ETCetera

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Getting Your Pontiac Roadworthy, Fuel System Service

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In The Garage

Fuel System Service

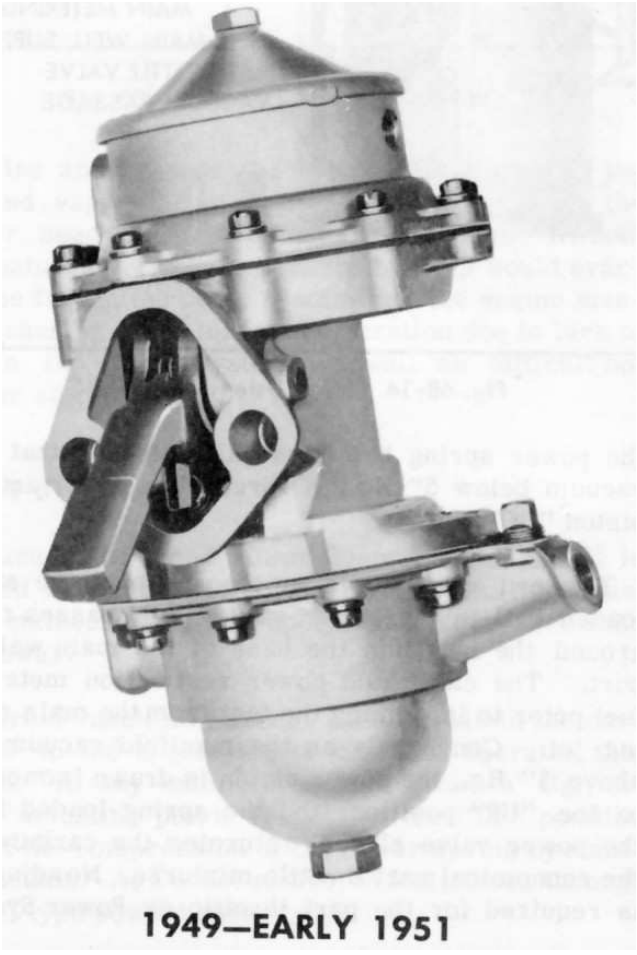
This month we will cover the fuel system of your vintage Pontiac, in keeping with the theme of past articles, we begin with the assumption that your car is in generally good condition and requires merely a thorough check-up before you begin driving it again.

The number one item of fuel system service is to thoroughly inspect the entire system for any possible leaks, and carefully check all rubber hoses for deterioration. Proper inspection of rubber hoses includes visual inspection for cracking of the outer surface, apparent leakage at connections and along the entire length of hoses, plus squeezing the hose to determine if it is either too soft or too firm. In some cases the hose will swell up and become very soft due to modern gasoline, or other chemical additives that may have been used such as dry gas or a fuel system cleaner. The other extreme is the nearly rigid stiffness of hose as affected by heat and age. In either case, this affected hose must be replaced with new; and you want to buy your hose from a reputable auto parts supplier and make sure they know you are using it as part of the fuel system. Good quality hose will usually be printed with the wording "fuel and emission hose" to be sure there is no mistaking its intended use.

We are fortunate that our vintage Pontiacs used very little rubber hose as the cars came from the factory. Typically there is a section between the fuel tank and the steel line on the frame, and another section from the frame line to the fuel pump. This second rubber line is actually a composite assembly of rubber and brass fittings as originally installed. Regardless of what combination of hoses and lines are used on your car, it is essential that you inspect them at least once a year, and preferably twice; spring and fall. A realistic life expectancy for synthetic rubber hose under the conditions that the majority of us use our cars is probably 4 to 5 years. Beyond this age, a failure could result in a relatively short time, so pay attention to any fuel odor or spots on the pavement under your parked car.

NOTE: If you find any fuel hose on your car that has swollen and become very soft, it is very likely that chemical action has caused this and the diaphragm(s) in your fuel pump are also highly suspect for the same kind of damage. The vacuum advance unit of your distributor could also be affected as fuel fumes do come in contact with it.

