CARBURETION

Technical Training Series

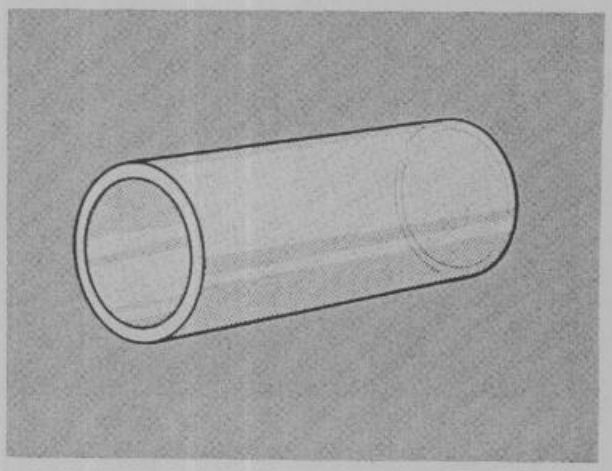
Performance
Publishing

CONTENTS

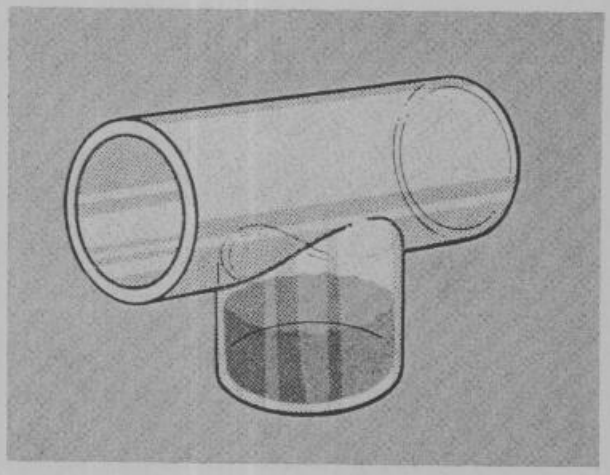
INTRODUCTION

This workbook is to be used as a guide when serving and tuning British Leyland cars fitted with carburetors. Both the SU and ZENITH-STROMBERG carburetors are covered. However the theory sections of this booklet emphasize the STROMBERG.

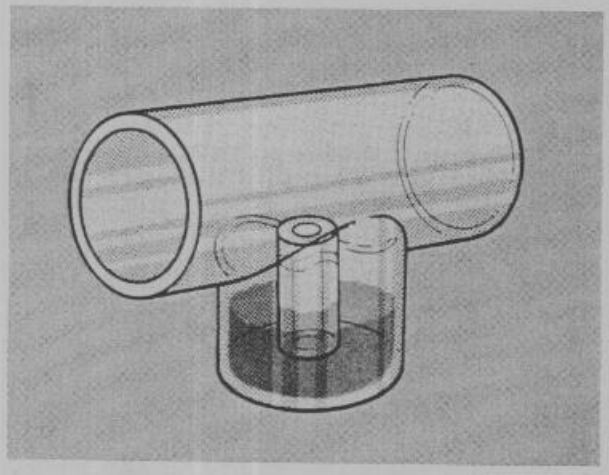
Specifications for carburetor settings are contained in the British Leyland Repair Operations Manual and on the emission decal located in the car's engine compartment.



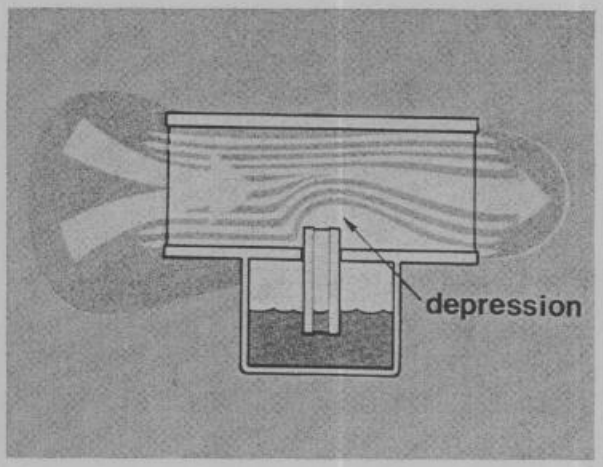
A carburetor has three essential elements: A tube for high velocity air flow called a venturi;



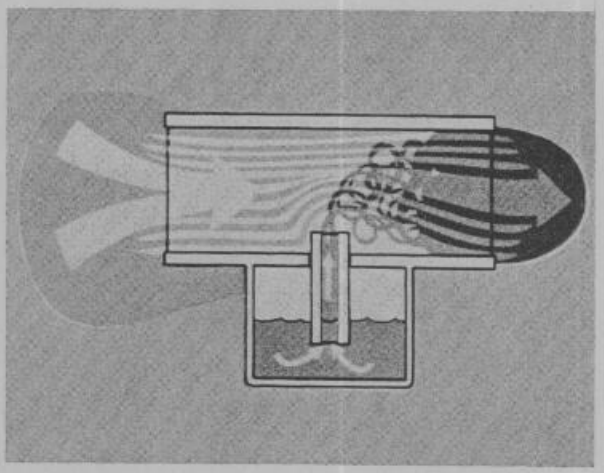
A fuel supply . . . usually in a bowl beneath the venturi;



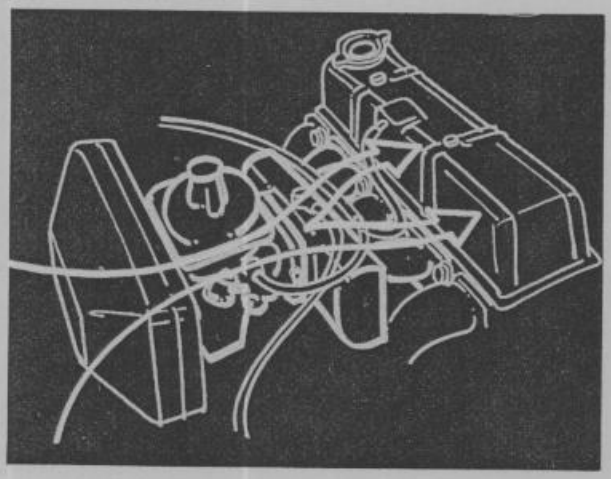
And . . . a small orifice for transferring fuel from the fuel bowl into the venturi. This is generally referred to as a jet.



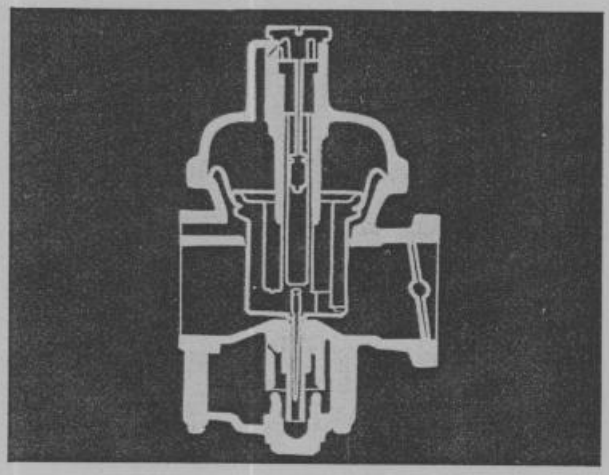
The operation is quite simple. As the engine draws air through the venturi, a low pressure area . . . or depression is created over the jet opening.



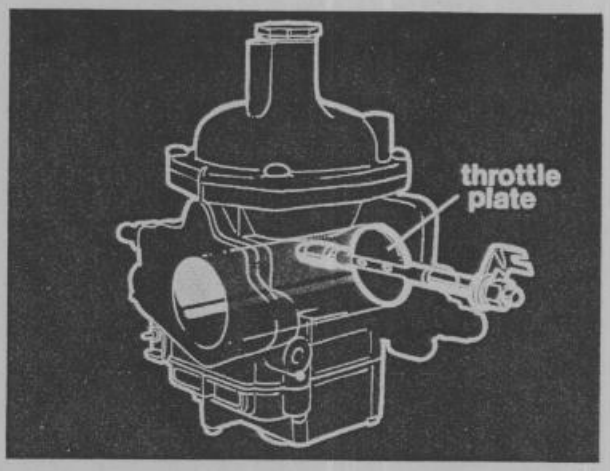
The depression draws fuel through the jet from the fuel bowl. The fuel then mixes with the fast moving air in the venturi.



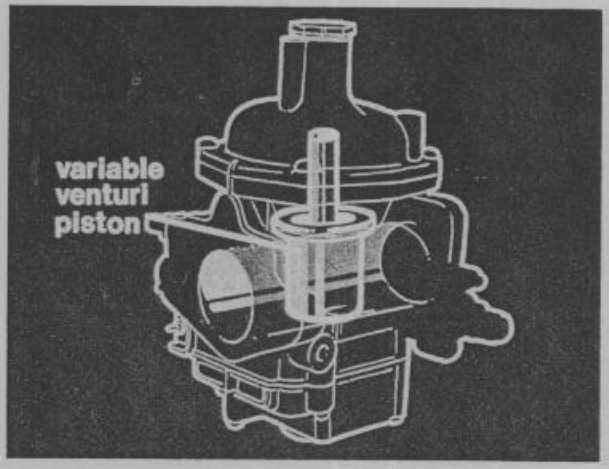
The fuel/air mixture passes into the engine's combustion chamber where it is ignited and burned to produce power. But the type of carburetor we have just illustrated would only be satisfactory if the engine were to run at one speed, however, it would not be suitable for varying engine speeds and loads . . . and would require an external starting aid to start the engine.



