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HOW TO LOCATE CARBURETOR TROUBLES

Analysis of the Carburetion System—Effects of Lean and Rich Mixtures—Cause of Leakage — Carburetor Adjustment

By THE TROUBLE MAN

WHILE the majority of engine troubles may be attributed to causes other than from carburetion, those which are traceable to carburetion are usually somewhat baffling, and to enlighten the motorist and repair man on such troubles, this article will cover all the important troubles which are due to carburetion and cause irregular running of the engine, loss of power, etc.

The function of the carburetor is to first vaporize the fuel and then mix this vapor with the correct proportion of air to form the most nearly combustible mixture when compressed by the piston in the cylinder head. This is accomplished automaticaliy through the carburetor adjustment, which controls either the volume of the fuel or the air, or both, so that the mixture is always correctly proportioned. As this adjustment only controls the proportions of the mixture, there are many other conditions which must be considered under the subject of carburetion. Thus, the carburetor cannot proportion the mixture correctly if the fuel supply is not constant, or natural wear tends to disturb the members which control the adjustment.

In tracing trouble of any kind, regardless of its nature, time can always be saved by following a systematic process of elimination, eliminating the units, which are found when tested, to be all right. In locating carburetor troubles, these can be divided into various groups as outlined in the chart presented herewith. These can all be traced by certain symptoms. Thus, too lean a mixture will cause backfiring and stall the engine when the throttle is opened suddenly. Misfiring, when due to carburetion, is caused by unequal fuel distribution, while refusal to start is due to a lack of mixture at the carburetor. The above troubles frequently present themselves in cold weather and are more frequent than those mentioned below, as one is always interested in obtaining the maximum economy and likely to favor too lean a mixture. Troubles due to leaks and too rich a mixture are more apt to be caused by natural wear of the parts comprising the fuel system. Leaks are usually evident when the engine is idle, while too rich a mixture is indicated by several symptoms as listed in the chart.

Analysis of the Carburetion System

The first step in shooting carburetor troubles is to test the engine while running and noting its general action to establish the symptoms. To do this testing it is many times necessary to race the engine, but this should be avoided whenever possible, as it will eventually lead to troubles of greater consequence, such as loose bearings, noisy engine, etc. A careful study of the symptoms will readily lead one to the general nature of the trouble and then permit a systematic search for the cause. Careful attention to details while making the test is essential and will in the end result in the definite location and repair of the trouble. Trouble should never be looked for in the carburetion system unless the engine is warm and in good running condition otherwise. Correctness of any carburetor adjustment can be determined by the idling condition of the engine. Too lean a low-speed adjustment will cause the engine to idle poorly and it will often die after running spasmodically. An extremely rich adjustment of the low speed at idling speeds will produce a very pungent odor to the exhaust. Too rich a mixture at high speed produces a black smoke at the exhaust and too lean a mixture will cause backfiring through the carburetor. The high-speed adjustment is correct when the engine faintly indicates backfiring with retarded spark which disappears when the spark is advanced.

When the above symptoms present themselves, one should not jump at conclusions and assume that the carburetor adjustment is at fault, for these conditions can also be set up by mechanical defects. Any restriction of the fuel flow through the carburetor will cause backfiring and irregular running; this is also true of air leaks at the manifold connections or valve stems. A leaky float or worn float valve will disturb the adjustment of the mixture, making it more rich and thus cause a sluggish action of the engine. Wear in the levers which connect the strangler valve at the carburetor to the choke or dash control will cause hard starting and a rich mixture.

The carburetor adjustment may be wrong, but this cannot be proven until the engine is running; therefore, the logical point to start with is the fuel supply. Examine the rear tank for gasoline, open the lower drain of the vacuum tank and insert a wire in the opening if gasoline does not flow, as sediment many times will clog this outlet. Next lift the float valve of the carburetor for a few seconds. This systematic examination of these units will prove the presence of fuel in the float chamber and eliminates the possibility of major troubles, permitting an analysis of the minor details.

