Aug. 20, 1957 R. T. DILLON 2,803,443

CARBURETOR STEP-UP

Filed Sept. 20, 1954

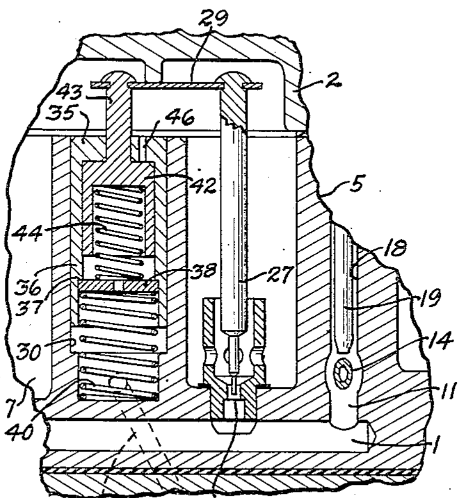
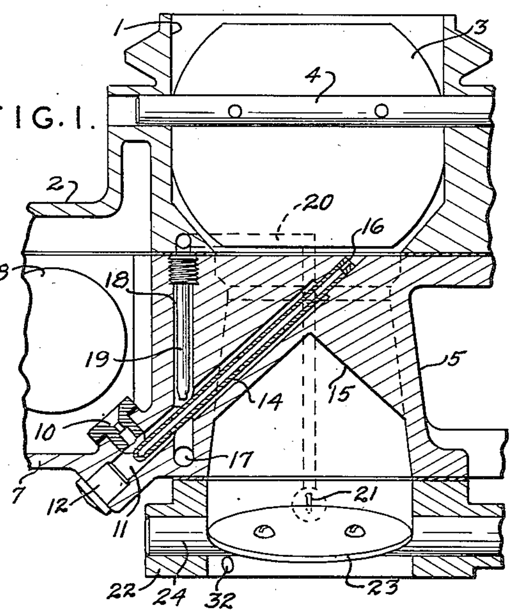


FIG.2.

FIG.1.



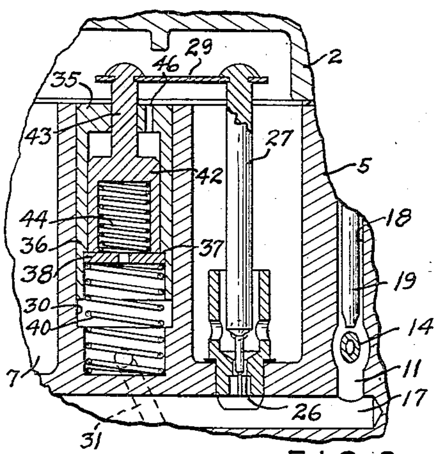


FIG.3

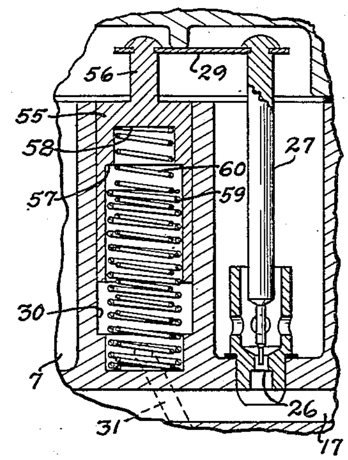


FIG.5.

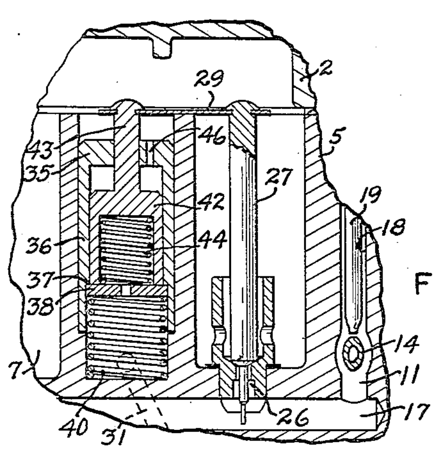


FIG.4.

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2,803,443

Patented Aug. 20, 1957

2,803,443

CARBURETOR STEP-UP

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Application September 20, 1954, Serial No. 456,985

3 Claims. (Cl. 261—41)

This invention relates to carburetors for internal combustion engines and, more particularly, to a novel step-up device for varying the fuel metering orifice supplying the main fuel nozzle.

It is well understood in the art that carburetors for motor vehicles are frequently provided with means for varying the ratio of fuel to air supplied to the mixture conduit according to the demands on the associated engine. When the engine is subjected to a relatively heavy load, a richer mixture is supplied by the carburetor than is the case when the engine is subjected to a relatively light load in the so-called part-throttle range. To accomplish this purpose, it is believed conventional to provide a step-up device responsive to throttle opening or responsive to engine load, or both. This device is usually a graduated metering rod or rods associated with either the main or auxiliary fuel metering orifices. The metering rod is connected mechanically to the throttle valve so as to increase the effective area of the orifice during opening of the throttle, and vice versa. The same rod or an independent rod can also be connected to a means responsive to the load on the engine. This latter means may be a spring biased piston or diaphragm responsive to intake manifold pressure in such a way that the piston or diaphragm will tend to close the orifice by actuating the metering pin at high suctions in the intake manifold, and open the orifice at high pressures in the intake manifold. The two devices, when combined to control the same metering pin, are usually so arranged that the throttle actuation will override any control by the suction device. Two metering pins may also be independently operated, one by the throttle and one by the suction motor.