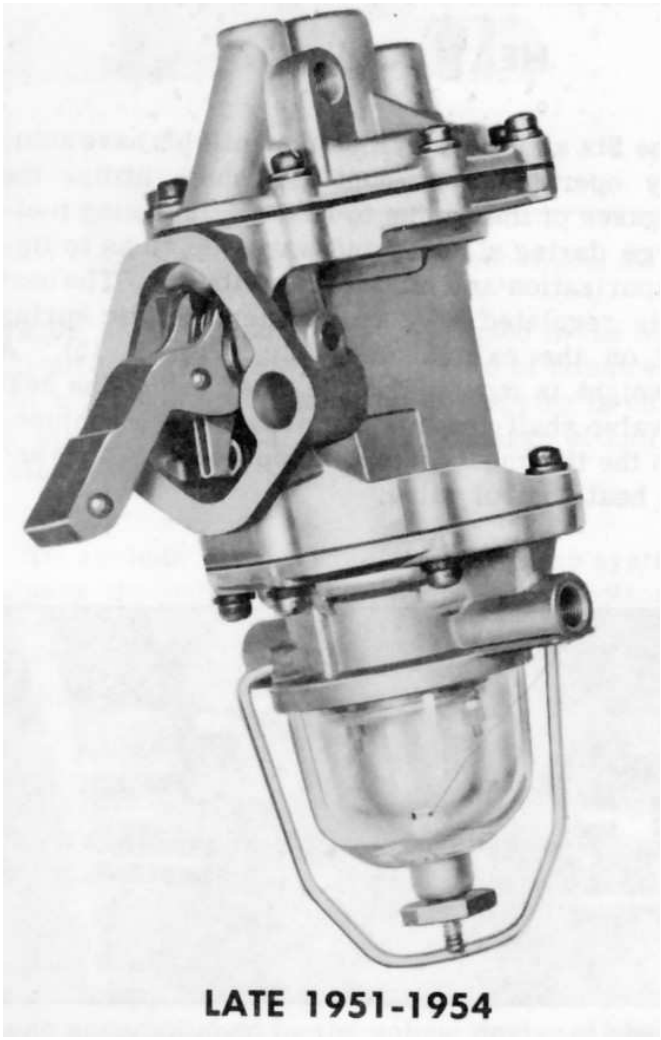
Once you have inspected the fuel lines, examine the fuel pump, sediment bowl and the carburetor for any signs of excessive leakage. It is nearly impossible to prevent fuel from weeping at the edges of the fuel pump and sections of the carburetor where the gaskets protrude. The difference between slight weeping and a fuel leak is the presence of dirt. Any connections or seams between fuel pump or carburetor components will attract an accumulation of dirt due to trace wetness. An actual leak will have sufficient flow of fuel to wash away the dirt, so any areas that are leaking are usually conspicuously clean. Bear in mind that the fuel line from the tank is subject to slight vacuum when the engine is running, so it is more likely to leak as soon as the engine is stopped, this also applies for the sediment bowl section of the fuel pump. The pressure side of the fuel system includes the pump diaphragm and the line connected to the carburetor, also an accessory sediment bowl, if installed. This section of the fuel system is more likely to leak with the engine running.



1949—EARLY 1951

The sediment bowl in the pump functions to capture foreign material or water before it gets to the carburetor. There is also a screen installed in the fuel inlet of the carburetor that should contain any parti-

particles big enough to cause the needle valve to stick open. If you want to install a pleated paper fuel filter, it should be placed in the line between the pump and carburetor, fuel filters are designed to be in the pressure side of the system and not on the suction side. You could cause vapor lock problems by trying to draw fuel through the filter.



The stipulations regarding synthetic rubber fuel hose also apply to the diaphragm in your fuel pump. If it has been more then 10 years since your pump was rebuilt, I would highly recommend that you buy a rebuild kit and replace the diaphragm(s). Be sure to buy a new kit; do not use N.O.S. rubber parts in the fuel pump! If you carry a rebuilt or N.O.S. fuel pump in your trunk for roadside emergencies, it also needs to have a new diaphragm installed. The synthetic rubber in recent years is designed to be compatible with today's gasoline; any rubber older then about 10 years is suspect. From what I have read, fuel formulations seem to have stabilized in the past few years and the synthetic rubber compounds now available should perform well years into the future.

