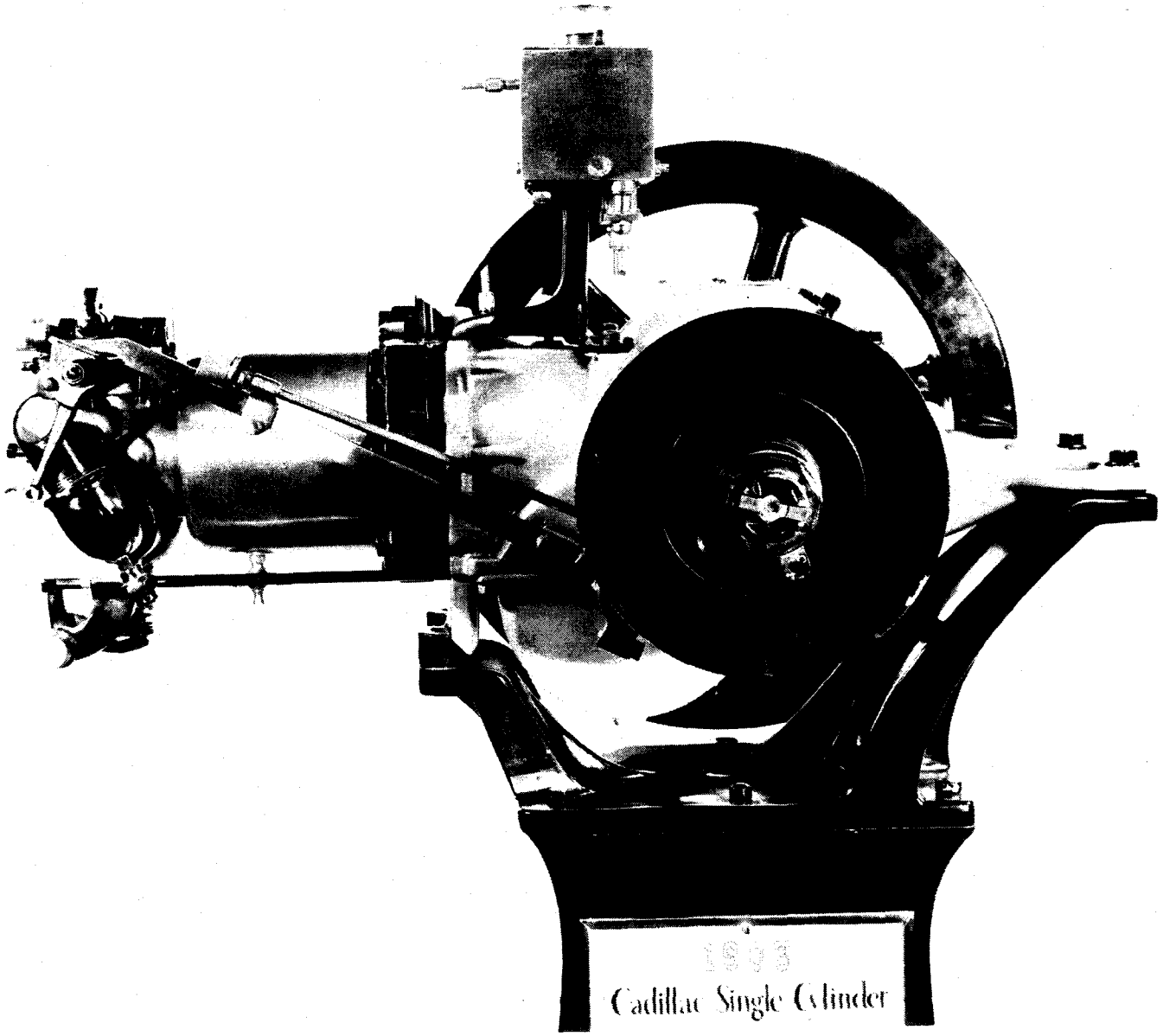
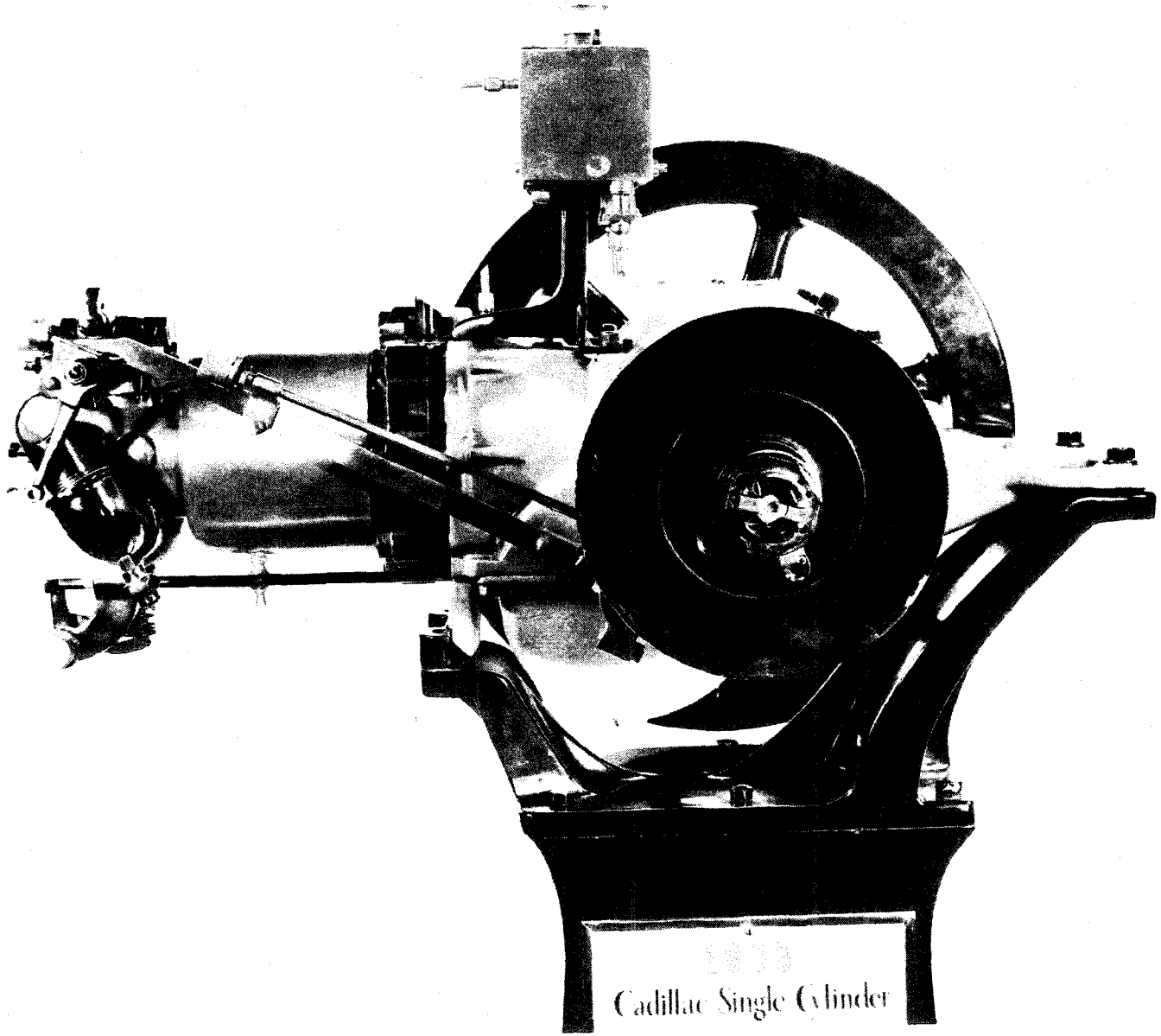


1903
Cadillac Single Cylinder



Cadillac Single Cylinder

1903

CADILLAC

LA MOTHE CADILLAC

FIRST EDITION

NUMBER THREE

CADILLAC AUTOMOBILES

THEIR USE AND CARE

A BOOK of Instructions useful to drivers and caretakers of SINGLE CYLINDER CADILLAC Automobiles. Containing also some information intended especially for the repair man and for owners who are mechanically inclined. The contents of this book have been arranged so that the illustrations and instructions necessary to the successful operation of a CADILLAC may be easily understood

PARTS AND REPAIRS

To the Owner:

To avoid unnecessary delay and useless correspondence PARTS FOR REPAIRS should, where possible, be ordered from the dealer from whom machine was purchased or from nearest local Cadillac dealer who is generally in a position to know what is desired and how to order it. (If he is not we should like to know it).

