

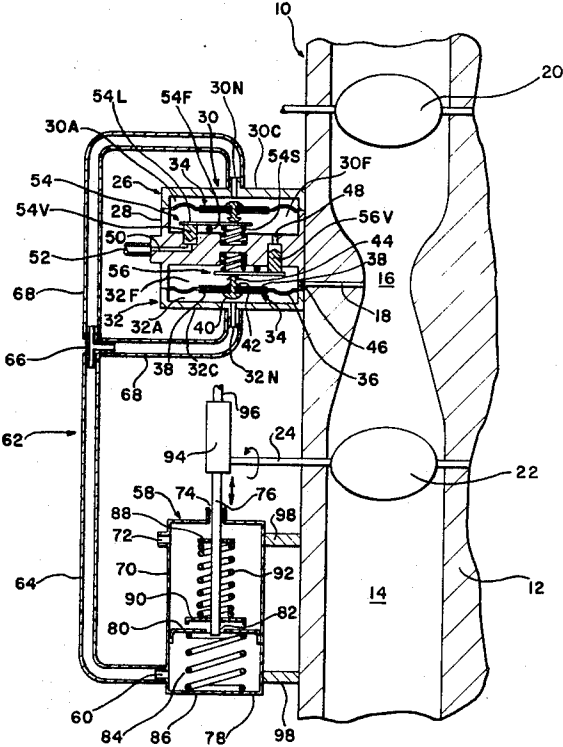
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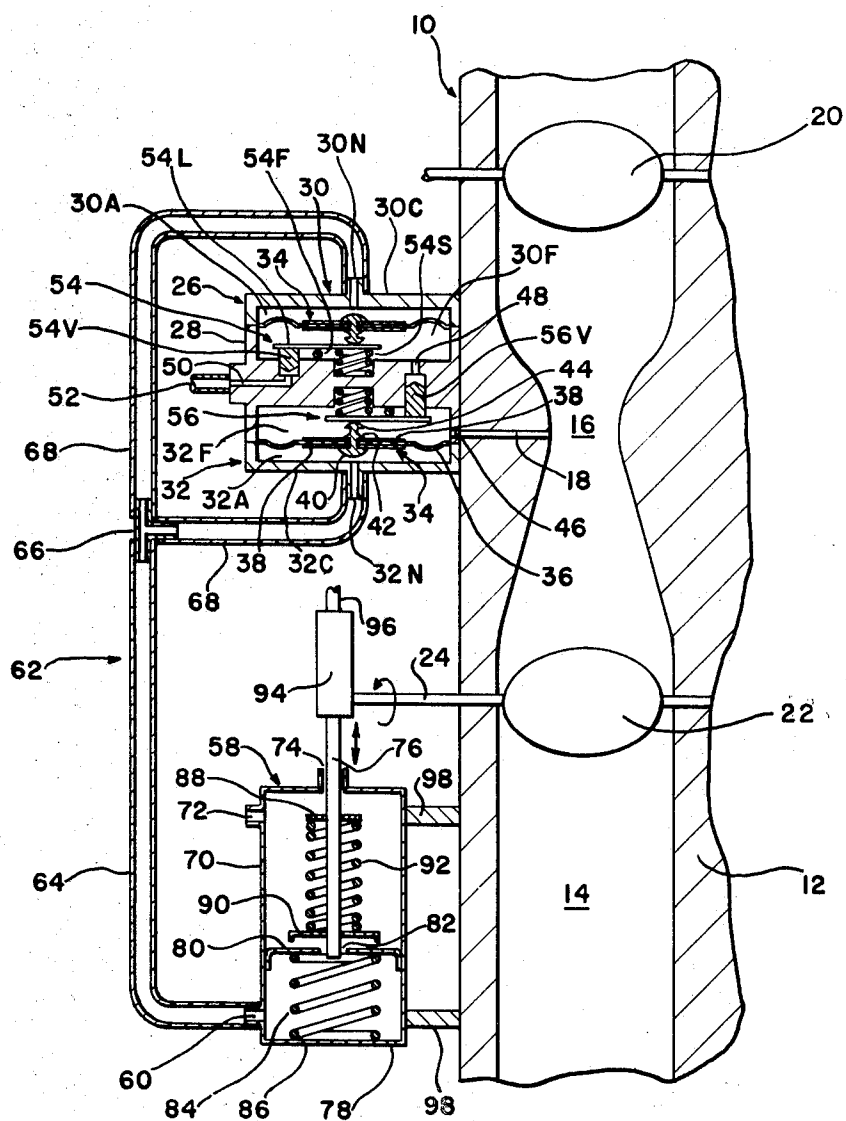
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[54] **SEALED CARBURETOR**
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34.1, 51, 67

ABSTRACT: The invention comprises a carburetor having a controller in the fuel line feeding the main carburetor venturi to seal the fuel system against evaporative losses. The controller comprises two diaphragm operated valves arranged in cascade series. A throttle-actuated pump is also provided to operate the diaphragms to open the valves simultaneously and quickly for fast acceleration.





