Nov. 8, 1966 R. E. KALERT, JR 3,284,060

CARBURETOR

Filed Aug. 16, 1965 2 Sheets-Sheet 1

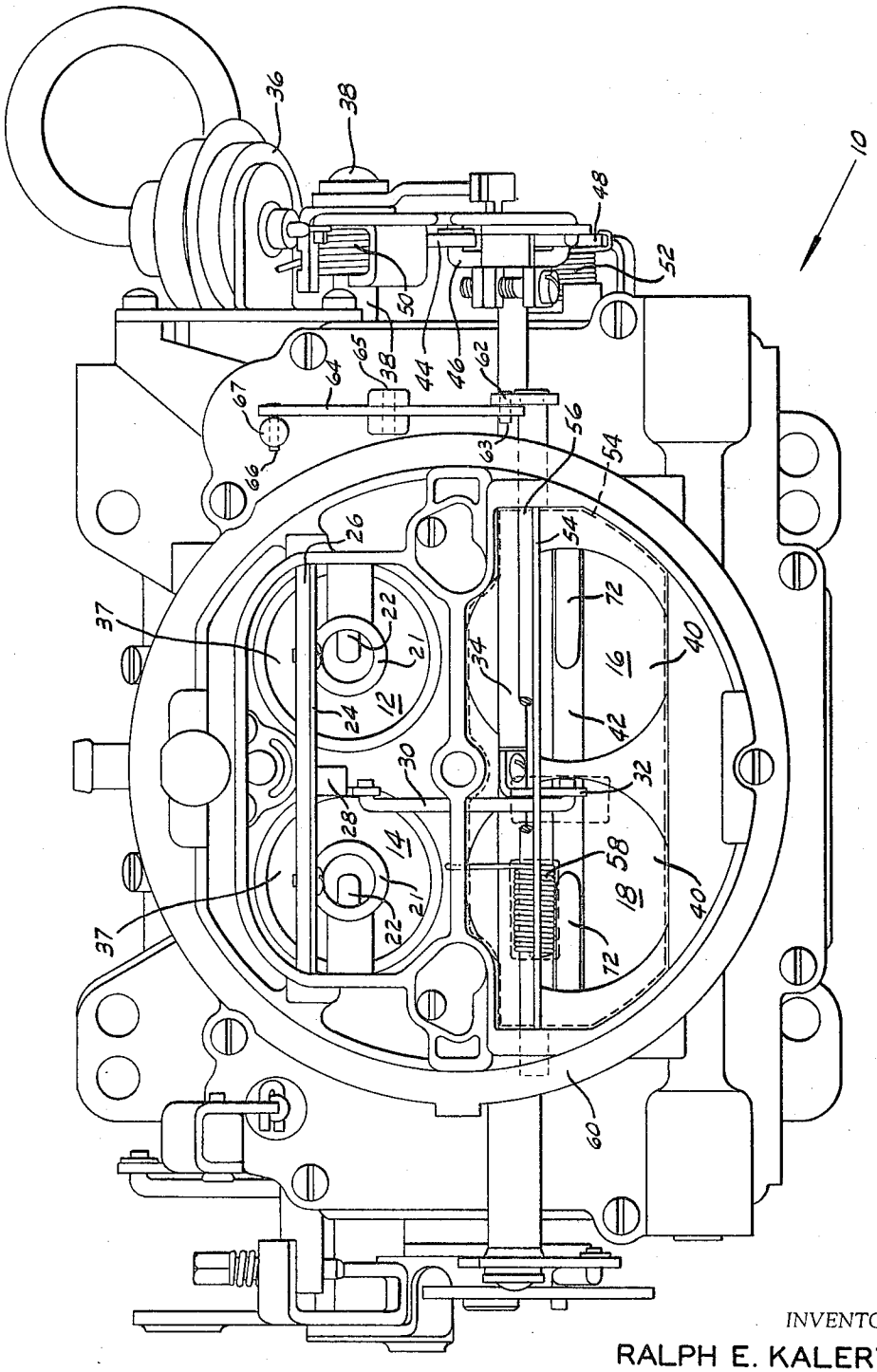


FIG. I.

