Section Q

FUEL & EXHAUST SYSTEM

The fuel and exhaust system consists of the fuel tank, fuel pump, carburetor, air cleaner, and fuel filter, intake and exhaust manifold, manifold heat control and the exhaust system. Fuel stored in the fuel tank flows through the fuel filter into the fuel pump. The pump forces the fuel, as required, into the carburetor. There, it is properly mixed with the air that has been cleaned by the air cleaner, and drawn into the combustion chamber of the engine by vacuum, caused by the downward stroke of the pistons. After combustion, the exhaust gases are directed away by the exhaust system.

Fuel System Adjustments

There are certain adjustments and tests to be made on the fuel system which are occasioned by normal operations. These adjustments are discussed in the succeeding groups of this section under the various component parts of the system, and should be studied in connection with the symptoms itemized under "Service Diagnosis" and "Corrective Methods". With the knowledge of the operation and adjustment of each unit in the fuel system, and the items listed under "Service Diagnosis" a logical sequence of inspection and adjustment may be determined to localize any particular symptom.

CARBURETOR

The down-draft carburetor illustrated in Fig. 1, with which these vehicles are equipped, contribute to the smooth, quiet operation and power of the valve-in-head engine. Down-draft as the name implies, means that the gas mixture is drawn into the intake manifold rather than lifted up from the carburetor into the intake manifold, as is done in the up-draft carburetor. This improves the breathing ability of the intake system without effecting its flexibility.

This carburetor embodies a principle which employs three venturis, one located above and two below the level of the fuel in the float chamber. This triple venturi has the effect of increasing the suction on the first or primary venturi, causing the nozzle to start delivering fuel at very low air speeds. The nozzle enters the primary venturi at an angle, discharging upward against the air stream. This angle provides an even flow of correctly proportioned and finely atomized fuel.

The fuel thus atomized in the primary venturi is kept centrally located in the air stream by the surrounding blanket of air passing into the second venturi. By this means the fuel is carried to the cylinders in a more perfectly atomized condition. This insulated atomization results in increased smoothness of operation at both low and high speeds.

The mixture quality is controlled by a metering rod which operates within the metering rod jet and is operated by the throttle lever. There are two steps of different diameters on this metering rod. The larger diameter is tapered and controls the fuel flow to about seven-eighths throttle, when the smaller diameter, or power step becomes effective giving full power for either high speed or hard low speed pulling. By this simple means both maximum power and less fuel consumption are available without changing the carburetor adjustment. A cross-section view of the carburetor, showing the various passages, is illustrated in Fig. 1.

This carburetor known as the "balanced type" is used on all the vehicles described in this manual. The air-pressure in the carburetor float chamber is balanced with the pressure on the inside of the air horn by a system of passages in the carburetor

OPERATION

Starting

With the choke valve in the closed position, as when starting a cold engine, suction from the down stroke of the piston draws a small amount of air past the choke valve.

This air is then mixed with gasoline drawn from the main nozzle which forms a rich mixture for easy starting. When the engine starts, the incoming rush of air overcomes the choke shaft spring tension and opens the choke valve just the right amount to maintain a running mixture.

Idling

At idling speed the throttle is closed and the suction from the down stroke of the piston is concentrated on the idling port below the throttle valve. This suction is applied to the low speed passage in the carburetor body and results in air being drawn in through the by-pass hole in the carburetor body. The air is then swept over the top of the low speed jet, lifting gasoline from the jet. The gasoline and air mixture then passes through the economizer and down the idle passage to the idling port where it is discharged into the throat of the carburetor and then through the manifold to the cylinders.

As the throttle valve is opened the idling port above the throttle valve is uncovered and increases the suction on the idling system, permitting it to furnish the necessary fuel mixture for the increase in engine speed.

Low Speed

At low engine speed the throttle is partly open and suction from the down stroke of the piston draws

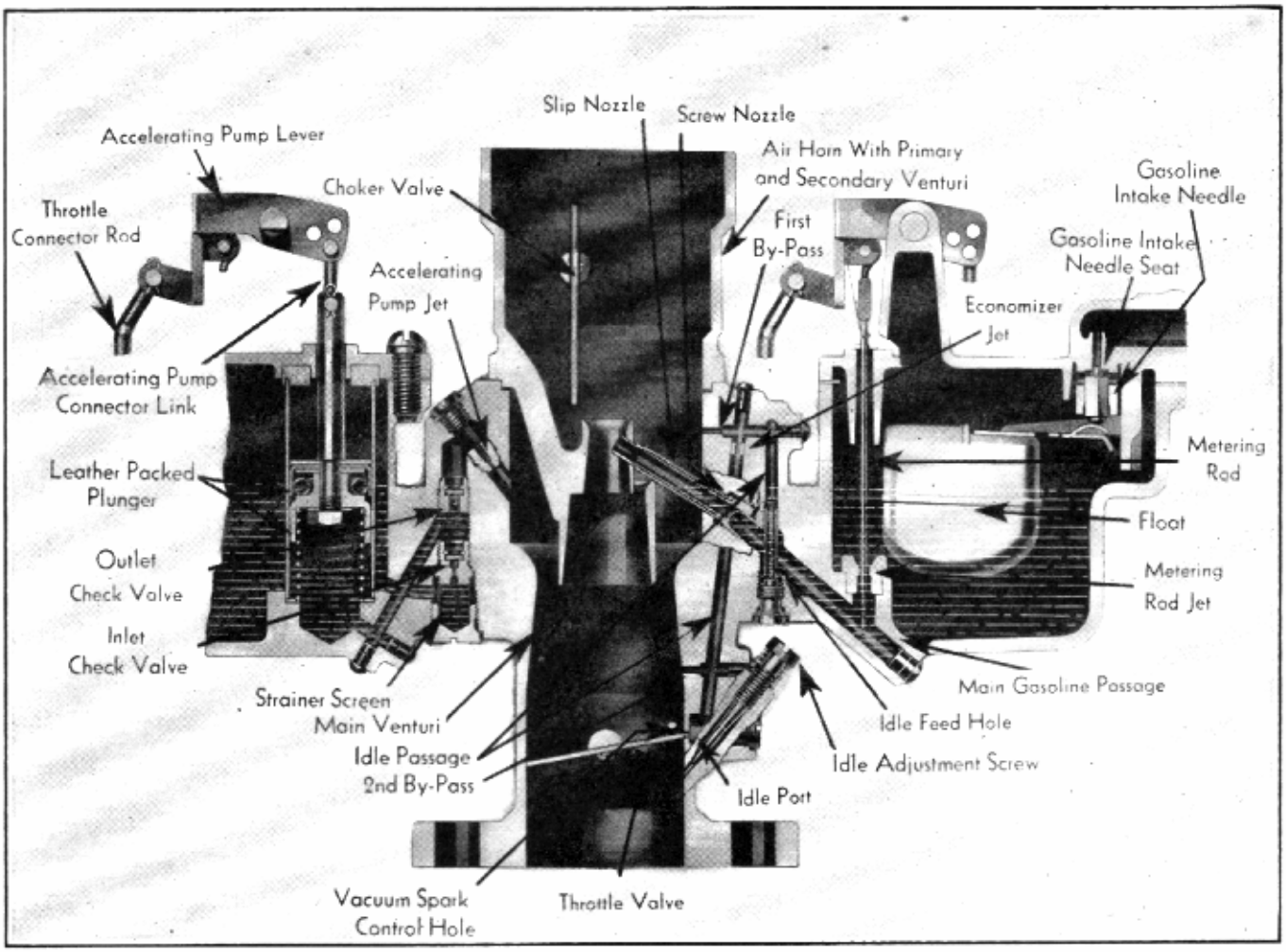


Fig. 1—Diagrammatic View of Carburetor

air in through the air horn. The air in passing through the main venturi, increases in velocity with the result that the suction is increased over the secondary venturi. This increased air speed through the secondary venturi in turn steps up the suction on the primary venturi. The air, passing through the primary venturi, draws gasoline from the main nozzle where it is mixed with the air passing through the primary, secondary and main venturi forming a finely atomized mixture which then passes to the manifold and cylinders.

High Speed

The operation of the carburetor at higher speeds is similar to the low speed operation with the exception of raising the metering rod in the metering rod jet. This is the same as increasing the size of the jet and thereby furnishes additional gasoline required for high speeds and wide-open throttle power operation.

MINOR SERVICE OPERATIONS

The carburetor used on these vehicles is of the plain tube type, throttle operated accelerating pump, and uses a metering rod for measurement of gasoline.

The function of the carburetor is to deliver to the engine the proper ratio of air and gasoline for all motor speeds and conditions.

The circuit service method of repair is recommended and this will be discussed in the following pages. There are five circuits to the Carburetor. They are:

1. Float Circuit.
2. Low-Speed Circuit
3. High-Speed Circuit.
4. Pump Circuit.
5. Choke Circuit.

By treating each circuit separately the study of carburetor repair is greatly simplified.

Float Circuit

The float circuit controls the liquid level of gasoline in the bowl of the carburetor. If this level is too high or too low it will cause trouble in the circuits described in these pages.

The bowl of the carburetor acts as a reservoir to hold a ready supply of gasoline. The level of gasoline in this bowl is controlled by a float and a needle valve.

