS TO START EASILY WHEN COLD. Indicates poor gasoline, slow vaporization of gasoline. Follow instructions in Paragraph 1.

MOTOR DOES NOT CRANK FREELY. Indicates tight bearings, tight pistons. Read Paragraphs A, B and C, Oiling Instructions, and Paragraph 39.

MOTOR FAILS TO START EASILY. Indicates a dirty switch key or switch key not in place, weak batteries, dirty spark plugs, dirty timer, timer not making contact with cylinder, loose wiring. Clean switch key and insert it properly, and follow instructions in Paragraphs 10, 11, 12 and 32.

MOTOR VIBRATES BADLY WHEN RUNNING ON HIGH SPEED. Indicates that front or rear motor supports are loose or broken. Follow instuctions in Paragraph 46.

MOTOR RUNS IRREGULARLY. Indicates dirt or water in gasoline, gasoline not flowing freely to carburetor, weak batteries, timer not making good contact, loose wires, dirty spark plugs, dirty timer. Follow instructions in Paragraphs 4, 7, 9, 10, 12 and 32.

MOTOR KNOCKS SHARPLY WHEN RUNNING IDLE. Indicates a loose connecting rod; when this knock is heard, run your car slowly and tighten this connecting rod at the first possible moment. If you do not, you are liable to damage the motor beyond repair. Follow instructions in Paragraph 35.

MOTOR CONTINUES TO RUN AFTER PULLING OUT THE SWITCH KEY. Indicates a carbon deposit in the cylinders, which is holding heat and exploding gasoline; poor carburetor adjustment, too much space between exhaust valve stem and push rod, causing the motor to overheat. Follow instructions in Paragraphs 4, 34 and 33.

MOTOR LACKS POWER. Indicates too little gasoline being fed by carburetor, too much gasoline being fed by carburetor, carburetor clogged, weak batteries, timer not making contact with each cylinder, misfiring, too much space between exhaust valve stem and push rod, carbon deposit, leak in intake manifold, loss of compression, no oil in engine. Follow instructions in Paragraphs 4, 5, 7, 10, 11, 32, 33, 34, 36, 38 and 39.

MUFFLER BLOWING UP. Indicates weak batteries, loose wiring, dirty spark plugs, timer making poor contact, dirty timer, coil not working properly, sticking exhaust valve. Follow instructions in Paragraphs 10, 32, 11, 12, 15, 16, 17, 18, 13, 14 and 43.

OILER OR FAN BELT TOO LOOSE. Indicated by hot motor. Follow instructions in Paragraph 48.

OVERHEATING. Indicates too little gasoline being fed by carburetor, weak batteries, timer not making contact with each cylinder, wrong adjustment of friction wheel and friction plate, clutches not propery adjusted, misfiring, too much space between exhaust vave stem and push rod, carbon deposit, leak in intake manifold, poor compression caused by leak, exhaust valve gummed up with soot, accumulation of dirt packed on cylinders, spark lever retarded, fan belt loose or lost off, large pulley operating fans loose on shaft, oiler belt loose or lost off. Read Paragraphs A, B and C, Oiling Instructions, and Paragraphs 4, 5, 10, 11, 28, 29, 32, 33, 34, 36, 38, 39, 43, 47 and 48.

PORCELAIN ON SPARK PLUGS CRACKED. Indicated by motor hard to start, misfiring. Follow instructions in Paragraph 32.

POWER PEDAL JERKS. Indicates that clutches are adjusted too loose, too tight or unequally; internal pin sheared off, chains too tight. Follow instructions in Paragraphs 28 and 29.

POWER PEDAL MOVES TOO FAR AHEAD. Indicates that the distance between the friction ring and the friction plate is too great. Follow instructions in Paragraph 28.

POWER PEDAL JERKS BADLY WHEN PULLING OUT OF HARD PLACE. Indicates that the speed lever is too far forward for a hard pull. Change position of speed lever to a point which will make the contact between the fiber ring and the friction disc nearer the center. Keep heel of foot which applies the power planted firmly on floor when starting car.

SLOTTED NUTS ON END OF JACK SHAFT CUTTING OR RUNNING HOT. Indicates clutches are too oily and slip. Follow instructions in Paragraph 29.

SPARK PLUG POINTS ADJUSTED TOO CLOSE. Indicated by misfiring. Follow instrustions in Paragraph 32.

SPEED LEVER TRAVELS. Indicates that the motor is either too high or too low. Follow instructions in Paragraph 30.

SPEED LEVER DOES NOT TRAVEL FREELY. Indicates that the jack shaft needs oil at the point where the friction wheel slides, and also where the end of the bell crank slides in the yoke on friction wheel. Read Paragraph C, Oiling Instructions.

STARTING CRANK SLIPS OFF EASILY. Indicates that the slot in the starting ratchet is worn so badly that it will not hold the pin. Follow instructions in Paragraph 3.

TIMER THROWS A SHOWER OF SPARKS WHEN THE TIMER PIN COMES IN CONTACT WITH THE DISCS. Indicates that the timer is dry and dirty, platinum points on coil are dirty or not properly adjusted, vibrator spring is broken or adjusted too tight. If vibrator spring is broken, replace with a new one. Follow instructions in Paragraphs 12, 13 and 14.

TIMER PIN WORN SHORT. Indicated by misfiring, motor hard to start, explosions in muffler. Follow instructions in Paragraph 11.

TIMER WIRES SHORT CIRCUITED. Indicated by vibrators on coil staying down, and when an attempt is made to force them op they will offer resistance, cause sparks and give a buzzing sound. Follow instructions in Paragraph 16.

TIRES WORN TOO CLOSE TO CHANNELS. Follow instructions in Paragraph 52.

TIRES OPEN AT JOINTS. Follow instructions in Paragraph 51.

VIBRATORS ON COIL STICKING. Indicated by vibrators failing to click, misfiring. Follow instructions in Paragraphs 16, 17 and 18.

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