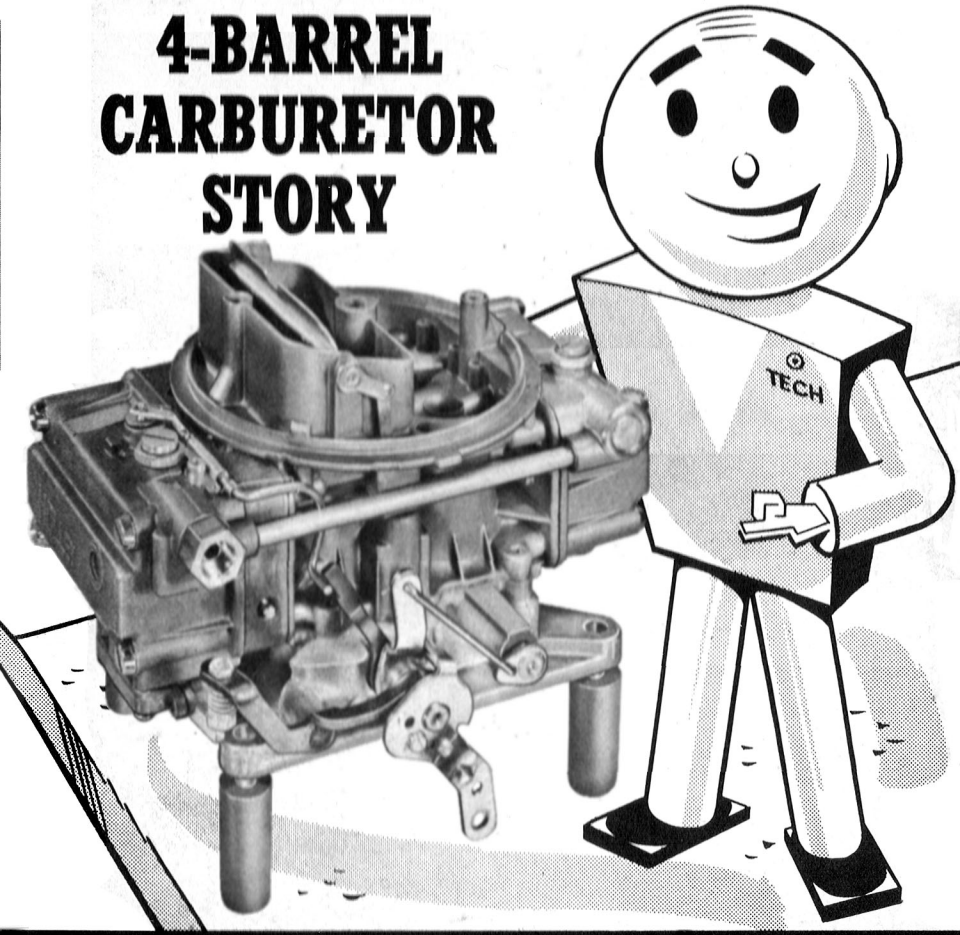
SERVICE REFERENCE BOOK

of the MASTER TECHNICIANS SERVICE CONFERENCE

session no. 149

THE HOLLEY 4-BARREL CARBURETOR STORY



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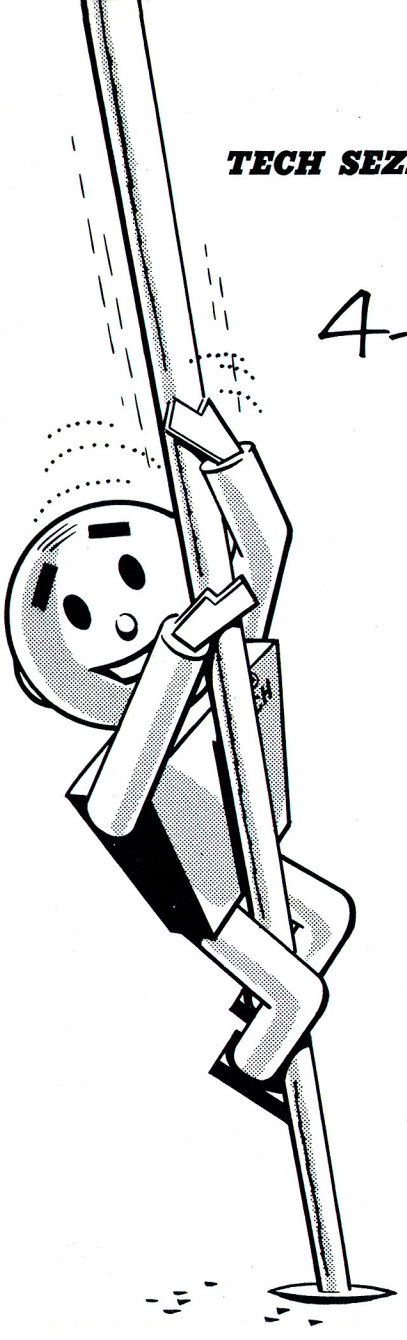


TECH SEZ: "Ready up for the new Holley 4-barrel carburetor!"

The Holley 4-barrel carburetor is new to some of us, but it does the same basic job that other carburetors do. Therefore, it has certain adjustments that may need to be inspected and corrected, and the same accurate work is required.

Another thing to remember is that all other engine tune-up factors—compression, ignition, timing, points and plugs—must be up to specifications before you make any adjustments to the carburetor.

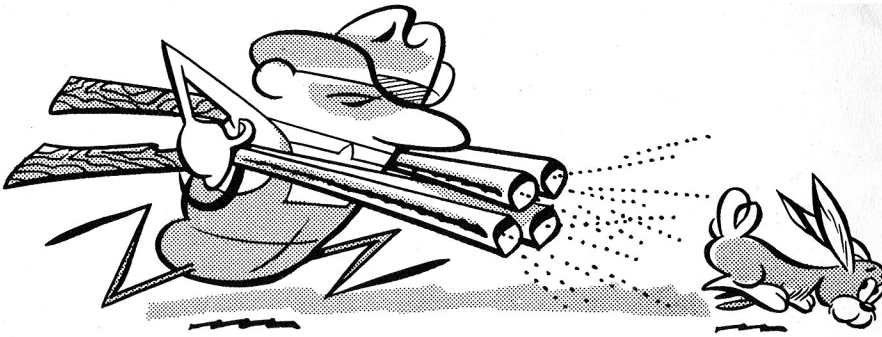
When you get to that point, you'll find this reference book helpful. It describes the Holley 4-barrel carburetor used on the Dodge 383-cubic-inch Ram-Fire engine.

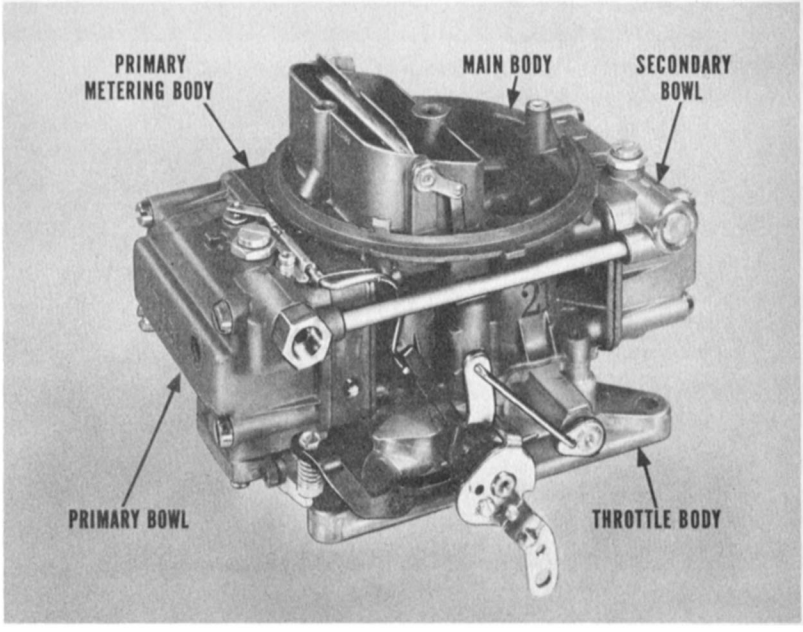
The various systems involved are explained. Adjustments that can be made are also described, as well as some service conditions and recommended corrective procedures.