Many refinements are necessary to make this basic carburetor suitable for automobile use. All carbureted BLM cars use constant velocity variable venturi carburetors. The refinements for this type of carburetor are as follows:

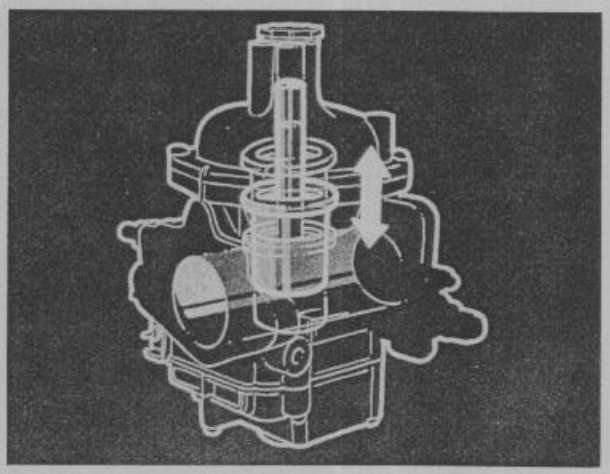


The first necessary refinement is a throttle plate. As the throttle plate is opened and closed, it controls the amount and velocity of air passing through the carburetor.



Now, a variable venturi piston is added. The action of the throttle plate controls the position of the piston which varies the venturi size (or opening).

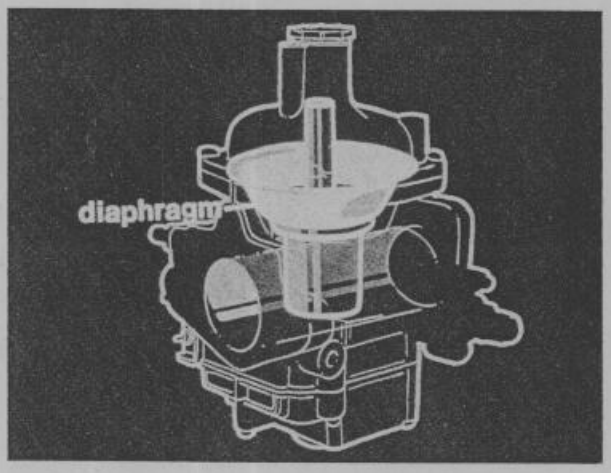
NOTE: THE PISTON IS OFTEN REFERRED TO AS AN AIR VALVE.



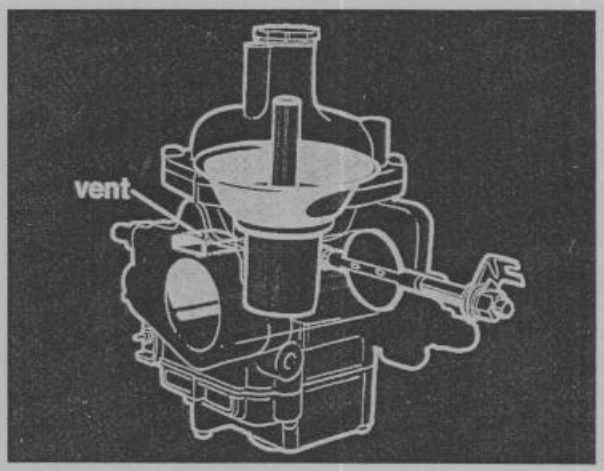
The piston moves up and down to increase or decrease the venturi size.

This is accomplished by using the difference in pressure between the atmosphere and the downstream side of the piston.

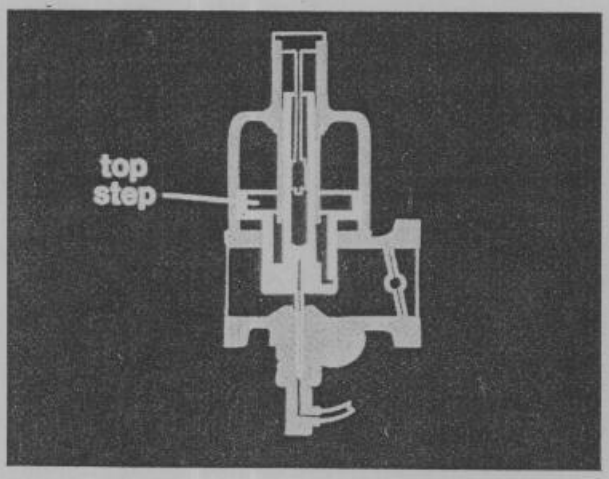
The downstream side of the piston is vented to the top of the piston by two drillings in the piston itself.



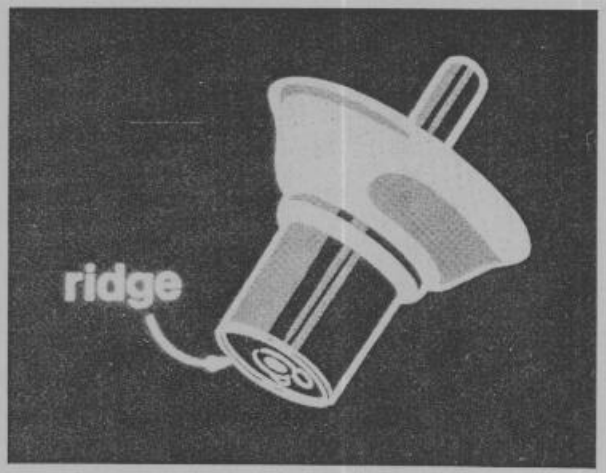
At the top of the piston, atmospheric pressure and the downstream venturi pressure are channeled into separate chambers. In the Stromberg, the chambers are separated by a diaphragm.



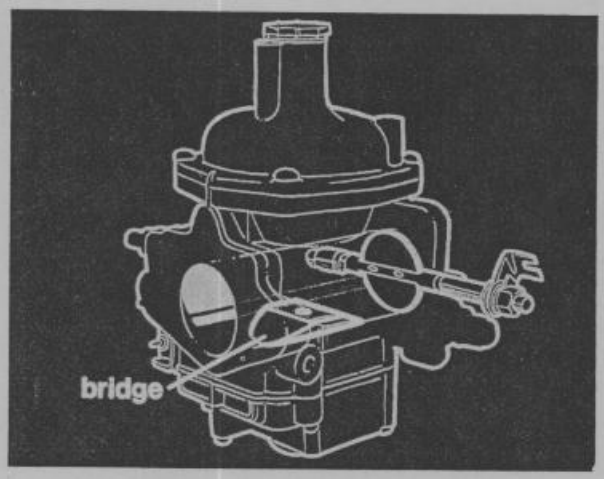
And . . . the underside of the diaphragm or upper piston is vented to the atmosphere through a drilling in the carburetor body.



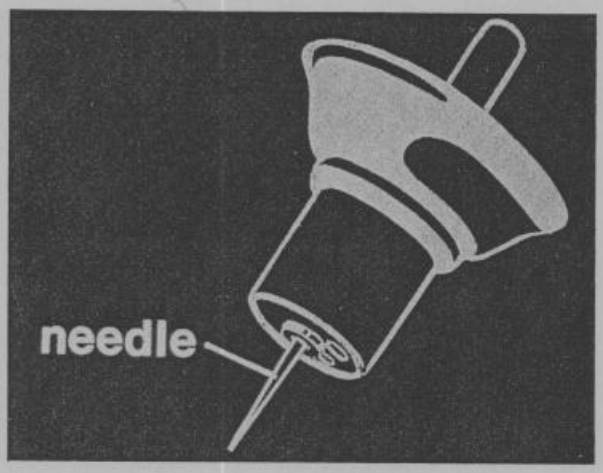
In the SU, they are separated by another step on the piston.



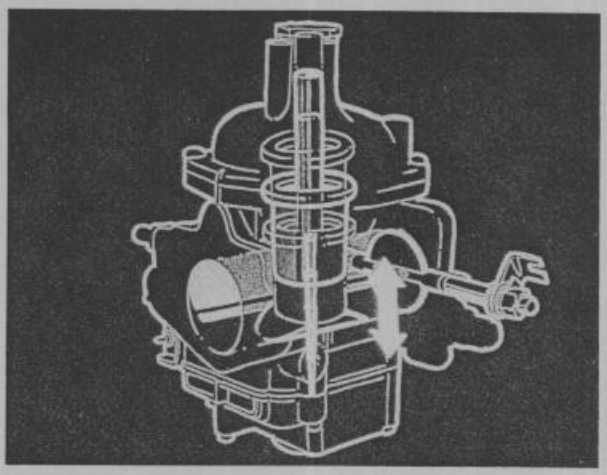
At rest, the piston does not completely cut off the venturi as it is held open by a ridge or pad at the bottom of piston. This allows starting and idling.



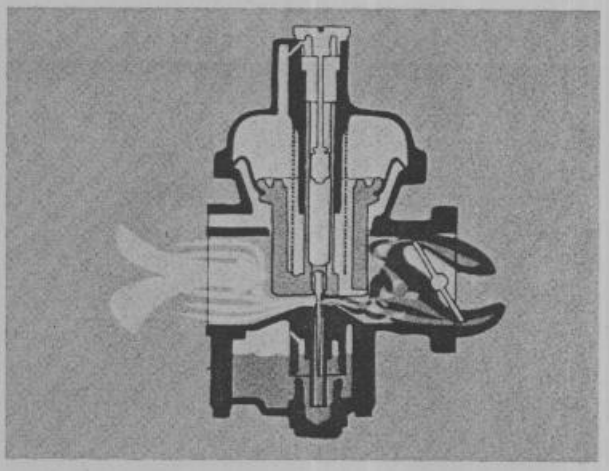
The next refinement is a bridge under the piston which creates turbulence and produces better fuel atomization. It also provides depression at full throttle.