INVENTOR.
RALPH E. KALERT, JR.
BY Edward H Casey
ATTORNEY

Nov. 8, 1966 R. E. KALERT, JR 3,284,060

CARBURETOR

Filed Aug. 16, 1965 2 Sheets-Sheet 2

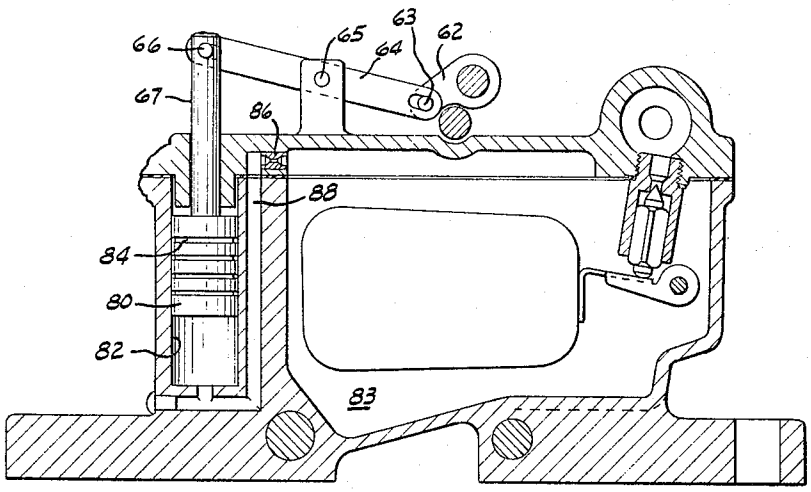


FIG. 2.

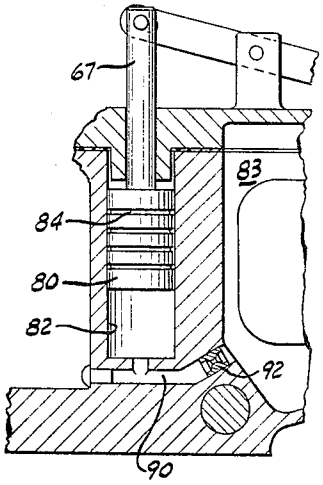


FIG. 3.

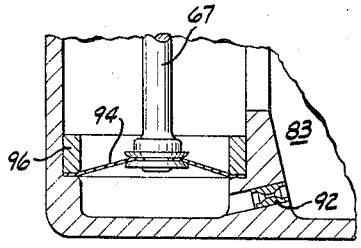


FIG. 4.

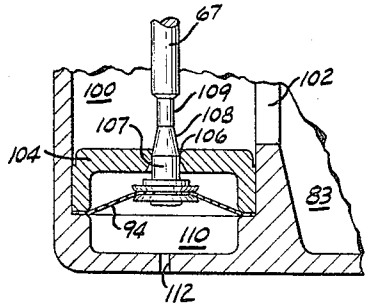


FIG. 5.

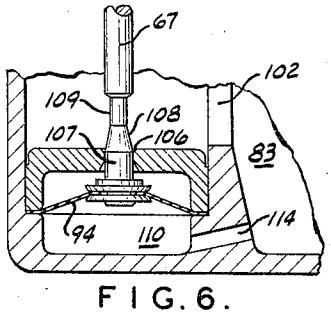


FIG. 6.

INVENTOR.
RALPH E. KALERT, JR.
BY Edward H Casey
ATTORNEY

United States Patent Office

3,284,060

Patented Nov. 8, 1966

3,284,060

CARBURETOR

Ralph E. Kalert, Jr., Granite City, Ill., assignor to ACF Industries, Incorporated, New York, N.Y., a corporation of New Jersey

Filed Aug. 16, 1965, Ser. No. 479,803
3 Claims. (Cl. 261—23)

This invention relates to carburetors and in particular to multistage, multibarrel carburetors of the air valve secondary type. In one of its aspects, the invention relates to a carburetor having an air valve in the secondary barrel, which is responsive to engine demand. In another of its aspects, the invention relates to a carburetor of the air valve secondary type in which control of the air valve in its opening and closing movements is effected by a dashpot.

Multistage carburetors are those which have a plurality of fuel and air mixture passages leading to the intake manifold of an internal combustion engine. At least one of the mixture conduits, called a primary, is used to supply the correct fuel mixture to the engine during starting and from low to normal driving speeds under light loads. One or more other mixture conduits, called a secondary, becomes opertaive when a certain primary throttle opening is reached and thereby provides more fuel and air to the engine for higher speeds or for greater loads at low speeds. A multibarrel, multistage carburetor of the air valve secondary type is shown and described in U.S. Patent 2,832,576 to Otto Henning.