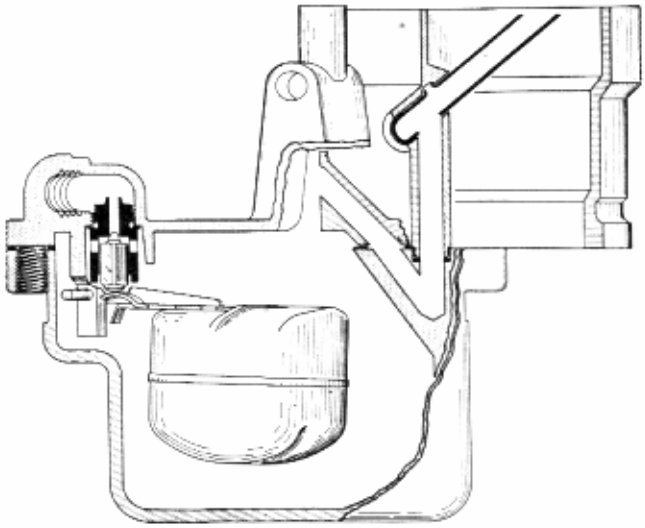


Fig. 2

As speed is increased, the liquid level in the bowl is lowered, thus permitting an increased amount of gasoline to flow into the carburetor. The liquid level will be lower at 60 miles per hour than it will at 20 or 30 miles per hour.

The gasoline flows from the bowl through the various passages and jets into the throat of the carburetor where it is mixed with the incoming air. The pressure in the bowl is one of the factors which govern the amount of gasoline entering the air stream.

This is a balanced (inside vented) carburetor. The bowl vent passage connects to the inside of the air horn instead of to the outside atmospheric pressure. Consequently, this type of carburetor, automatically compensates for any restrictions to the incoming air such as a dirty air cleaner. (Restricted air cleaners usually cause rich conditions with outside vented carburetors).

In all inside vented carburetors, at the speed of 20 miles per hour or more, pressure in the bowl is slightly less than atmospheric. Consequently any leak of outside air to the bowl will cause the carburetor to deliver a rich mixture.

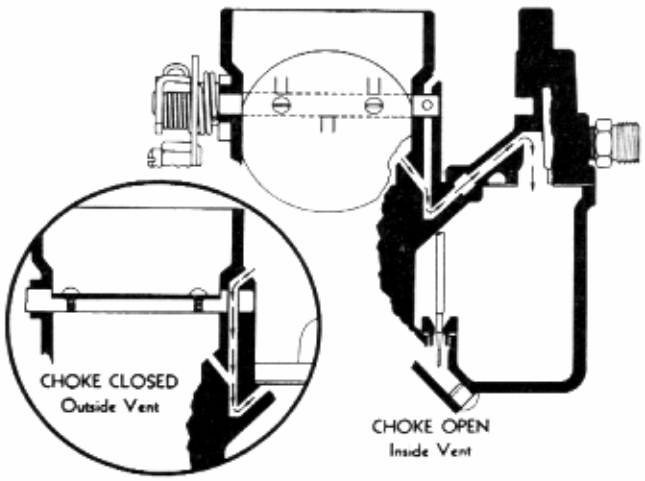


Fig. 3

The carburetor uses an inside vent which enters the air horn below the choke valve. Due to the location of this vent, when the choke valve is closed the same pressure will be effected in the bowl as at the tip of the nozzle. The pressure in the bowl must be greater than the pressure in the nozzle in order to cause gasoline to flow through the high speed circuit (for starting purposes). Therefore, a temporary outside (atmospheric) bowl vent must be provided.

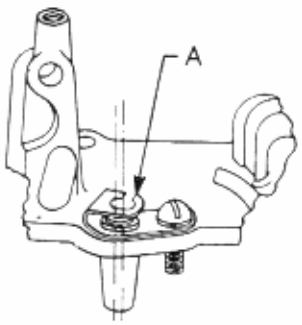


Fig. 4

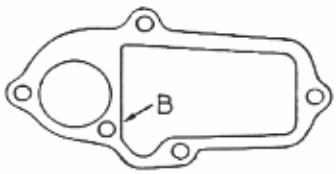


Fig. 5

Note in figure 3 that the vent passage from the bowl enters the air horn below the choke valve. We have already mentioned that a temporary outside vent must be available for starting purposes. A temporary outside vent is provided by using the choke shaft as a valve. When the choke is closed, a small hole drilled through the choke shaft lines up with a passage and admits outside air to the bowl. When the choke is open, this hole in the shaft no longer lines up with the passage and in this way does not allow outside air to enter.

One factor worthy of consideration, is the small disc which rides on the metering rod. This disc stops the free admission of outside air to the bowl. A metering rod disc retainer (A, Fig. 4) prevents this disc from clinging to the rod and thus keeps the bowl sealed from outside air at all times. If this retainer is omitted, or if the metering rod disc is lost, the outside vent so produced may cause a mileage decrease of several miles per gallon.

Note the hole B in Fig. 5. This hole is necessary so that the vent passage between the bowl cover and the body casting is not blocked.

Servicing and Adjusting the Float Circuit

A high float level can generally be determined by looking down through the throat of the carburetor with a flashlight while the engine is idling. If the end of the main nozzle flushes alternately wet and dry, it is a true indication of a high gasoline level in the float bowl which must be corrected before the engine will idle smoothly.

If float is loaded with gasoline or damaged, or if the holes for the float pin are worn egg-shaped, the carburetor will flood or leak. Poor action of float needle results if the lip of the float bracket has a ridge on it; smooth with emery cloth. If

float pin or holes in float pin bracket are worn it will cause erratic action of the float and has the same effect as a high float level.

The needle and seat may leak because of wear, damage or sticking and will cause the carburetor to flood. The needles and seats are available only in matched sets. Never replace the needle without replacing the seat.

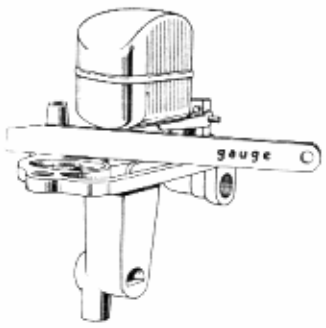


Fig. 6

In adjusting the float level, place gauge at the free end of float as shown in Fig. 6. Vertical distance between bowl cover and free end of float should be 3/8"—needle valve seated.

To make a change in the float level remove the float bowl cover. It is best to press down with a screw driver on the brass lip of the float, holding up on the float while assembled to the cover of the carburetor. Bending the lip in this way allows it to retain its curvature which is necessary for the correct operation of the float valve. (See Fig. 7).

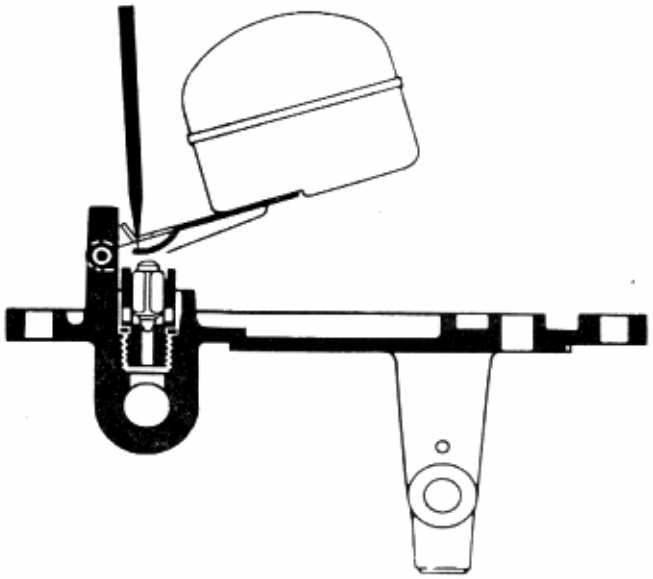


Fig. 7

Low-Speed Circuit

The low-speed circuit controls the supply of gasoline to the engine, during idle and light load speeds, to approximately 20 m.p.h. It also partially controls the supply for light load speeds between 20 and 30 m.p.h. (Fig. 8).

During idling and low speed operations of the engine, gasoline flows from the float bowl through the idle jet to the point where it is combined with a stream of air coming in through the by-pass (a metered passage from the bore of the carburetor).

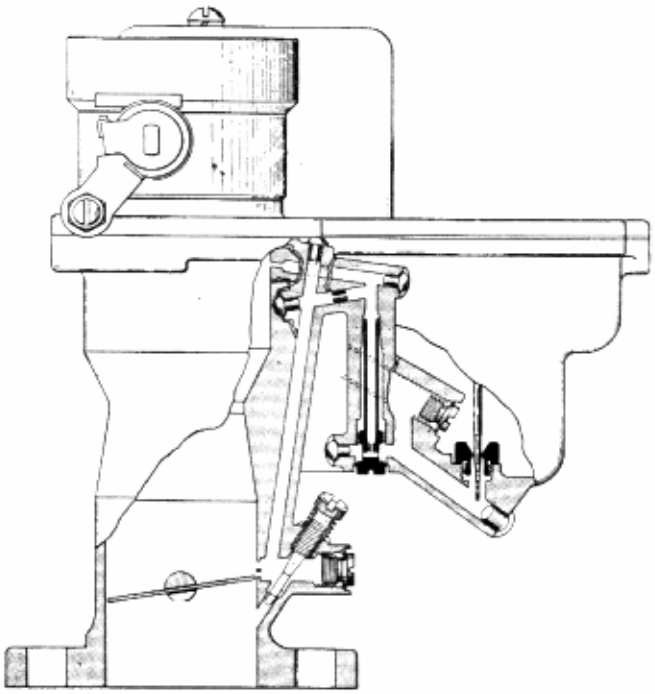


Fig. 8

This combination of air and gasoline passes through the economizer, (a small restriction in the idle passage) which tends to atomize or break up the gasoline into a vapour. This mixture of air and gasoline flows downward to the idle port and then into the engine, through the idle port and the idle adjusting screw seat just below. This mixture is richer than the engine requires, but when mixed with the air coming past the throttle valve, it forms a combustible mixture of the right proportion for idle speeds.