With nearly or quite ten thousand Cadillac automobiles in use it is obviously impractical for us to deal direct with all Cadillac owners. We cannot open accounts with or sell at a discount to any except regular dealers with whom we make annual contracts. Where conditions are such as to, in our judgment, warrant it we will fill orders for parts at prices listed in our parts catalogue f. o. b. factory ***providing Cash accompanies the Order.***

In case orders are sent under above conditions we must have motor number, and model of machine with correct description, name and number of the part, as per price list of parts. If these are not procurable return the part properly tagged, *charges prepaid*, (or it will not be accepted), a special letter of instructions written and return instructions given. Otherwise we cannot promise prompt service or an intelligent fulfillment of the order.

Our responsibility in all cases ceases with delivery to the transportation company.

To Cadillac Dealers:

We prefer to transact all our business through our regular dealers with whom we have contracts. However, in order to give Cadillac owners more prompt service we are willing to open accounts with sub-dealers in your territory with your guarantee and consent. It is our desire to protect our dealers as well as the owner and for this reason have adopted the above policy.

Broken parts must invariably be sent to us transportation charges *prepaid* for examination before any claim will be allowed. The new parts will be charged for, and if any allowance is made credit will be given for old parts if returned within 30 days.

Above instructions to owner relative to ordering parts must also be followed.

CADILLAC AUTOMOBILE COMPANY.

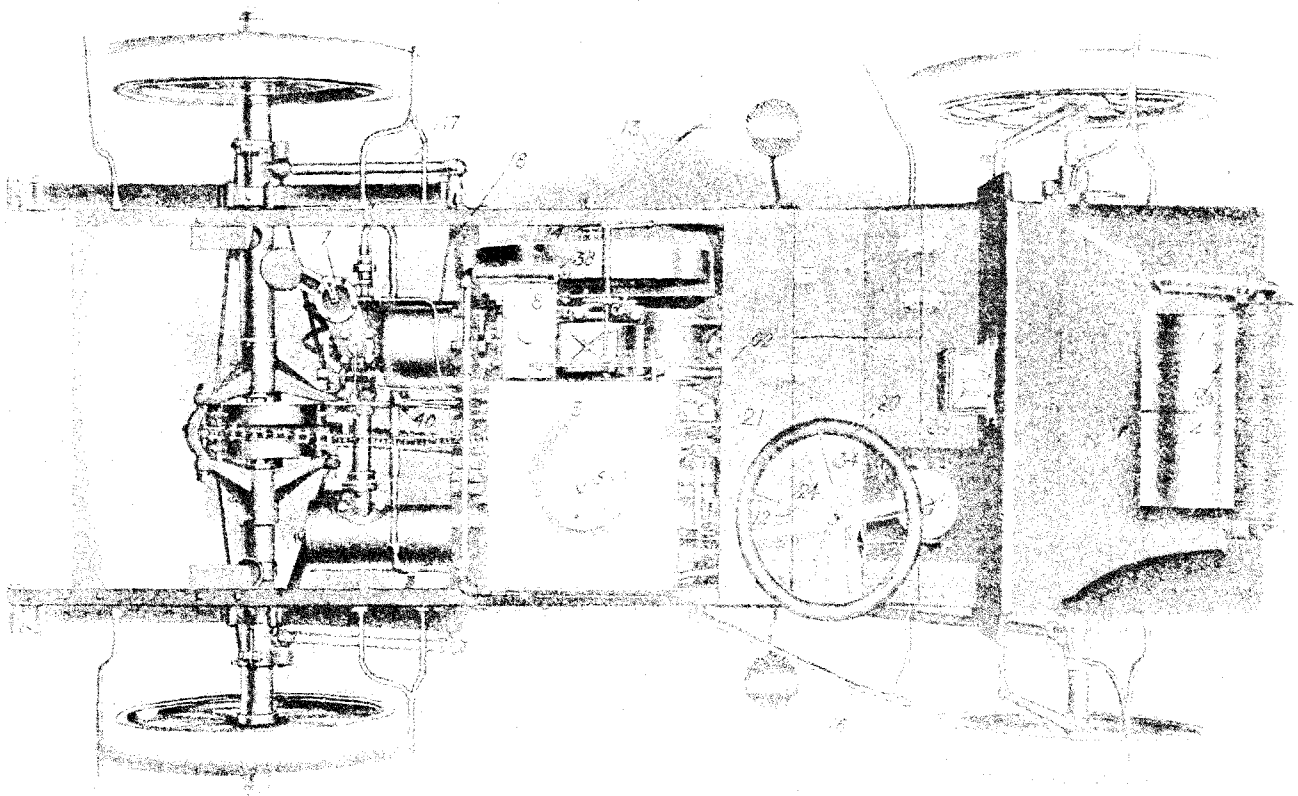


Figure 1

WHAT TO DO TO A NEW CAR

In the care and operation of an automobile much detail must be left to the judgment of the operator. It will suffice to say, however, that at all points where one part moves or works upon another, there is more or less friction, and these parts require occasional oiling. Springs, radius rod ends, and shackle joints may last indefinitely without oil, but to avoid disagreeable squeaking and grinding, and to insure more freedom and longer life, one can well afford to give such parts the little attention they require.

Raise hood cover and fill water tank (Fig. I). To do this remove plug (2) in top of tank (1), insert funnel and fill with water. In freezing weather use some good anti-freezing solution. In filling tank first time or after water system has been drained, open cock (38) in end of stand pipe at side of lubricator. To get at this cock remove front cushion on left side and raise seat panel. **Be sure** to close cock (38) after tank is filled.

Take out cushion on right side front seat, raise seat panel, remove plug (5) in gasoline tank (3), insert the funnel and fill with clean gasoline, straining the gasoline through a screen, or preferably, a chamois skin in the funnel, and then replace the gasoline and water filling plugs (5 and 2, Fig. 1), screwing them in firmly, but not too tight. See that the gasoline valve (6) is open and that gasoline flows freely to Carburetor (7) by pressing down with the finger the primer (17, Fig. 1 and 3) until the gasoline flows out of the bottom of the Carburetor.

After a motor has stood some hours, or long enough to have entirely cooled down, the primer rod may be pressed down until the gasoline flows out of the intake tube before trying to start. However, if a motor has just been stopped or has stood only a short time, it will usually start without priming. If it does not it should be primed, but only for a few seconds. Holding down the primer until the gasoline flows out would on a warm motor make it necessary to turn the motor over the compression possibly three or four times, as the first charges would be too rich in gasoline vapor to be explosive.

See that oil cup (8, Fig. 1) is full and feeds about 15 to 20 drops per minute. (No exact rule for oil feed can be given—too much oil is indicated by blue smoke from exhausts.) This cup, which also feeds the main bearings, is of the utmost importance (see Fig. 13, page 27).

Oil the transmission (49, Fig. 4) through the oil hole in the flange between it and the small driving sprocket (33) with about half pint of heavy lubricating oil at least as often as once per week. In cold weather a lighter oil should be used.

The steering gear should be oiled occasionally at the top and bottom of the steering post (45, Fig. 1), also on the rack (46, Fig. 3).

The wheel knuckles are oiled at 47 and 48, Fig. 4.

Radius rods (50, Fig. 4) should be oiled at both ends.

See that all grease cups (39, 40, Fig. 4, and 43, Fig. 4), are filled. The cups 39, 40 and 43 should be given a turn every two or three days. A small amount of powdered

