INTERMEDIATE SYSTEM WITH DISC TYPE THROTTLE VALVE AND VACUUM PISTON

As the disc type throttle valve is opened, there is a transition from low speed fuel discharge orifices to an intermediate system, similar to that which occurs in carburetors using slide type throttle valves. However, there is more accurate venturi control, as the vacuum piston moves independently.

When a *slide* type throttle valve is opened, the venturi constriction is widened in direct proportion to throttle opening, as these are functions of one integral part. If the slide throttle valve is mechanically linked to the throttle grip, venturi size is regulated by the rider, whose wishes will not necessarily coincide with the needs of the carburetor. An independently controlled vacuum piston (or a vacuum controlled slide throttle valve, see pages 23-24) ensures correct venturi size and air velocity throughout the intermediate operating range.

Vacuum Piston Construction:

The bottom of the vacuum piston is vented to allow air pressure in the carburetor bore and air pressure in the chamber above the vacuum piston to equalize. The chamber below the vacuum piston diaphragm or rim is vented to the atmosphere.

Vacuum piston design may utilize a diaphragm to separate the upper and lower air chambers (Fig. 28 & 29). Designs which do not utilize a diaphragm rely on a close fit between the piston and the walls of the carburetor top to separate the air chambers (Fig. 30 & 31).

When air pressure in the carburetor bore becomes significantly lower than atmospheric pressure, atmospheric pressure forces the piston upward. When air pressure in the carburetor bore approaches atmospheric pressure, the piston will then fall of its own weight, sometimes assisted by a return spring.