Mixture Too Lean

Too lean a mixture causes starvation of the engine and is likely to be caused by the inability of the carburetor to vaporize the fuel due to it being too heavy or non-volatile. Present-day fuels require considerable heat for vaporization and if the hot-air pipe is disconnected or the provision for heating is obstructed in any way proper vaporization cannot take place. Sediment in the carburetor may restrict the flow of fuel and thus cause starvation, while an inadequate gasoline supply will also indicate the same condition. Air leaks at the carburetor flange, manifold connection, carburetor throttle valve stem or leaks around the intake valve stems will also create a lean mixture and disturb the carburetor adjustment. Misplaced gaskets which tend to shut off the manifold or cylinder port openings will also create trouble which may be attributed to the carburetor unless one is very thorough in the search for the cause. Carburetors which are provided with auxiliary air valves for air adjustment at high speeds will also provide too lean a mixture if the auxiliary air valve spring is too weak or its adjustment has been disturbed. Excessive wear of the valve stem combined with engine vibration may cause the valve to stick in the open position and thus disturb the mixture proportions. After a thorough investigation of all likely possibilities, one may suspect the needle valve adjustment, which may have been disturbed,

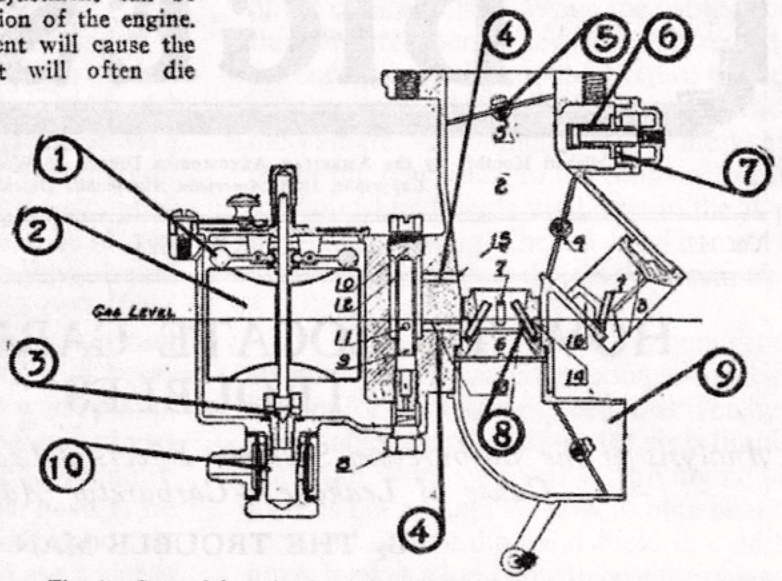

Fig. 1. Some defects in the carburetor which are responsible for trouble with this unit:

1—Worn float mechanism.
2—Punctured float.
3—Needle valve not seating.
4—Passage clogged.
5—Throttle Valve stem worn.
6—Auxiliary air valve spring weak.
7—Auxiliary air valve stuck.
8—Nozzle clogged.
9—Hot air line obstructed.
10—Fuel strainer clogged.