Here's how this useful information is arranged:

THE HOLLEY 4-BARREL CARBURETOR

General Description. This carburetor, used on currently produced Dodge 383-cubic-inch Ram-Fire engines, is basically two dual downdraft carburetors mounted side by side. It has a main body and a throttle body. There's a primary and secondary fuel bowl, each with a separate float; primary and secondary fuel metering systems, each with a separate metering body. The secondary metering body is located under the fuel bowl.

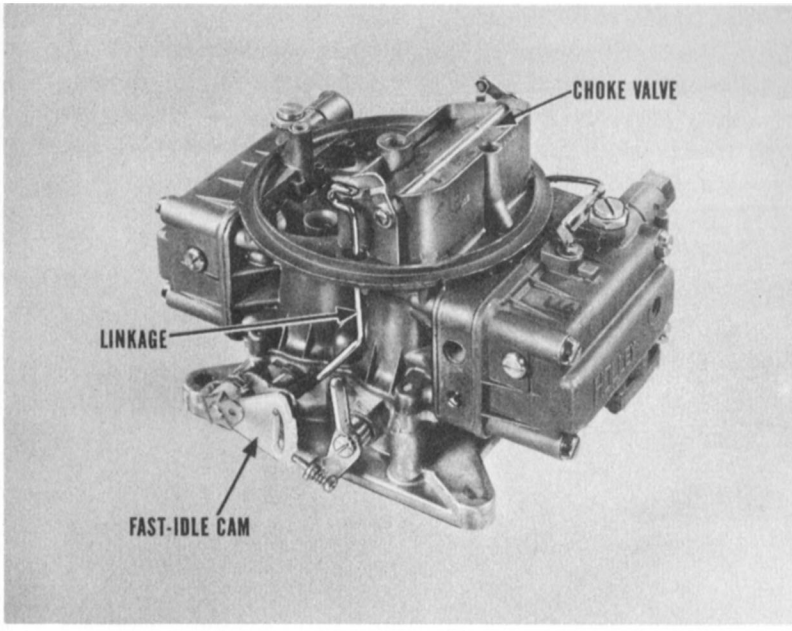




Description

Choke. A single choke valve in the air horn on the primary side is controlled through linkage by a well-type automatic choke mechanism. This mechanism is mounted in a well over the exhaust crossover passage in the intake manifold.

The fast-idle cam also is actuated by the choke linkage to improve engine warm-up. Choke unloading is done by depressing the acceler-



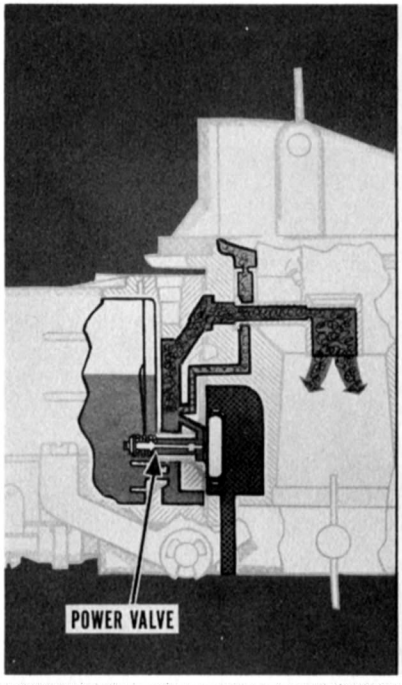
ator pedal to full throttle position while the engine is being cranked.

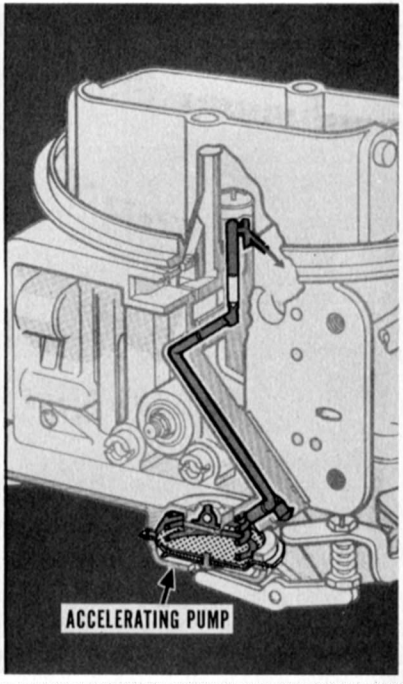
Wide-open throttle has no effect on the secondary throttle valves when the choke is closed. That's because the secondary stop lever is held by a choke secondary interlock when the choke valve is closed.

Systems. Fuel enters through a single inlet fitting in the primary fuel bowl. A horizontally positioned fuel tube connecting the primary and secondary fuel bowls and located ahead of the needle valves feeds the secondary system. Between both bowls a balance tube equalizes air pressure within the fuel bowls.

Both bowls are vented by passages located inside the air horn. These vents release excess vapors and almost eliminate any tendency toward percolation. When the engine is stopped or running at curb idle, the primary fuel bowl is also mechanically vented to atmosphere.

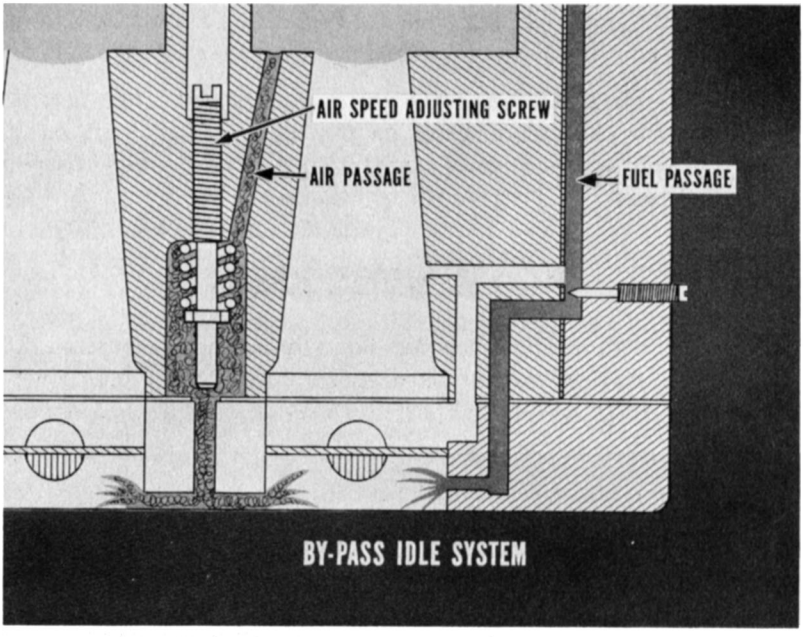
Each of the four barrels has its own venturi, main fuel discharge nozzle, booster venturi, and throttle valve. Fuel-air mixture throughout the entire speed range is provided by the primary system. The secondary fuel system supplies fuel-air mixture at idle, and during high speed. When speed increases so additional breathing and fuel are needed, a tang on the throttle lever engages the secondary throttle lever and opens the secondary throttle valves. This happens at about a ¾-primary throttle opening.