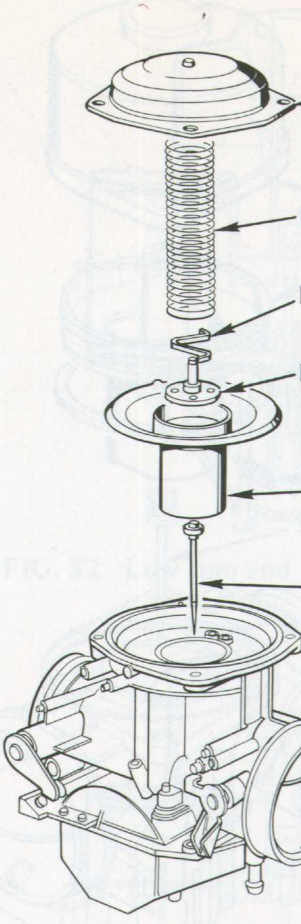

FIG. 28 COMPONENTS
Vacuum Piston with Diaphragm

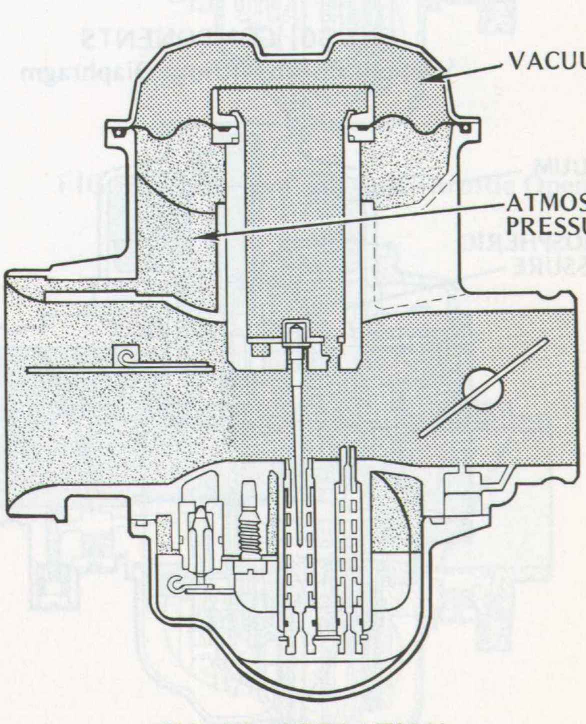

FIG. 29 OPERATION
Vacuum Piston with Diaphragm

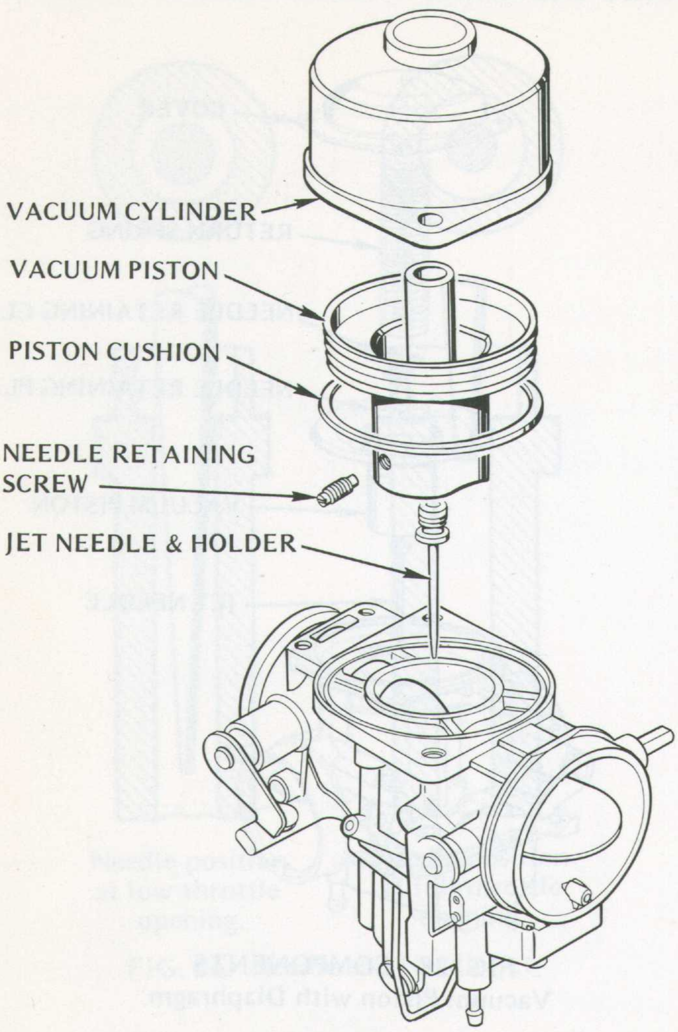

FIG. 30 COMPONENTS
Vacuum Piston without Diaphragm

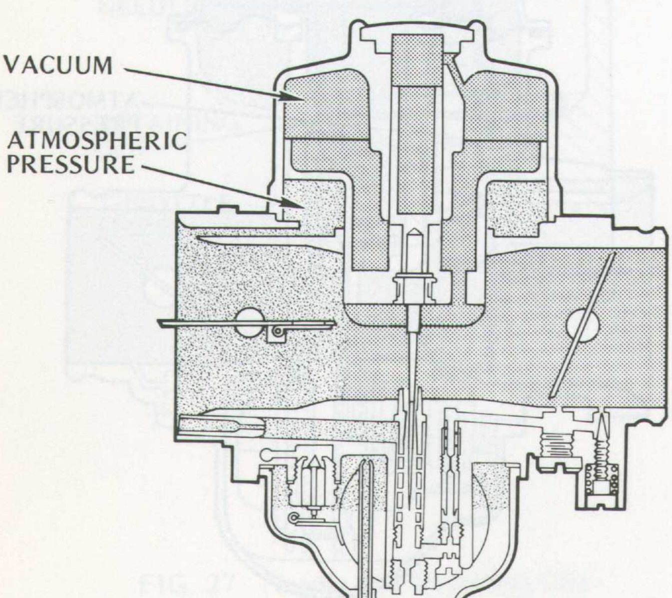

FIG. 31 OPERATION
Vacuum Piston without Diaphragm

Diaphragm type vacuum pistons have return springs to ensure closure because additional pressure is required to flex the diaphragm. Non-diaphragm type vacuum pistons fall freely and do not require return springs for positive closure. Non-diaphragm type vacuum pistons are sometimes fitted with return springs in order to modify the piston's operating characteristics. Adding a return spring has the same effect as increasing the weight of the piston.

Vacuum Piston Operation:

During idle and low speed operation, when the throttle valve is nearly closed, induction port vacuum is confined to the area downstream of the throttle valve. Air pressure at the vacuum piston is nearly the same as atmospheric pressure, and the vacuum piston is in the fully closed position (Fig. 32).