This invention relates to an arrangement where the metering pin is operated independently by the suction motor in an auxiliary variable orifice controlling an auxiliary supply of fuel to the main nozzle. As distinguished from prior step-up devices, the instant invention provides two distinct positions for the metering pin so as to give better control of the step-up device in the part-throttle range. This is accomplished by a compound spring and piston arrangement, or by either one separately, arranged whereby, in one range of manifold pressures, the step-up device opens partially, and, in another range of manifold pressures, the step-up device opens fully. The difference in spring rates also affects the degree of piston displacement within each range.

These objects are attained by the structure illustrated in the accompanying drawings, in which:

Fig. 1 is a longitudinal section of a carburetor of conventional construction.

Fig. 2 is a sectional view on a much enlarged scale showing a step-up device for a carburetor.

Fig. 3 is a view similar to Fig. 2 showing a position of the parts in the part-throttle range.

Fig. 4 is a view similar to Fig. 2 showing the parts in the closed position of the throttle.

Fig. 5 is a section on an enlarged scale of a modified form of the step-up device.

Turning now to the drawings,

Fig. 1 illustrates a carburetor of conventional construction having a mixture conduit 1 formed as a single casting and including a fuel bowl cover 2. Journaled within the upper portion of this casting is a choke valve 3 supported on a shaft 4 journaled in the walls of the conduit 1 and operated by a conventional choke mechanism responsive to suction and engine temperature (not shown).

Casting 1 supporting the choke valve is secured to a body casting 5 of the carburetor. The body casting 5 includes a fuel bowl 7 in which is mounted a float 8 for controlling the needle valve in the fuel supply to the fuel bowl 7. At the bottom of the fuel bowl 7 is an orifice 10 for controlling the flow of fuel to the main fuel jet passage 11 which, in turn, is sealed externally by the plug 12. A ported mixture tube 14 is supported within a nozzle bar 15 and extends downwardly within the main fuel passage 11 from an air bleed 16. Main fuel nozzles (not shown) are in opposite sides of the fuel nozzle bar 15 in communication with the passage 11.

Below the main fuel passage 11 is an auxiliary fuel supply passage 17 which is connected with the passage 11 and extends upwardly in the carburetor body casting 5, as shown at 18, forming a well containing the idle tube 19. The passage 20 shown in dotted lines forms a continuation from the well and extends downwardly to the idle port 21 within the throttle body 22. Throttle 23 is secured on a shaft 24 journaled in the throttle body 22, and has the usual manual control (not shown). The port 21 is positioned at the edge of the throttle valve 23 when closed.

In Figs. 2 to 4, inclusive, is shown one embodiment of the present invention using a step-up device including a variable orifice operated by a compound piston and compound spring arrangement. Within the carburetor body casting 5 containing the fuel bowl is an auxiliary orifice 26 for metering the flow of fuel from the bowl 7 into the transverse passage 17. Orifice 26 is controlled by a stepped metering rod 27 which is, in turn, raised and lowered by the suction motor of the step-up device through a connector in the form of a bridge member 29.

The suction motor comprises a cylinder 30 formed within the fuel bowl and integral with the body casting 5. A passage 31 connects with the bottom of the cylinder 30 and leads to a port 32 posterior of the throttle, as shown in Fig. 1. Slidably mounted within cylinder 30 is a piston 35 having a skirt 36 with a shoulder 37 for supporting the apertured disc 38. Piston 35 is biased towards the upper position in the cylinder 30 as shown in Fig. 2 by a coil spring 40 interposed between the disc 38 and the bottom of the cylinder 30.

Slidable within the piston 35 is a piston 42 with a stem 43 extending through the crown of piston 35 and secured to the bridging member 29. The piston 42 is urged to the uppermost position within the piston 35 by a spring 44 compressed between the bottom of piston 42 and the apertured disc 38. A vent hole 46 in the crown of piston 35 communicates the atmospheric pressure present in the fuel bowl 7 to the upper surface of the piston 42.