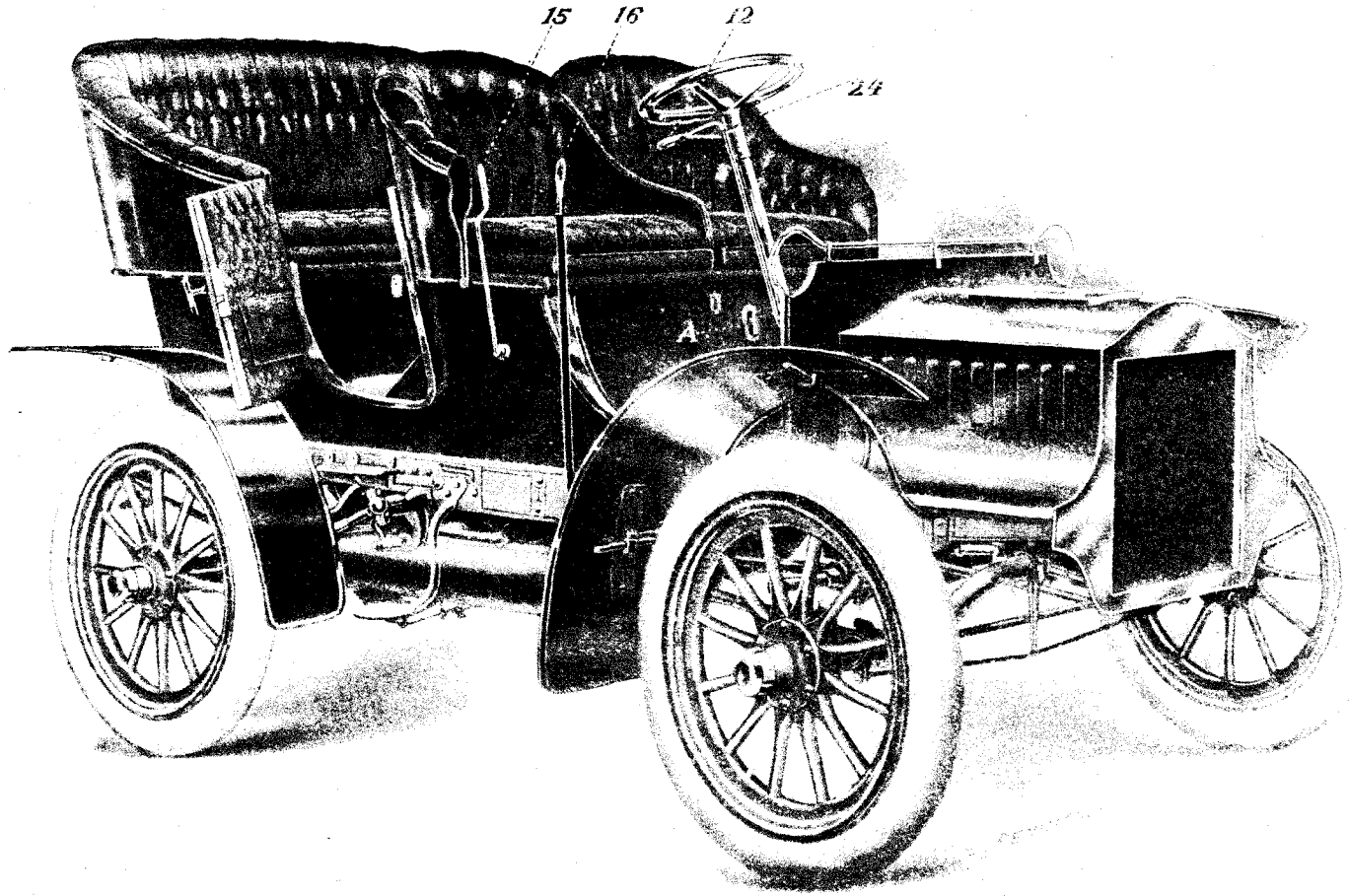


Figure 2

graphite mixed with the grease adds materially to its lubricating qualities and to the life of the lubricant, and also gives it more body for resisting the heat.

TO START THE MOTOR

First. Push the throttle lever (12, Fig. 2) to extreme left.

Second. Turn switch handle (A, Fig. 2) up.

Third. Push spark lever (15, Fig. 2) way back.

Fourth. See that controlling lever (16, Fig. 2) is neutral.

Fifth. Insert starting crank (13, Fig. 1) in end of shaft (14, Fig. 1), turn crank (in direction indicated by arrow under fly wheel (Fig. 3) until the compresson is felt to resist further motion, then turn the engine quickly over compression once. If engine fails to start, "prime it" by pressing down rod (17, Fig. 1) until gasoline flows. If the motor fails to start after the third or fourth time over compression there is some good reason. Cranking at random is a useless waste of energy.

Make sure that spark lever is way back, that switch is turned on to connect with battery and that you can hear vibrator "buzz" every time engine goes over compression. The contact points may be dirty or burned or it may need adjusting. A weak battery will cause vibrator to give less movement than is desirable. See if battery wires and all electrical connections are properly and securely adjusted as per instructons on page 24. See that spark plug is clean and that the battery will carry a hot spark across the opening between the wire points. This opening should be from 1-64 to 3-64 in., according to strength of battery. To obtain good results with a weak battery you must make the opening between the wires less than when battery is developing full strength. Be sure controlling lever is neutral and that engine turns easily. No gasoline or internal combustion motor of any type can start under a load.

In extreme cold weather gasoline motors are sometimes hard to start and require more generous "priming" than in moderate temperature. It may be necessary to saturate a handkerchief with gasoline and hold in the hands a few seconds, then place over or in the intake air pipe. This warms the mixture and aids in starting a cold motor on a zero morning. It is usually unnecessary to "prime" a motor unless it has been standing idle for an hour or more. Too much priming will make too rich a mixture and necessitate unnecessary cranking.

After the motor has been started, turn the handle (A) horizontally in either direction, turning off one battery, but leaving the oil turned on. The oil is off only when the handle is down. Push the throttle lever (12) under the steering wheel to the extreme left, just before stopping the motor, which is accomplished by turning the handle (A) down.

"A FEW DON'TS"

Don't try to start without the switch turned on.

Don't try to start without seeing that the spark lever (15, Fig. 2) is way back.

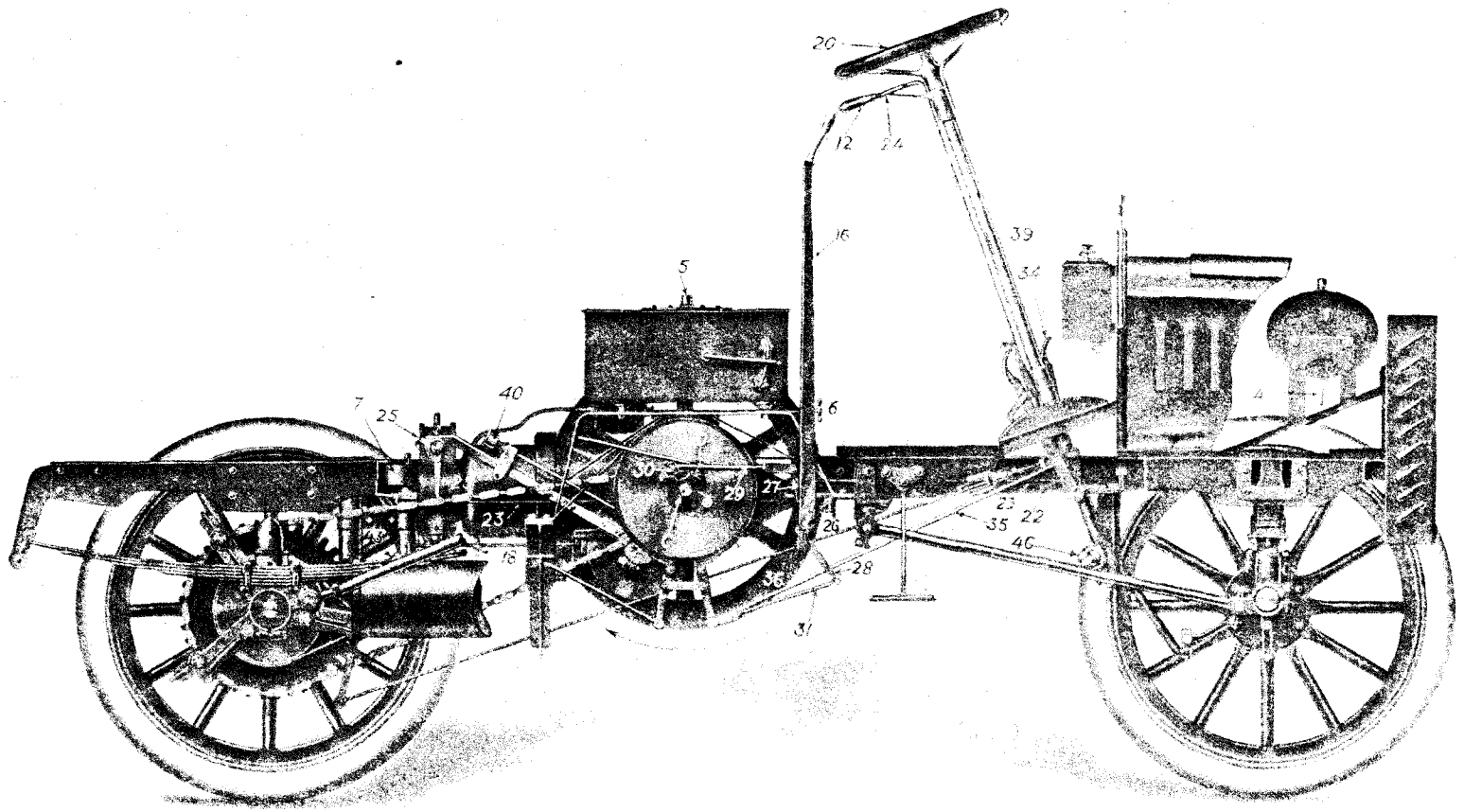


Figure 3

SECTIONAL VIEW

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

Don't crank a motor, that is, don't turn it over the compression more than three or four times after priming. If it does not start at once there is something wrong. See page 12 on common sources of trouble.