The idle port consists of two holes, which are staggered so that as the throttle valve is opened it will not only allow more air to pass through the throat of the carburetor, but will also expose more of the idle port to the intake manifold and in so doing will allow a greater quantity of gasoline and air mixture to be delivered to the intake manifold.

When the position of the throttle is set at an idle speed of approximately 7 m.p.h., it leaves enough of the idle port as reserve to cover the range in speed between idle and the time when the high-speed circuit begins to function.

The idle adjusting screw (just below the idle port) varies the quantity of the idle mixture.

A small copper plug, just above the idle port plug, makes the idle bleed readily accessible for cleaning purposes.

The low-speed jet used in the carburetor has a small horizontal hole just above the threaded portion of the jet.

Servicing and Adjusting the Low Speed Circuit

The by-pass and air bleed holes, may be restricted. Carbon deposit which forms in the throat

of the carburetor may restrict the air bleed holes to the extent that insufficient air will be supplied to mix with the gasoline before it reaches the idle port.

This condition will generally be indicated if it is necessary to screw the idle mixture adjusting screw, in more than the minimum limit of one turn. If the condition is bad, a rolling idle may continue even after the idle mixture adjusting screw is screwed entirely in against the seat. These air bleed holes may be cleaned with a soft copper wire.

When a low-speed jet is installed the upper tip is forced into a tapered portion of the casting, therefore, it is always advisable to renew this jet when it has been removed.

The idle port must be clean and unrestricted If it is damaged, the engine will not perform properly at low speeds and a new casting will be necessary.

A letter "C" enclosed within a circle is stamped on the face of the throttle valve. When installed in the carburetor, this side should be toward the idle port, viewed from the manifold side.

To properly centre the valve in the throat of the carburetor, the screws should be started in the shaft, and then with the valve tightly closed, it should be lightly tapped. This will centralize the valve in the carburetor throat. Pressure should then be maintained with the fingers until the screws are tightened.

The carburetor throat may be restricted with carbon deposits. This will make it necessary to open the throttle wider than the specified opening to obtain the proper idle speed. Opening the throttle more than the specified amount in order to obtain the proper idle will then uncover more of the slotted idle port than was intended. This will result in leaving an insufficient amount of the idle port as a reserve to cover the period between idle and 20 miles per hour, where the high-speed system begins to cut in (and a flat spot will result). Clean by scraping or with sandpaper.

There are two adjustments on the carburetor, one for idling mixture and the other for idling speed. Both of these adjustments should be made together.

To adjust the idling mixture, proceed as follows: Open the idle adjusting screw from ½ to 1 turn. Let engine idle. Try turning screw both ways from this position until the best setting is made.

To adjust for idling speeds, proceed as follows: With the hand throttle on the instrument panel closed, set the throttle lever stop screw so that the engine runs at approximately 400 revolutions per minute. If the engine runs too fast, back the screw out. If too slow, turn it until the proper speed is obtained.

High-Speed Circuit

The high-speed circuit (Fig. 9) cuts in as the throttle is opened wide enough for a motor speed of approximately 20 miles per hour. At this

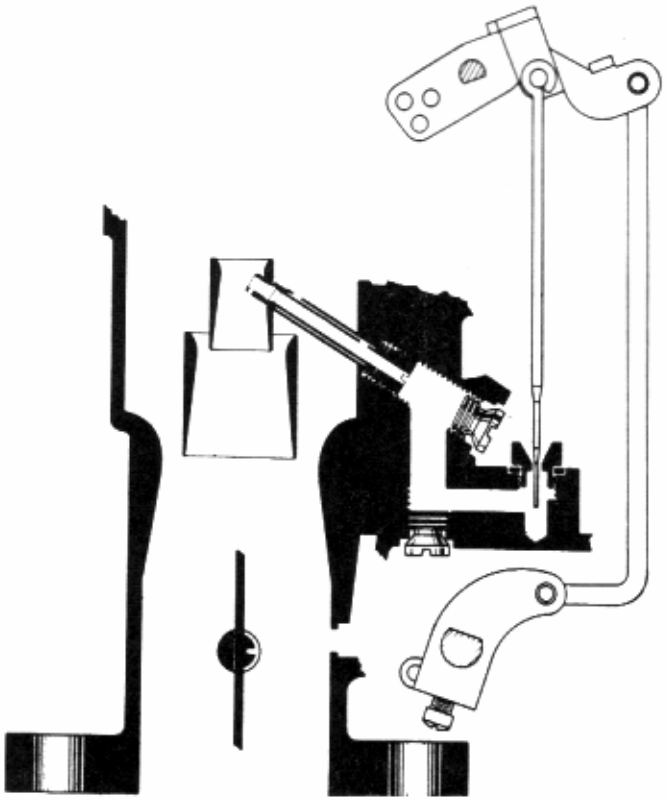


Fig. 9

speed the velocity of the air flowing through the carburetor throat creates a pressure less than

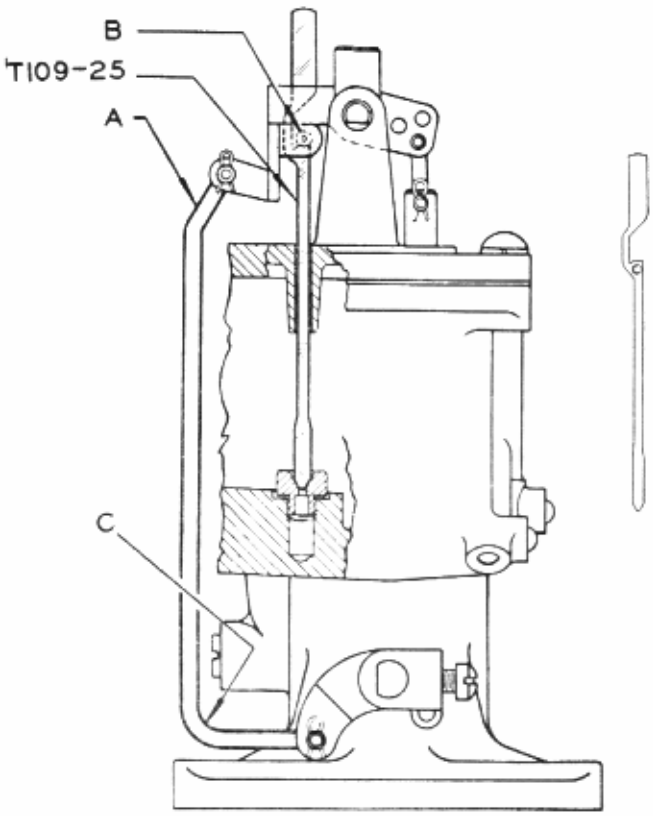


Fig. 10

atmospheric pressure, at the tip of the nozzle. A greater pressure acting on the gasoline in the bowl forces it through the metering rod jet, up through the nozzle and out into the air stream.

At higher speeds the area of the opening between the jet and the metering rod governs the amount of gasoline allowed to enter the manifold. At top speed the smallest section of the rod is in the jet.

The nozzle used in this unit is of the air-bleed type. It consists of two separate parts, the slip nozzle and the screw nozzle. The screw nozzle fits into the slip nozzle and seats at both ends.

Servicing and Adjusting the High Speed Circuit

If the carburetor has been in service for a long time or has been tampered with, it may be found the metering rod is improperly adjusted or worn. A worn metering rod will have the effect of a rich mixture above 20 miles per hour. If the metering rod is worn, the metering rod jet will also be worn and both should be replaced.

To adjust metering rod back out throttle lever set screw, so that throttle valve is seated. Install gauge T109-25 in place of metering rod, (see Fig. 10). Disconnect upper end of throttle connector rod (A). Metering rod pin (B) is now resting on shoulder of metering rod gauge. Throttle connector rod (A) should slide freely into hole in pump arm.