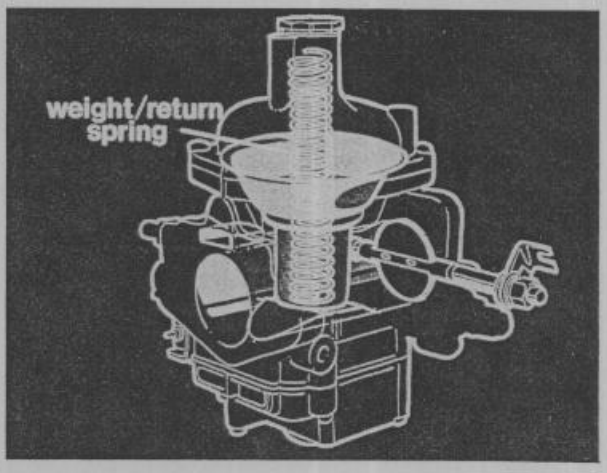
A further refinement is the tapered fuel metering needle. The needle is attached to the piston and moves up and down with it.



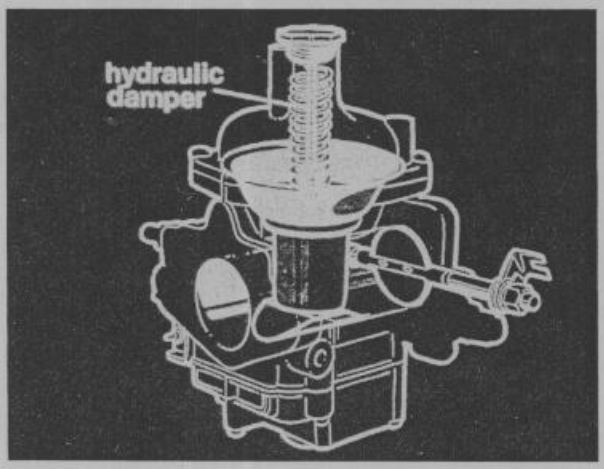
The needle taper varies the jet opening size as the needle moves up and down with the piston. This controls the amount of fuel flowing into the venturi.



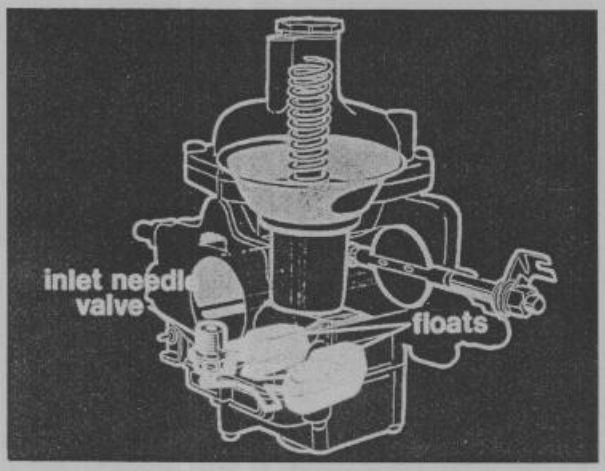
So now we have a way of metering the fuel into the venturi in relationship to the throttle position and the venturi size. This allows very precise response and smooth operation.



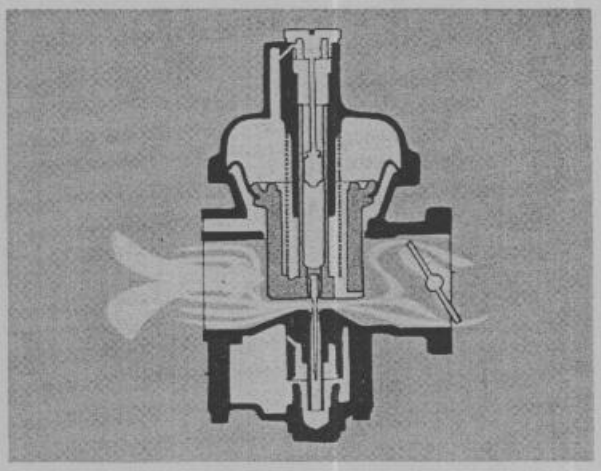
Further refinements to the basic carburetor include: A weight/return spring which helps move the piston down.



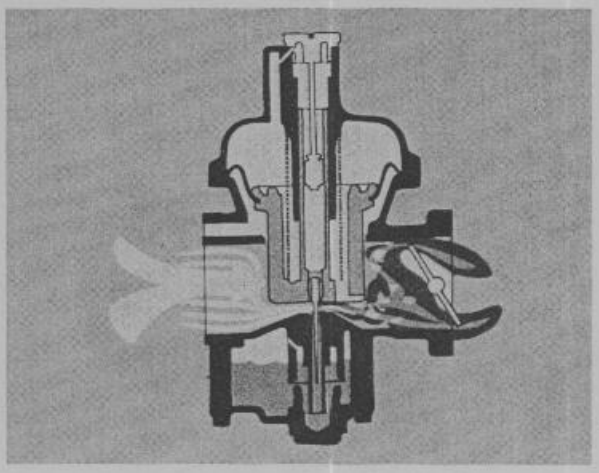
A hydraulic damper which limits the initial piston movement. This provides initial enrichment on acceleration.



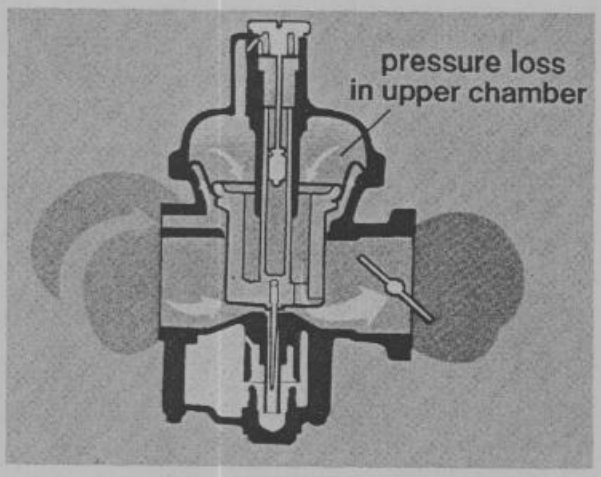
And . . . a float controlled inlet needle valve in the fuel bowl which governs the fuel level. Now we have a carburetor that is suitable for automotive use. So, let's look at how it operates . . . druing idle, cruise and acceleration.



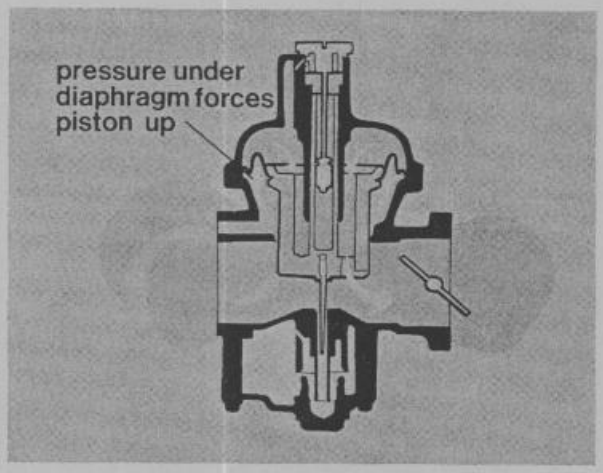
At idle, the throttle plate is partially open and a slight depression is created on the downstream side of the piston. The slight depression is channeled to the upper chamber. However the piston is only partially raised because the difference in pressure is not great enough to overcome the weight of the piston and the spring tension.



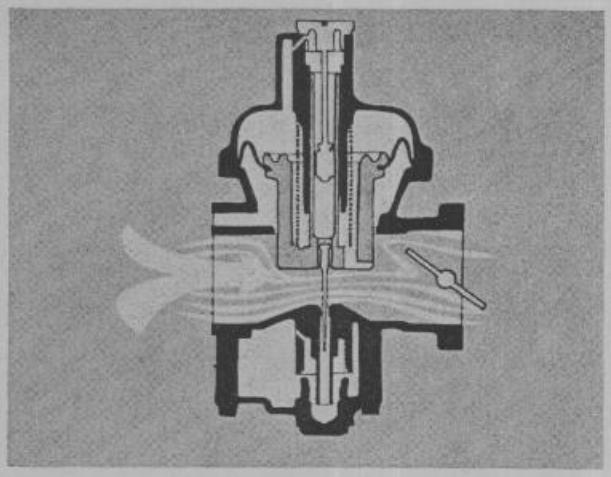
The depression over the jet draws fuel into the venturi from the fuel bowl which atomizes and mixes with the incoming air. The mixture then passes into the engine's combustion chamber where it is ignited and burned.



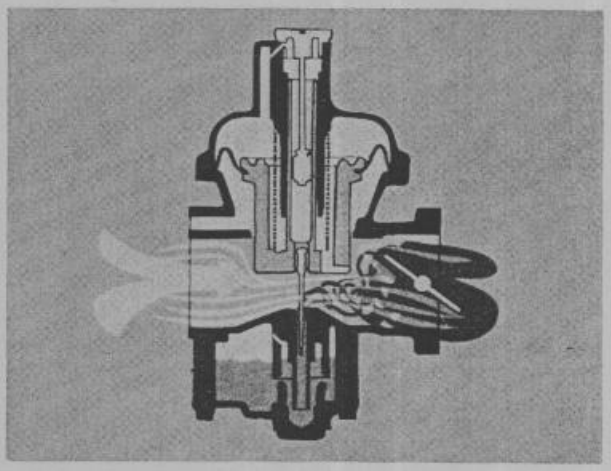
At cruise, the throttle plate is open approximately half way, causing a greater depression on the downstream side of the piston. The depression is channeled to the upper chamber, and this produces a substantial difference in pressure in the two chambers on top of the piston.