Don't drive fast nor attempt to stop quickly on a wet, slippery road or pavement.

Don't allow an automobile to stand in cold weather with pure water in the circulating system. It will freeze and burst something. In cold weather use some good anti-freezing solution.

Don't run a motor fast when the automobile is standing still; there is no worse abuse.

Don't use slow speed lever for brake, you may break your crank shaft.

Don't advance spark lever too fast or too far (crank shafts can be broken by injudicious use of spark advance).

Don't throw high speed lever (No. 16) forward **before** low speed lever (34, Fig. 3) is released or vice versa, or a broken crank shaft may result.

TO INSPECT THE CADILLAC

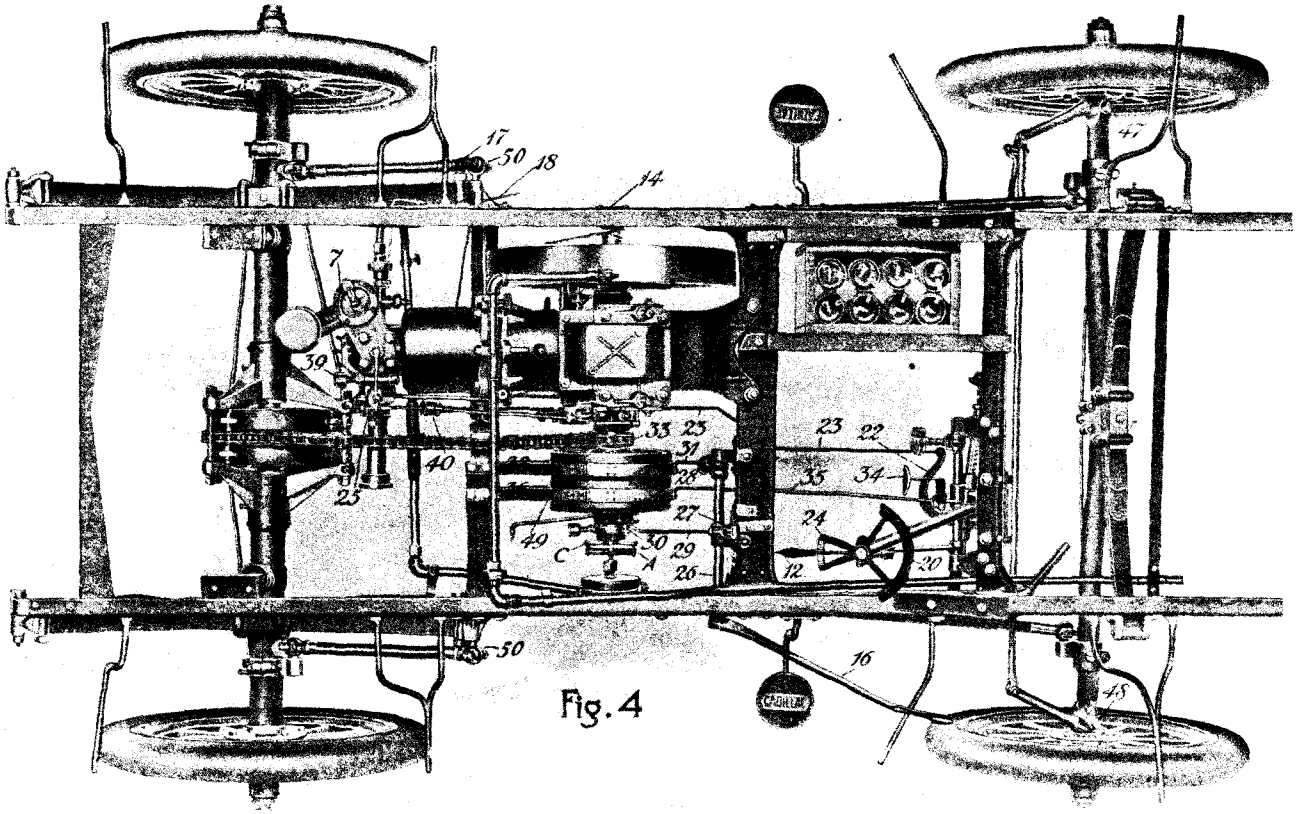
All parts of the motor must work easily. Valves must be tight when closed, giving good compression. The spark must be good and timed to give the explosion at the proper point. The carburetor must allow a flow of gasoline when the primer is held down (17, Fig. 1) and must stop the flow when it is released. The carburetor valve must have the proper amount of lift to give the right mixture when running. (See Fig. 10, page 20.)

To see that the parts are working properly as outlined above, proceed as follows:

Open the cylinder drain valve (18, Fig. 3) so as to release the compression, then put the controller lever (16) in its neutral position, about half way between the ends of its travel. Now, by inserting the starting crank in the end of starting shaft (14) the motor should turn with very little resistance. Close the valve (18); the motor should turn as easily as before, except on the compression stroke, when throttle is wide open, which should give a considerable resistance to the turning of the starting crank. When the handle (A, Fig. 2) is turned up, and the spark lever (15) is moved toward the back of the seat, the spark should occur just after the end of the compression stroke of the piston. That is, just as the resistance of the compression on the starting crank has stopped, the sound of the vibrator (39, Fig. 3) on the coil should commence. If no sound of the vibrator can be heard when turning the motor over slowly by hand at the end of each compression stroke, the electrical outfit should be inspected separately. See electrical explanation (Fig. 5, pages 24 and 25).

SUGGESTIONS FOR OPERATING

The speed of the motor is controlled by either or both of two methods. An examination of cuts (Figs. 1, 3 and 4)


17
50
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34
24
12
20
50
16
45

Fig. 4

will show how the throttle lever (12) just under the steering wheel (20) extends down below the floor (21) and ends in an arm (22) which is connected to the rod (23, Fig. 4) so as to move the rod (23) endways as the lever (12) is shifted in its quadrant (24). Trace the rod (23) back and it will be seen to engage the throttle cam (25) at its rear end in such a manner that the throttle cam (25) is shifted by any endwise movement of the rod (23).

The shifting of the cam (25, Fig. 3) increases or decreases the size of the opening into the cylinder through which the explosive mixture of air and gasoline must pass, thereby increasing or decreasing the amount of the charge which, of course, has a corresponding effect on the speed and power of the motor.

The other method of controlling the speed and power of the motor is to change the time of igniting the compressed charge of gasoline and air. Three simple facts should be remembered in connection with this timing of ignition.

First: The lever (15, Fig. 2) must be as far back as possible in starting the motor to give a late spark and avoid an explosion that will throw the crank in a **reverse** direction.

Second: The faster the motor runs the farther forward the lever (15) may be placed, giving an earlier spark.

Third: When the motor is slowed down on a hill or a bad road it will pull better and is less liable to be stopped by an overload if the lever (15) is kept farther back than at high speed. To keep this lever as far forward as possible **without** making the motor **pound** or **jerk** means a greater amount of power for a given amount of gasoline.

Figs. 3 and 4 show the method of engaging the different gears. The controlling lever (16) is attached to the controller shaft (26), which has attached to it two arms (27 and 28). Arm 27 has attached to its end a rod (29) which engages and controls the high speed clutch (30). Arm 28 has attached to its end a rod (31) which engages and controls the reverse brake band (32). If the controlling lever be moved forward, the arm (27) and rod (29) cause the high speed clutch to lock the transmission gearing all together so that it revolves with the motor shaft and acts as an additional fly wheel, carrying with it the driving sprocket (33).

It will thus be seen that when the automobile is being driven with the high speed gear in operation, there are no gears running and no loss of power between the motor and the ground except the friction of the chain and rear axle.

If the controlling lever (16) be moved back, the high speed clutch releases, leaving the motor free to run without driving the automobile. This is the neutral position. If the controlling lever be moved still further back it is evident that the rod (31) attached to the arm (28) will be drawn forward and by its engagement with the reverse brake band (32) will close the band upon its part of the transmission gearing. When that part of the transmission gear within the reverse brake band (32) is prevented from turning, the sprocket (33) must turn in the opposite direction from that of the motor, but at a slower speed. It is

apparent that the band (32) may be made to clasp its part of the transmission gearing more or less closely, allowing more or less slip.

A slow speed or hill-climbing gear is provided and works as follows (shown in Figs. 3 and 4).

If the controlling lever (16) be in the neutral position, that is, with both the high speed clutch and reverse brake band released, and the slow speed foot pedal (34) be pushed forward it moves with it the attached rod (35), the other end of which engages the slow speed brake band (36) which, when moved forward by the pedal (34), closes the slow speed brake band (36) upon its part of the transmission gearing. When the part of the transmission gearing clasped by the brake band (36) is prevented from turning, the driving sprocket (33) must revolve in the same direction as the motor shaft, but at a slower speed.