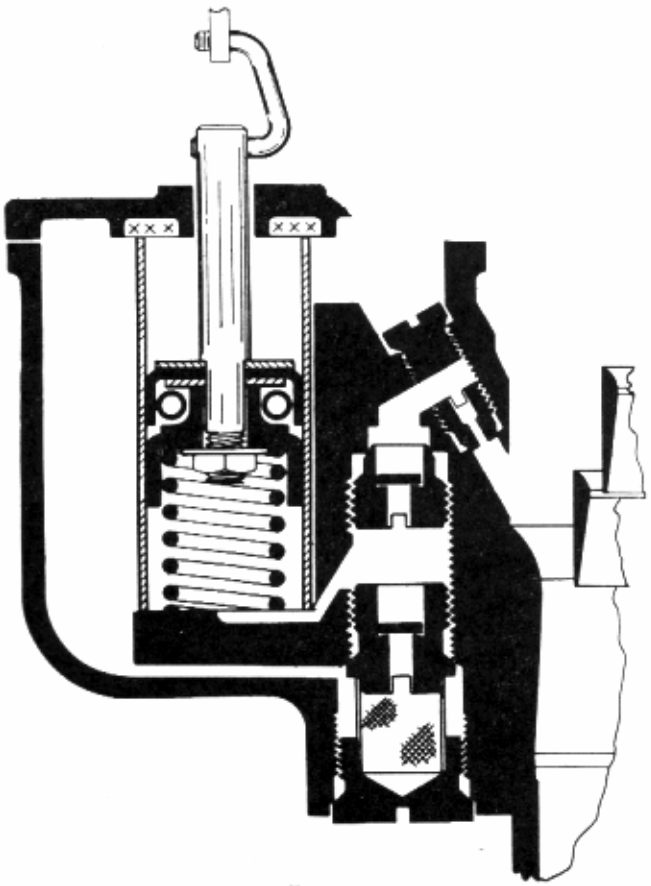


Fig. 11

Adjustment may be made by bending connector rod at "C".

Remove metering rod gauge; install connector rod (A) and install metering rod, disc, and spring, being certain the metering rod disc retainer is in place.

The metering rod, which controls the amount of gasoline passing through the jet can be changed to meet various climatical, fuel or driving conditions. These various sizes are available through parts warehouses and are marked with their size below the eye of the metering rod.

The metering rods are marked as follows:

Standard	67—40
Lean	69—43
Rich	66—37

The Pump Circuit

The primary purpose of the accelerating pump circuit is to momentarily supply gasoline to the air-stream when the throttle is suddenly opened and the car is travelling at low speed. When the throttle is suddenly opened the increase in air velocity is great, but the gasoline (being a heavy liquid) moves slowly and the charge to the cylinders is momentarily very lean.

To supply the necessary mixture under these conditions, as the throttle is opened, a charge of gasoline is injected directly into the air stream by means of the pump. In this manner the proper mixture of air and fuel is supplied for accelerating purposes.

It may require a few seconds for the high speed circuit to begin to deliver sufficient gasoline to the nozzle; therefore, the discharge action of the pump must be prolonged or delayed so that it will continue to discharge gasoline directly into the air stream for several seconds. This is known as "delayed action".

As the accelerator pedal is depressed, the pump plunger is forced downward. This causes the gasoline to leave the cylinder; closes the intake check valve, opens the discharge check valve, and forces gasoline into the throat of the carburetor.

This action is prolonged by the pocket of air under the pump plunger, and the small hole in the tip of the pump jet restricts the flow of fuel as long as it is being forced out of the pump cylinder.

As the throttle is closed, the pump plunger is lifted upward by the connector rod. This creates a reduced pressure in the pump cylinder which opens the intake check valve and closes the discharge check valve, drawing in a new charge of gasoline from the bowl.

Servicing and Adjusting the Pump Circuit

If the pump plunger is worn, sticks, or the spring under the leather has lost its tension, replace the plunger assembly.

If the accelerator pump intake valve leaks, part of the discharge of the accelerating pump will be

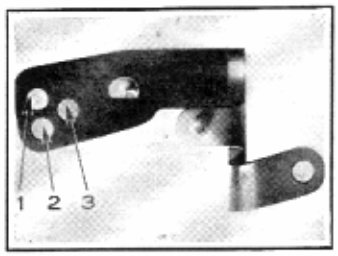


Fig. 12—Accelerating Pump Plunger Arm

forced back through the valve into the float bowl thereby causing an insufficient amount of gasoline to be discharged from the jet for proper acceleration. If the valve cannot be cleaned with compressed air, it must be replaced.

If the accelerator pump discharge valve leaks, air will be drawn into the pump cylinder on the upstroke of the pump plunger. This gives an insufficient charge of gasoline into the throat of the carburetor upon acceleration causing a flat spot. If the valve cannot be cleaned with compressed air so that it works properly, it must be replaced.

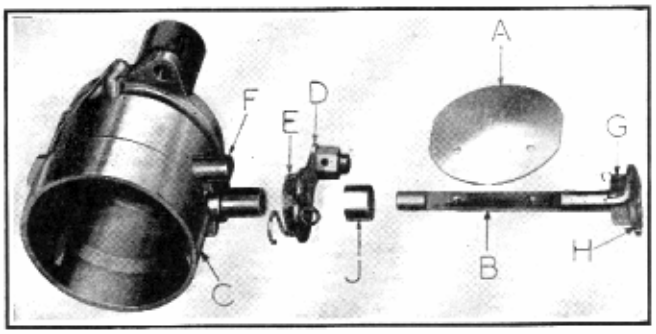


Fig. 13—Choke Parts

If the hole in the accelerating pump jet is too large, the accelerating charge will be allowed to pass too fast and will make the mixture too rich, resulting in a stumble on acceleration or sluggishness. An enlarged jet must be replaced. A jet loose on its seat gives the same effect. A clogged jet will result in poor acceleration.

Fig. 14—Air Horn and Choke Assembly

The accelerator linkage is properly adjusted when vehicle leaves the factory, however, in time component parts will become settled and may require adjusting to maintain a smooth even control of engine speed.

The lever which operates the accelerating pump plunger arm is provided with three adjustments or settings. See Fig. 12. Medium stroke is the correct setting for ordinary temperatures and standard gasoline. Short stroke is for use in extremely hot climates, at high altitudes or with high test fuel. The long stroke is for use in extremely cold climates.

To set this pump arm lever it is necessary to remove the cover from the top of the accelerating pump. When this cover is removed, the countershaft that operates the accelerating pump should be lubricated with graphite grease. To lubricate this shaft, fill the cover screw hole with graphite grease.

The Choke Circuit

This circuit is used only in the starting and warming up of the engine, its purpose being to supply a rich mixture for starting. It consists of shaft and valve, a spring, and a means of controlling the action of the valve.

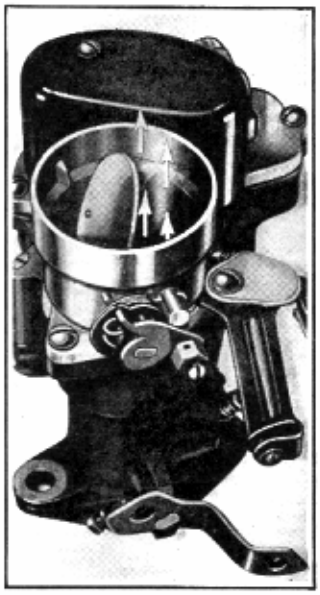


Fig. 15—Choke Valve Partially Open

The choke valve is mounted eccentric on this shaft so that when the motor starts (choke valve closed) the outside air pushing on the eccentric valve will be admitted, thus preventing an overly rich mixture. This action is controlled by spring tension.

The choke (Fig. 13) consists of a one piece choker valve (A), fastened by means of two screws to the choker shaft (B) which is offset to one side of the carburetor air horn (C).

The choker lever (D), illustrated in Fig. 13, is a stamping, and floats on this shaft between two springs. The inner or choker lever spring (E) is a wire coil, one end of which is stopped against a lug (F) on the air horn which also acts as a stop for the lever.

The other end of the spring is hooked into a radial slot in the lever itself. The outer, or choker valve spring (G) hooks to the choker lever and to the camlike choker valve shaft lever (H) which is fastened to the end of the choker shaft.

As the choke button on the instrument panel is pulled out against the pressure of the torsion spring, the light valve spring (G) (Fig. 13) causes the valve to follow the movement of the lever, closing the choke valve. As the engine starts, the rush of incoming air through the air horn of the carburetor overcomes the tension of the light valve spring (Fig. 14) and the valve automatically assumes the correct position to provide the proper amount of air for the mixture to enter and prevent over-choking.

In the event of back fire with the choke partially closed, the torsion spring (E) (Fig. 13) absorbs the shock by permitting the choke valve to swing up beyond the horizontal position (Fig. 15) and thus prevent damage to the valve.

MAJOR SERVICE OPERATIONS

Removal and Replacement of the Carburetor

The removal of the carburetor can be made in the following manner:

1. Remove the air cleaner from the carburetor after the clamp screw has been loosened.
2. Disconnect the hand choke and throttle.
3. Disconnect the carburetor throttle control rod.
4. Disconnect the carburetor fuel line at the carburetor.
5. Disconnect the carburetor to distributor octane selector vacuum line.
6. Remove the carburetor to manifold stud nuts and remove the carburetor.

The carburetor can be replaced in the reverse order of the removal.

Carburetor Disassembly

The following instructions cover the overhaul and repair operations for this type of carburetor.

1. Remove the dust cover from the carburetor body.
2. Remove the throttle connector rod and the accelerating pump plunger shaft connection from the accelerator pump arm.
3. Remove the metering rod spring from around the metering rod and remove the metering rod from the cover.