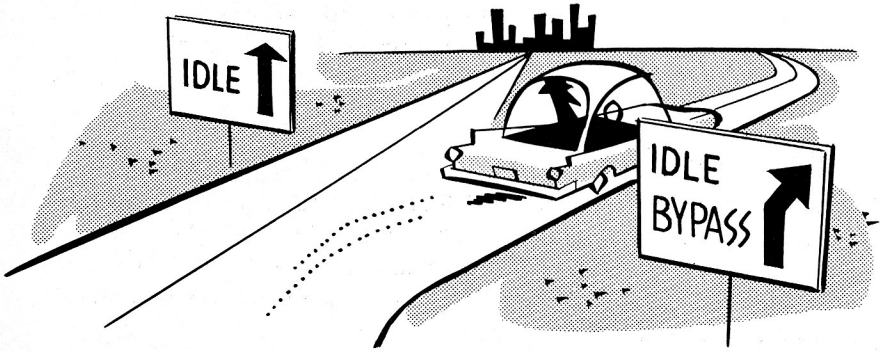




Additional fuel for full-power and high-speed operation is provided by a vacuum-actuated power valve in the main metering body. And on acceleration, additional fuel is supplied by the action of a diaphragm-type, mechanically operated accelerating pump. This pump is located below the primary fuel bowl. An override spring on the pump's operating lever helps prolong discharge of fuel for smoother acceleration.

Instead of the usual idle speed stop screw setup, this carburetor uses a bypass idle system to control curb-idle speed. This design helps minimize possibility of carburetor icing. Throttle valves are completely closed at slow idle. An air passage and a separate fuel passage open into the carburetor below the throttle valves.





An adjustable air-speed screw, which controls the amount of air admitted to the bypass idle system, is located at the bottom of the air cleaner anchor stud hole. You have to remove the air cleaner to get to the air-speed screw.

You'll save time adjusting the fuel level since this can be done with the carburetor on the car, and while the engine is running. This feature provides an adjustment that takes fuel pump pressure into account.

Both fuel bowls have inlet valve and seat assemblies that can be removed while the carburetor is on the engine—another timesaver. Inlet valve and seat assemblies are positioned vertically in the topside of the fuel bowls.

FLOW SYSTEMS

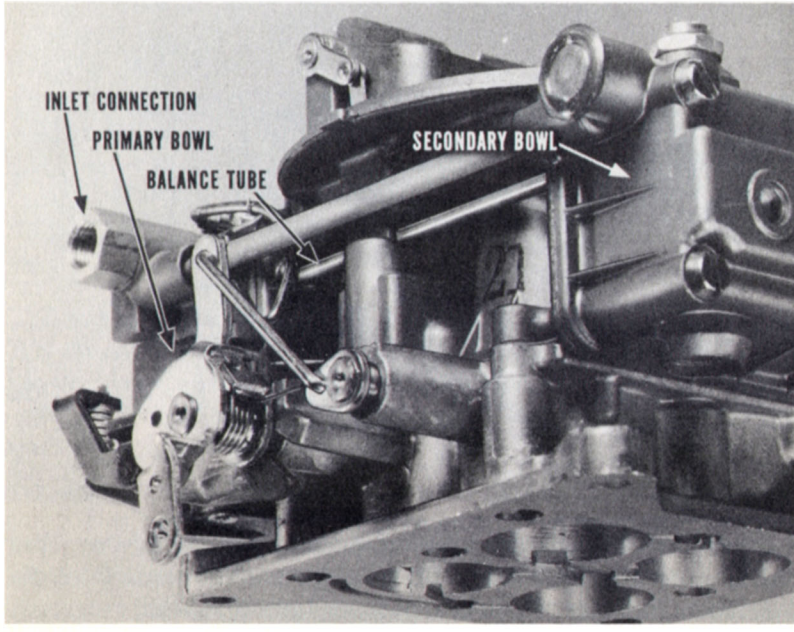
The more you know about how fuel flows through the carburetor, the more easily you'll be able to diagnose and correct carburetor conditions. In the Holley 4-barrel carburetor there are these eight flow systems:

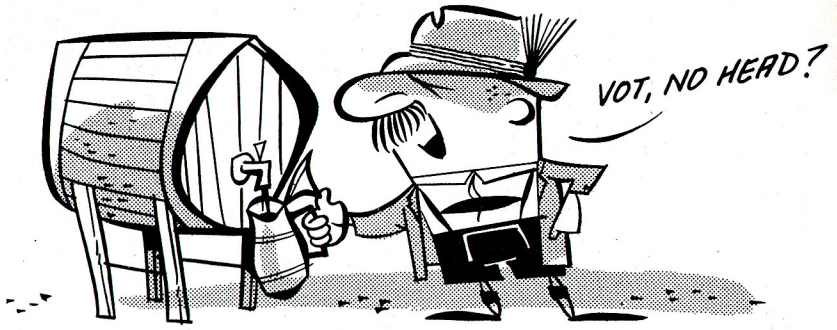
- **primary fuel inlet**
- **primary idle**
- **idle bypass**
- **secondary idle**
- **primary main metering**
- **secondary main metering**
- **power enrichment**
- **accelerating pump**

Operation

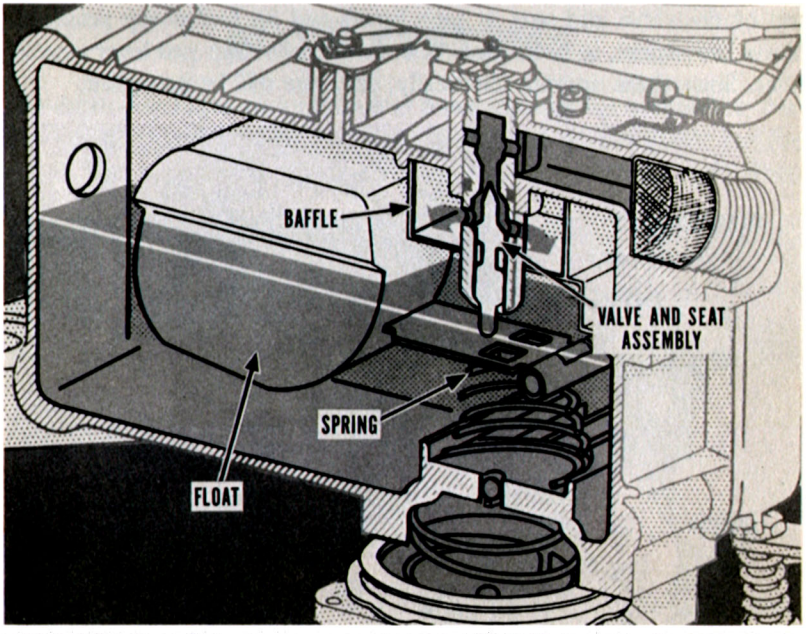
Primary Fuel Inlet System. Fuel first enters the primary fuel bowl through an inlet connection and a filter screen. Its flow is then divided, part of it going directly into the primary fuel inlet valve, and part through a fuel tube into the secondary fuel inlet valve. So both bowls are kept filled with fuel.