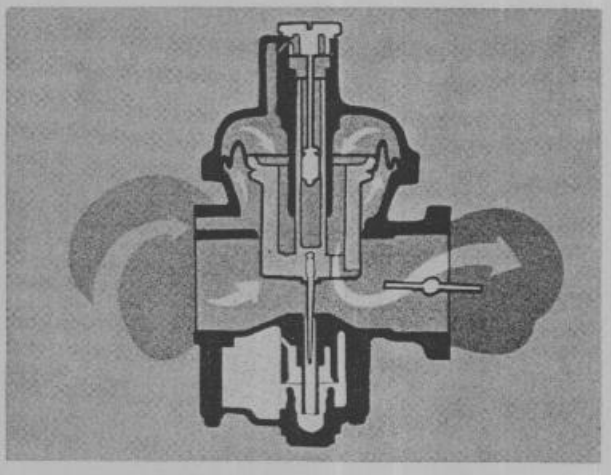
The difference in pressure causes the piston to be raised to a partially open position. This occurs because the atmospheric pressure, acting on the bottom of the diaphragm, is greater than the venturi pressure.



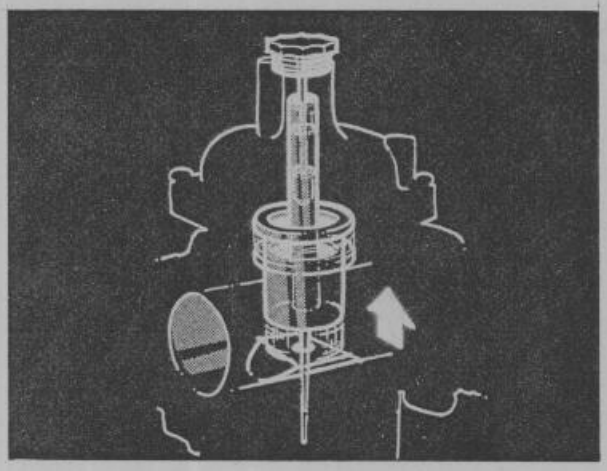
The depression over the jet is greater due to the increased air velocity. And . . . as the metering needle has moved up with the piston, more fuel flows into the venturi.



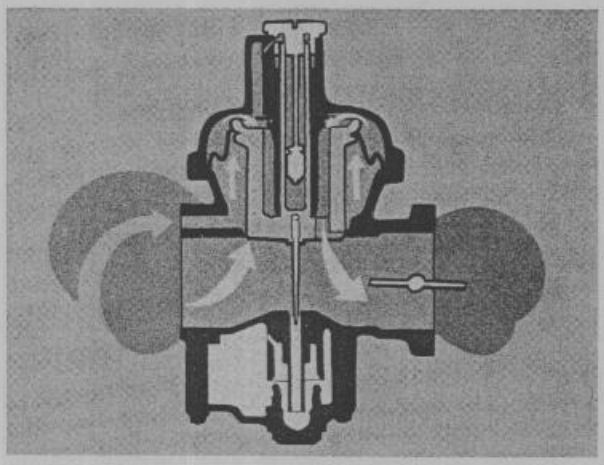
Again . . . the fuel atomizes and mixes with the incoming air. The mixture then passes into the combustion chamber where it is ignited and burned.



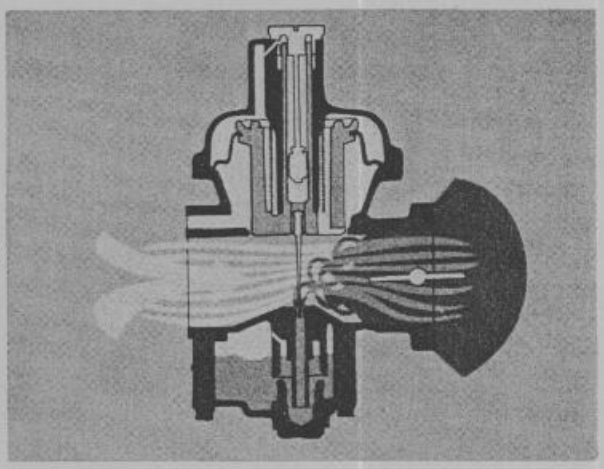
During acceleration, the throttle plate is completely open. This creates an even greater depression in the venturi and the pressure difference in the two chambers is the greatest. Remember, the venturi and atmospheric pressures are channeled to the chambers on top of the piston.



The initial upward movement of the piston is limited by the hydraulic damper. This provides initial mixture enrichment to prevent hesitation.



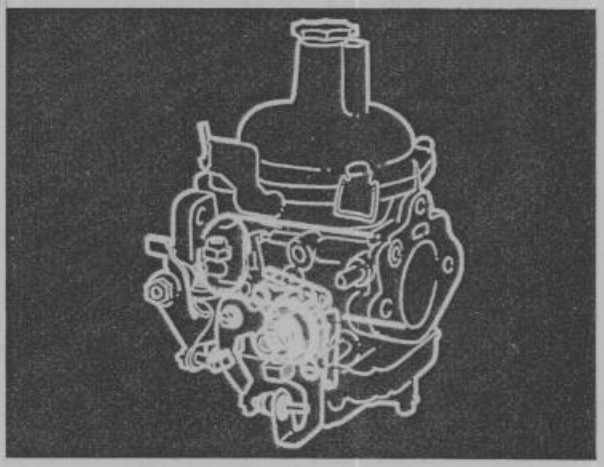
After the initial dampening, the piston gradually raises all the way, opening the venturi to its maximum size, giving a very smooth transition from low speed to high speed.



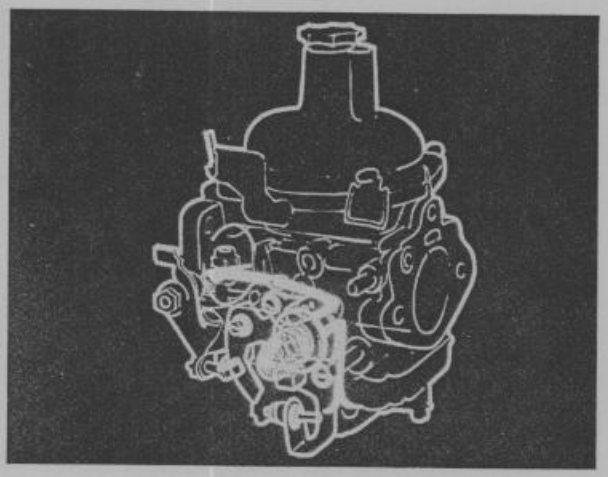
The depression over the jet becomes greater as the piston moves up and the air velocity increases. Also, the metering needle allows more and more fuel to enter the venturi as it raises with the piston. When the piston is raised all the way (open), the needle allows maximum fuel flow and the piston allows maximum air flow. The mixture passes onto the combustion chamber where it is ignited and burned producing maximum power.

You can see that the relatively simple constant velocity-variable venturi carburetor provides excellent response and control over all engine operating modes.

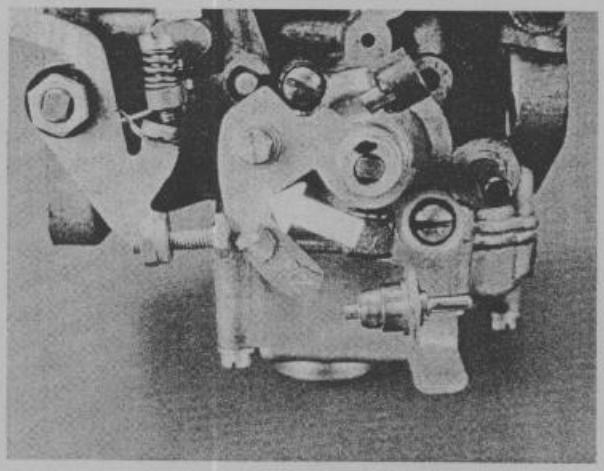
Because of the requirements of cold starting, additional controls have been added to the carburetor.



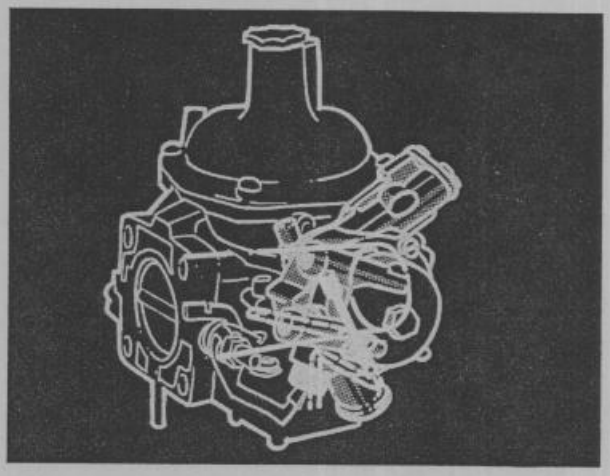
Some versions of the Stromberg carburetor use a manual choke to aid in cold starting. A separate channel is made between the fuel bowl and the low depression area of the carburetor. A disc with a series of drillings is positioned to control flow in the channel.