   Care should be taken to remove the metering rod without bending it. This can be done by threading the metering rod carefully over the pin on the throttle lever.
4. Remove the screws holding the bowl cover and float.
5. Remove the float and needle valve and the seat from the cover.
6. Remove the accelerating pump plunger and spring from the carburetor body.
7. Remove the nozzle plug, nozzle and nozzle shroud from the carburetor body.

   In removing the nozzle shroud, press only on the flat spot or shoulder of the nozzle shroud which extends up into the air horn. If the end of the nozzle shroud is burred it will affect the gasoline consumption and the proper operation of the carburetor.
8. Remove the low speed jet, air horn with choke valve, idle adjusting screw and port plug, accelerating pump intake screen, accelerating pump intake bakelite disc check and the accelerating pump discharge check from the carburetor body.
9. Remove the throttle connector rod lever from the end of the throttle shaft and remove the throttle valve screws, throttle valve and the shaft.

Inspection of Carburetor Parts

Cleanliness is very essential for proper carburetor operation, as a very small piece of dirt or lint will materially affect the operation of this very important unit. Therefore:

1. Wash all parts in clean gasoline or other cleaning solvent.
2. Check the idle ports and first by-pass for carbon deposits. Then blow out all drilled passages with compressed air in the opposite direction to that of the normal flow of air or gasoline.
3. Inspect the main nozzle for burrs on the end of the nozzle. Blow out the low speed jet and make sure the metering hole is clean.
4. Check the operation of both the inlet and outlet check valves. Inspect the accelerating pump jet and make sure it is clean.
5. Inspect the accelerating pump plunger. If the leather or its expanding spring are damaged in any way, the plunger assembly should be replaced.
6. Inspect the metering rod jet and metering rod. If the rod is worn or damaged, it should be replaced. Also make sure it is the correct size for the carburetor.

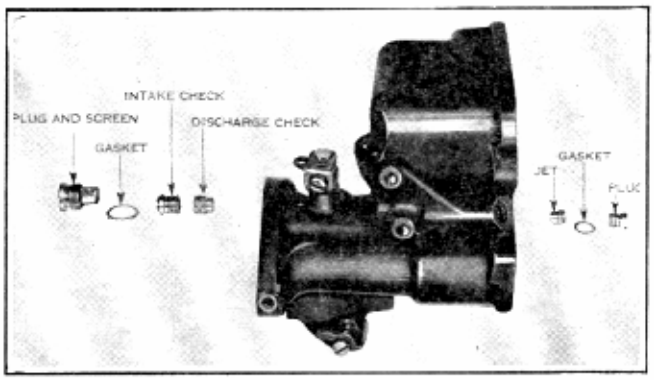


Fig. 16—Accelerating Pump Jet and Checks

Carburetor Reassembly

1. Assemble the throttle valve shaft and throttle valve.
2. Assemble the throttle connector rod lever to the end of the throttle shaft and assemble the throttle connector rod to this end.
3. Assemble the accelerating pump discharge disc check, accelerating pump intake disc check, disc check plug with gasket and screen, accelerating pump discharge jet and discharge jet plug with a gasket as shown in Fig. 16.
4. Assemble the air-horn with choke valve to the carburetor body, making sure the round gasket is in place between the air horn and body.
5. Check the clearance between the air horn and the edge of the choke valve. This should be .002″ all the way around the valve.

6. Assemble the idle adjusting screw, idle port plug with gasket, low speed jet, nozzle shroud with gasket, nozzle and nozzle plug with gasket to the carburetor body.
7. Assemble the metering rod jet and the accelerator pump spring and pump to the carburetor body.
8. Assemble the inlet needle seat with gasket, needle, float and pin to the carburetor bowl cover.
9. Check the float level.

   This must be 3/8" from the outer end of the float to the machined surface of the cover with the valve closed; 1" when in the maximum open position for best operation and economy. An easy method of checking this dimension is to take a round piece of drill rod 3/8" in diameter, and roll this part under the float. Bending the lip on the float lever with a pair of round nosed pliers, will change the float level; a slight bend is all that is necessary to complete this operation.
10. Assemble the cover and gasket to the carburetor body.
11. Synchronize the metering rod with the throttle valve using a metering rod gauge (T109-25)
12. Assemble the bakelite metering rod hole cover disc to the metering rod, making sure that the hole cover disc slides freely up and down on the metering rod. Make certain that the hole cover disc retainer is in place.
13. Assemble the metering rod spring around the metering rod.
14. Hook up the pump plunger shaft and the throttle connector rod to the pump plunger arm.
15. Put a small amount of graphite grease in cover screw hole and assemble the cover in place on the carburetor.

CARBURETOR CONTROLS

Carburetor controls consist of the accelerator pedal, choke, throttle, levers and rods.

Accelerator Pedal Controls

The accelerator pedal rod and carburetor control levers are mounted on the side of the cylinder block. It is important that these rods work freely and do not bind. Return springs are provided to return the levers to the off position when the accelerator pedal is released or the throttle button pushed in.

Choke

The hand choke is a wire and flexible housing type and is used to obtain a richer mixture of fuel for starting the engine.

The proper choke adjustment is important in order to obtain maximum economy.

Correct choke adjustment is obtained in the following manner:

1. Tighten the choke wire locknut behind the instrument panel.
2. Loosen the set screw at the carburetor end of the choke wire.
3. Push in the choke button until there is 1/16" clearance between the button and the instrument panel.
4. Inspect the carburetor choke valve to be sure that it is fully opened; that is, the valve should be in a vertical position.
5. When it has been determined that the valve is fully opened, and the valve lever is in the full open position, insert the choke wire in the lever swivel and tighten the set screw securely.
6. The outer wire clamp should also be tightened sufficiently to hold the flexible housing securely.

Throttle

The hand throttle is a wire and flexible housing type and is used when starting the engine or when making engine adjustments.

Proper throttle button adjustment should be made before the idling adjustment is attempted.

1. Tighten the throttle wire lock nut behind the instrument panel.
2. Push in the throttle button until it stops against the instrument panel.
3. Check the clearance between the collar at the carburetor or throttle lever. There should be 1/4" clearance between the lever and the throttle wire collar.

Replacement of Choke and Throttle Rods

A special piano wire .041" diameter is used to replace broken wire in the choke and throttle rod assemblies.

Replacement of this wire may be made as follows:

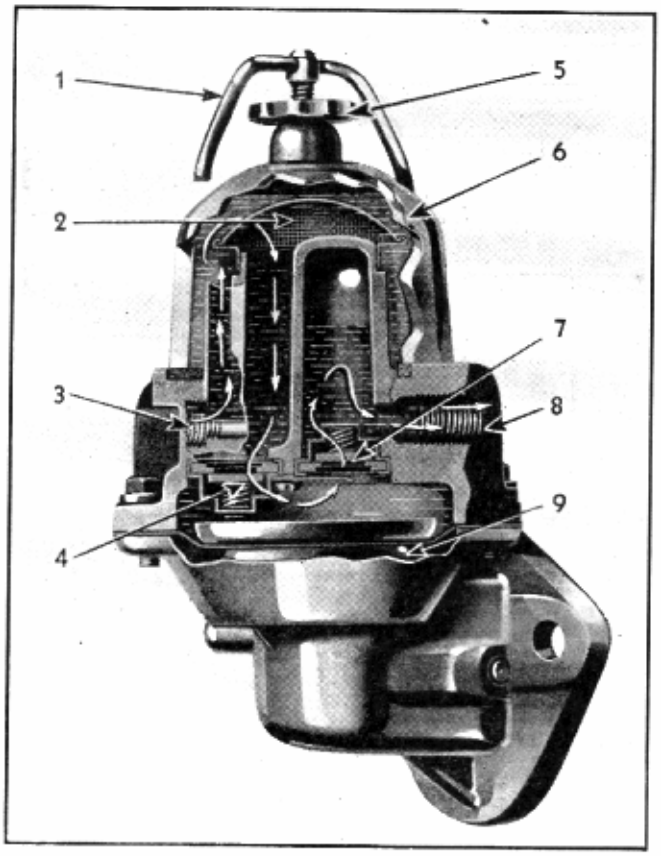
1. Remove the broken wire and control casing.
2. Cut off the end of the control rod at the shoulder.
3. Drill a hole in the end of the control rod 1/4" deep, using a 3/64" drill.
4. Cut the correct length of wire.
5. Insert the wire in the drilled hole in the end of the control rod and silver solder or braze it in place. After the wire has been soldered, it should be tested with a strong pull to be sure it is held solidly.
6. Replace the wire and the control rod in the casing.

FUEL PUMP

The fuel pump, Fig. 17, is of the diaphragm type and is attached to the crankcase and is operated from an eccentric on the camshaft.

The diaphragm is composed of several layers of especially treated cloth which is impervious to gasoline and benzol. The cloth material is held between two metal discs and is pushed upward by a pump spring, and downward by the arm on the camshaft. The diaphragm, in its downward movement, causes a vacuum in the pump chamber and fuel is drawn in through the glass bowl and strainer to fill this vacuum. The upward movement of the diaphragm forces fuel to the carburetor.