How much fuel enters each bowl depends on the space between the top of the valve and seat in each bowl—and on fuel pump pressure. Valve movement, in both cases, is controlled by float and lever assemblies. Since these operate identically, only one will be described.



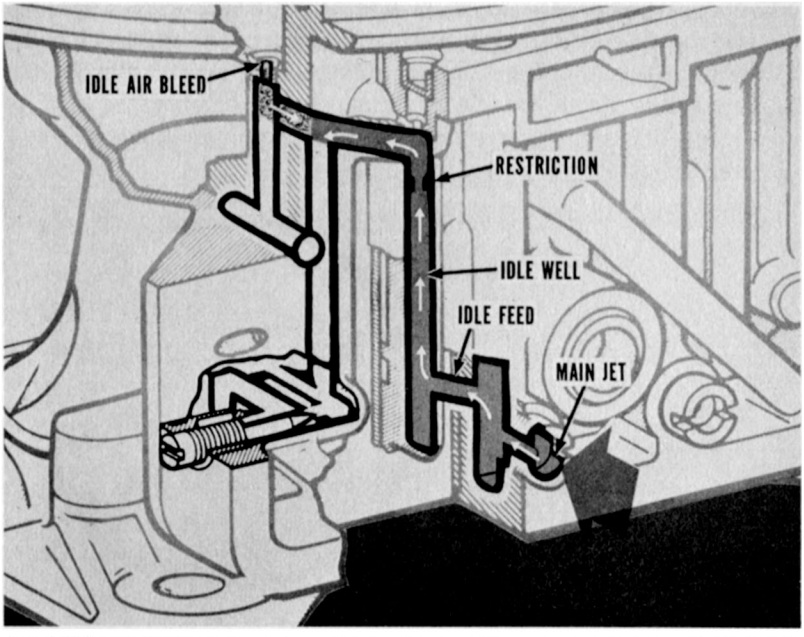


A coil-shaped spring under the lever helps keep the float in a stable position. A baffle around the valve and seat breaks up any tendency of the fuel to foam.



As the fuel level drops, the float drops and opens the valve so more fuel can enter the bowl. When fuel reaches a predetermined level, the float moves the valve to shut off the flow of additional fuel.

Primary Idle System. Air flow at idle and low speeds isn't strong enough to draw fuel through the primary barrel venturi for the main metering system. But manifold vacuum is high because of the closed, or nearly closed throttle valves. This provides a pressure differential that operates the primary idle system.

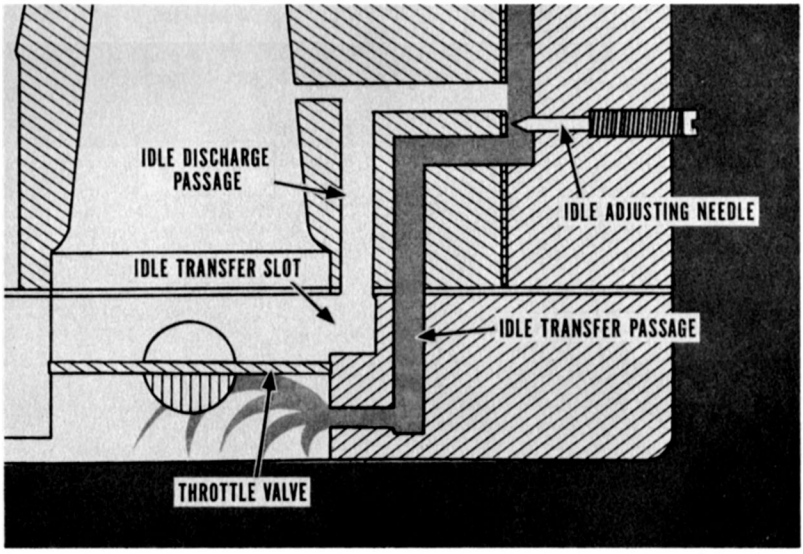


Because both sides of the carburetor work very much alike, flow of fuel on only one side will be described. At engine idle speed, normal air pressure causes fuel to flow from the bowl through the main jet, and into a small angular passage called an "idle feed". The main jet and idle feed are both in the primary metering body.

From the idle feed, fuel flows up a vertical passage called the idle well, and passes through an idle-feed restriction, both of which are also in the primary metering body. The fuel then goes into a horizontal passage in the main body where it mixes with air from the idle air bleed.

This mixture then flows through a short horizontal passage and down another vertical passage in the metering body. At the bottom, the mixture branches off through the idle discharge passage and through the idle transfer passage.

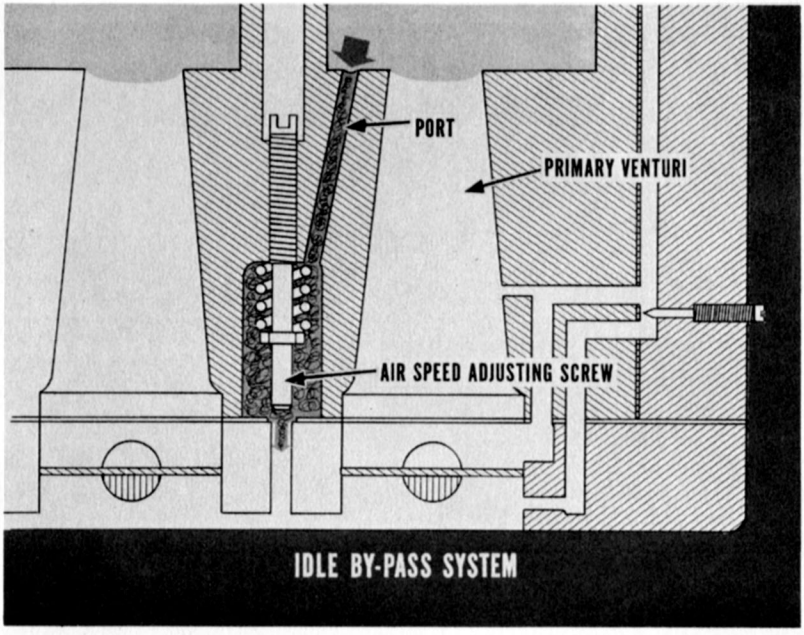
Fuel mixture in the idle discharge passage is controlled by an idle adjusting needle in the end of the primary metering body. There are no idle mixture adjusting screws in the secondary metering body. Turning the needle *in* leans out the mixture. Turning it *out* makes the mixture richer. From the idle adjusting needle chamber, the mixture goes through main and throttle body passages and is discharged below the throttle valve.



As the throttle valve opens slightly, fuel flows through the idle transfer passage from the metering body into the main body and throttle passages. Then, as the throttle is opened wider and more of the idle transfer slot is exposed to vacuum, fuel-air mixture is discharged into the throttle bore. Vacuum in the throttle body increases as the throttle opens still wider. This brings the main metering system into action to smooth out the change from idle to cruising speeds.

Remember that the fuel supply to the primary barrels is controlled by the idle fuel adjusting needles located in each side of the primary metering body. There is no idle fuel adjustment for the secondary barrels. Idle fuel for the secondary barrels is controlled by means of orifices of predetermined sizes.