The carburetor illustrated in the Henning patent is one in which the primary barrel and secondary barrel is of substantially the same diameter and each barrel employs a venturi and nozzle cluster as has long been the practice. More recent practice has been to use a larger diameter secondary barrel having a smooth bore and no venturi cluster for the main fuel nozzle. In such a carburetor the main fuel nozzle is brought into use through a combination of factors, these being a depression in the barrel of the secondary side occasioned by the partial or complete opening of the throttle, coupled with a restrictive action of the air valve, which in effect meters the air. Also the velocity of the air passing over the nozzle aids in pulling fuel out of the nozzle.

In air valve secondary carburetors using an air valve above the secondary nozzle, the air valve itself is biased toward a closed position by a weight or by a spring. The biasing action of the spring or weight must be such that the air valve is freely movable from a closed or partially open position to a more fully open position, and this requires that the bias be a relatively slight one.

Carburetors of the type just described have frequently encountered difficulties in proper metering and flow of fuel. When these difficulties exist, they arise on initial opening of the secondary throttle or on the complete closing of the secondary throttle. In the first instance, the secondary barrel sometimes fails to receive enough fuel on the initial opening of the throttle for the reason that the air valve can open more rapidly than flow of fuel is initiated and this has a tendency to create a lean mixture in the manifold under the carburetor. During throttle closing, if the air valve closes rapidly, it may reach the closed position before the throttle valve is closed, in which case unwanted fuel may be drawn out of the nozzle to create an overly rich mixture.

I have found that the movement of the air valve can be more precisely controlled and through this control the flow of fuel can be controlled to achieve optimum mixtures throughout the range of opening of the secondary bore. To accomplish this I provide a dashpot mechanism operatively linked to the air valve to aid in the control of

the air valve movement at critical times during its operation. According to one embodiment of the invention, a dashpot is provided that provides a relatively constant resistance to rapid movement throughout the entire range of operation both on the opening and closing sequences. With such a dashpot, low speed movement is retarded very little if at all, whereas high speed movement is retarded substantially according to the ability of the dashpot to move fluid. According to a second embodiment of my invention, I have provided a dashpot with a modulated action wherein it is possible to afford great resistance at a selected portion of the movement and a lesser resistance throughout the remainder of the movement of the air valve. In particular, I have found that it is sometimes desirable to have considerable resistance at the moment of initial opening and at the final moment of closing of the air valve.

In the drawings,

FIGURE 1 is a top plan view of the carburetor embodying my invention.

FIGURE 2 is a sectional view showing one form of dashpot.

FIGURE 3 is a partial section showing an alternate form of dashpot.

FIGURE 4 shows still another form of dashpot.

FIGURE 5 shows another embodiment using a diaphragm dashpot, having a modulated action and

FIGURE 6 shows another form of the dashpot of FIGURE 5.

Referring now to the drawing and to FIGURE 1 in particular, there is indicated generally at **10** a carburetor which as shown is of the four-barrel type, having a pair of primary barrels **12** and **14** and a pair of secondary barrels **16** and **18**. Each of the primary barrels is provided with a boost venturi **21** and a main fuel nozzle **22**. The primary side of the carburetor is provided with a choke valve **24** rotatably mounted on a shaft **26**. The choke valve is shown in FIGURE 1 in its fully open position.

Each secondary barrel is provided with a main fuel nozzle **72**, which projects outwardly and downwardly into the respective bores **16** and **18**. The secondary bores are also provided with a pair of throttle plates **40**, rotatably mounted on a throttle shaft **42**. In similar fashion each of the primary barrels is provided with a throttle plate **37**, mounted for rotation on a shaft **38**. Shaft **38** is linked to shaft **42** by way of a lever arm **44**, link **46**, and secondary lever arm **48**. The linkage is such that the primary bores are opened to a predetermined amount, e.g. 60 to 70 degrees, before the secondary valves begin to open, after which the two pairs of valves open together to reach the full open position at the same time.

The secondary side of the carburetor is provided with a single large air valve **54**, shown in fully opened position by the solid lines and in closed position by the dashed line. The air valve **54** is of such a shape and configuration as to substantially completely close off that portion of the air horn immediately above the bores **16** and **18**. Air valve **54** is mounted for rotation on a shaft **56**. A coil spring **58** is provided for biasing the valve **54** towards its normally closed position. A circular air horn **60** is provided for mounting an air filter or cleaner as is customary.

Outboard of the air horn ring, shaft **56** is provided with a short lever arm **62** which is connected by means of a pin **63** to a pivoted lever **64**. Lever **64** pivots on a pin **65**. The other end of lever **64** is connected by way of a pin **66** to the stem **67** of a dashpot.