The repeated movement of the diaphragm is possible indefinitely, without injury due to the extreme flexibility of this material. Further, the movement of the diaphragm occurs only when the carburetor needs fuel. When the carburetor needs fuel, this movement is directly proportional to the amount of gasoline used by the engine. This means that in practically all normal driving conditions this diaphragm is pulsating in a movement of a few thousandths of an inch.



1—Sediment Bowl Retainer
2—Filter Screen
3—Inlet
4—Inlet Valve
5—Sediment Bowl Retainer Nut
6—Sediment Bowl
7—Outlet Valve
8—Outlet
9—Diaphragm (Ass'y)

Fig. 17—Fuel Pump

This movement is controlled by linkage because, when the diaphragm is in the depressed position, due to sufficient fuel in the carburetor, the up and down movement of the fuel pump link ceases and the rocker arm spring keeps the rocker arm in contact with the eccentric on the camshaft.

The fuel pump has a large reservoir and surge chamber. The glass filter bowl is clamped to the cover assembly, making it a simple matter to detect the presence of sediment in the fuel pump. The inlet and outlet valve assemblies are interchangeable, and each assembly is a self-contained unit made up of a valve cage, a fibre valve, and a valve spring. Both valve assemblies are held in place by a valve retainer, permitting easy and speedy removal of the assemblies.

Minor Adjustment

The glass bowl and filter screen should be removed and cleaned frequently to avoid excessive accumulation of water and dirt.

The knurled nut at the top glass bowl (Fig. 17) should be kept tight to prevent leaks. All connections should be inspected and tightened when necessary.

Testing the Fuel Pump

In order to obtain maximum fuel economy, it is important to test the fuel pump to determine whether or not it is giving enough yield to insure sufficient fuel flowing to the carburetor at all times, also whether or not the fuel pump may be exerting an over pressure.

THESE TESTS ARE SEPARATE AND DISTINCT FROM EACH OTHER AND MUST BE MADE WITH THE PUMP MOUNTED ON THE ENGINE.

The capacity and pressure tests can be made before the pump is overhauled to determine the condition of the unit. These tests should also be made after the pump is overhauled to test its performance.

In making the capacity test there should be no need for referring to a pressure gauge, as there is no interest in minimum or maximum pressure, but rather simply to determine that a sufficient amount of fuel is flowing. The capacity for this pump is one pint or over in one minute. In many instances, the test may disclose that more fuel is flowing than specified, however, this is not an indication that the pump is defective but rather that the pump is most efficient. When the flow is greater than the minimum required, the pressure test should be made to insure against excessive pressure.

In making the pressure test, it is only necessary to determine that the pump does not produce an over-pressure. If a lower pressure is developed than the maximum (2 lbs. min.—3¾ lbs. max.) it is not an indication that the pump is defective but rather gives assurance that the pump operates within the prescribed limits. So long as the test does not show a pressure over the maximum but does give at least the minimum flow in capacity, or first test, efficient engine operation from a standpoint of the fuel pump is assured.

The above tests may be effectively accomplished by the use of a vacuum and pressure gauge such as fuel pump analyzer KMO-144 used in the following manner.

1. Disconnect the fuel pump to carburetor fuel line.
2. Remove the fuel pump outlet fitting and replace it with the one supplied with the analyzer.
3. To the above connection, attach the "T" connection supplied with the analyzer.
4. Attach the analyzer to the side outlet of the "T"

5. Attach a special gasoline proof rubber tube to the end of the "T", loop it and attach the opposite end to the loose end of the fuel line.
6. The capacity test is made with the engine speed comparable to 30 or 35 m.p.h. road speed with the SHUT OFF VALVE OPEN. The outlet of fuel "bleed" must be at carburetor level or slightly higher. The flow of fuel should be 1 pint or over in one minute.
7. The pressure test is made with the engine running at its lowest idling speed with the SHUT OFF COCK CLOSED. The pressure shown should be within 2 and 3¾ lbs.

   If the tests indicate that the pump is not functioning correctly, remove and overhaul the unit.

Disassembly of Fuel Pump

1. Loosen the sediment bowl retainer nut at the top of the sediment bowl and turn the sediment bowl retainer down so that the sediment bowl is free to be lifted off.
2. Remove the filter screen, cover top screws and top cover assembly.
3. Raise the edge of the diaphragm and using a thin-bladed screw driver, lift the spring and oil seal over the edge of the boss in the fuel pump body.
4. Unhook the diaphragm from the link by pressing down and away from the rocker arm side.
5. Remove the valve assembly retainer screws and remove the valve retainer.
6. Remove the valve assemblies and gaskets, noting that the inlet valve is assembled in the cover so that the valve opens downward, the valve spring being visible at the bottom of the valve cage. The outlet valve is assembled in the cover so that the valve opens upward, the valve spring not being visible when the valve is assembled in the cover in this position.
7. Inspect the valves to make sure they are clean.

Inspection

While the fuel pump is disassembled, the following inspection should be made:

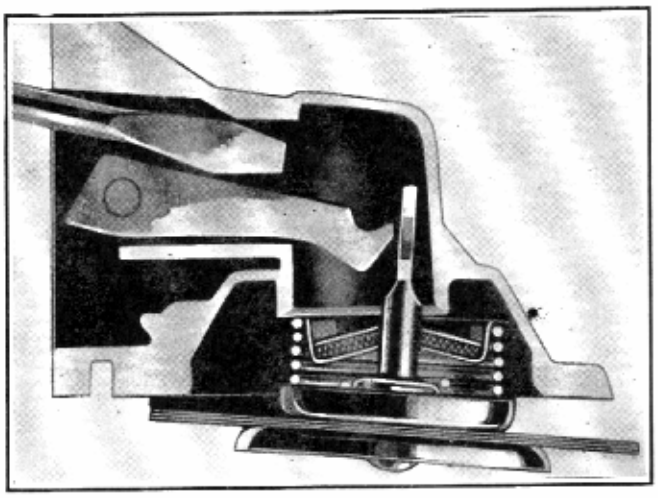


Fig. 18—Method of Assembling Diaphragm Assembly to Link

1. Inspect the diaphragm and replace it if it is worn.
2. Inspect the linkage and pull rod and replace it if it is worn.
3. Inspect the inlet and outlet valves to make sure that they are clean and that the spring is closing the valve washer.
4. Inspect the oil seal and replace it, if it is worn.
5. Inspect the glass bowl gasket and replace it, if it is necessary.
6. Clean the strainer or replace it, if it is necessary.

Assembling of the Fuel Pump

1. Install the oil seal to the diaphragm push rod in the following manner: Assemble the oil seal spring, upper retainer, two leather seals, and the lower retainer with the convex side out. This is extremely important in order to seal the fuel pump from any oil that might come up from the crankcase.
2. Raise the fuel pump link with a screw driver, Fig. 18, install the diaphragm spring and hook the diaphragm pull rod over the end of the link.
3. Install the valve assemblies and paper gaskets, making sure to install the inlet valve with the spring down and the outlet valve with the spring up. The inlet valve is assembled in the cover assembly next to the tapped passage marked "INT."
4. Install the valve retainer with the convex side up, and install the two retainer screws.
5. Assemble the top cover assembly to the fuel pump body and tighten the cover screws alternately and securely.
6. Assemble the screen on the cover and assemble the glass filter bowl to the cover, making sure that the cork gasket is in good condition and that the bowl nut is tight to prevent air leaks at this point.

AIR CLEANER

The oil bath type air cleaner, illustrated in Fig. 19, is mounted directly to the top of the carburetor.

Air, entering the cleaner, passes into the oil chamber. Due to the impact, and sudden reversal

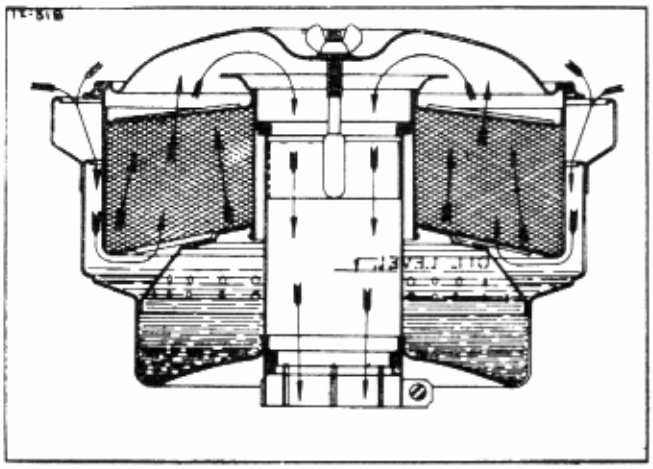


Fig. 19—Sectional View of Air Cleaner

of the air flow, most of the dust in the air strainer is thrown into the oil in the sump and settles to the bottom of the cleaner. Partially cleaned air passes through a dense oil wetted copper mesh where the remaining dust is trapped.

The filtering element will successfully clean the air before it enters the carburetor; however it is necessary to clean the element at frequent intervals.

Servicing Air Cleaners

The importance of keeping the air cleaner in a proper condition should be impressed on those responsible for the mechanical up-keep of the engine.

The air cleaner is used to keep road dust out of the engine and carburetor. This dust is loaded with minute particles of abrasives which, if permitted to enter the engine, will cause rapid wear of the cylinder walls, pistons, and rings; with resultant loss of power, and an increase of oil and fuel consumption.