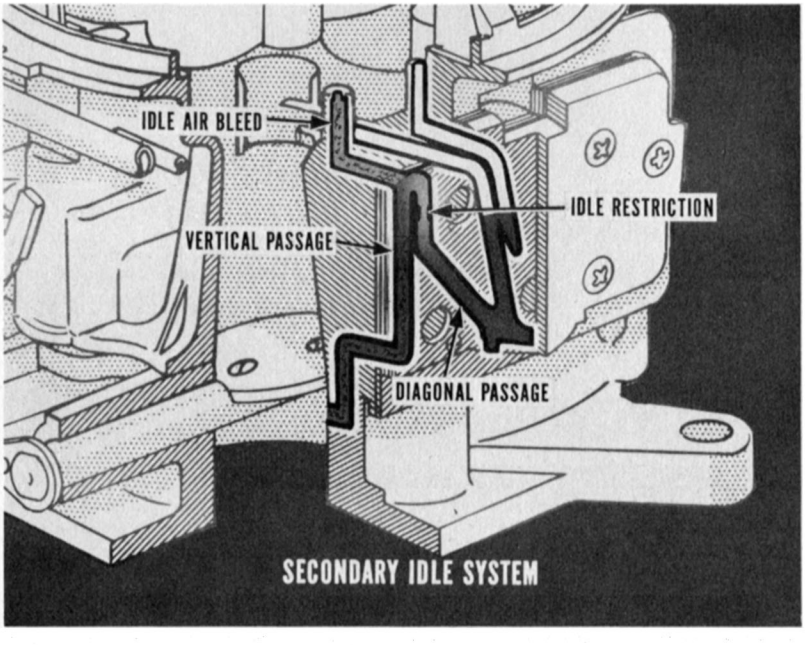
Idle Bypass System. This system, which operates during curb-idle speed, is adjusted by means of the air-speed screw inside the air cleaner stud hole. It helps prevent engine stalling due to carburetor icing.



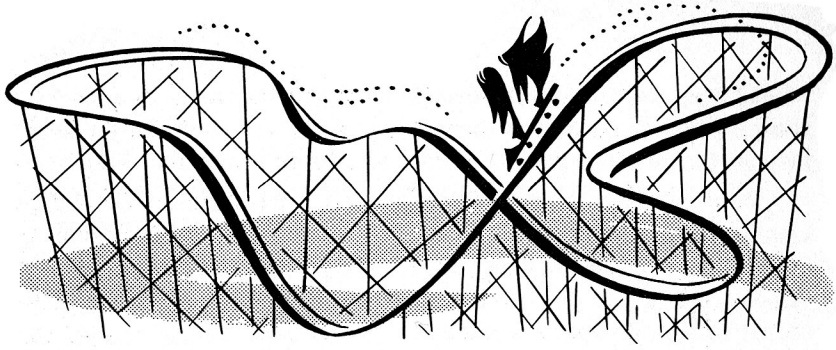
As we mentioned before, fuel enters the throttle bores below the throttle valves. Even though no air flows past the throttle valves which are closed completely during curb idle, air does enter the idle bypass through a port between the primary venturis. It then flows past the curb idle air speed adjusting screw. From there, it goes down through a cross groove at the bottom of the carburetor where it mixes with the fuel going to the combustion chambers.

To regulate the idle bypass system, turn the air-speed adjusting screw clockwise to reduce the amount of air. That makes the combustion chamber mixture richer and reduces idle speed. Turn the screw counterclockwise to admit more air, and you get a leaner combustion chamber mixture. This tends to increase engine idle speed.

Secondary Idle System. This system operates during idle and low speeds when the secondary throttle valves are closed. Instead of idle fuel adjustments for the secondary barrels, passages of a predetermined size in the secondary metering body and main body control the flow of fuel.

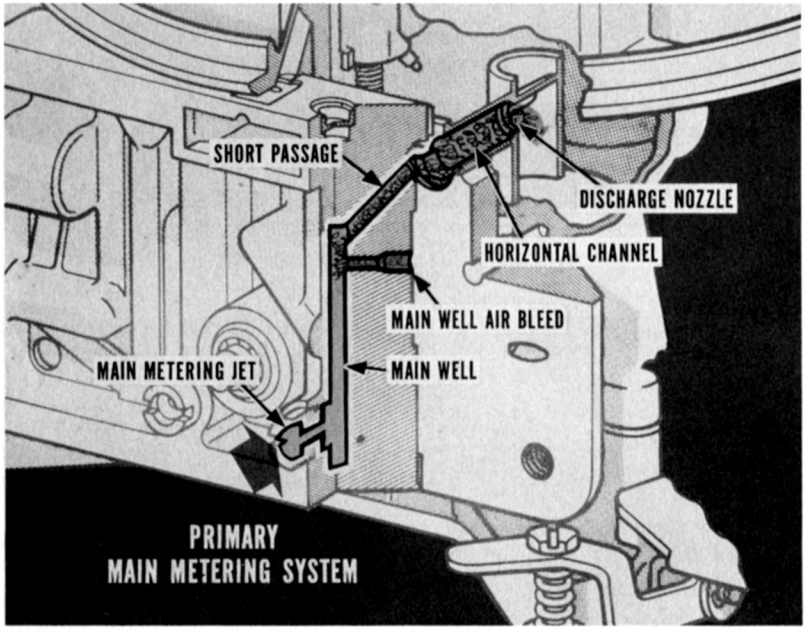


Fuel, in this system, flows through main metering restrictions which are used in place of jets. The fuel goes up a diagonal passage and through an idle restriction in the secondary metering body. It flows past the idle air bleed, picks up air, and flows down a vertical passage in the main body.



At the lower end, the fuel-air mixture flows through passages in the main body and into the throttle body. It is discharged below the throttle valve from the idle discharge port.

Primary Main Metering System. This system operates at cruising speed. The difference between vacuum in the booster venturi and air pressure in the fuel bowl causes fuel to flow through the main metering system.

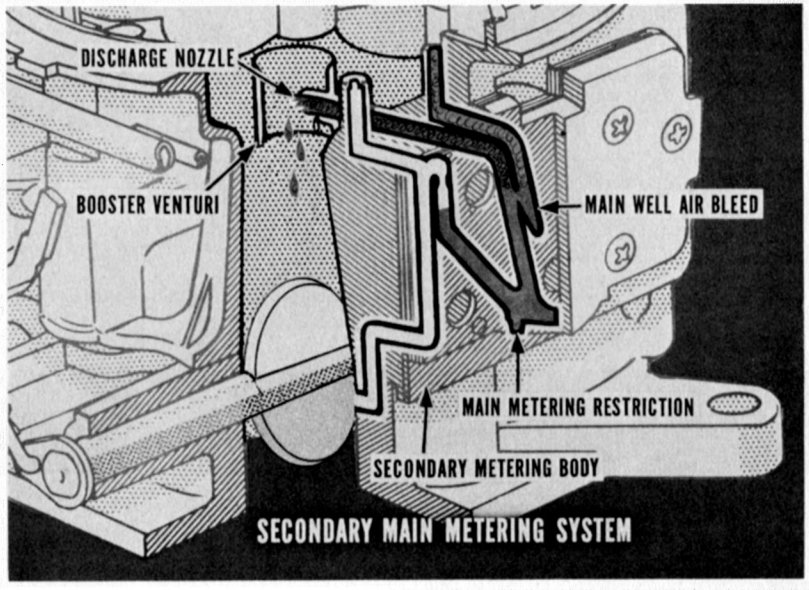


Fuel from the bowl flows through the main metering jet and into the bottom of the main well. It then moves up the well and past the main well air bleed. Filtered air from the bleed mixes with the fuel.

As the mixture moves up the main well, it passes into a short passage to the main body. It then flows through the horizontal channel of the discharge nozzle. At every point in the system, the fuel-air mixture responds quickly to changes in venturi vacuum. When discharged into the air stream, it vaporizes readily for combustion.