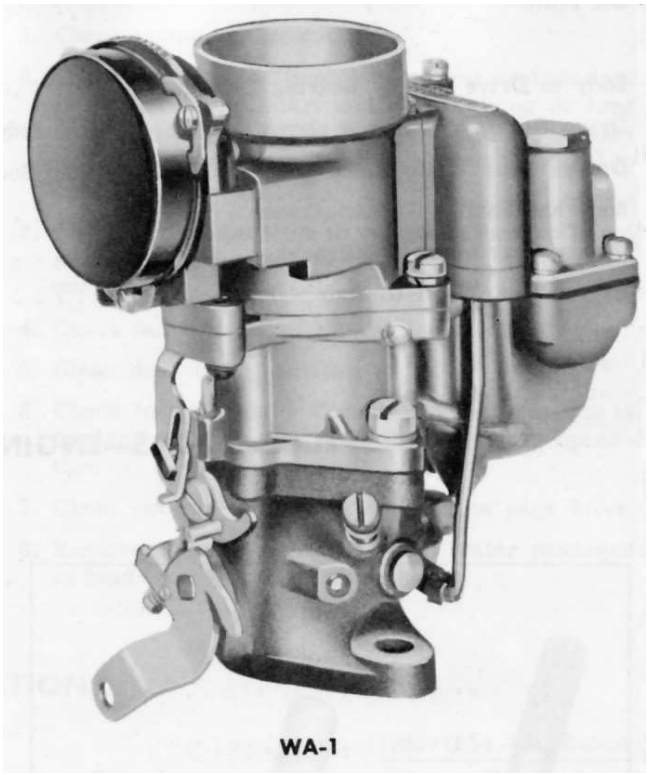
I personally do not change the valves in a fuel pump I know to be working, only the diaphragm. I treat the vacuum section of a compound pump the same way; if it works I only service the diaphragm. If you don't seal the new valves absolutely air tight in the housing, the fuel pump will not work at cranking speed. The fiber disc valves of factory fuel pumps seem to be unaffected by gasoline formulations and I've not had any problem leaving them in place.

Most eight cylinder cars have the compound fuel pump installed, while you are inspecting fuel lines, be sure to look at the vacuum lines as well. A vacuum leak will result in poor windshield wiper operation and could also cause rough idle or stalling. Since the vacuum connection to the wiper motor came from either end of the intake manifold, a leak could cause a burned valve at that end of the engine if not corrected. Beginning in late 1951, the compound pump used a glass sediment bowl held in place with a heavy wire bail and thumb wheel screw. The cork gasket for the bowl is quite thick to cushion the glass, but this thick gasket compresses with age and the bowl becomes loose, so be sure to check the thumb screw regularly. I had an intermittent leak on my '53 due to this, now I check the screw several times each season!

Pontiac was careful to design their fuel system to work in hot weather without undue concern for vapor lock. The fuel line is routed along the frame opposite the exhaust system and the carburetor has a shield to deflect radiant heat. The most likely cause for vapor lock on an ETC-era Pontiac is a stuck heat riser valve, so you want to be sure that yours is in good working condition. Modern gasoline is more aromatic then it was 50 years ago, especially the higher octane, this can cause problems in hot weather. I personally try to park my car facing into the wind when ever possible; I also raise the hood during short rest stops of 10-15 minutes to allow engine heat to readily escape.

Despite snide comments from the fuel injection people that a carburetor is nothing but a calibrated leak; it is in fact a delicate, precision instrument and if handled by an expert, will perform quite well. My own experience with the Carter WA-1 and WCD carburetors has been very good. Fortunately none of the Carter carburetors from the ETC-era has a synthetic rubber accelerator pump plunger, they are leather and very durable. Repair kits are readily available and once the carburetor is properly adjusted, it will perform reliably without further attention for thousands of miles. Unfortunately special tools are required for the critical adjustments of

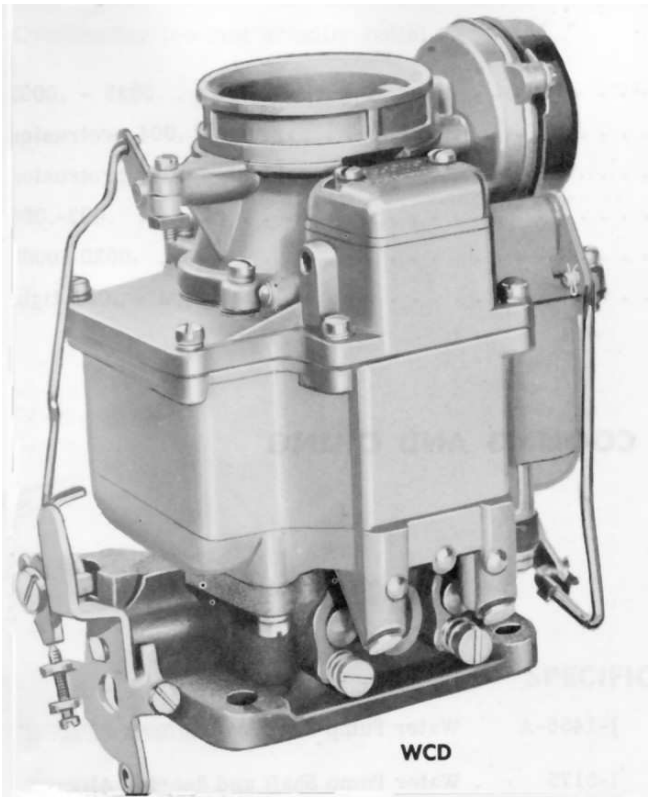
Carter carburetors being rebuilt, if you determine that your carburetor is not working properly, I recommend that you send it to a reputable carburetor specialist for repair.