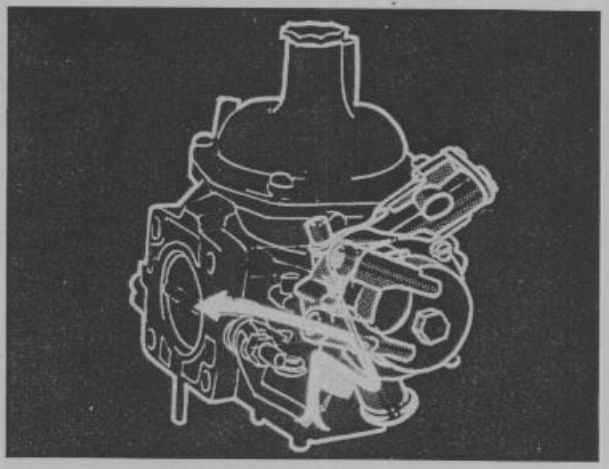
The disc, which is manually controlled by a cable, rotates to allow fuel flow directly into the low depression area. With the choke off, the disc is in a position which prevents fuel flow.



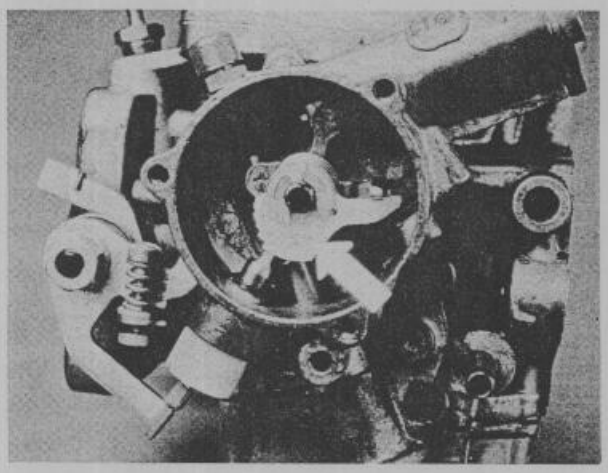
Besides mixture enrichment, the choke cable also controls the carburetor fast idle cam. This provides increased engine RPM during warmup.



Other versions of the carburetor use an automatic choke, which also has a separate channel from the fuel bowl to the low depression area of the carburetor. However, fuel flow is controlled by a jet and needle. The jet is in turn controlled by a bi-metal strip.

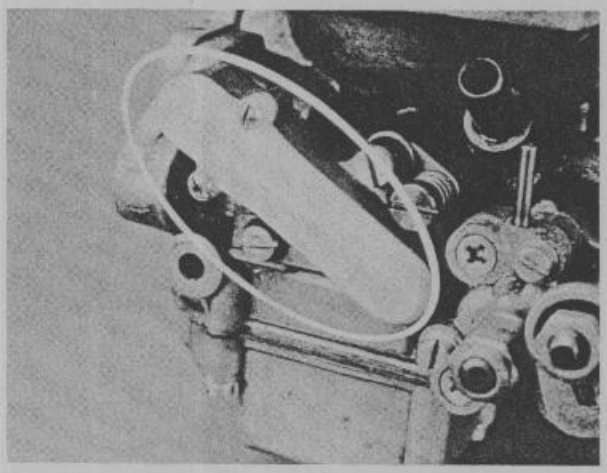


The needle moves to meter fuel into the carburetor with changes in engine coolant temperature. A bi-metal spring attached to the needle senses coolant temperature. When the temperature is low, full fuel flow is allowed. As the engine warms up, fuel flow is gradually decreased by movement of the spring and the needle. When the engine is completely warmed up, the fuel flow is cut off.

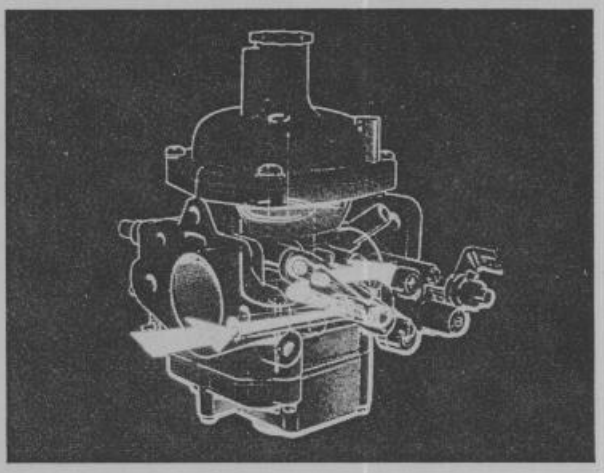


Fast idle is provided by a stepped cam and an adjusting screw. The cam and bi-metal spring use the same pivot.

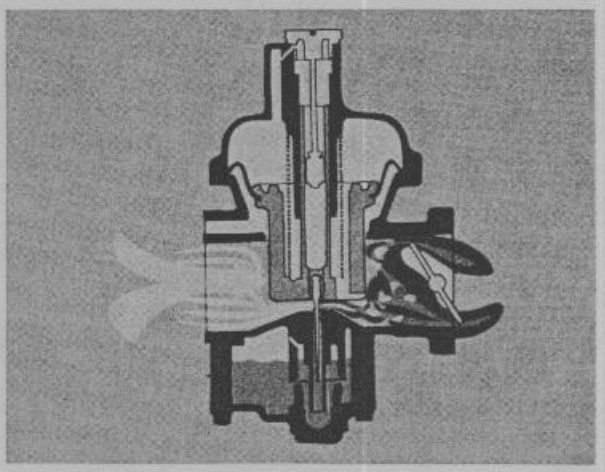
To help control emissions, several devices have been added to the carburetor.



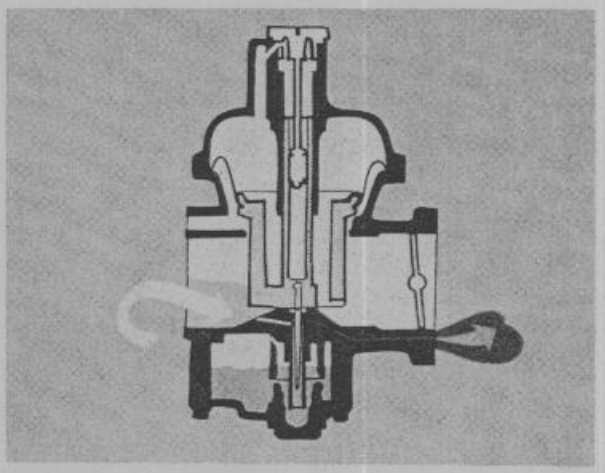
A temperature compensator helps reduce emissions at hot idle by creating a leaner mixture.



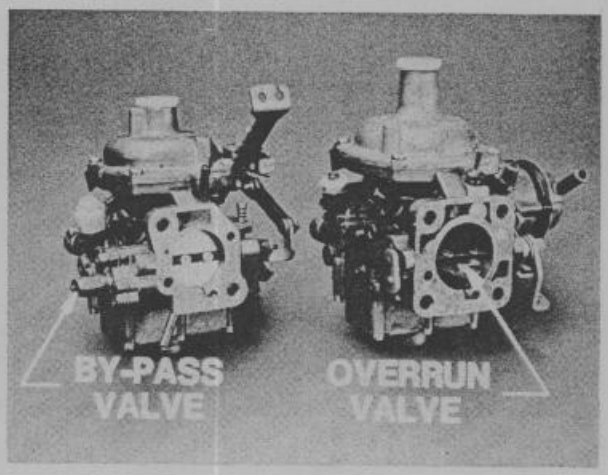
At operating temperature, a tapered valve controlled by a bi-metal strip allows air to bypass the bridge and enter the carburetor in the low depression area.



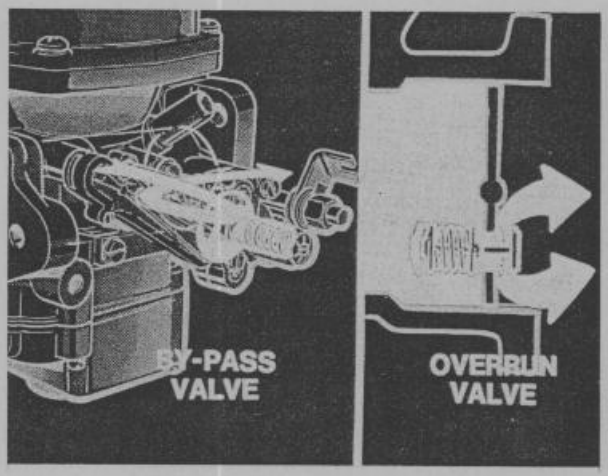
This weakens the depression and the piston falls slightly. The fuel supply is reduced by the lowering of the needle and this creates a leaner mixture.



In some versions, an idle/slow run emulsion circuit replaces the temperature compensator. This is a separate circuit which discharges its mixture downstream of the throttle plate.

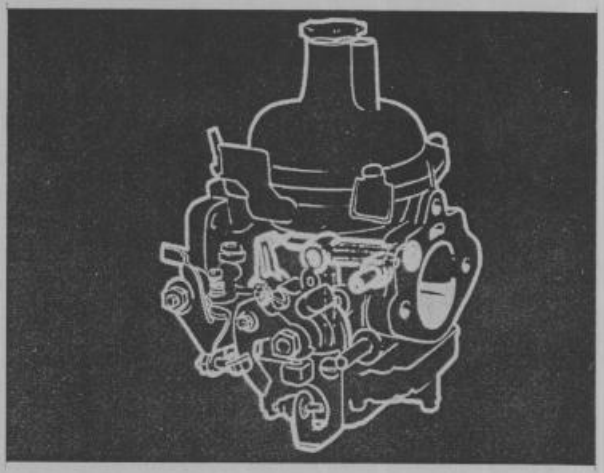


All carburetors are now fitted with a bypass valve or an overrun valve to reduce emissions on deceleration.