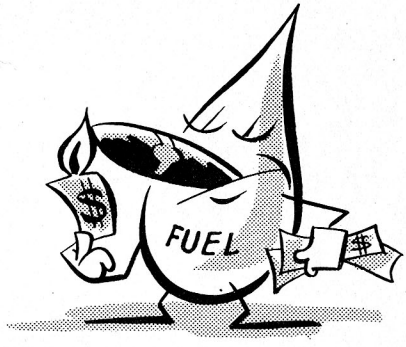
The throttle valve indirectly controls the amount of mixture drawn into the manifold by varying the amount of air drawn through the carburetor. So engine speed and power output are regulated as needed by pressure on the accelerator pedal.

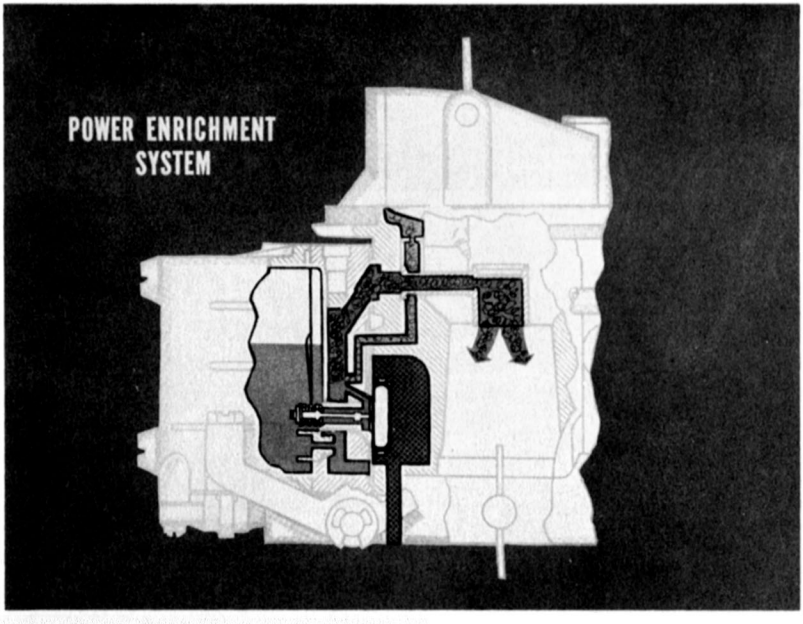
Secondary Main Metering System. Operation of this system begins when the secondary throttle valves start to open. This takes place when the primary throttle valve shaft is rotated about three-quarters of the way toward wide-open throttle position. That's why it can't be pinned down to any particular speed.



Fuel in this system enters the secondary metering body through the main metering restriction. It moves up a vertical passage where it mixes with air from the main well air bleed. From there it moves into the discharge nozzle. It is then discharged into the booster venturi and air stream.

Power Enrichment System. Fuel from this system enriches the mixture when the engine is under heavy load and manifold vacuum is low. It works a lot like the power bypass jet and step-up rod arrangements used on other carburetors. The mixture provided is richer than that normally needed at cruising speed.

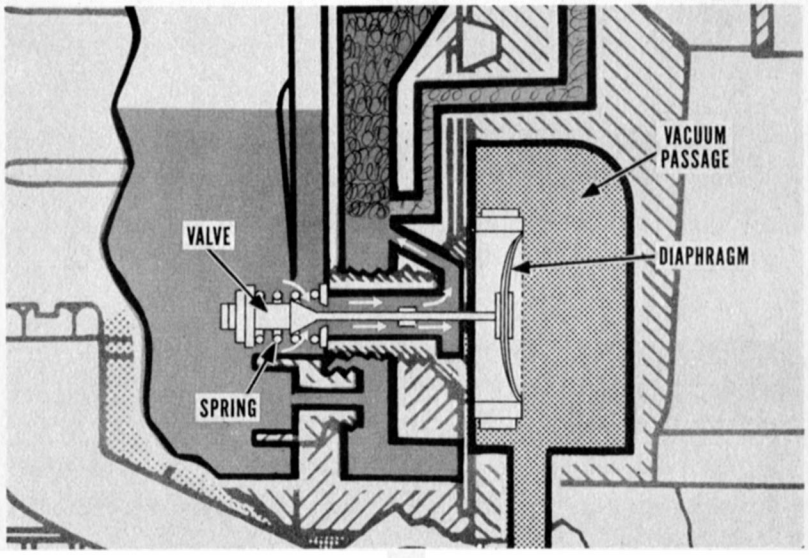




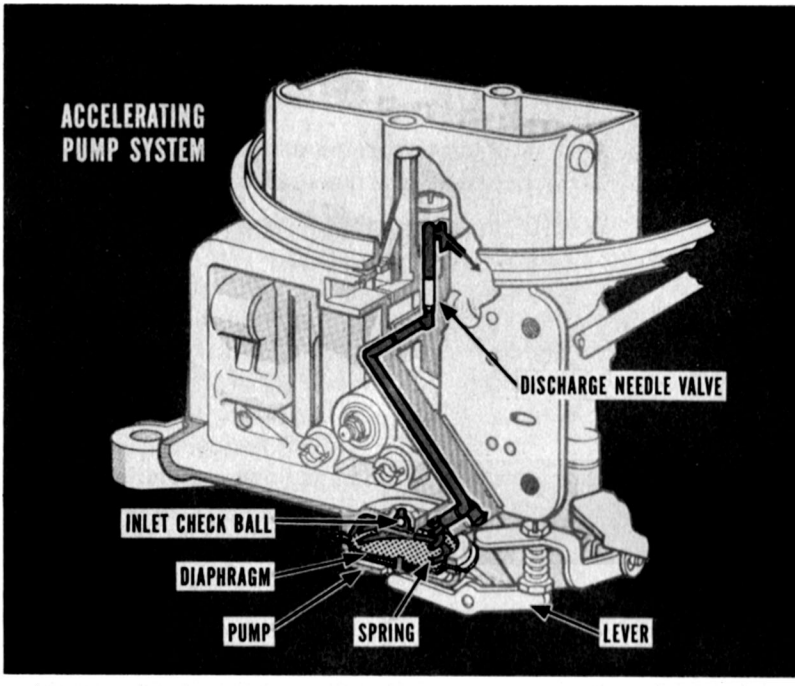
Manifold vacuum is sensitive to engine power demands. At idle, when the throttle valves are closed, vacuum is strongest. As engine load is increased, the throttle valves must open wider to maintain a given speed. That reduces vacuum because the opened throttle valves offer less restriction to the air entering the intake manifold.

Changes in manifold vacuum are reflected through a passage in the main body on a diaphragm-type power valve located in the primary metering body. During idle and normal load operation the vacuum is strong enough to hold the valve closed against spring pressure.

But when engine load increases and vacuum drops, the spring opens the power valve. This lets additional fuel from the fuel bowl flow through the valve and out the small holes in the side of the valve through the diagonal restriction in the main metering well. In the main well, this fuel joins the fuel flow in the main metering system, thus enriching the mixture. As engine demands decrease, manifold vacuum increases. The increased vacuum acts on the diaphragm and overcomes pressure of the power valve spring. This closes the power valve and shuts off the added supply of fuel no longer needed.



Accelerating Pump System. On acceleration, air flow through the carburetor increases quickly as the throttle valves are suddenly opened. To maintain proper balance of fuel and air, an accelerating pump supplies an extra charge of fuel until the main metering system can step up an increased flow.