WA-1

The only carburetor adjustments we are going to cover are the basic tune-up settings for the automatic choke, idle mixture and speed. Speaking of tune-ups, think about the fact that electronic controls have made them obsolete. New cars have no valve, ignition timing or idle mixture/speed adjustments. An electronic control module monitors engine parameters through sensors and makes corrections in real time, plus in most systems it has the ability to learn and maintain the corrections to keep the engine in peak tune. Even the sensors lack adjustment, once installed on the car, the module reads the data from the new sensor and accepts it so long as it falls with a pre-determined range. Electronic controls are basically on or off, the car either runs or it doesn't, although there is usually some provision for limp-home in the event of a component or system failure.

Contrast this with our ETC-era cars; we have the ability to adjust the valves, ignition timing and the fuel delivery at every engine speed due to initial and tune-up adjustment provisions of the carburetor. The ability to adjust is a double-edged sword; if the adjustments are merely adequate the car will probably run, but not very reliably. If on the other hand, the adjustments are properly "tuned" the car will run very well and quite reliably. A measure of good performance is achieving the fuel economy the factory claims possible for a given model year. This is the reason that Pontiac provided that information in their service manual, fuel economy is a quantifiable measure of automobile performance readily available to the car owner.

An excellent tune-up is not only dependant upon making every available adjustment precisely; it is also possible to finesse the results by knowing how the adjustments interact and applying that knowledge with how the car will be driven. If your goal is a Pontiac for parade use and minimal driving to and from car shows; then "tight" (minimum setting) adjustment of the valve clearances will provide near silent idle and low speed running. You would also increase the spark plug gap from the recommended .025" to .030" or .032" as the wider gap will give you a smoother idle. The ignition timing could also be advanced with the octane selector; additional advance improves the idle quality and throttle response during low speed, part-throttle driving.


WCD

If however you are going to drive your car on road trips, the previous adjustments are poor choices. The valve clearance, especially on the exhaust valves, needs to be set "loose" (maximum clearance) to insure adequate cooling. The plug gap needs to be .025" or you are likely to experience miss-fire at high speed or upon heavy acceleration to highway speeds. You are also likely to hear

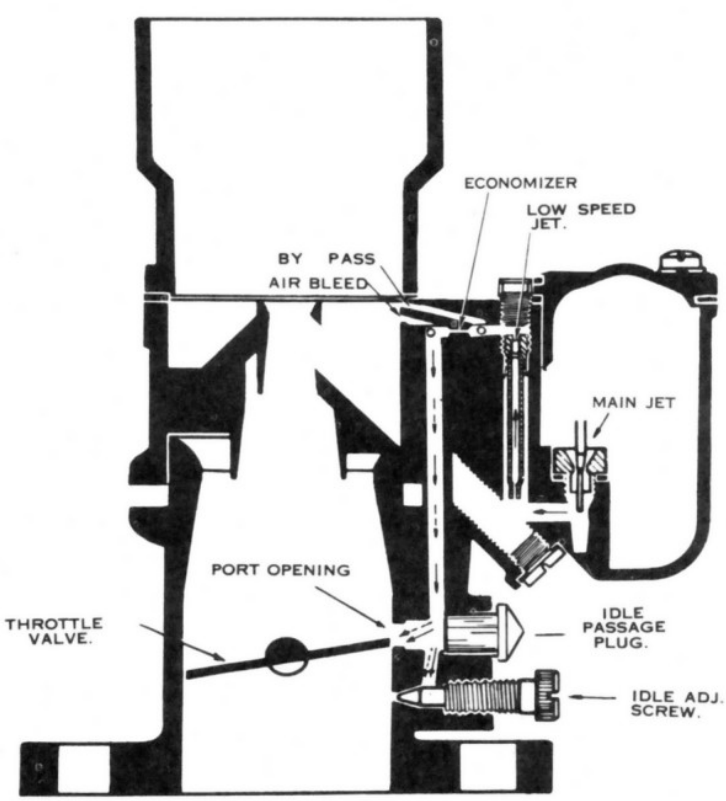
excessive spark knock on acceleration because the timing is too far advanced.