As shown in FIGURES 2 through 6, the stem **67** is attached either to a piston or to a diaphragm assembly. In each instance the piston or the diaphragm serves as an operative part of the dashpot. In FIGURES 2 and 3 a

piston **80** is shown in a cylinder **82**. If desired, the piston may be provided with one or more grooves **84**. The grooves are not necessary but if used will serve to create turbulence and thus make a more effective seal between the piston and the wall of the cylinder. Also, the grooves **84** will reduce the area of metal contacting the cylinder wall. In all of FIGURES 2 through 6, the dashpot is shown in its uppermost position, which is reached when the air valve is fully closed. It is to be mentioned that by reversing the levers and linkages the dashpot could be at its bottommost position when the air valve is fully closed.

Returning to FIGURE 2, the dashpot illustrated is of the type using air as a fluid medium. Clean filtered air is drawn from an upper portion of the carburetor, near the air space above the liquid in the float chamber **83**. Air passes through a metering restriction **86** into a passageway **88** and thence into the lower portion of cylinder **82**. When piston **80** moves downwardly, air is forced out through passage **88** and restriction **86**. The size of the restriction **86** governs the rate at which the piston will move.

In FIGURE 3 the dashpot assembly is similar to that of FIGURE 2, excepting that the fuel in the carburetor is used as the fluid medium. Fuel from float chamber **83** is drawn into a passage **90** by way of a restriction **92** and the fuel exits by the same route. The dashpot of FIGURE 4 is similar to that of FIGURE 3, excepting that the piston **80** is replaced by a diaphragm unit **94** retained at its outer periphery by a retainer **96**.

In FIGURE 5 the dashpot assembly is contained within a chamber **100**, which communicates by a slot **102** with the fuel bowl **83** of the carburetor. A diaphragm **94** is retained by a cover structure **104** having a fixed diameter aperture **106**. The space **110** under the diaphragm communicates with atmosphere by way of an aperture **112**. Stem **67** is provided with a large diameter portion **107**, a tapered portion **108**, and a small diameter portion **109**. The portion **107** is just slightly less in diameter than the aperture **106**. Thus, the narrow annular space between the aperture **106** and the portion **107** of the stem serves as a metering area to meter the quantity of fuel that passes through the annular space when the diaphragm is forced downwardly. After an initial interval of travel, the tapered section **108** will enter the aperture **106** and a movement will be more rapid with less force being required for the movement. Finally, as the narrow diameter section **109** enters the aperture **106**, the resistance to movement will be very small. The embodiment shown in FIGURE 6 is very similar to that of FIGURE 5, excepting that the space **110** communicates by way of a passage **114** with the lower portion of the fuel bowl **83**. In all other respects the embodiment of FIGURE 6 will operate as does the embodiment of FIGURE 5.

The operation of a multistage carburetor using an air valve differs somewhat from the operation of a conventional single stage carburetor. The primary side of the multistage carburetor operates identically to the single stage carburetor. In other words, the idle system functions in the primary side much as it does in the single stage carburetor. Also, the part throttle range of the primary side operates in a similar fashion to that of the single stage carburetor. As the primary throttle is opened beyond the curb idle position, additional fuel is supplied by the idle fuel system until fuel requirements become great enough to cause the main fuel nozzles to come into use. At that time the fuel systems switch over so that most of the fuel is supplied by the main fuel nozzle and very little, if any, fuel is supplied by the idle fuel system.

As the throttles of the primary side are opened wider, to approximately 60 degrees from the closed position, suitable linkages come into play and initiate the opening of the secondary throttles. From that point on the primary and secondary throttles open together and in such a fashion that both sets of throttles reach the full open condition at the same time. When the secondary throttles begin to open, there is no fuel flowing in the fuel system of the secondary barrel. Accordingly, it is necessary to initiate fuel flow in the secondary side of the carburetor and this must be done quickly or a too lean mixture will be supplied to the engine at a time when the engine may in fact require a somewhat rich mixture.

One of the main functions served by the dashpot of the invention is that it will retard the initial opening of the air valve at the time the secondary throttles first begin to open. The dashpot offering resistance to movement of the air valve will tend to keep the air valve closed for a short interval of time after the secondary throttles begin to open. This slight delay will create a lower pressure within the bore of the secondary side and this lowered pressure will cause fuel to be drawn out of the secondary fuel nozzles. Then as the secondary air valve continues to open, the air metered by the air valve will co-mingle with the fuel from the secondary fuel nozzles and a proper mixture of air and fuel will be furnished to the intake manifold of the engine. As the secondary throttles are opened more widely, the air valve, of course, will follow along to meter the correct quantity of air to the engine.