COMMON SOURCES OF TROUBLE

1. Inadequate lubrication.
2. Imperfect vibrator action. The vibrator (39) can be seen by taking top off the coil box.
3. Dirty spark plugs.
4. Exhausted batteries.
5. Loose or broken wires.
6. A weak commutator spring.
7. Tight brake bands or any imperfect adjustment.
8. Dirty gasoline.
9. Water in the gasoline.
10. Frozen circulating water.
11. Lack of circulation of water.
12. Charred or sticky valve stems.

Common sources of troubles do not include accidents, and such things as may be termed occasional or accidental troubles, so that in dealing with common sources, remember that the difference between a comprehensive understanding of your automobile and the superficial knowledge possessed by many owners and drivers is the difference between having troubles and annoyances and not having them. Familiarity with a machine does not call for special mechanical ability, only a careful study of the directions and explanations contained in this book, and a common sense application of them to your automobile.

Of the common sources outlined above, the first, inadequate lubrication, is by far the most detrimental, as it may ruin all of the most important wearing surfaces of the motor. Use the utmost care and vigilance to see that the sight feed oil cup (8, Fig. 1) is feeding about 20 drops per minute on a new machine. This feed may be reduced to about 15 drops after a few weeks use.

Of equal importance are the two feed pipes (M2-M4, Fig. 13) which lubricate the main shaft bearing. See page 27, Fig. 13.

Next in importance is the transmission gear which should have about half a pint of heavy oil every three or four hundred miles of use. This rule applies to average

conditions. If used on hilly, muddy or sandy roads where the hill-climbing gear is used much, one hundred miles might be far enough on one oiling, although that would mean exceptionally severe conditions.

After these come the minor oiling points that need attention occasionally, say from two days to a week, depending on conditions of use.

Referring to Fig. 4, the most important would be the high speed clutch (30). There are two clutch rings here that do not revolve, and that bear against the clutch disc on one side, and against the adjusting nut on the other, having a race of balls at each side which should have a little oil occasionally.

The three grease cups (40 and 43, Figs 3 and 4 and 39, Fig. 4) and the rolls which operate the inlet valve at (25) should have occasional attention. This makes a total of only nine places to oil on both the motor and the transmission gears. Remember that a properly oiled and adjusted motor may be turned by one finger against a spoke of the fly-wheel.

Troubles Nos. 2, 3, 4, 5 and 6 will all give the same symptoms; uncertainty in starting, skipping of explosions and irregular action when running.

The least liable to occur and the easiest to discover is (6) a weak or broken commutator spring. Stand on the left side of the car and look under the side of the body through the fly-wheel and the commutator and its action can be plainly seen.

Spark plugs that have become sooty from excess of oil and long use, or that have the sparking points too far apart, must be removed, and if dirty, replaced by clean ones; or if the gap is too wide, the wires (1 and 2, Fig. 5) should be bent until there is a space between them of from 1/64" to 1/32", or a little more than the thickness of an ordinary card. Dirty spark plugs may be made as good as new by removing the mica cores and cleaning them thoroughly with sand paper.

When the vibrator contact points become worn, so that the vibrator action is not uniform, they should be smoothed off.

Troubles Nos. 4 and 5 must be discovered by inspection. In a motor well cared for, and properly adjusted so as to turn easily, nearly all failures to start promptly and run regularly are electrical. If, after inspecting the wiring switch, commutator and spark coil, and being sure that the spark plug is clean and the points not too far apart, the motor misses explosions, the trouble is probably due to weak batteries, and these should be replaced with new ones immediately, as from this time on they will deteriorate very rapidly and finally refuse to give any spark whatever. Batteries usually give ample warning of their weakening by the symptoms already described. This trouble is liable to deceive the operator, since the motor will nearly always start readily, but will miss explosions and will probably stop; then after a time the motor will start as before. This is because of the batteries having temporarily recuperated during the rest. This trouble can be temporarily relieved by turning handle (A Fig. 2) up, which connect **both** batteries. By this method you have temporarily increased the

efficiency of your battery. However, the battery from now on is necessarily short lived, and should be replaced at the earliest opportunity.

The true condition of the batteries can only be determined by the use of an amperemeter. These electrical instruments are small and inexpensive, and indispensable when purchasing new cells, since new cells of this nature deteriorate rapidly even though not in use. New cells will register from 12 to 16 amperes, which will gradually become weaker from use. When the ampereage falls below about 8 the cells should be renewed.

Do not waste time and patience cranking a motor, for if in proper condition it will start as surely and run as regularly as a locomotive. The conditions necessary are easily understood and quickly attainable.

No. 7. A motor which when turned over for starting shows good compression, gives one explosion and fails to go far enough to get a second explosion, may be out of adjustment. There is too much friction somewhere, usually in the adjustment of the high speed friction or the friction bands around the transmission case.

Nos. 8 and 9. The motor is provided with a settling chamber or dirt trap in the gasoline pipe just before it reaches the carburetor. This will arrest a limited amount of fine sediment, for should too much dirt find its way into the gasoline tank it may either stop up the pipe or carburetor valve.

The cover of the carburetor may be removed by taking out the four screws that hold it in place and the dirt washed out. By removing the settling chamber also, gasoline may be poured through the carburetor backward to make sure of absolute cleansing. This trouble, with ordinary care, ought never to be met with, but is easily discoverable, either by a continuous flow of gasoline from the bottom of the careburetor when the motor is not running, or a failure to flow when the priming rod projecting from the bottom of the carburetor is held up as far as it will go. Do not readjust the carburetor after it has been right until you are sure it is clean. The adjustment will not be altered by the removal of the cover.

Nos. 10 and 11. Always be sure that you have water in the circulating system, and if the weather is cold see that the pump is not frozen, by trying the pump driver (A, Fig. 4) and see that the pump spindle turns freely **before** starting the motor. Otherwise, if you have no anti-freezing mixture, and the pump has frozen, you may break the blades inside loose from the shaft. Of course some mixture to prevent freezing **must** be used in cold weather.

No. 12. One of the most annoying troubles, and sometimes the most difficult for an amateur to locate, is a sticky exhaust valve stem, causing the valve to stay off the seat and thus lose all the compression, or seat so slowly that the motor will start but not run up to speed. This seldom occurs unless a great excess of oil has been used in the large cup, causing it to work back through the combustion chamber and burn on the exhaust valve stem. This trouble can be quickly and easily remedied by taking off the spark plug cap and working the valve by hand, using kerosene or gasoline to wash the thick oil off the stem.

EXPLANATION OF MOTOR

The following is an explanation of our four cycle motor. The cuts (Figs. 6, 7, 8, and 9, pages 16 and 17) show the correct timing of the valves. The same letters refer to the same parts in the different cuts. The piston travel indicated by the white space shown on cylinder is five inches.

Fig. 6 shows the beginning of the first or suction stroke of the cycle. At 1/16 inch past the center the inlet valve (A) commences to open, which allows the vapor supplied by the carburetor (Fig. 10) to be drawn into the cylinder, the motor running as indicated by arrows. During this stroke the exhaust valve (B, Fig. 6) is closed. The inlet valve (A) is opened by the eccentric rod (C), its movement being controlled by the eccentric on the secondary shaft (D). This shaft is driven one-half the speed of the motor by the two to one gear (E) and pinion (F).

The way this inlet valve (A) controls the speed and power of the motor is taken up in Fig. 10 and the accompanying explanation.

Fig. 7 illustrates the beginning of the second or compression stroke at the closing point of the inlet valve, both valves being closed during this stroke.

The piston, traveling as indicated by the arrow, compresses the charge, which is ignited at or before the end of this stroke by the spark plug (see electrical explanation), and drives the piston forward to the position as in Fig. 8.

During these two compression and working strokes both valves (A and B) should be closed.

Fig. 8 illustrates the end of the third or working stroke of the cycle where the exhaust valve commences to open 5/16 inch before the center. During the fourth or exhaust stroke the gases are expelled from the cylinder through the valve (B). The exhaust valve (B) is operated by the cam (1) which pushes the exhaust rocker arm (J) and lifts the exhaust valve (B).

Fig. 9 shows the position when the exhaust valve (B) has just closed just 1/32 inch past the dead center. The inlet valve (A) will open 1/32 inch later, admitting new vapor as in Fig. 1.