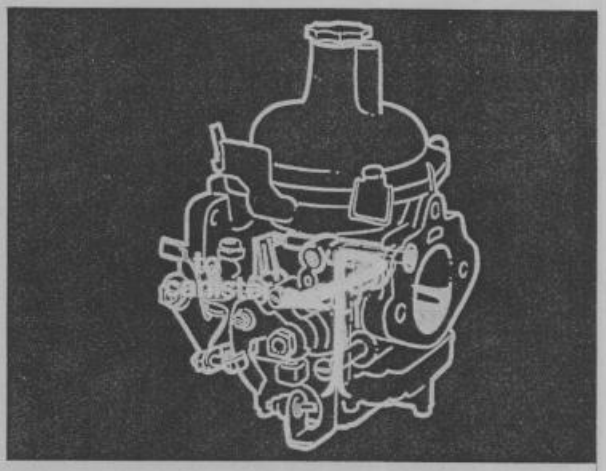


These one way, spring loaded valves, allow the mixture to bypass the throttle plate when the throttle plate is suddenly closed. The high manifold vacuum present at this time, unseats the valve and allows the mixture to flow directly into the combustion chamber.

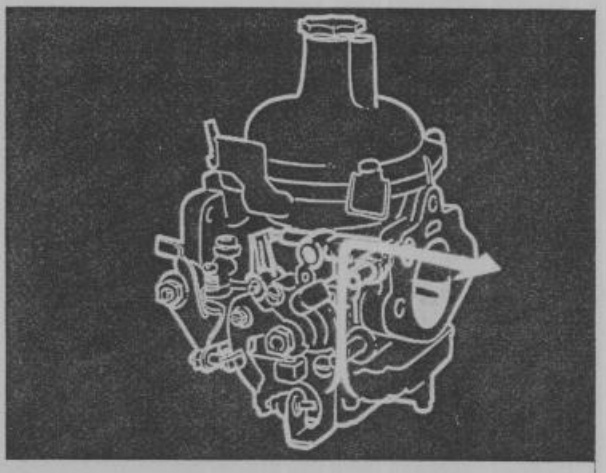
This prevents fuel residue in the intake manifold from passing through the engine in a raw state during deceleration.



Another emission reducing device found on some versions is a vent valve. The vent valve controls the fuel bowl venting, which, in turn, is controlled by the throttle position.



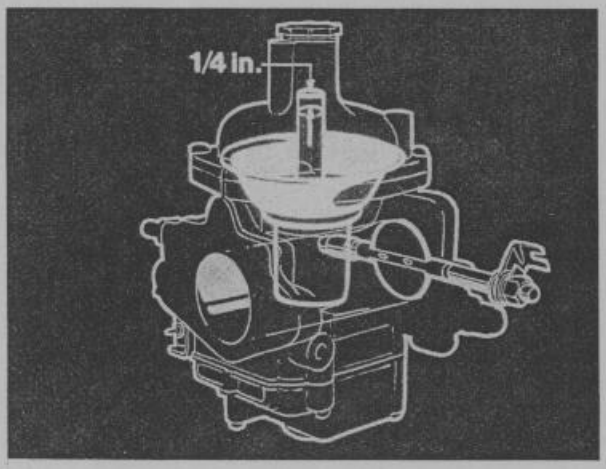
The vent valve vents the fuel bowl to the charcoal canister during idle.



And . . . to the air filter housing when the throttle is opened.

STROMBERG DAMPER OIL LEVEL

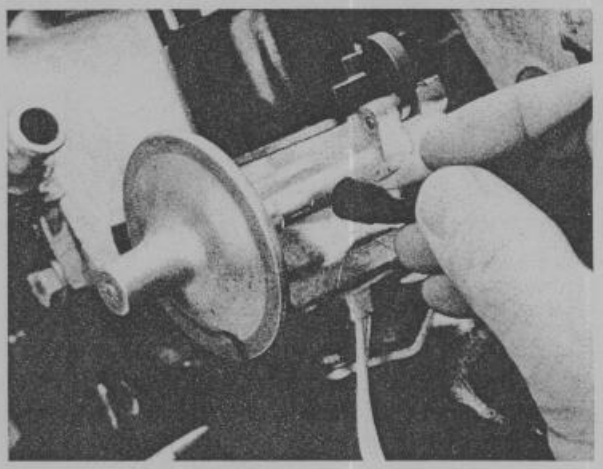
The piston damper oil level should be checked at each service interval and after performing a mixture needle adjustment.



Remove the damper assembly from the top of the carburetor. Raise the piston with your finger through the carburetor opening. With the piston raised all the way, top up the damper tube with engine oil until the level is ¼ inch from the top of the tube. Then, re-install the damper assembly. Again, raise the piston all the way. This will enable you to position the oil retaining clip during installation.

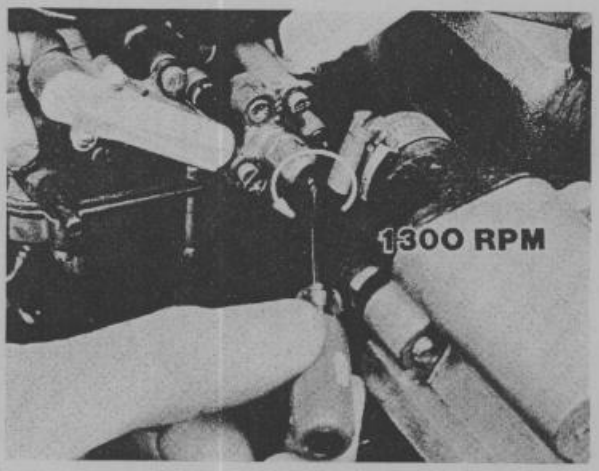
STROMBERG BYPASS VALVE ADJUSTMENT

During tune-up, the bypass valve operation should be checked, and adjusted if necessary.

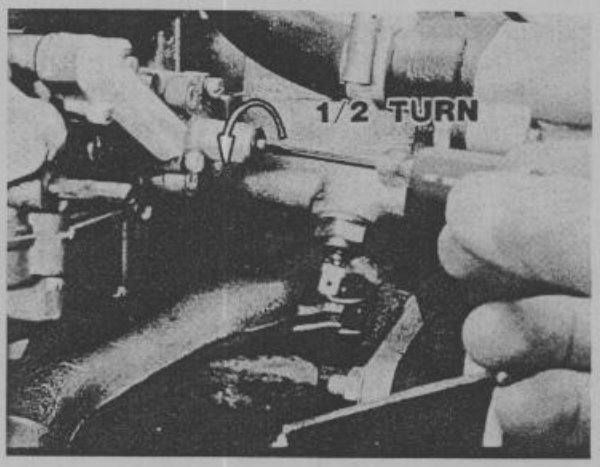


Bring the engine to normal operating temperature, then remove the vacuum hose from the distributor and plug the hose. If the valve is adjusted correctly, the engine speed will rise to 1300 RPM. If the engine speed is greater than 1300 RPM or rises abruptly to 2000 to 2500 RPM, the bypass valve needs adjustment.

If adjustment is necessary on a single carburetor installation, begin by turning the valve clockwise until the engine speed increases abruptly to 2000 to 2500 RPM.



Then, turn the valve adjusting screw counter clockwise until the engine speed returns to 1300 RPM. Now, open and close the throttle. The engine speed should drop to approximately 1300 RPM when the throttle is closed. Adjust as necessary to achieve this condition.

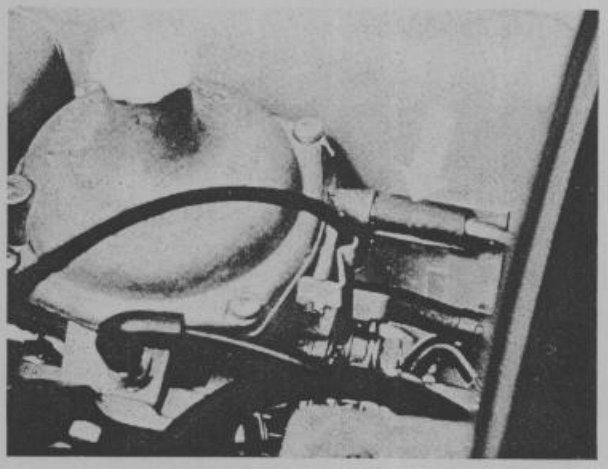


Finally, turn the valve adjusting screw one half turn more in the counter clockwise direction. Then reconnect the vacuum hose to the distributor.

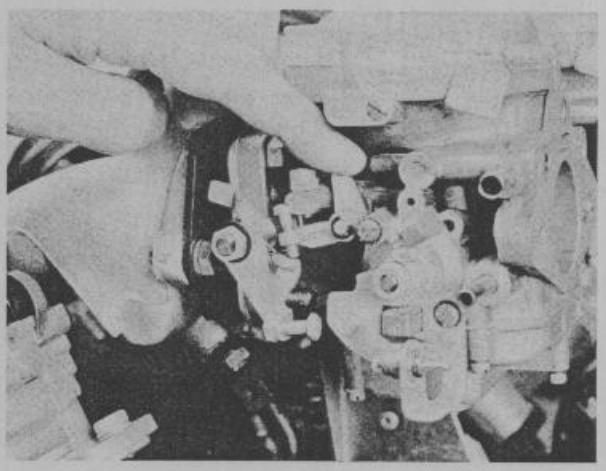
On cars equipped with twin carburetors, the procedure is the same; but, first shut off completely one bypass valve by turning the valve adjusting screw fully counter clockwise. This will prevent erroneous readings while making the initial check and adjustment.