I want to briefly mention the correct sequence for performing a tune-up. Assuming that no major repairs are necessary, the valves should be adjusted first. Then perform the ignition system service, beginning with the spark plugs. The contact (ignition) points can initially be set with a **clean dry** feeler gauge, but ideally you should adjust them to obtain the correct reading on a dwell meter. Finally you can zero the octane selector and adjust the base ignition timing. Disconnect the vacuum pipe at the distributor to insure the advance unit is not working. Always remember that changing the dwell changes the ignition timing, but changing the timing will not change the dwell. The final tune-up adjustments will be the idle mixture and speed.

There is a critical relationship between idle speed and proper idle mixture adjustment, and also between the carburetor adjustments and base ignition timing / vacuum advance operation. All ETC-era Pontiac engines with vacuum advance use a "ported" vacuum source at the carburetor. The vacuum advance port is positioned just **above** the throttle plate when it is in the idle position; vacuum is only present under the throttle plate. As the accelerator is depressed and the throttle plate opens, the advance port is exposed to engine vacuum under the throttle plate. If the idle speed is not correct, neither is the relationship with the vacuum advance port. A similar relationship exists for the carburetor during idle and off-idle operation.

To better understand these relationships, it will helpful to refer to the cut-away carburetor diagram. Note the idle mixture screw passage well below the throttle plate and also the port opening (off-idle passage) near the edge of the closed throttle plate. When the tune-up adjustments are correct, all of the fuel mixture necessary for engine idle is being fed past the mixture screw. When you step on the accelerator, the throttle plate opens along the off-idle passage exposing it to engine vacuum, which draws additional fuel to supplement the amount still coming past the idle mixture screw. This off-idle fuel is necessary for smooth acceleration and engine operation at very low speed. Naturally the vacuum advance port is also exposed to engine vacuum in the same manner and the ignition timing advances along with the increase in engine speed.

If you continue to accelerate, the air flowing through the venturi will become sufficient to cause fuel to flow from the discharge nozzle and the "main" or high-speed fuel circuit takes over to supply all of the engine's fuel. Since the throttle is still only partially open, there is sufficient vacuum for the distributor advance unit to continue working. At wide-open throttle there isn't any measurable engine vacuum, but the engine doe not need additional advance under this condition, so the system works very well as designed.



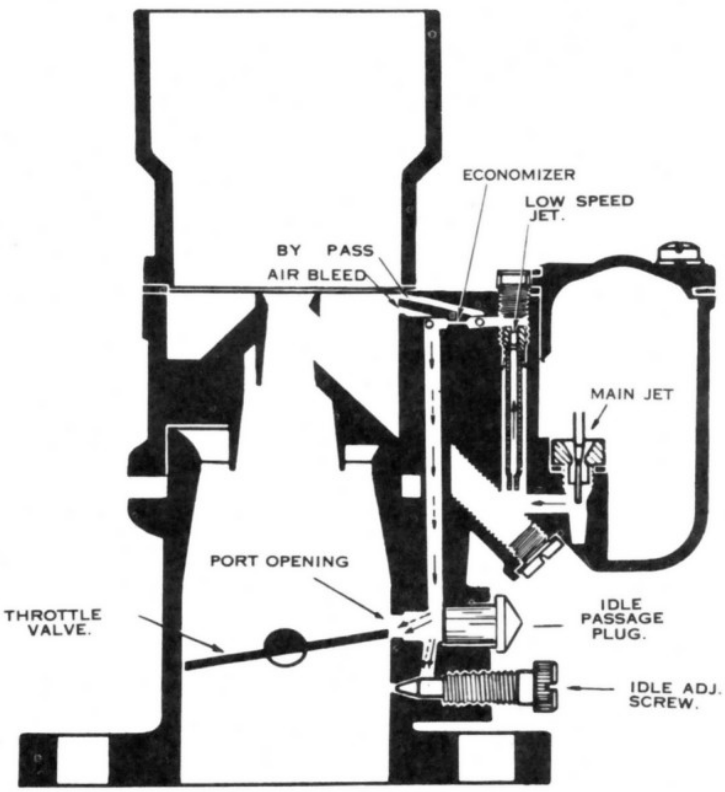
Now its time to adjust the carburetor, the automatic choke housing is marked for rich and lean, you merely have to loosen the retaining screws and rotate the cover to the correct setting. If your car starts well, I would leave the setting where it is. The engine needs to be at normal operating temperature, with the air cleaner installed, to properly adjust the idle mixture and speed. Before starting the engine I turn the idle mixture screw in until it is **lightly seated**, I count by 1/2 turns so I can turn it back out to its original position. Naturally on a two barrel carburetor you have to do this with both mixture screws, and they should both take an equal number of turns! If you find more than ¼ turn difference between them, it is possible there is a carburetor problem. A vacuum gauge is a great help in adjusting the idle mixture screws, if you have one available. You can connect it at the vacuum port for the windshield wipers.