The above described construction of the suction motor has, as will be readily recognized, a compound piston arrangement with a compound spring arrangement. Since the pistons are of different area, different forces will be developed in response to the same degree of suction. In order that the correct and desired response of the pistons to the degree of suction will be obtained, a compound spring is used. Spring 40 can be so calibrated that when the suction in the intake manifold drops to eight inches of mercury, it will overcome the pressure acting upon the piston 35 and move it upwardly within the cylinder 30 to the upper position shown in Fig. 3. This action can take place independent of the force of suction acting upon the smaller piston **42**. Spring **44** acting upon piston **42** can be calibrated so that it will overcome the force acting upon the smaller piston when the suction in the manifold drops to three inches of mercury. Of course, when the outer or larger piston **35** moves, it will necessarily carry the smaller piston with it so as to raise the metering rod **27** to its proper position on its first step. Obviously, any movement of the smaller piston, either independently or otherwise, will also move the metering rod **27**. When piston **42** moves in piston **35**, however, it will position the metering rod on its second step. Because of the forces involved, smaller piston **42** cannot move up until piston **35** has moved, and vice versa.

With this arrangement of the parts, the springs and pistons can be so calibrated as to move individually in response to and within certain ranges of intake manifold suction as above described to give a much more certain and positive position than a single spring and a metered orifice in the suction motor. These ranges can be arbitrarily chosen to suit the requirements of the particular engine. If the engine is at rest, the parts of the suction motor and metering rod will be in the position shown in Fig. 2 in order that a supply of fuel will be available to the main nozzle when the choke valve **3** is closed, or nearly so, by its temperature responsive means. During operation of the engine with the throttle closed, the parts will be in the position as shown in Fig. 4, wherein the metering rod **27** restricts the flow through the orifice **26** or closes it completely. Auxiliary fuel is not required during the idle or under low load conditions experienced at part-throttle.

In the part-throttle range, the manifold pressure may increase (suction decrease) as a result of the load imposed upon the engine. If the suction in the manifold decreases to the point in which the particular engine requires additional fuel, then spring **40** overcomes the force of suction on the outer piston **35** and raises the parts to the position shown in Fig. 3. In this position the metering rod is raised to supply a richer mixture to the main fuel nozzles, and thus to the engine. This arrangement provides an intermediate range of fuel-air mixtures between the economy range and the full-throttle, full-load range.

If the engine is under heavy load, the throttle will be in its wide open range. A further drop in manifold suction will occur. To get full engine power, a rich mixture is required, and spring **44** is calibrated to overcome the forces acting upon piston **42** so that the parts assume the position shown in Fig. 2, with the metering pin **27** on its last step.

In Fig. 5 is shown a modified form of the invention. In this view similar parts have the same reference characters. This description will be confined to the differences in structure. The cylinder **30** contains a slidable piston **55** with a stem **56** attached to the bridge **29**. The skirt of the piston **55** is counter-bored to provide a shoulder **57** and a seat **58**. Co-axially mounted within the cylinder **30** and the skirt of the piston **55** are a pair of springs **59** and **60**. Spring **60** is biased between the bottom of the cylinder **30** and the seat **58** in the crown of the piston **55**. Spring **59** is larger in diameter than the former spring **60**, and cooperates with the shoulder **57**. Although Fig. 5 has but a single piston, in operation it resembles the structures shown in Figs. 2 to 4 to provide three distinct positions for the metering rod **27**.

In the position shown, the metering jet **26** is only slightly restricted. If the manifold pressure is reduced gradually, first spring **60** will be compressed until shoulder **57** contacts spring **59**. Both springs then support the piston and resist downward movement. During this range of movement, pin **27** further restricts jet **26**. When piston **55** reaches the bottom of its stroke, both springs **59** and **60** are compressed, and pin **27** reaches its point of maximum restriction in jet **26**.

During increases in manifold pressure, the reverse action takes place with the pin **27** moving to an intermediate position at the end of travel of spring **59**, and then gradually to wide-open under the influence of spring **60**.

A structure has been described which will carry out all the objects of the present invention, but it is contemplated that other forms will occur to those skilled in the art which are within the scope of the appended claims.

I claim:

1. In a carburetor, a mixing conduit having a fuel nozzle therein, a fuel bowl having a main fuel passage leading to said nozzle, a throttle valve in said conduit posterior of said nozzle, a step-up device for supplying additional fuel from said bowl to said passage, comprising a metering rod movable through an orifice to control the flow of additional fuel from said bowl to said passage, a cylinder having a suction chamber at one end thereof communicating with said conduit posterior of said throttle, the other end of said cylinder being open to atmosphere, piston means in said cylinder connected to said metering rod, a plurality of compression springs of relatively different sizes and compression rates in said chamber successively compressed by said piston means responsive to an increase in suction in said chamber, whereby said metering rod moves step by step to decrease the flow of additional fuel through said orifice to said nozzle.

2. A carburetor according to claim 1 wherein, said piston means comprises inner and outer pistons telescopically engaged one within the other, an apertured wall provided within the outer piston, one of said springs being engaged between said wall and a spring seat in said chamber, and another of said springs being engaged between said wall and said inner piston and offering less resistance to compressive forces than said one spring.

3. A carburetor according to claim 1 wherein, said piston means comprises a piston having a plurality of axially spaced spring seats therein, and a plurality of coaxial springs of different lengths and compression rates seated in said chamber for serial engagement with their respective piston seats.

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