Unless the air cleaner is cleaned regularly, as service conditions require, it will not function properly, and in some instances, actually aggravate the condition which it is designed to prevent. If the air cleaner is allowed to become clogged with dirt, and left in that condition, the flow of air to the carburetor will be restricted, thus causing increased fuel consumption, engine heating up, crankcase dilution, and otherwise, prevent good performance of the engine.

For these reasons, the air cleaner must be cleaned at regular intervals, at least every 1,000 miles, or more often if conditions warrant. Under adverse conditions or extensive operation on dusty or sandy roads, the unit should be cleaned every day or at least every 200 miles.

The air cleaner on a vehicle operating in dust-storm areas should be cleaned immediately after such storms occur.

Minor Adjustment and Removal

The air cleaner cover wing nut and cleaner clamp screw should be kept tight at all times to prevent air entering the carburetor through means other than the air cleaner.

The air cleaner may be readily removed from the vehicle by loosening the air cleaner clamp screw.

Cleaning the Air Cleaner

1. Remove the assembly from the carburetor after the clamp screw has been loosened.
2. Remove the wing nut at the centre of the top cover so that the cover can be taken off. Lift out the filter unit.

   CAUTION: The filter element should not be pried loose, but must be removed by hand because the filter element flange may become damaged. This flange must lie flat against the body to insure a tight seal at this point to prevent air leaks when the cover is assembled.

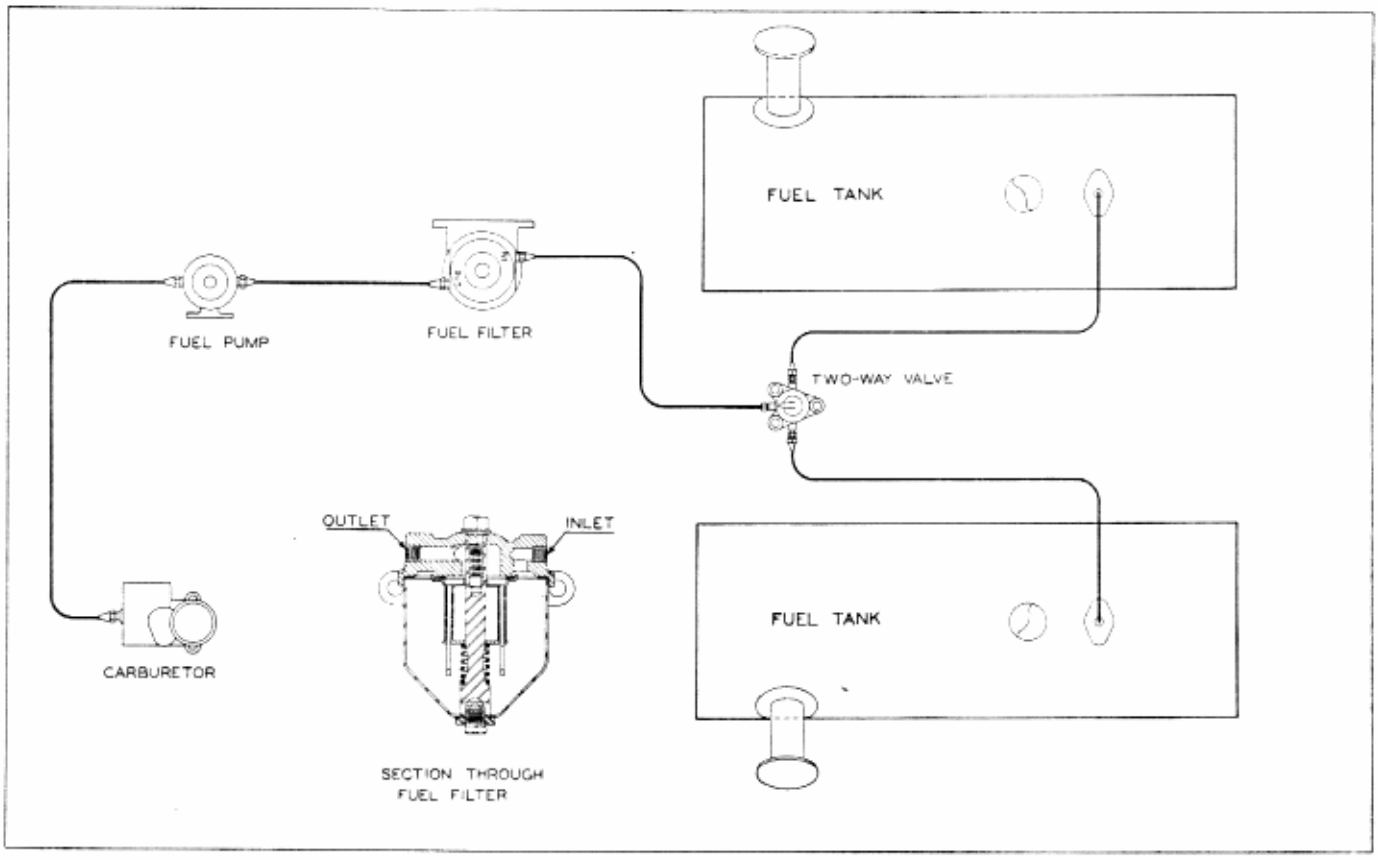


Fig. 20 – General Arrangement of Fuel System

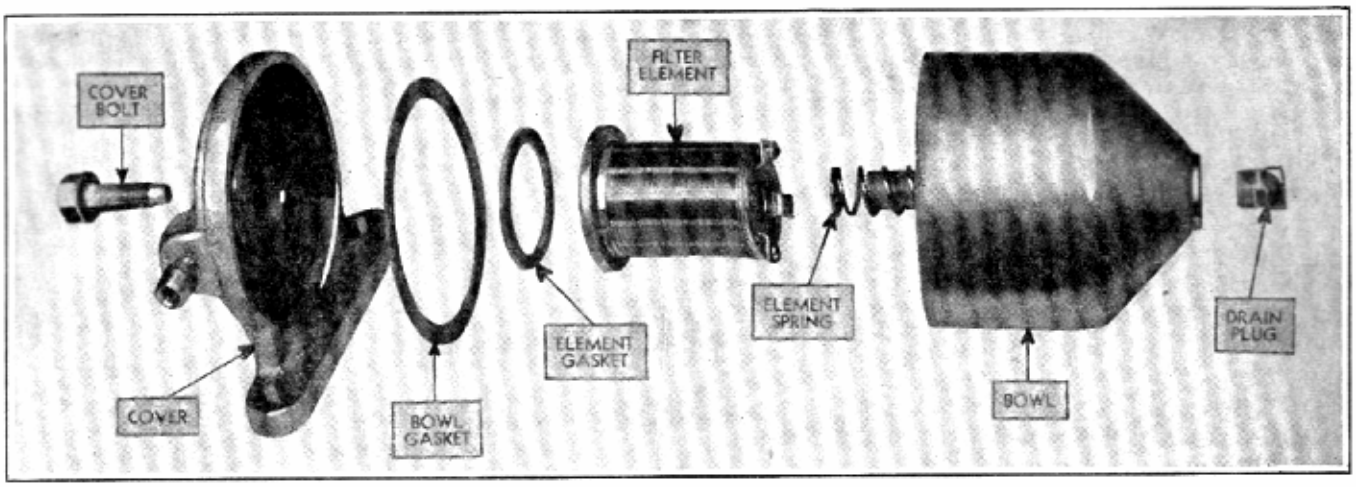


Fig. 21—Fuel Filter

3. Clean the filter element thoroughly by "swishing" it in a pan of suitable cleaning fluid. This operation should be repeated until all the dirt is removed from the filter.
4. Blow the mesh dry and clean with air pressure. Do not use an extremely high pressure as the mesh will become compressed and render the filter unsatisfactory for further use.
5. Clean out the oil and sediment from the reservoir with a clean cloth.
6. Fill the reservoir to the "Oil Level" stamped on the inner side of the cleaner, using S.A.E. 50 engine oil when the temperature is above 32°F. and 20-W when the temperature is below 32°F.
7. Reassemble the filter, making sure that the filter element flange sets flat against the top flange of the body. Make sure that the cover gasket is clean and in good condition over its entire surface, so that a tight seat can be obtained at this point. Install the wing nut and tighten it securely.
8. Replace the complete unit to the carburetor and tighten the clamp screw securely.

FUEL TANKS

Two fuel tanks are used and are mounted, one on the outside of the right hand frame side rail, and one on the outside of the left hand frame side rail. They are held rigidly by straps, which should be checked periodically and tightened if loose.

Fuel tanks should be kept tight at all times, as any small movement of the tank may eventually wear a hole in the tank, causing it to leak.

The outlet from each tank is controlled by a valve operated from inside the cab. This valve permits fuel to be taken from either tank.

FUEL FILTER

A fuel filter of the multiple disc type is bolted on the inside of the right frame side member between the gasoline tank and the fuel pump. This is an added precaution against water or dirt reaching the carburetor. Figure 21 shows an exploded view of the fuel filter. The drain plug in the bottom of the filter bowl may be removed to drain dirt and water from the filter. To clean the filter, disconnect the inlet and outlet gasoline lines. Remove the two bolts which attach the filter to the frame side rail and remove the filter.