It has also been found that it is undesirable for an air valve to close more quickly than the secondary throttles. Under spring bias it is possible for an air valve to close before the secondary throttle is closed and this is undesirable because fuel will still be flowing from the main nozzles of the secondary side and an overly rich mixture will be delivered to the engine. The dashpot of the invention prevents such an action in that, as the secondary throttles are closed, the air valve is prevented from closing too rapidly and the result is that a leaner mixture is supplied from the secondary side of the carburetor.

The embodiments of FIGURES 2, 3 and 4 illustrate dashpot arrangements that are effective throughout the entire range of opening and closing of the air valve. However, the embodiments of FIGURES 5 and 6 illustrate a dashpot arrangement that offers the greatest resistance to movement of the dashpot only during the initial opening and during the final closing of the air valve. As was mentioned above, it is the time of opening and the time of closing that is most important in the operation of the air valve.

Although the modulated dashpot is illustrated only in FIGURES 5 and 6 in connection with the diapraghm, it is apparent that a similar action could be achieved with a piston. One such approach would be to utilize a piston that is in its lowermost position when the air valve is closed and to install a pin on the bottom of the piston to substantially close off the fluid entry port under the piston. If this were done, a piston dashpot would operate substantially in the same manner as the modulated dashpot of FIGURES 5 and 6.

Various other modifications will occur to one skilled in the art, which modifications will come within the scope of the appended claims.

I claim:

1. A multistage carburetor comprising:

a body structure having a primary mixture conduit and a secondary mixture conduit for the flow of an air and fuel mixture therethrough,

means including a primary nozzle for providing fuel flow into the said primary conduit.

a secondary nozzle for providing fuel flow into the said secondary conduit,

manually operable means including a primary throttle and a secondary throttle movably mounted respectively within said primary and secondary conduits and downstream respectively of said primary and secondary fuel nozzles.

an air valve within said secondary conduit upstream of said secondary fuel nozzle,

means eccentrically mounting said air valve for movement from a position closing said secondary conduit toward an open position for air flow through said secondary conduit,

biasing means operatively connected to said air valve normally biasing said air valve against said air flow toward said closed position, and

dashpot means operatively connected to said air valve for retarding the movement of said air valve from a first position to a second position the said dashpot also having means for modulating the action of said dashpot whereby greater resistance to movement is provided only at initial opening and final closing of the said air valve.

2. The invention of claim **1** in which the said means for modulating comprises a fluid passageway and an enlarged portion on the stem of said dashpot.

3. A multistage carburetor comprising:

a body structure having a primary mixture conduit and a secondary mixture conduit for the flow of an air and fuel mixture therethrough,

means including a primary nozzle for providing fuel flow in said primary conduit,

a secondary nozzle for providing fuel flow into the said secondary conduit,

manually operable means including a primary throttle and a secondary throttle movably mounted respectively within said primary and secondary conduits and downstream respectively of said primary and secondary fuel nozzles,

means for serially rotating said primary and said secondary throttles including a primary throttle shaft, a secondary throttle shaft, a lever arm mounted on said primary throttle shaft, a link connecting the said lever arm to another lever arm mounted on said secondary shaft,

an air valve within said secondary conduit upstream of said secondary fuel nozzle,

means eccentrically mounting said air valve for movement from a position closing said secondary conduit

toward an open position for air flow through said secondary conduit,

biasing means operatively connected to said air valve normally biasing said air valve against said air flow toward said closed position,

a lever arm mounted on the shaft of the said air valve,

a rocker arm connected at one end to the said lever arm of the said air valve shaft and at its other end to the stem of a dashpot,

a dashpot comprising a movable member within a substantially closed chamber and adapted to displace fluid from said chamber by way of a passageway,

said passageway communicating with a source of a fluid,

a cover structure above the said dashpot,

said cover having an aperture for receiving the said stem,

the said stem having a section of large diameter, a section of taper and a section of small diameter, said sections coacting with said aperture to modulate the action of said dashpot.

References Cited by the Examiner

UNITED STATES PATENTS

1,264,126	4/1918	Pierce.	
1,802,604	4/1931	Hofbauer.	
1,807,423	5/1931	Matson.	
1,999,334	4/1935	Mallory.	
2,271,115	1/1942	Bracke	261—23
2,807,457	9/1957	Brueder.	
2,832,576	4/1958	Henning.	
3,030,085	4/1962	Read.	
3,043,572	7/1962	Ott et al.	

HARRY B. THORNTON, *Primary Examiner.*

RONALD R. WEAVER, *Examiner.*