As the throttle valve is opened, the area under induction port vacuum extends upstream to the vacuum piston. The intermediate system becomes operative, and the vacuum piston moves in response to differences between atmospheric pressure and vacuum in the carburetor bore. Piston movement stabilizes at a height where the pressure differential balances piston weight (Fig. 34).

As engine rpm increases, the *volume* of air passing through the carburetor bore also *increases.* The *velocity* of air passing through the venturi *remains constant,* however, throughout the operating range of the vacuum piston.

An increase in flow volume is accomodated by increasing the size of the air passage rather than by increasing air *speed.* Piston movement varies the size of the venturi so that air velocity can remain constant regardless of changes in flow volume. Carburetors equipped with vacuum pistons are therefore frequently referred to as "constant velocity carburetors."

Acceleration:

The main advantage of constant velocity carburetors is apparent during hard acceleration. If a motorcycle is equipped with conventional slide throttle carburetors, sudden full throttle opening at low speed may produce poor engine response, as vacuum and venturi air velocity will drop to a point where very little fuel is drawn from the jets. If the motorcycle is equipped with constant velocity carburetors, the vacuum pistons ensure sufficient venturi air velocity to prevent a lean fuel mixture on sudden throttle opening.

In automotive applications, the vacuum piston may be equipped with an oil damper to retard upward movement of the piston for a richer acceleration mixture. Alternatively, an automotive carburetor may use an "accelerator pump" which squirts additional fuel into the carburetor bore on sudden throttle opening.

Jet Needle:

Because venturi air velocity is held to a constant speed, air pressure against the fuel jet nozzle(s) is also constant. This causes the fuel to tend to flow from the jet(s) at a constant rate, regardless of engine rpm, so the vacuum piston must carry a metering rod (jet needle) to regulate fuel flow in proportion to air flow volume.

Jet needles used in constant velocity carburetors are similar to those used in slide throttle carburetors, except that most models of constant velocity carburetors do not provide any needle height adjustment. Fuel mixture adjustment for the intermediate operating range is achieved by replacing the main jet(s) with jets of larger or smaller diameter. In some cases, replacement needles with other profiles may be available to alter the fuel flow rate.