HOW TO SET CADILLAC VALVES

To set the valves after the shaft has been removed, proceed as follows: First, turn the crank shaft so that the center of the crank pin will be in the same horizontal plane with the center of the crank shaft, having the crank pin at the same time extending back toward the cylinder of the motor. By referring to Fig. 9 on page 17, you will see that the crank pin is in very nearly the position suggested above; although the crank pin must be dropped a little lower than shown on the cut, to bring its center in the same horizontal plane as the center of the crank shaft. Then mesh the valve gears so that the commutator key, which is in the end of the commutator shaft, will be in a vertical position, and will point either directly up, or directly down, when the crank pin bears the relation to the crank shaft above specified. Use special care to make

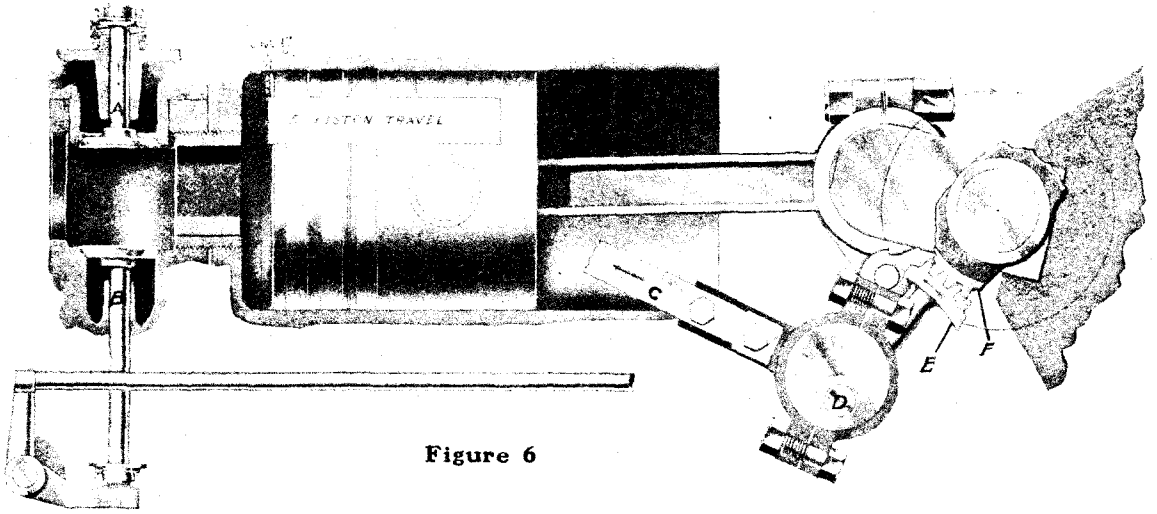


Figure 6

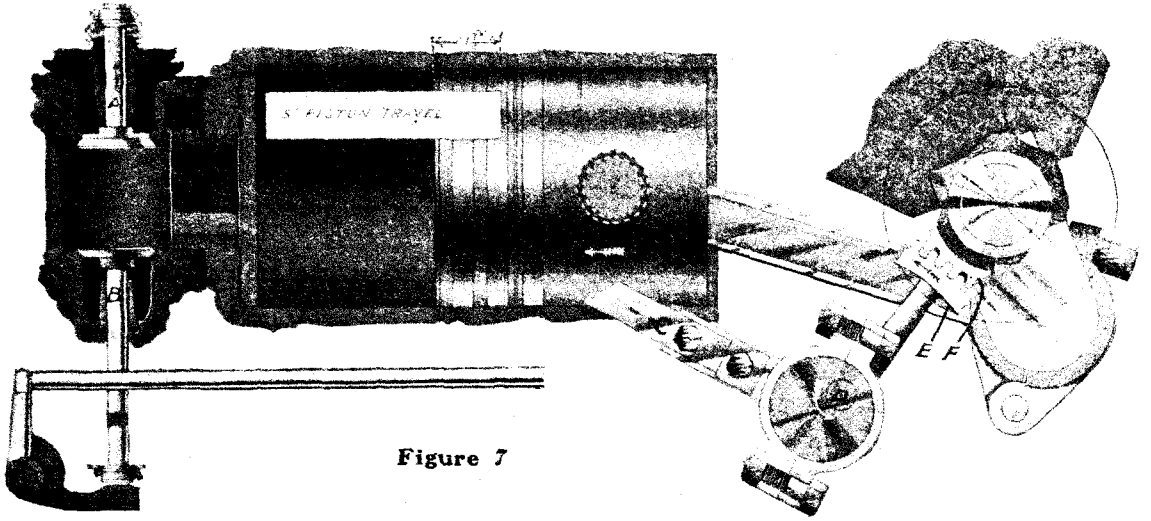


Figure 7

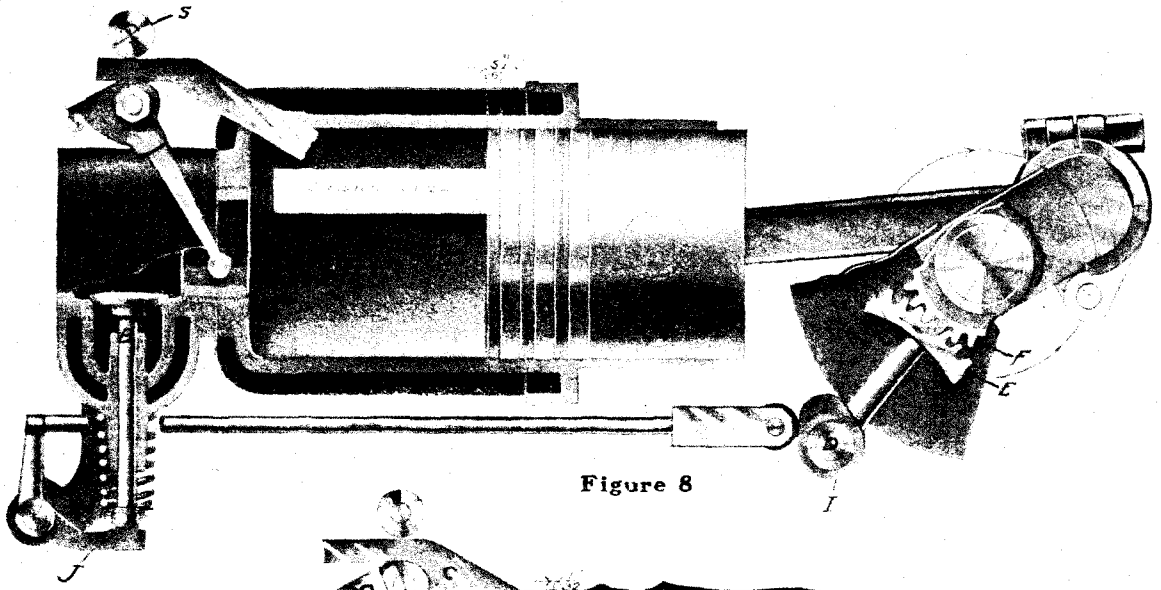


Figure 8

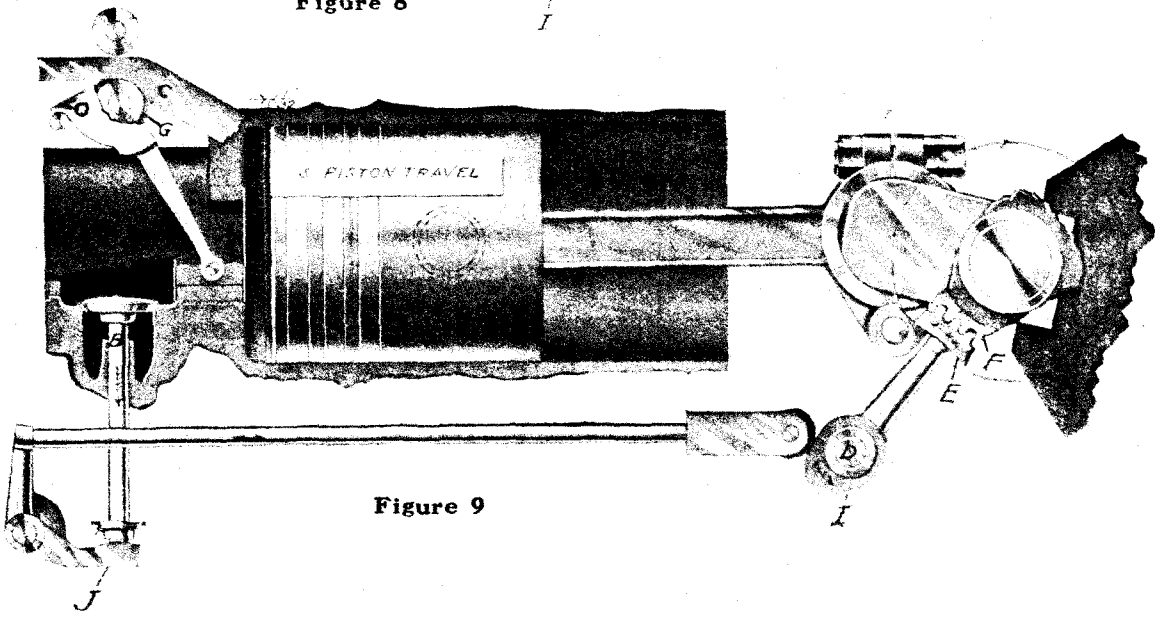


Figure 9

sure that this commutator key is practically vertical, and that it is not standing one tooth away from the vertical position.