STROMBERG VENT VALVE ADJUSTMENT

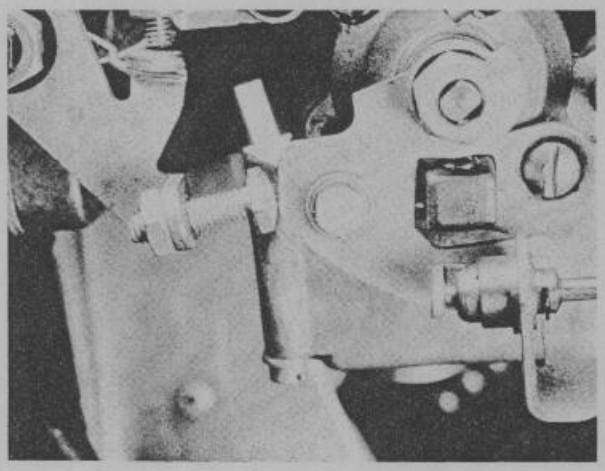
For the limited number of carburetors fitted with a vent valve, the adjustment is as follows:



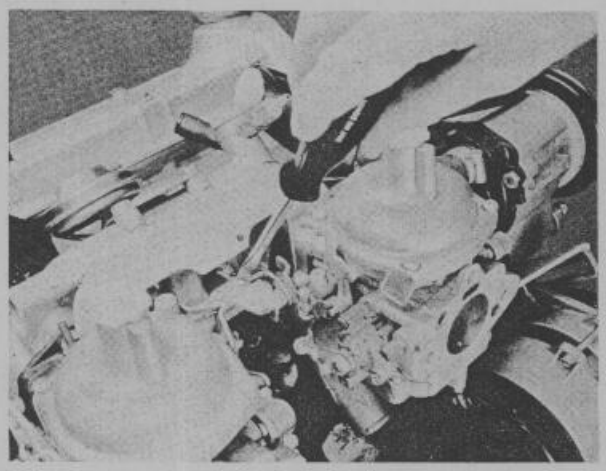
Ensure that the engine idle speed is set to the correct specification. Then, stop the engine, and remove the existing vent valve hose from the carburetor. Attach a separate piece of hose to the vent valve tube on the carburetor.



Now, blow into the hose and at the same time move the lever that operates the vent valve. As the lever is operated, a sudden restriction will be felt while blowing into the tube. This will allow you to feel the valve operation.



Release the lever and allow the mechanism to return to the idle position.



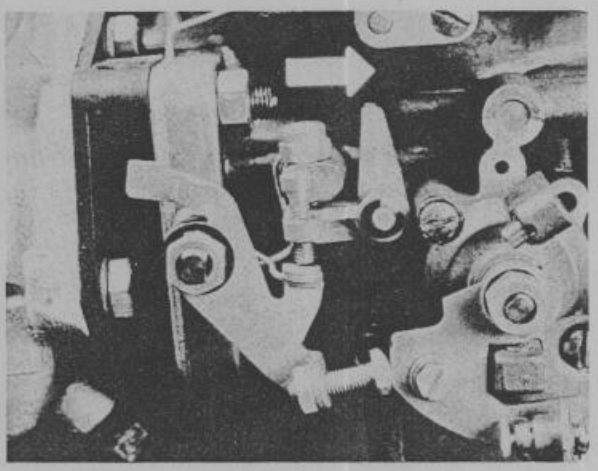
Blow into the hose again. If no restriction is felt, the vent valve is adjusted correctly. If a restriction is felt, turn the adjusting screw counter clockwise until the restriction just disappears. This is the correct setting.

If twin carburetors are fitted, repeat the procedure for the other carburetor. When the adjustments are complete, remove the auxiliary hose and re-fit the vent hose.

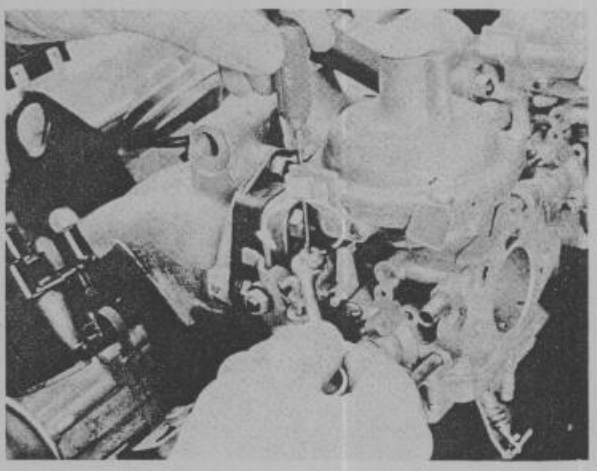
STROMBERG TUNING

During carburetor tune-up, do not allow the engine to idle for longer than three minutes without clearing out the system by holding the throttle at 2000 RPM for one minute.

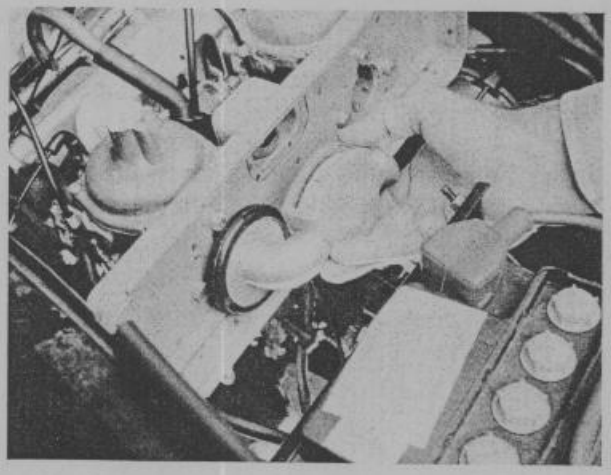
First, we make the idle adjustments. Bring the engine up to normal operating temperature, and remove the air cleaner.



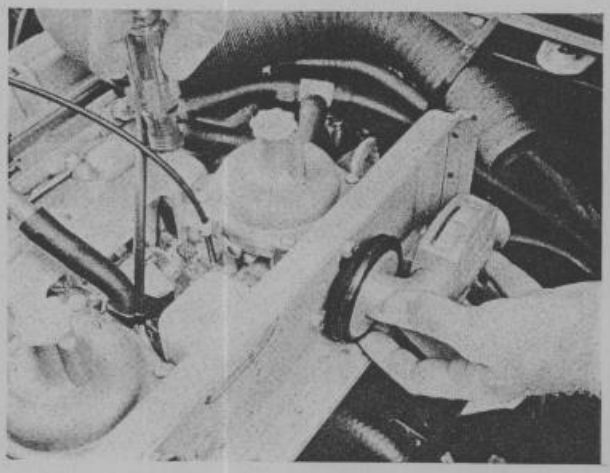
Be sure the choke is off and the fast idle cam is not in contact with the adjustment screw.



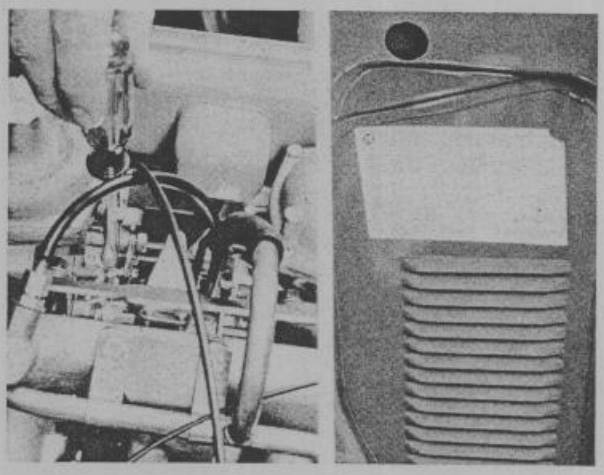
On twin carburetor installations, disconnect, slacken, or adjust the interconnecting links. Refer to the appropriate workshop manual for the specific procedure.



Using an air flow meter, check the air flow of each carburetor.

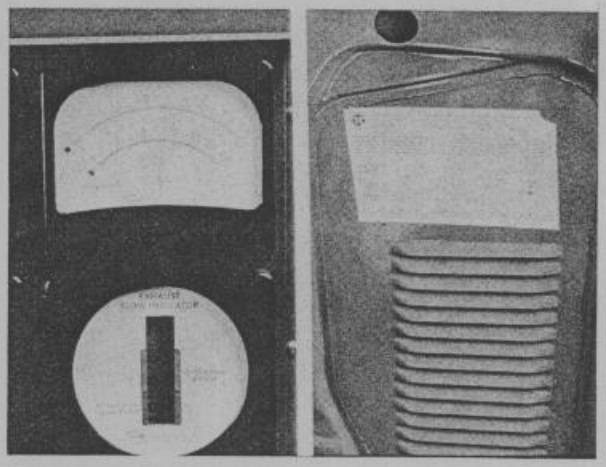


Adjust the idle speed screws of both carburetors until the air flow and RPM are equal. Then, tighten or further adjust the interconnecting links according to the instructions in the appropriate workshop manual. And . . . recheck the air flow.



Now, set the idle speed to specification. If, twin carburetors are fitted, turn both adjusting screws in equal amounts and check the air flow to ensure balance.