The accelerating pump used on this carburetor is a diaphragm-type, located on the bottom of the primary fuel bowl. It goes to work when the pump operating lever is actuated by the throttle opening. As the throttle opens, pump linkage, actuated by a nylon cam on the primary throttle shaft, forces the pump diaphragm up against spring pressure. Diaphragm pressure forces a pump inlet check ball onto its seat to keep fuel from going back to the bowl.

Instead, the fuel is sent into a long diagonal passage. From there it goes into the pump discharge chamber. Pressure of the fuel raises a

discharge needle check valve off its seat, and the fuel is discharged out into the venturi.

When the throttle closes, returning the linkage to its original position, the spring pushes the diaphragm back down. That lets the inlet check ball drop off its seat so the chamber can be reloaded with fuel and held ready for the next accelerating charge.

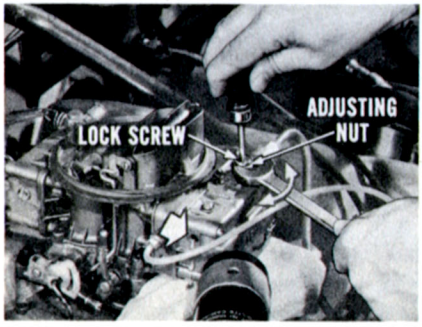
CARBURETOR ADJUSTMENTS

General. Only three external carburetor adjustments are normally required in connection with an engine tune-up:

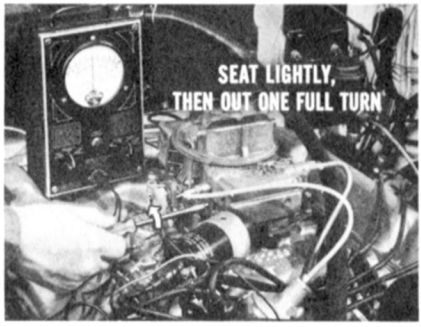
1. **Fuel level adjustment** (Both bowls)
2. **Idle mixture adjustment**
3. **Idle air-speed adjustment**

All of these can be made with the engine running.

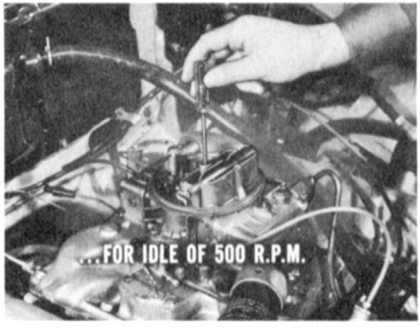
Fuel Level Adjustment. Since fuel level is affected by fuel pump pressure, the level adjustment should be made at two speeds—curb idle and 1400 r.p.m. Therefore, before starting the adjustment, connect a reliable engine tachometer. Then, place a rag under the primary bowl to catch any spillage in case the level is too high. Next, start the engine and allow it to run at curb idle and remove the sight plug. With a screwdriver and wrench, loosen the adjusting nut lock screw. Some models use a hex-head lock screw. Then, turn the nut *slowly* up or down until fuel just trickles out. Hold the nut and tighten the lock screw. Increase the engine speed to 1400 r.p.m. and note the fuel flow from the sight hole. If there is more than a trickle, the level should be reduced. If there is no flow, raise the level until a trickle is noted. Secure the lock screw. Then, install the sight plug and tighten it securely.



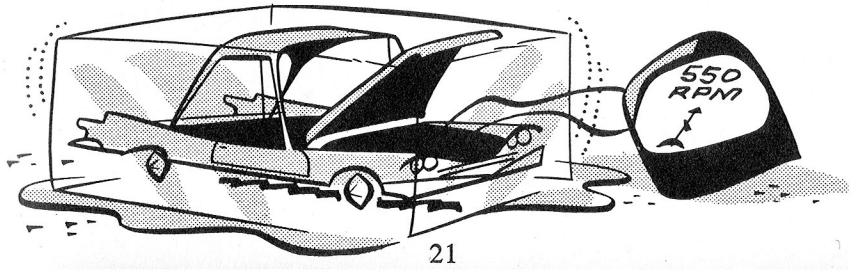
Idle Mixture Adjustment. With the choke valve wide open, turn both idle adjusting needles in the primary metering body *lightly* until they seat. Next, turn both needles out one full turn. This gives you a temporary setting from which you can adjust each needle individually until you get the smoothest idle performance.



Idle Air-Speed Adjustment. Use a narrow-blade screwdriver to reach the idle air-speed screw at the bottom of the air cleaner anchor stud hole. Turn the screw in *lightly* against its seat, then back out one full turn. Readjust the screw as needed to get an idle speed of 500 r.p.m. Remember that turning the screw *in* cuts down the amount of air. That makes the combustion chamber mixture richer and reduces the r.p.m. Turning the screw *out* admits more air, makes the combustion chamber mixture leaner, and increases the r.p.m.



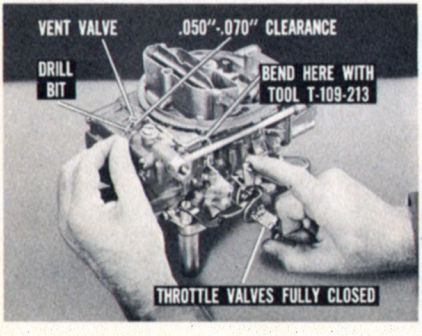
NOTE: On cars with air conditioning, turn on the compressor to put a load on the engine. Then adjust the idle air-speed screw for an engine speed of 550 r.p.m.



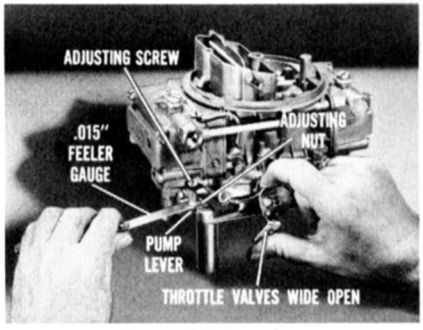
ADJUSTING THE CARBURETOR OFF THE CAR

You may find it occasionally necessary to remove the carburetor for certain service operations. When reassembling the carburetor, the following adjustments should be made.

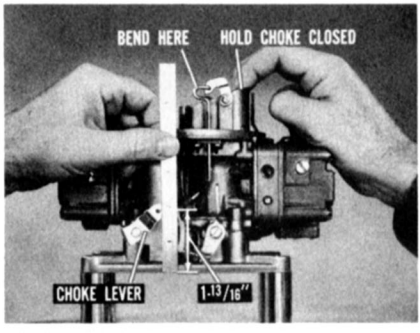
Bowl Vent Clearance. First mount the carburetor on elevating legs (Part T-109-287S). Then, hold the throttle valves fully closed. See if you can insert a .050″ to .070″ drill shank between the center of the vent valve and the float bowl. If not, use Tool T-109-213 to bend the air vent valve rod at its right-angle turn to change the arc of contact with the throttle lever until bowl vent clearance is correct.



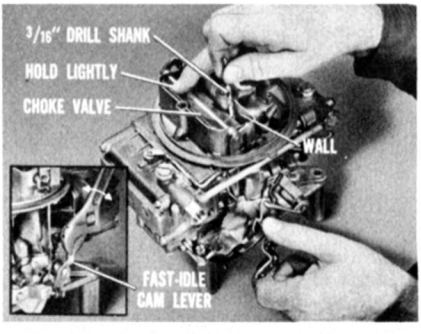
Accelerating Pump Lever Clearance. To get the proper pump override clearance, put the carburetor on elevating legs. Hold the throttle lever in the wide-open position and the pump lever down. You should be able to insert a .015″ feeler gauge between the adjusting nut and the pump lever. If not, turn the pump override screw until you do get the proper override clearance.