CARBURETOR TROUBLE CHART

Trouble	Symptoms	Causes
Too lean mixture.....	Back firing through carburetor. Engine is "killed" when throttle is opened quickly.	Gasoline too heavy (non-volatile.) Hot air pipe disconnected. Hot water circulation obstructed. Gasoline needle valve closed too far. Auxiliary air valve spring too weak. Air leaks around throttle valve stem. Auxiliary air valve stuck open. Spray nozzle obstructed. Loose or leaky gaskets. Inadequate gasoline supply.
Unequal fuel distribution...	Misfiring of one or more cylinders.	Gasoline too heavy. Insufficient heat supply. Partial obstruction in fuel line. Weak exhaust valve springs. Intake pipe too large. Air leaks around inlet valve stems. Air leaks at manifold and carburetor joints. Air leak in cylinder head gasket. Shortage of fuel due to insufficient drop between vacuum tank and carburetor. Fuel strainer clogged. Idling passage in carburetor clogged. On long hills vacuum in manifold too low to raise gasoline to vacuum tank. Motor too cold for low grade gasoline used.
No mixture.....	Engine stops and refuses to start.	No fuel in tank. Vacuum tank empty. Gasoline line valve shut. Carburetor needle valve shut. Strainer in bottom of carburetor clogged. Float valve stuck closed. Spray nozzle clogged. Air lock in fuel line. Water in fuel line frozen. Water in float chamber above nozzle. Gasoline going into intake manifold through vacuum tank suction connection. Leaky vacuum tank connections. Cylinders flooded with gasoline. Insufficient pressure on fuel (pressure feed system.) Carburetor adjustment disarranged.
Leak in float chamber or connections ..... Level in float chamber above mouth of spray nozzle....	Gasoline leaking when engine is idle.	Leak in gasoline pipe joint to carburetor. Leak in pipe near carburetor. Leaky float chamber. Metal float punctured. Cork float loaded. Wrong adjustment of float valve. Float valve bent. Float valve seat rough. Dirt on float valve seat. Carburetor primer stuck. Float riding side of float chamber. Too much pressure on fuel (pressure feed system.)
Too rich mixture.....	Heavy black smoke in exhaust when opening throttle quickly. Engine does not respond immediately to opening of throttle. Engine will not run up to speed. Rumbling noise from open exhaust. Red flame from exhaust port. Engine overheats.	Gasoline needle valve open too far. Auxiliary air valve stuck closed. Auxiliary air valve spring too strong. Main air inlet to carburetor screened off or choked. Running with choke control closed. Leaky float valve. Leaky vacuum tank float valve. Stove or tube choked. Choke spring weak or broken. Punctured float valve stuck open. Carburetor adjusted to run with motor cold without use of choke. Dirt in vacuum tank. Leaky vacuum tank float.

being closed too far to permit the proper fuel proportions.

Unequal Fuel Distribution

This is a very common trouble, although more likely to be caused by mechanical defects rather than carburetor adjustment. Those due to the carburetor are a lack of heat supply, a clogged idling passage or the intermittent flow of fuel. An intermittent flow of fuel can be detected by disconnecting the fuel line at the carburetor float chamber, or if the float chamber is provided with a drain cock this may be used for the purpose. If the fuel does not escape in a good-sized stream, disconnect the fuel feed pipe to be sure it is not obstructed, also examine the fuel strainer in the carburetor and vacuum tank, as sediment may clog these and thus permit the fuel to flow very slowly.

Misfiring due to mechanical defects can readily be determined by a few simple tests. Air leaks at the manifold joints listed in the trouble chart will affect carburetion and thus cause an unequal distribution of fuel. Should a leak be suspected at any point, it can readily be located by squirting gasoline around the joints while the engine is running slowly. If the engine picks up in speed there is a leak. Defective exhaust valve springs can be located by testing their tension. This is accomplished by inserting a screw driver between the coils of the spring and turning it while the engine is running, thereby increasing the tension of the spring. The reason a weak exhaust valve spring can cause unequal distribution is that, when the throttle is closed, the piston cannot draw in much of a charge, and consequently it sucks the exhaust valve open and draws back some of the burnt gases, which dilutes the charge in the cylinder.