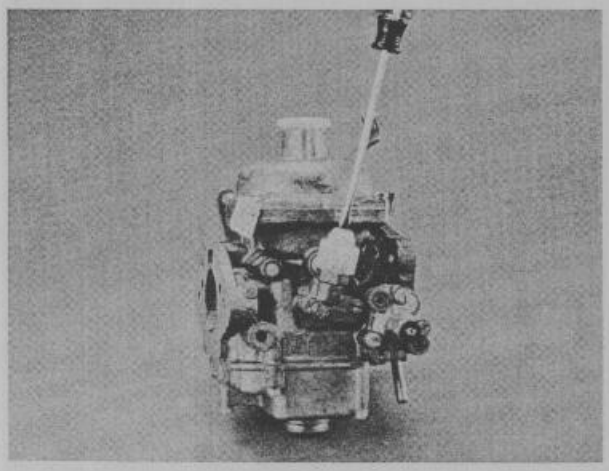
Refit the air cleaner.



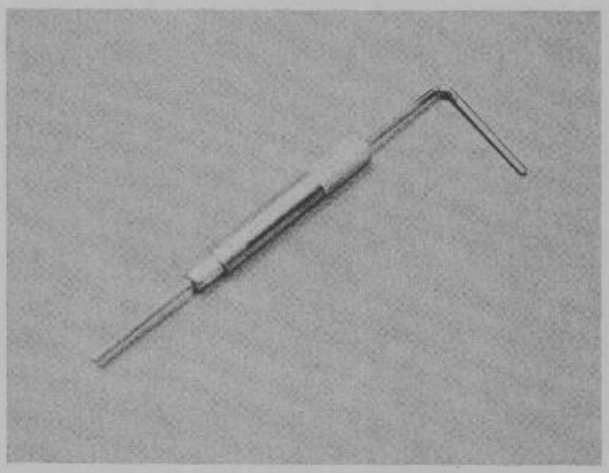
Next using an approved infra-red analyzer, check the CO at idle level against that listed on the emission decal. Be sure to disconnect and plug the manifold side of the air pump hose where applicable. Do not restrict the air pump.

ADJUSTMENTS AND TUNING

If the reading is not within specification, adjust the mixture as follows:

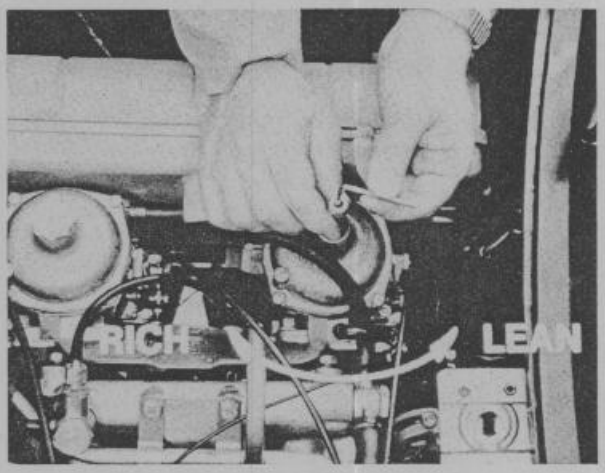


First, adjust the fine mixture trim screw. If twin carburetors are fitted, adjust both carburetors in equal amounts.



If adjusting the trim screw does not bring the CO level into specification, adjust the mixture needle. This requires a special tool.

With the engine operating at idle, remove the carburetor piston damper.



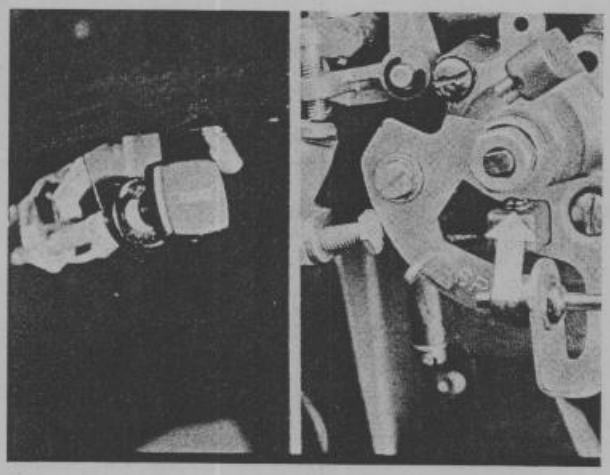
Slowly insert the special tool into the dashpot until the outer tool engages the air valve and . . . the inner tool engages the hexagon in the needle adjuster plug.

CAUTION: The outer tool must be correctly engaged and held to prevent damage to the diaphragm.

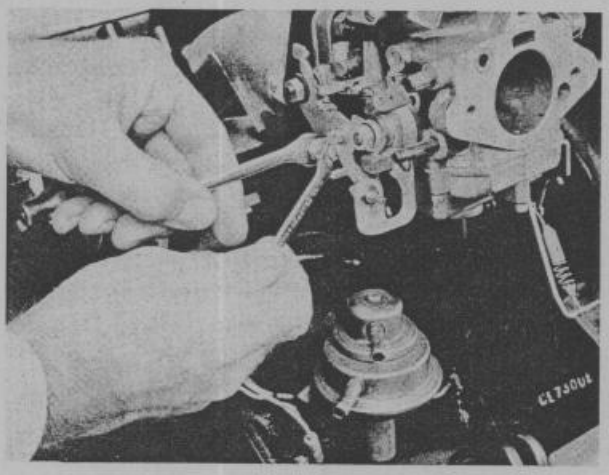
Hold the outer tool firmly, and turn the inner tool in small increments. Clockwise for a richer mixture, counter clockwise for a leaner mixture. If twin carburetors are fitted, adjust each carburetor in equal amounts.
When the correct CO level is obtained, reinstall the piston damper. After the engine is shut off, position the oil retaining clip and re-check the damper oil level as shown preveously. Also, re-check the idle speed and the CO level. Hold the engine speed at 2000 RPM for one minute before re-checking the CO level at idle.

STROMBERG FAST IDLE ADJUSTMENT

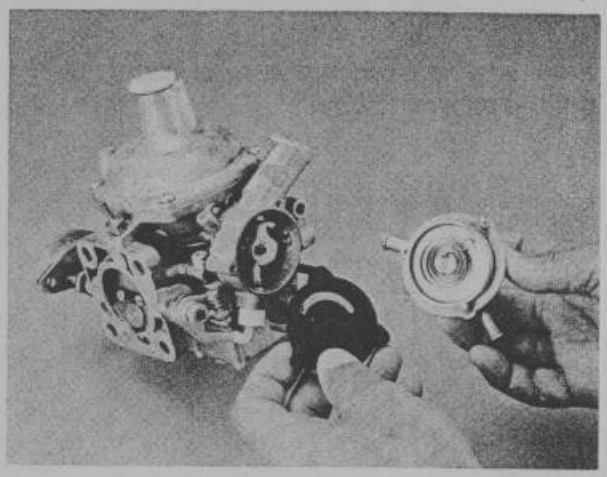
For manual choke versions, first ensure that the misture control cable has free movement.



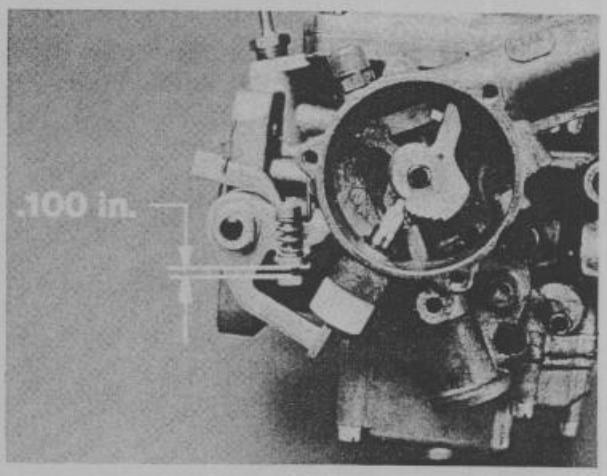
Then pull out the misture control knob on the panel approximately ¼ inch until the fast idle cams are correctly engaged with the ball locaters.



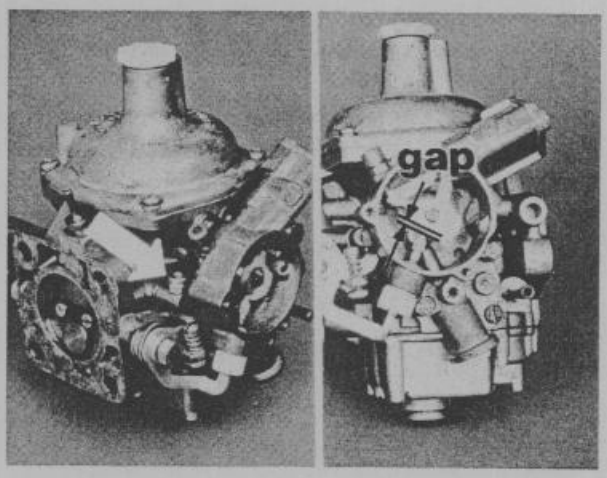
Adjust the fast idle screw and lock nut to specification. On twin carburetor installations, ensure equal air flow through each carburetor.



On automatic choke versions, remove the carburetors, then remove water jacket, gasket, sealing ring, and the heat mass and the insulator from the choke unit.



Then, set the linkage gap to a minimum of 100".



Now, turn the adjusting screw until the gap between the throttle stop and the cam is as specified. The specification can be found in your workshop manual or training aid.

After adjustment, re-assemble the components and refit the carburetors.