The first step in adjusting the carburetor is to check the idle speed and adjust it as necessary. Assuming you can adjust the speed to specification,

then turn the mixture screw in (leaning the mixture) by 1/8 increments while watching for the idle speed to drop. On two barrel carburetors, always turn both screws in the same direction and the same amount. Once you see the idle speed drop, then back the mixture screw out (richening the mixture) by 1/8 turn increments to achieve the highest idle speed. Adjust the idle speed back to specification and repeat the process of first leaning the mixture and then richening it for the highest idle speed. It should not idle beyond specification the second time if everything is correct. Now that the speed is stable at the specified rpm, slightly raise the engine speed by moving the throttle linkage at the carburetor, or by having a helper step on the accelerator, and abruptly release the throttle. Does the idle return to the specified rpm immediately? If the engine stalls, the idle mixture is too lean, if it stays fast or slowly returns to the proper speed, the idle mixture is too rich. Adjust the mixture screw(s) in 1/8 increment and repeat the speed-up test. The idle mixture is adjusted correctly when the engine immediately settles to the specified rpm and idles smoothly with a steady vacuum reading between 17 & 21 in. hg. (inches of mercury).

If you are unable to achieve a smooth steady idle, begin by turning one mixture screw in (lean) until the engine stalls, then back to its original setting, and do the same with the second screw. It should stall with either screw lightly seated, if it kept running then fuel is getting into the engine somewhere that it shouldn't be. Remove both mixture screws and examine them. The tip of each screw should have a smooth taper to a nearly sharp point, and both screws should be identical. Assuming you do not find any damage to either screw, you could try squirting aerosol carburetor cleaner into each mixture screw passage to clean out any varnish or dirt that might be there. There is one other situation you can check before removing the carburetor for repair. It is possible that the float level is slightly too high. Remove the air cleaner and look into the carburetor with the engine idling, you should **not** see fuel dripping from the nozzle in either venturi. If you see fuel dripping, you could carefully remove the top of the carburetor and adjust the float level to specification. Be aware that setting the float level too low is as bad as having it too high! The float level is a critical adjustment for proper operation of the carburetor at every engine speed and must be set correctly.

Now that I have explained how everything is supposed to work, we will consider the effect of improper adjustments. If the ignition timing is "late" or retarded from the proper specification, the engine will idle slower and by necessity, the idle speed screw will have to hold the throttle plate open further to achieve idle. If the mixture screws are set too lean, the idle will slow and the same situation occurs with regard to the idle speed screw. If the ignition adjustments are correct, but you adjust the idle speed higher then the specification, you have created the same problem yourself.



The problem is this; at idle all of the fuel mixture necessary should be supplied by the idle mixture screw **only**, if the off-idle passage is exposed because the speed screw is adjusted too fast, some mixture will naturally come from this source, and the mixture screw will be set artificially lean to achieve the best idle quality. The engine will idle just fine, but when you attempt to accelerate the engine and put the car in motion, it is very likely to hesitate due to a momentary lean condition. Since the off-idle passage was already supplying fuel for idle, there will not be enough fuel to accelerate the engine smoothly up to the point that the main metering system takes over. The car will also be "flat" when driving at very low speeds, when the off-idle passage is essential for smooth performance. This whole problem will be compounded if the base timing was adjusted while the vacuum advance was working. With vacuum applied, you would naturally

be retarding the timing to get the marks aligned and retarded timing also results in sluggish performance.