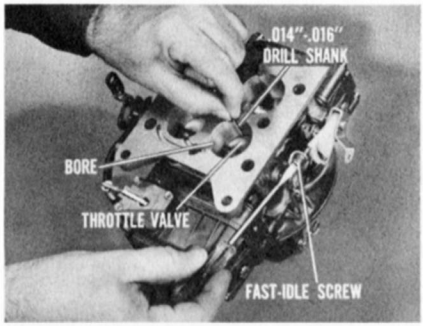
Choke Lever Position. Hold the choke valve closed. Use a scale and measure the distance from the center of the hole in the lever to the underside of the throttle body. It should measure $1\frac{13}{16}$″. If it doesn't, use the bending tool (T-109-213) to bend the top part of the choke connector rod until you do get the proper dimension.



Choke Unloader Adjustment. Use your finger to hold the choke valve lightly closed. Then, open the throttle valves to wide-open position. That should cause the choke valve to open wide enough so a $\frac{3}{16}$″ drill shank can be inserted between the lower edge of the choke valve and wall of the main body. If you cannot get this $\frac{3}{16}$″ clearance, bend the fast-idle cam lever until you do.

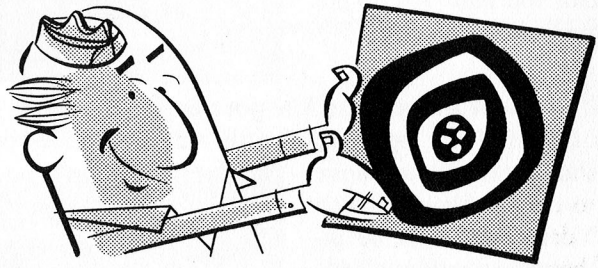


Fast-Idle Adjustment. Proper fast-idle adjustment is necessary to keep the engine running during pre-warm-up. So, invert the carburetor and close the choke and throttle valves completely. Place the fast-idle screw in contact with the high step of the fast-idle cam. Turn the screw in or out until you can insert a .014″ to .016″ drill shank between the primary throttle valve and side of the bore toward the center of the carburetor. Turn the screw in until the drill shank is held tightly. Then, back it off until you can feel a slight drag as you remove the drill.



TROUBLESHOOTING TIPS

Knowing where to aim is half the battle in carburetor diagnosis. The following tips are outlined according to conditions that may occur, where to look, and what to do.



HARD STARTING. This may be caused by some maladjustments, minor wear, or damage in the primary fuel inlet or accelerating pump systems. In the primary fuel inlet system, inspect the following:

Inlet Valve and Seat Worn. If there's a ridge in the valve or seat, the assembly won't control fuel pressure. So replace the valve and seat assembly and readjust the float level.

Fuel Level Too High, Too Low. Correct the fuel level by adjustment provided in the top of the primary fuel bowl while the engine is running as previously described.

Choke Operation Incorrect. A vacuum piston that sticks in its bore due to gum, chips, or other foreign matter calls for removing the piston and thorough cleaning of the bore and piston with solvent. Use compressed air to blow cleaned parts dry. Reassemble and test choke operation.

Choke Doesn't Close. An improper choke lever position can keep the choke from closing properly. Adjust the choke connector rod to specifications.

Choke Unloader Maladjustment. An improperly adjusted fast-idle cam lever can keep the choke from opening wide enough for proper unloading. In this case, bend the fast-idle cam lever to specifications.

Clogged Bowl Vents. Clean with solvent and blow out with compressed air.

Damaged Pump Diaphragm. A ruptured pump diaphragm in the accelerating system will drain the primary fuel bowl and cause hard starting. In a case like this, replace the diaphragm.

POOR IDLE, POOR TRANSITION IDLE TO HIGH-SPEED, STUMBLE, HESITATION. These conditions may point to trouble in the primary idle or accelerating pump systems. Here are items to inspect:

Idle Air-Speed Maladjustment. With the engine running, turn the idle air-speed adjustment screw as needed to get an engine speed of 500 r.p.m.

Idle Passages Clogged. Idle passages in the primary metering body or main body may need cleaning with solvent. Use compressed air to blow them out.

CAUTION: Use only solvent to clean carburetor passages. Wire, toothpicks, and sharpened drill rods will damage passages beyond repair!

Accelerator Pump Override Maladjustment. Test accelerator pump action by opening and closing the throttle lever several times. There should be an immediate fuel ejection from the discharge nozzle. If there is no ejection, or ejection is not uniform, the pump override adjustment may need correction, or the discharge passages and nozzles may need cleaning.

Pump Diaphragm Damage. Inspect the diaphragm for damage and replace it if necessary.

NOTE: Inspect the accelerator pump system first if the flat spot or hesitation is noticed on acceleration.

MIXTURE TOO RICH, POOR IDLE, POOR FUEL ECONOMY. If you test all adjustments and find that you cannot correct a mixture that is too rich, the trouble may be in the secondary idle or power enrichment systems. Here are inspections to make:

Secondary and Main Body Passages Clogged. Use solvent to clean these passages, blow them out with compressed air.

Improper Assembly. Over-rich mixture after carburetor reconditioning may be due to an improper assembly of the secondary metering body plate and gasket. Partially disassemble the carburetor, inspect, and reassemble parts correctly.

Power Valve Diaphragm Damage. Look at this diaphragm if you get a case of poor idle along with poor fuel economy. If the diaphragm is damaged, replace the power valve assembly. When you reinstall a new valve assembly, be sure the gasket (a slip-fit) is properly installed.

RESTRICTED HIGH-SPEED OPERATION, POWER LOSS AT TOP OF HIGH-SPEED RANGE. Possible source of trouble is in either the primary main metering, or the secondary main metering systems. Use solvent to clean the main metering jets and passages, blow them out with compressed air.

A FINAL WORD

Keep in mind that other engine malfunctions may lead you to suspect a faulty carburetor condition. If compression and ignition are all right, then turn your attention to the carburetor. In this case, the information outlined in this book is designed to make carburetor service *easier*. What you do *easier* you'll naturally do *better* and make a lot of service customers *happier* with your work. It all starts with a good look at the tips in this book.

RECORD YOUR ANSWERS TO THESE QUESTIONS ON QUESTIONNAIRE NO. 149

The balance tube equalizes the amount of fuel in both bowls.	RIGHT	1	WRONG
The adjustable mechanical vent in the primary bowl releases excessive vapors at idle and minimizes percolation possibilities.	RIGHT	2	WRONG
Idle fuel mixture is controlled by two idle adjusting needles, one in each side of the primary metering body.	RIGHT	3	WRONG
Idle speed is controlled by the idle air-speed adjusting screw.	RIGHT	4	WRONG
The secondary idle system has two idle adjustment screws in the secondary metering block.	RIGHT	5	WRONG
Only three external adjustments—fuel level, idle mixture, idle air-speed—are generally needed, and all are made while the engine is running.	RIGHT	6	WRONG
Fuel level in the secondary bowl doesn't need to be adjusted.	RIGHT	7	WRONG
When adjusting the Holley carburetor on a car with air conditioning, leave the air-conditioning compressor turned "off".	RIGHT	8	WRONG
If solvent won't clean the passages, use a soft wire or sharpened match stick.	RIGHT	9	WRONG
Poor idle along with poor economy may be traced to power valve diaphragm damage.	RIGHT	10	WRONG

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