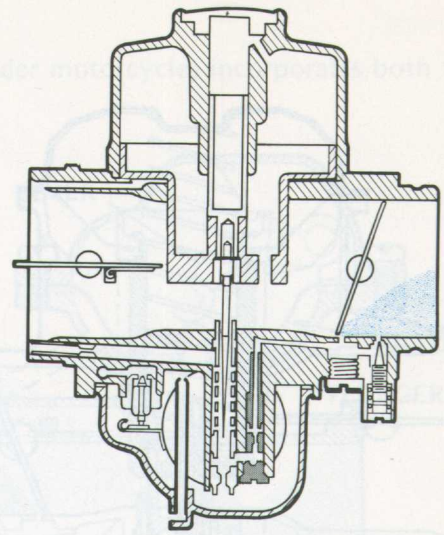

FIG. 32 Low rpm and Low Throttle Opening

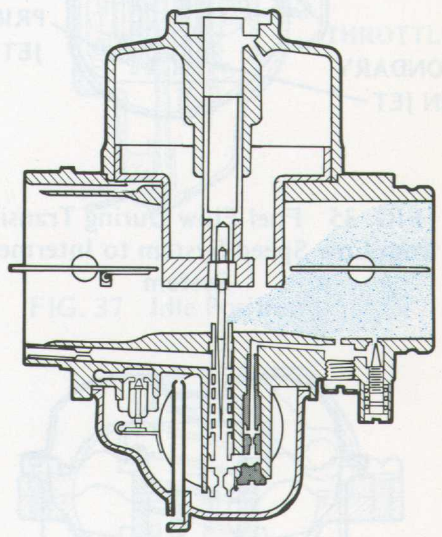

FIG. 33 Low rpm and Full Throttle Opening

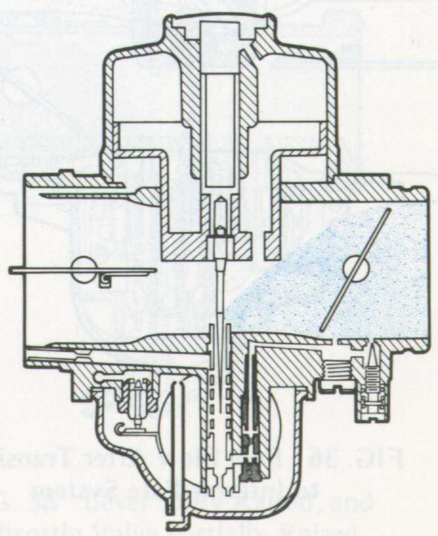

FIG. 34 Intermediate rpm and Intermediate Throttle Opening

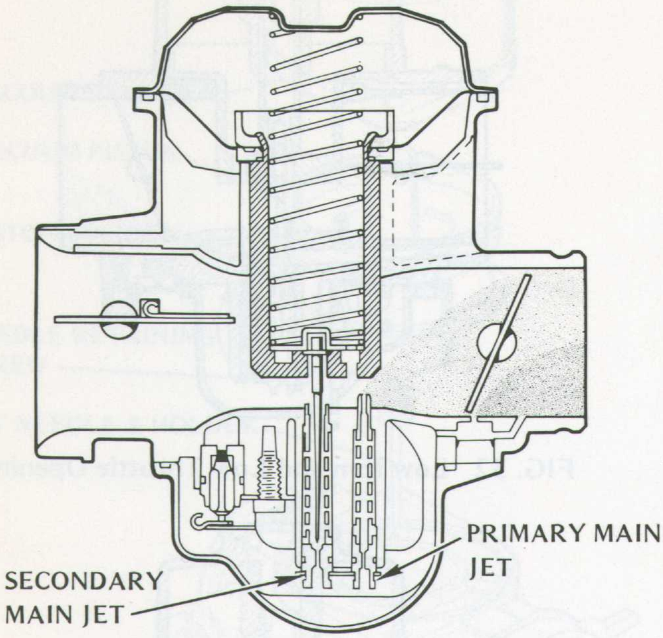

FIG. 35 Fuel Flow During Transition from Low Speed System to Intermediate System

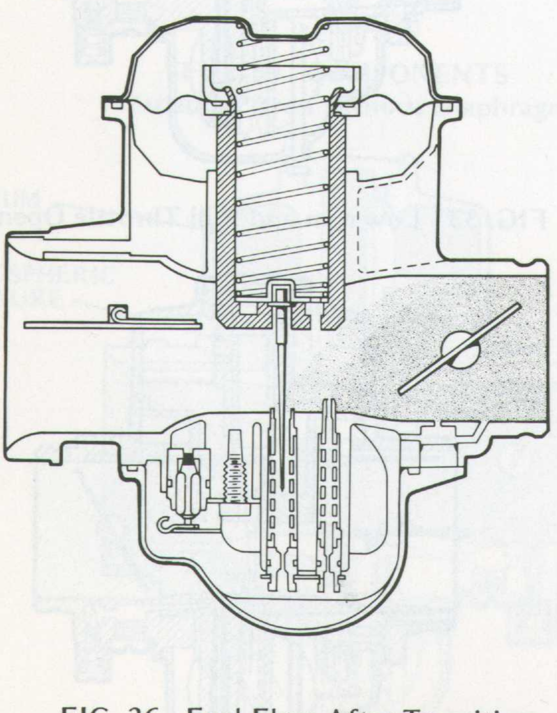

FIG. 36 Fuel Flow After Transition to Intermediate System

Single Main Fuel Circuit:

The carburetor illustrated in Fig. 32, 33, & 34 discharges fuel from a single jet assembly throughout the operating range of the intermediate and high speed systems. Main jet and needle jet functions are similar to those in carburetors with slide type throttle valves.

Primary and Secondary Main Fuel Circuits:

The carburetor illustrated in Fig. 35 & 36 divides the main jet system into primary and secondary circuits. The purpose of this design is to provide a smoother transition from low speed to intermediate systems.

As the throttle valve starts to open and induction port vacuum extends upstream, fuel is discharged from the primary main jet nozzle before the secondary circuit becomes operative (Fig. 35).

As the throttle valve opens farther, fuel is discharged from the secondary main jet nozzle (needle jet), and the vacuum piston begins to rise (Fig. 36).

Fuel is delivered from both primary and secondary circuits throughout the operating range of the vacuum piston. Fuel mixture adjustment can be made by replacing the main jets with jets of larger or smaller diameter.