The relationship between the throttle plate(s) and the off-idle passage(s) and the distributor vacuum port is essential for smooth acceleration and responsive low speed driving; so it is essential that the idle speed and mixture be adjusted correctly.

The float level setting is absolutely critical because it effects the fuel mixture throughout the entire operating range of the carburetor; too high and the mixture is rich, too low and the mixture is lean. Regardless of engine speed or load, the float admits fuel into the float bowl at the same rate it is being used, so the fuel level within the carburetor float bowl remains at a constant level. The level of fuel within the carburetor was carefully determined by Pontiac and Carter Carburetor engineers to provide the best all around compromise for smooth reliable performance and operating economy.

For the sake of this discussion, let us make two assumptions with regard to the cut-away at left. The first is that the correct fuel level is even with the words "main jet", and the second is that the float level specification is 1/2 inch.

Notice that all of the fuel must pass through that main jet to reach either the idle or main metering circuits of the carburetor. This makes it essential to keep the main jet covered with gasoline, if the jet was to be uncovered, on a sharp turn for instance, the fuel flow would be interrupted and the engine could hesitate or even stall completely.

Bear in mind that all of the carburetor passages will have fuel in them at the same level as the float bowl. Note that the low speed jet, which meters the total amount of fuel to reach the idle mixture screw and the off-idle passage, is above the fuel level. Engine vacuum, even at cranking speed is sufficient to draw gasoline up through the low speed jet and the economizer restriction, from there vacuum is no longer needed for fuel to flow.

The (idle) air bleed actually admits air into the idle circuit, this emulsifies the fuel with air even before it reaches the mixture screw and gives better idle quality. The (idle) by-pass opening connects to the float bowl side of the economizer restriction, when the throttle is open to the point that the main metering circuit is supplying fuel, airflow back through the by-pass passage prevents fuel from flowing in the idle circuit. Shutting off the idle circuit is an economy measure, hence the term economizer. This is an example of the sophistication of the went into designing the Carter carburetor.

Although it is not shown in any detail, the main metering passage is the one that runs upward at a 45 degree angle to the discharge nozzle at the top of the venturi. As the throttle is opened beyond idle, air flowing down through the venturi creates the vacuum necessary to draw fuel up the main passage to the discharge nozzle.

Our cut-away carburetor has a float level specification of 1/2 inch, and the service manual shows how this measurement is to be made. If you set the float at 3/4 inch, you would be lowering the fuel level in the bowl, conversely if you set it at 1/4 inch you would be raising the fuel level. I already mentioned the possibility of uncovering the main jet due to low fuel level, and interrupting the flow. If set too high, fuel can slosh out of bowl vent passages on abrupt turns or stops and momentarily flood the engine with too much fuel. Unfortunately the symptoms are nearly identical to insufficient fuel, a hesitation or possible stalling. The one unique symptom of a high float level is the likelihood of gasoline odor.

A low float level is very likely to cause a part throttle hesitation or surge. Remember that the idle circuit is limited by the low speed jet and can only supply a fixed amount of fuel. If the float level is low, it will take more vacuum, (airflow) to draw the fuel up main metering passage to the point of discharge from the nozzle. This extra air is too much for the fixed amount of fuel from the idle circuit and the mixture suddenly goes very lean, affecting engine performance.

Once you have your carburetor adjusted correctly, it is unlikely to need any attention for thousands of miles. The fuel system is much more reliable then the ignition system, both in terms of required maintenance, and also with regard to potential failures.

I keep record of the fuel mileage of our '53 Chieftain; it is a reliable indicator of vehicle performance and any significant change in fuel economy needs to be investigated. Your engine can be running perfectly, but one wheel with a dragging brake will definitely affect your fuel economy!

I have not had any trouble using 87 octane gasoline, nor do I worry about ethanol blends. I do not buy gasoline if the tank truck is there delivering fuel, because it is likely to agitate any sediment or water that might be lurking in the underground tank. In general, today's gasoline is significantly less likely to contain water or other contaminants, but the possibility will always exist.

I hope I have not thoroughly confused you, but I prefer to explain how things work and not just tell you to do this, that and the other if you want your car to perform properly.