After setting the cam shaft according to the above instructions it will be necessary to make a test to make sure that the cam and crank shaft gears are meshed correctly. This can be readily done by inserting the round exhaust push rod. Next put in the exhaust bell crank and pin, which form the connection between the valve stem and push rod. After this has been securely fastened it will be necessary to move the fly wheel forward. Take hold of the exhaust push rod which will turn freely except when performing its duty of lifting the exhaust valve. Move the fly wheel slowly forward and turn the exhaust push rod at the same time. Take care to detect the instant the exhaust push rod begins to bind. This position is termed the opening of the exhaust valve, as a valve in this position will be opened with the slightest movement of the fly wheel. To make sure that the motor has not been turned past the point desired, insert the fingers in the spark plug hole and see that the exhaust valve is on its seat and does not turn freely.

Next insert a rule allowing it to bear firmly on the piston. Without removing the measuring device move the fly wheel forward and note the distance the rule has traveled. This, on a new engine would be 5/16 of an inch (as shown in Fig. 8, page 17), but if the engine had been running for some time the valves would be expected to be slightly out of time. In this event, the exhaust would be opening ⅛ or 1/16 of an inch instead of 5/16.

Next, it will be necessary to time the closing of this valve. Continue the movement of the fly wheel until the exhaust push rod begins to loosen, making sure that the exhaust push rod bears slightly on the valve mechanism and that the valve does not twist on its seat. This we call the closing of the exhaust valve, as a valve in this position has just closed.

Next, insert the rule and back up on the fly wheel and note the distance that the piston pushes the rule, which should be 1/32 of an inch. On an engine that has been run long, the valves would probably be closing on dead center. To recover the time lost by the slight wear of the valve mechanism, it is necessary to remove the exhaust push rod and pene (stretch) in the center. This will lengthen the push rod slightly and give the timing the engine originally had. If, in trying to determine the opening or closing of a valve the fly wheel has been turned too far, back up and begin over again as the back lash must always be out the way the engine is running. If a valve is opening too early and closing too early, or opening too late and closing too late, it is a sure indication that the cam shaft gear does not bear the proper relation to the crank shaft, and this gear must be turned one tooth in the proper direction and retested before any satisfactory results can be obtained.

When timing the inlet valve, disconnect the throttle cam rod, and with the right hand hold the throttle cam

open and down as it would be when the throttle is wide open. Turn the fly wheel in the direction the motor runs until the inlet lever roll (S, Fig. 10, page 20) begins to bear on the inlet push rod. (C, Fig. 9, page 17). Insert the fingers in the spark plug hole and see that the inlet valve is not off its seat. The inlet push rod at the least movement of the fly wheel will now start to open the inlet valve. However, stop in this position and, if the engine is new, you will find the inlet valve opening 1/16 of an inch past center as indicated in Fig. 6, page 16. To measure this distance, insert a rule and turn the fly wheel backwards, noting the distance the piston pushed the rule outward. This will be the time the inlet valve opens after the piston has passed the center. An engine that has been run for some time will probably open 1/8 or 3/16 past center. An engine in this condition would be considered out of time. The closing of an inlet valve is determined by turning the engine forward making sure that you are again holding the inlet lever down and open as above. Turn the fly wheel forward until the inlet lever roll begins to loosen, but is still contracting on the inlet push rod. Make sure that your valve is closed; try again to twist the inlet valve, which should be on its seat. This we term the closing of the inlet valve, and on a new engine would be 1½ inch past center (Fig. 7, page 16).

Next, insert your rule and turn the fly wheel backwards, compelling the rule to follow the piston without slipping. The distance the rule travels in will be the distance past center that the inlet valve is closing. When the cam shaft is set correctly, an inlet valve that is out of time will open late and close early. Both of these errors may be corrected by removing the two screws, clip and shim in push rod C, Fig. 6. In all probability you will have to elongate the holes in the push rod in order that it may be pushed up slightly to produce the original timing of the inlet valve. After elongating the holes it will be necessary to make a new shim by filing down a piece of one-quarter inch square stock. One hundredth or one sixty-fourth of an inch is usually enough to put the valve in proper time. One who is familiar with the setting of a valve can determine the size of shim at once, but a beginner will probably have to make two or three trials.

CAUTION.

Never pull the inlet push rod sideways in taking off the mixer. If the mixer has been put on and the inlet push rod left out of place, remove the mixer again and put the inlet push rod in position before putting the mixer on.

This is **important**, as the inlet push rod which has been strained and does not travel in the line which it was designed to travel in, will deduct from two to three H. P. from the efficiency of the engine, by causing the inlet valve to have an improper action, although it may be timed correctly.

ADJUSTMENT OF CARBURETOR

Fig. 10, page 20, is a sectional view of the carburetor and inlet valve mechanism as used on all single cylinder models. The air is taken in at the end of the intake pipe (K).

The intake of the air caused by the suction of the piston lifts the valve (L) and forms a partial vacuum at the terminal of the gasoline passage (M), the screw (N) being adjusted so as to allow the valve (L) to lift from its seat just far enough to admit the proper amount of gasoline to form with the in-going air a proper mixture. The adjusting screw (N) which regulates the amount of gasoline, should be adjusted **only** in case of improper mixture.

To secure the greatest efficiency, the mixer valve (which admits the gasoline into the carburetor) must open wider when the engine is running at high speed than is necessary when running at low speed. The method of accomplishing this is described below: Have throttle wide open, and spark away back.

Figure 1, page 21, shows the mixer adjusting screw (N) directly over the needle (L) of mixer valve. This position allows no spring action.

Figure 2, page 21, shows the mixer screw (N) moved to the extreme left. This position allows extreme spring action.

Figure 3, page 21, shows the mixer adjusting screw (N) in a normal position. This position allows the proper spring action.

When the adjusting screw is located as shown in Fig. 1, it is evident that the flat spring (Q), between the adjusting screw (N) and the top of the needle (L), cannot perform its function as a spring. With the screw (N) in this position, the mixer can be properly adjusted for any given speed, but this position is not favorable for securing the most desirable mixture at both low and high speeds.

If, for example, when the adjusting screw (N) is in the position shown in Fig. 1, we adjust the mixer properly for low speed, we will find that it will be too lean for high speed.

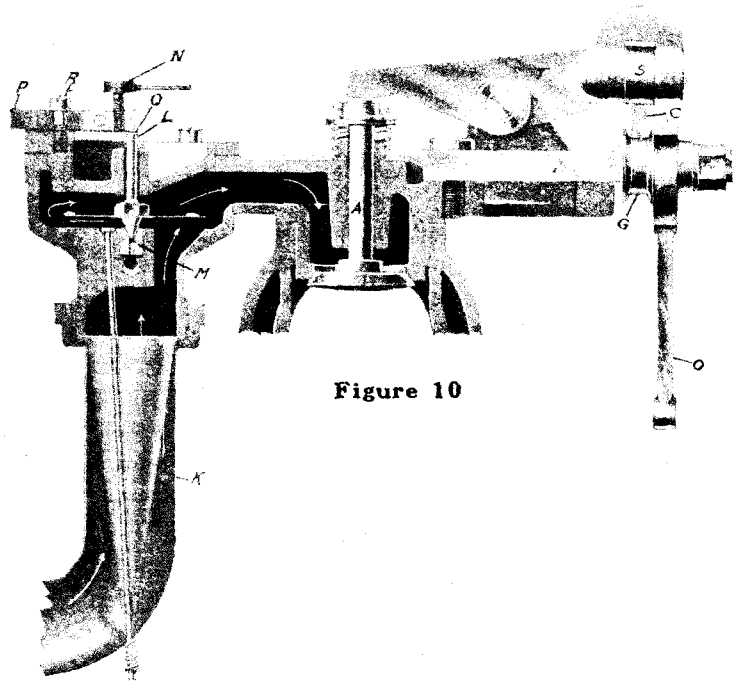
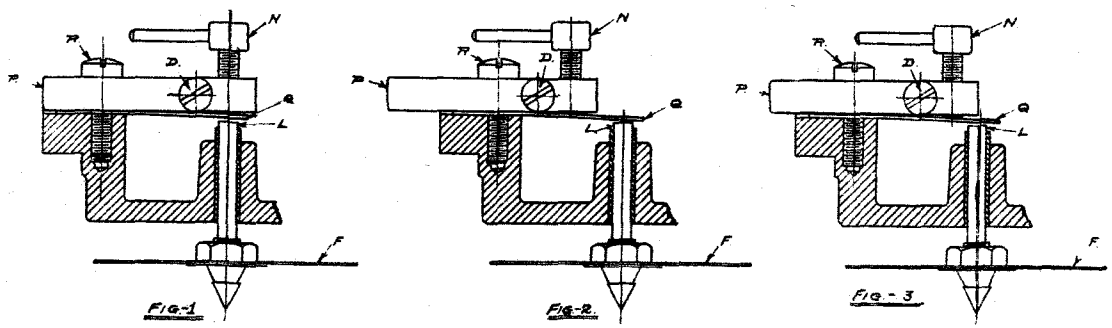


Figure 10

It is, therefore, necessary to in some way supply a larger quantity of gasoline when the engine is running at high speed. This is accomplished by the flexibility of the spring.