The filter may be disassembled by removing the bolt in the top of the filter. Wash all parts in clean gasoline. The filter element should be slushed back and forth in clean gasoline to remove any particles of dirt that might be lodged between the plates of the element.

Reassemble the filter, making sure the gaskets are in good condition.

FUEL GAUGE

The amount of fuel in the fuel tanks is indicated by a gauge located on the instrument panel. This gauge is operated electrically by a gauge unit in each fuel tank. Electrical current for operating the gauge first passes through the igniton switch. Therefore, the gauge will not operate when the switch is in the "off" position. The electrical connections should be kept tight and clean at all times.

For the electrical test to determine the efficiency of the gauge, refer to the "Miscellaneous Electrical" Section "R". In the event either unit proves unsatisfactory, replacement of the unit is the only remedy.

INTAKE AND EXHAUST MANIFOLDS

The intake manifold is a "D" shape which results in better atomizing and more even distribution of the fuel to each of the six cylinders. This is another contribution to smooth engine performance.

The exhaust manifold is designed to reduce the back pressure to a minimum. Located on the inside of the exhaust manifold is the thermostatically operated heat control.

The manifold to cylinder head stud nuts, also the intake to exhaust bolt nuts should be kept tight at all times to insure maximum engine performance.

The manifold to cylinder head, also the manifold to exhaust pipe bolt nuts must be tightened evenly to prevent the breaking of the manifold.

Removal and Replacement

The intake and exhaust manifold assembly can be removed in the following manner:—

1. Remove the carburetor as described under "Carburetor removal".
2. Disconnect the exhaust pipe from the manifold.
3. Remove the manifold to cylinder head stud bolts.
4. Remove the stud washers or clamps and remove the manifold.

Replacement may be accomplished in the reverse order of the removal. Always use new gaskets, as leaky gaskets will cause faulty engine performance.

EXHAUST SYSTEM

The complete exhaust system includes the muffler, pipes and mountings. The purpose of the exhaust system is to carry away the exhaust gases from the engine and to muffle or lessen the combustion noises of the engine.

At regular inspection intervals, the exhaust pipe flange to manifold bolt nuts should be inspected and tightened if necessary. Whenever the exhaust pipe is removed from the manifold, always use a new gasket.

The muffler is of integral construction employing the reverse flow and diffusion principles to obtain quiet operation. The gas flow from the engine reaches the muffler through the inlet tube, reverses at the rear end and flows back toward the front. Gases again flow back, this time through a tube leading to the outlet. The flow, however, is not restricted to the tubes, since the gases pour out through perforations in the tubes, mixing with the gases from the adjoining tube. The resulting mixing and baffling, with velocity changes and reversals in direction of flow, aids in silencing.

The exhaust pipe from the manifold slides into the muffler inlet tube and is held in place by a clamp. Small projections on the exhaust pipe locate the proper depth in the muffler. The muffler is attached to the transfer case support by a strap and clamp assembly. The tail pipe slides over the muffler outlet tube where it is held by a clamp. The outer end of the tail pipe is supported by a strap and bolt attached to the frame.

When assembling a new muffler and exhaust pipe assembly, all clamp bolts should be left loose until the parts are in correct relation to each other. Slight rotation of the muffler may be necessary to line up the inlet and outlet tubes properly. After correct position is obtained tighten the front muffler exhaust pipe clamp securely before tightening the muffler strap.

SERVICE DIAGNOSIS AND CORRECTIVE METHODS

Many symptoms which might indicate fuel system trouble is in reality due to faulty ignition.

Before making extensive adjustments or repairs on carburetor or fuel pump, check ignition system thoroughly.

SYMPTOMS AND PROBABLE CAUSE	REMEDY
Excessive Fuel Consumption	
1. Improper Carburetor Adjustment.	1. Adjust Float Level. 2. Adjust Idling Screw. 3. Adjust Choke Control. 4. Adjust Throttle Control and Stop Screw.
2. Dirty Air Cleaner.	1. Clean as Directed in "Fuel System" section of this book.
3. Fuel Leaks.	
a. At Fuel Tank.	1. Replace or Repair.
b. At Fuel Filter.	1. Tighten Cover Bolt. 2. Tighten Drain Plug. 3. Replace Gaskets.
c. At Fuel Pump.	1. Tighten Knurled Nut. 2. Replace Bowl Gasket. 3. Replace Diaphragm.
d. At Carburetor.	1. Tighten Cover to Body Screws. 2. Replace Gasket.
e. Fuel Lines.	1. Tighten Connections. 2. Replace.

SYMPTOMS AND PROBABLE CAUSE (Cont.)	REMEDY
4. Sticking Controls.	
a. Carburetor Choke.	1. Free up Valve Shaft and Lubricate. 2. Adjust Choke Control.
b. Carburetor Throttle.	1. Free Up Shaft and Linkage and Lubricate.
5. Excessive Idling.	1. Stop Engine When Vehicle Will Not be moving for Long Periods.
6. Improper Engine Temperature.	1. Refer to "Inspection of Cooling System" and "Service Diagnosis and Remedial Measures" in "Cooling System" Section of this book.
7. Brakes Dragging.	1. Refer to "Brake Service Diagnosis" in "Brake" Section of this Book.
8. Tires Under Inflated.	1. Inflate to Proper Pressure.
9. Engine Not Properly Tuned.	1. See "Engine Tune-Up" in "Engine" Section of this Book.
10. Vehicle Overloaded.	1. Load Only to Rated Capacity.
Fast Idling	
1. Improper Control Adjustment.	1. Adjust Throttle Control Button and Throttle Stop Screw.
2. Carburetor Controls Sticking.	1. Free-Up and Lubricate.
Engine Misses	
1. Engine misses on acceleration.	1. Adjust Spark Plugs. 2. Adjust Tappets. 3. Clean Accelerator Jet. 4. Clean or replace Accelerator Pump Check Valve.
Engine Dies	
1. Engine Will Not Idle.	1. Adjust Idling Screw. 2. Clean or Replace Idling Jet.
Low Fuel Pressure	
1. Fuel Pump Diaphragm Broken.	1. Replace.
2. Air Leaks.	1. Tighten All Fuel Line Connections. 2. Tighten Fuel Pump Glass Bowl Knurled Nut. 3. Tighten Fuel Filter Cover Bolt.
3. Worn Fuel Pump Linkage.	1. Replace.
Excessive Fuel Pressure	
1. Worn Fuel Pump Diaphragm.	1. Replace.

SPECIFICATIONS

CARBURETOR

Make.....Carter
Model.....387-S

Dimensions

Flange Size, 1¼ inches S.A.E.
Primary Venturi—11/32 inch inside diameter.
Secondary Venturi—11/16 inch inside diameter.
Main Venturi—1¼ inch inside diameter.

Float Level

Distance from Float (at free end) to Float Cover to be ⅜ inch, plus or minus 1/64 when needle is seated.

Vents

Outside—none. Inside (balance vents) above choke valve through shaft, size No. 27 drill. Below choke No. 35 drill.

Gasoline Intake

Square vertical needle No. 48 drill size in needle seat.

Low Speed Jet Tube

Jet size—No. 72 drill.
By-pass in body—size No. 56 drill.
Economizer Jet—Size .059 to .060 inch diameter.
Idle passage bleed, into bore above port—Size No. 54 drill.

Idle Ports

Upper port diameter—No. 44 drill. Lower port diameter—No. 52 drill.

Idle Port Opening

Top of lower port—.034 to .038 inch above top edge of valve, with valve tightly closed.

Idle Screw Seat

Size. No. 50 drill.

Idle Adjustment Screw

Set one turn to two turns open. For richer mixture, turn screw out. Do not attempt to idle engine below 350 R.P.M.

Slip Nozzle

In primary venturi—angle 30°. Discharge jet size—.125 inch diameter.

Screw Nozzle

(Seats in Slip Nozzle)—Jet size, 31 drill.

Metering Rod

Economy step—.069 inch diameter, middle step tapers from .060 to .058 inch diameter, power step—.044 inch diameter. Length—3⅜ inches.

Metering Rod Jet

Size—.094 inch diameter.

Metering Rod Setting

Use Gauge T-109-25—2.795 inches.

Accelerating Pump

Low pressure type, with adjustable stroke.
Discharge jet—Size No. 72 drill.
Intake disk check plug size—No. 62 drill.
Discharge disk check plug size—No. 40 drill.

Vacuum Spark Ports

Upper port—Size No. 50 drill. Lower port (enters bore on angle)—Size No. 56 drill.

Air Cleaner

Make.....A.C.
Type.....Oil Bath

Fuel Pump

Make.....A.C.

Fuel Tanks (Two each vehicle)

Capacity (Each Tank)
C-GT.....20 Imperial Gallons
C-15, C-30, C-60S, C-60L, C-15A, C-8A—
12½ Imperial Gallons
Location.....Left and right frame side rails

SERVICE DATA

Carburetor

Float Level.....⅜"
Float Adjustment.....See Instructions

Air Cleaner

Clean element and change oil as operating conditions require—See Instructions.

Fuel Pump

Pressure.....3¾ lbs. max.

Accelerating Pump

Holes in pump arm provide pump adjustment. Set to longest stroke for extreme cold weather, shortest stroke for hot weather driving.