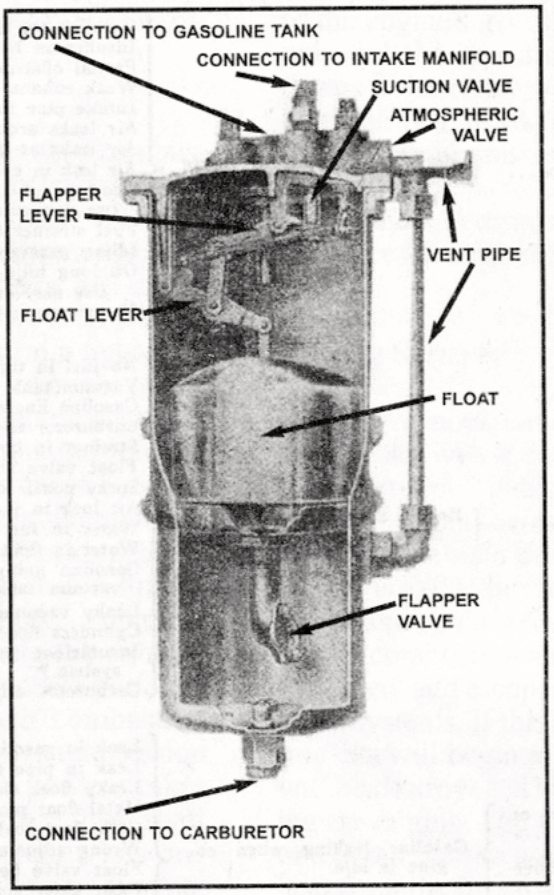

Fig. 2. Irregular operation of the vacuum tank may be due to stoppage of the vent hole in filler cap of the main tank, which is evident when the vent tube on the vacuum tank overflows regularly. Sudden stoppage of the engine with back firing indicates that gasoline is not feeding properly. Lack of gasoline in the carburetor float chamber denotes sticking float or a clogged line. If there is no gasoline in the lower chamber of the vacuum tank, strainer is clogged or one of the valves in the tank is stuck.

No Mixture

Should inspection indicate that the fuel does not reach the carburetor float chamber, the first supposition would be that the main fuel tank is empty. When the fuel supply becomes exhausted the engine will backfire, indicating that it is starving and that the fuel is not reaching the carburetor. In this case the main tank may be empty or the vacuum tank is not functioning properly, failing to supply fuel to the carburetor.

After the supply in the main tank has been determined, the fuel line can be traced to the shut-off valve and strainer if these are provided. The former may be closed or the latter clogged; if so, it will be necessary to remove and clean the strainer. Should the vacuum tank be empty, it can be primed by closing the throttle and spinning the engine with the starter for a few minutes. Should priming fail to fill the tank it is reasonable to assume that the strainer in the vacuum tank is clogged. This strainer is readily accessible and may be removed to clean it. To remedy a clogged fuel line it will be necessary to remove it and force air through it. This will generally force out all foreign matter. Another way is to run a wire through it, but the safest way is to use the tire pump and force the air through, as this will also remove any moisture that may be present.

If the fuel reaches the carburetor it is reasonable to assume that the trouble is in this unit. The first step is to determine whether the float valve is stuck closed or some other defect is preventing the fuel from reaching the spray nozzle or float chamber. Fuel may reach the float chamber, but cannot pass to the cylinders due to a clogged jet or dirt in the passage between the float and mixing chambers.

Leakage at Carburetor

Carburetor flooding is generally due to a punctured metal float, loaded cork float, or a large piece of dirt or sediment lodged on the needle valve seat. These causes are rare and are best determined by dismantling the carburetor.

In the case of a punctured metal float, leaky seams or minute holes must be soldered up.

Owing to the extreme thinness of a hollow metal float, care must be taken to heat as little as possible. To remedy a loaded cork float is quite simple; place the float in a moderate oven so it will be thoroughly dried out, and afterward give it several coats of shellac to make it liquor-proof. Shellac dissolved in grain alcohol will resist the action of gasoline better than that dissolved in wood alcohol.

Slow leakage is usually due to a small piece of lint or sediment lodging on the needle valve seat. If the leakage is serious, remove the float chamber cover or plug which encloses the needle valve and rotate the needle valve while bearing down slightly against its seat. If this does not help tap the needle valve lightly with a piece of wood, rotating the needle valve in different positions between taps. If, after this treatment the trouble still exists, it will be necessary to fit a new needle valve and seat.

Leakage may also be caused by defective fuel line connections, defective float chamber gaskets, or in the case of a pressure feed fuel system when there is too much pressure on the fuel. Another cause of leakage is a worn float valve and seat or a bent needle valve stem which does not permit the valve to seat properly. A bent float valve stem in the vacuum tank will permit the float to stick and thus cause flooding of the carburetor.

Mixture Too Rich

When the mixture is too rich the engine will be very sluggish and will stop almost immediately when a load is applied. A defective vacuum tank float is sometimes responsible for this condition, as it permits the tank to fill, and when this happens the engine will draw raw fuel from the main tank through the vacuum tank connection instead of through the carburetor. Leaky valves in the vacuum tank also cause the engine to load up on a pull and the spark plugs to become fouled.