Suppose, now, we change the adjusting screw (N) to the position shown in Fig. 2 (allowing excessive spring action),



and again adjust the mixture properly for low speed, we find that when the engine is running at low speed, the needle valve moves so slowly that it has not sufficient momentum to cause the spring to yield. When, however, the speed increases, the volume of air comes against the diaphragm of the valve at a more rapid rate and causes the needle (L) to strike against the spring (Q) with such force as to make it yield, thus allowing the mixer valve (L) to open wider at this high speed than it did at the low speed. Under these conditions, we may have too much spring action, allowing the valve (L) to open too wide, and making the mixture too rich at high speed.

In that case, we would again adjust mixer binder (P) to bring the adjusting screw (N) to the position shown in Fig. 3, giving less spring action than in Fig. 2, but more than in Fig. 1.

By a little experimenting, the adjusting screw can be located in a position where it will allow sufficient spring action to give the desired mixture at both low and high speeds.

The adjusting of the mixer should be done with throttle wide open and with the engine firing on the center (that is with the spark lever way back). Care should be taken not to run the engine at too high a speed without a load, as racing the engine determines nothing but shorter life.

SPEED OF THE MOTOR

The speed of the motor is controlled by the cam lever (O), which throws the roller (G, Figs. 9 and 10) farther under, the lever (C) giving the roller (S) on lever (T, Fig. 10) more or less throw, thus giving valve (A) more or less opening, admitting a greater or less amount of gasoline and air.

To get the best results, the speed and power of the motor should be controlled by the throttling of the charge and by changing the time of igniting it.

In getting a car under way, have the throttle wide open and the spark rather late, start the car on the low gear, then release the low gear pedal and throw in the high speed

clutch (not all at once), letting it slip a little so as not to throw too sudden a load on the motor.

After the car is fairly going obtain the desired speed by varying the position of the throttle lever under the steering wheel.

To get the greatest efficiency, keep the throttle as nearly closed and the spark as early as will get the desired speed without making the motor pound or jerk.

A motor will do its heaviest pulling with the throttle wide open and the spark advanced a trifle.

It will also burn the most fuel.

However, **do not** set the spark early enough or **close** the throttle enough to make a motor **pound**; it injures the motor.

CARBON DEPOSIT

This is one of the greatest enemies to the motor and electrical apparatus. One quarter of a pint of oil should be kept in the crank case of the motor. An engine that has had too much oil will allow same to leak back into the combustion chamber. The high temperature will evaporate this oil, which will be partially exhausted or condensed on the walls of the combustion chamber and spark plugs and form a sticky film. This film is ready to adhere to any lamp black or carbon which might be in the explosion should the mixture be set too rich. This film will cake up and also form carbon. In time the carbon will start to scale and a thin flake will adhere to the combustion chamber. The intense heat of the explosions of the motor will cause this carbon to become red hot, which will ignite the charge instead of allowing the spark to do so. This produces a pound in the engine and decreases the power of same. Oftimes these scales become lodged in the exhaust valve seat and the compression is lost.

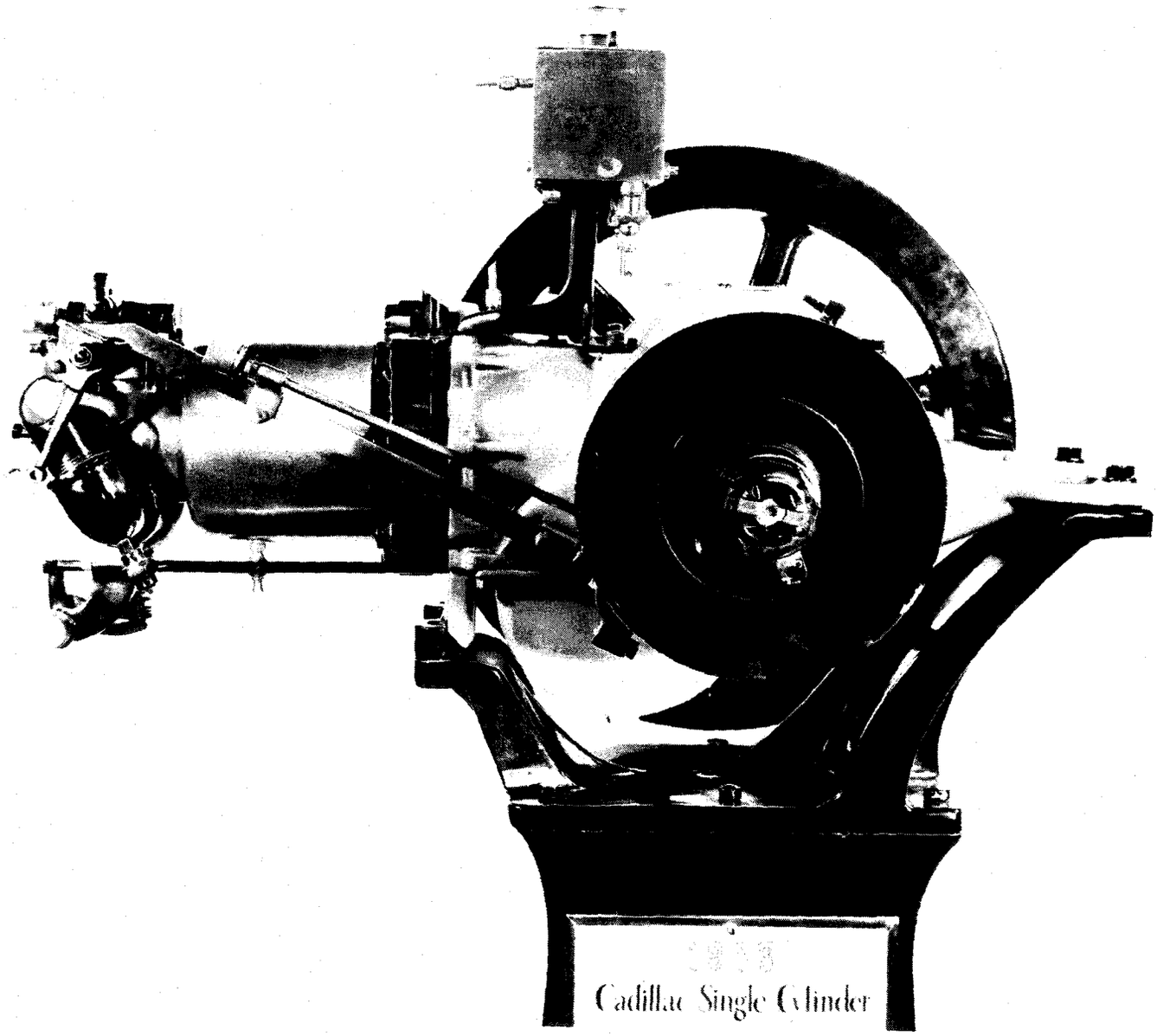
Carbon which is formed on the spark plugs forms a circuit for a high tension current to travel over, it meeting with less resistance than jumping the points between the spark plugs. Sometimes part of the current will travel over the carbon and the rest of it jump between the spark plug points. The operator looks at his spark plug and considers it is in perfect condition. The spark that will jump in the neighborhood of ½ inch in the open air will not jump more than 1/16 inch under sixty pounds pressure. Therefore a spark plug that is sending part of its current through the carbon deposit and the other part between the spark plug points will send all of the current over the carbon deposit when the compression is on. Great care must be taken to make sure that the combustion chamber and spark plugs are free from carbon. Otherwise the motor and electrical apparatus may be condemned through no fault of the same whatever.

BEARINGS

Fig. 11 shows the crank pin and the connecting rod in section.

A is the hollow crank pin, B and C are the babbitt facing and bronze backing of the removable bearings.

D is the cap of the rod F.



1903
Cadillac Single Cylinder