To test for a defect in the tank, disconnect the vacuum pipe from the manifold to the tank and hold the finger tightly over this opening. If this clears up engine loading the trouble is in the vacuum tank. Another method of testing for leaky valves is to remove the vacuum line from the manifold, to the tank and replace this with two pieces of rubber tubing. One end of each of these is fitted to a piece of copper tubing flared to fit the union nut so that one tube can be attached to the manifold and the other to the tank. The opposite ends of the rubber tubes are fitted with short pieces of copper tubing and these are placed in a cork which is fitted to a bottle. The tubing should be heavy enough so that it will not collapse under suction, and all connections should be tight. If a defect exists in the vacuum tank, gasoline will collect in the bottle.

When the engine seems to load continually during idling regardless of carburetor adjustment, the trouble will usually be located in a leaky vacuum tank float. Wear in the float mechanism of the carburetor has the effect of increasing the level of the fuel in the float chamber and thereby automatically enriching the mixture. Any defect which may tend to obstruct or cut off the air supply will also cause an overrich mixture.

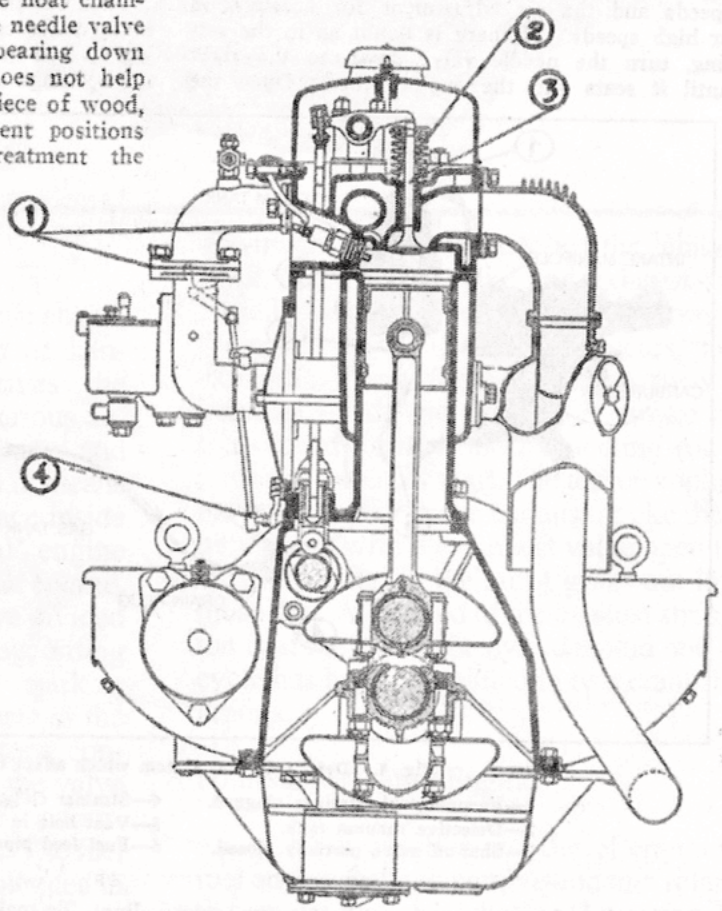

Fig. 3. Mechanical defects which will affect carburetion: 1—Defective gaskets permitting air leaks. 2—Weak exhaust valve spring. 3—Worn intake valve guides. 4—Throttle control worn

Carburetor Adjustment

Carburetors of the puddle type, such as the Kingston used on the Ford, may be tested by screwing in the needle valve until the valve seats and the engine stops. Unscrew the needle valve one and one-half turns, start the engine, and gradually turn the valve until the engine idles properly and seems to accelerate slightly as the mixture reaches the correct density. Allow sufficient time for the engine to take the gas from

the intake manifold before noting the difference in speed of the engine. Make these tests and set the carburetor only when the engine is warm, for if the carburetor is set with the engine cold, the operation will not be the same when the engine warms up.

Carburetors similar to the Marvel, used on the Oakland, have two adjustments, one for the needle valve and the second for adjusting the tension on the air shutter in the air inlet. The needle valve adjustment is for low or idling speeds and the air adjustment for acceleration or high speeds. If there is doubt as to the setting, turn the needle valve down to the right until it seats and the engine stops. Open the

thus enriching the mixture and preventing backfiring.

Carburetors such as the Stromberg and Zenith have spray nozzles with fixed opening to govern the flow of gasoline instead of needle valves. One nozzle is used for low speed and the other for high speed. The adjustment, therefore, is fixed and can only be altered by changing the nozzles. This is usually unnecessary, as the correct sized nozzles are fitted to the carburetor when the engine is tested at the factory.

Troubles that occur with these types are generally those caused from particles of dust working up into the small end of the nozzles, plugging the openings and preventing the passage of gaso-

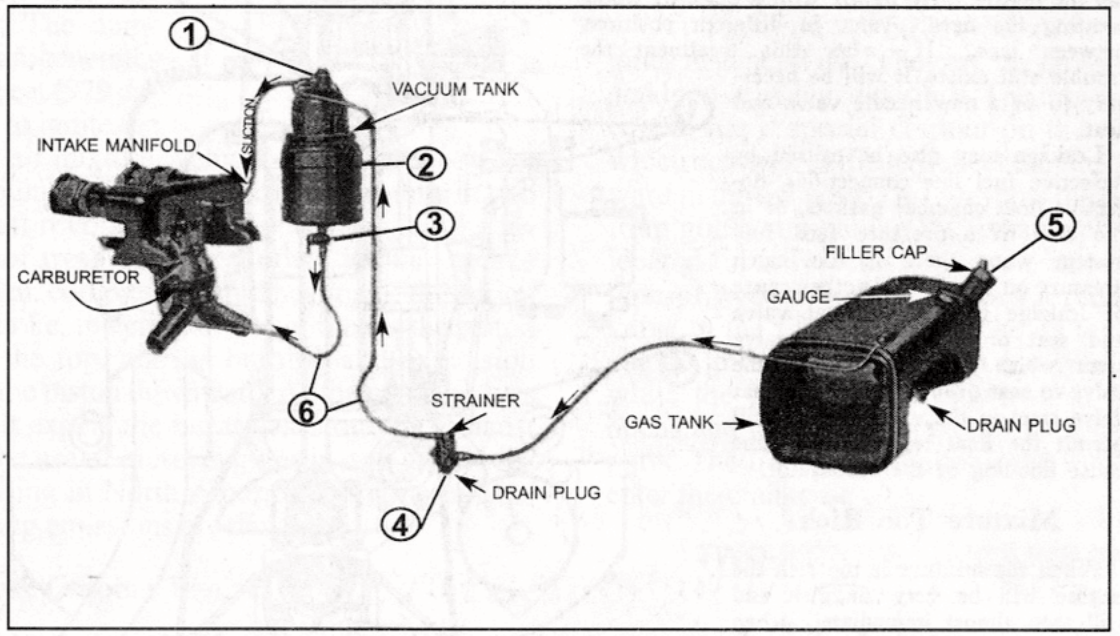

Fig. 4. Defects in fuel system which affect carburetion:

1—Vacuum tank strainer clogged.
2—Defective vacuum tank.
3—Shut-off valve partially closed.
4—Strainer clogged.
5—Vent hole in filler cap clogged.
6—Fuel feed pipes clogged.

needle valve about one and one-half turns, start the engine and turn the needle first to the right and then to the left until the engine runs smoothly without misfiring. When the point at which the engine seems to accelerate slightly is reached the adjustment is correct. With this adjustment the engine should idle smoothly and not show any indications of stalling.

When the low-speed adjustment has been set the next step is to set the high speed or air adjustment. This is accomplished by advancing the spark about two-thirds of the distance on the quadrant and opening the throttle quickly. If the engine accelerates freely without backfiring the adjustment is correct. Should the engine backfire the high-speed adjustment will have to be changed. This is done by tightening the tension of the air valve spring. As the tension of the spring is increased the flow of air is reduced,

line. To make the nozzles accessible for cleaning, small hexagonal studs are located beneath them so that these may be removed for cleaning.

Most carburetor troubles are preceded by some sort of a warning, which is accounted for by the action of the engine. In order to locate trouble quickly, regardless of its nature, one should always use a process of elimination, by establishing the symptoms of the trouble and then proceeding to study the various causes. First determine whether fuel is reaching the carburetor, then inspect the tank for supply, etc. By following this scheme less time will be wasted.

S.K.