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SEALED CARBURETOR

This invention relates to carburetors for mixing fuel and air for internal combustion engines.

More specifically, the invention provides a carburetor in which the usual float bowl is replaced by sealed valving means, whereby the fuel system from tank through carburetor is sealed from atmosphere. In conventional carburetors, as much as half a pint of gasoline is left in the carburetor float bowl, which is open to atmosphere, after the engine is turned off. Since the engine and hence the body of the carburetor is hot, this gasoline can evaporate and enter the atmosphere. In addition to being undesirable in the atmosphere, evaporation of this gasoline is wasteful, and refilling of the float bowl is necessary before the engine will resume satisfactory operation.

The present invention provides a sealed double diaphragm apparatus interposed in the fuel line in place of the float and float bowl, whereby the only fuel which will evaporate when the engine is turned off, and while it is still hot, is the relatively small amount in the device itself and the passageway between the device and the main venturi of the carburetor.

The invention provides apparatus of the character described in which the two diaphragm-operated valves operated in cascade series during normal operation to provide doubled security. Further, pump means to simultaneously open both valves are provided to override the normal cascade sequence to permit fast acceleration.

Additionally, said pump means take the place of the usual accelerator fuel pump on the carburetor which cooperates with the double diaphragm fuel-metering valve in such a way that the pump apparatus of the invention operates with atmospheric air as a working fluid rather than raw fuel, thus eliminating another source of evaporative fuel loss.

An advantage of the carburetor of the invention is that the engine with which the carburetor is associated will run smoother than it would with a conventional float-type carburetor because the random effects resulting from orientation of the carburetor with respect to gravity, which can effect the smoothness of fuel delivery in a float-type carburetor, are eliminated in the pressurized fuel supply carburetor of the invention.

Another advantage is that a simpler structure results in that the valves, jets, and passageways required in conventional carburetors for acceleration purposes are all eliminated. Additional fuel for acceleration in the carburetor of the invention is supplied directly to the main carburetor venturi.

A further advantage is that the invention provides a safer carburetor, in that in the event of an accident, less fuel will be spilled and/or vaporized thereby reducing fire hazard conditions. The above and other advantages of the invention will be pointed out or will become evident in the following detailed description and claims, and in the accompanying drawing also forming a part of the disclosure, in which the sole FIGURE is a cross-sectional view through a carburetor embodying the invention on a more or less hypothetical cutting plane designed to show the various parts. Referring now in detail to the drawing, 10 designates a carburetor embodying the invention, and comprises a main body 12 formed with a main air passageway 14 through which air passes from top to bottom. That is, the air filter would be above and the engine intake manifold would be below the apparatus as shown. Passageway 14 is formed with a restricted portion or main venturi throat 16. The velocity of the air flowing through venturi 16 will be increased because of the decreasing cross-sectional area, and this increased velocity creates a low-pressure region which operates to draw fuel into the venturi through a main fuel supply passageway 18, all in well-known manner, because of the venturi effect. Upstream from venturi throat 16, carburetor body 12 carries a choke plate 20. Downstream from venturi throat 16 body 12 carries a throttle plate 22 having an operating pin 24. The choke and throttle plates 20 and 22 turn about their associated operating pins to control the amount of air flow through the main

passageway 14 and venturi throat 16. The choke is either manually operated or operated by the usual temperature-sensing apparatus around the engine. The throttle plate 22 is manually operated from the accelerator or throttle pedal by the operator of the vehicle to control the speed of the engine in the usual manner, via a conventional throttle linkage, the pertinent portion only of which will be described below.

In conventional usage, fuel passageway 18 interconnects the venturi throat of the carburetor with a fuel float bowl which would be normally full of fuel. A significant quantity of raw fuel must always be present in this fuel bowl, and the evaporative loss of this fuel therefrom is a problem that is solved by the present invention. Means are provided to seal the fuel system at the carburetor, the remaining portions of the system being normally sealed between fuel passageway back to the fuel tank of the vehicle. To this end, the invention comprises the use of a double-diaphragm-sealed flow controller 26.

Controller 26 comprises a body portion 28 formed with a pair of chambers 30 and 32. Each chamber 30 and 32 is divided into a fuel-receiving portion 30F and 32F, and an operating fluid, usually air, receiving portion 30A and 32A, respectively, by a diaphragm assembly 34. The edge portions of the diaphragm assembly 34 are held in sealed relation between the edges of body portion 28 and a pair of cap members 30C and 32C respectively. Each cap is formed with an operating fluid supply nipple 30N and 32N respectively. Thus, each operating fluid-receiving chamber 30A and 32A is defined by diaphragm assembly 34 and cap 30C, and each fuel-receiving chamber is defined by the diaphragm and the body portion 28. While air is described as the working fluid, it will be understood by those skilled in this art that any other suitable fluid could be used.

Diaphragm assembly 34 comprises a flexible diaphragm member 36 and stiffener means comprising a pair of plates 38 on opposite sides of the central portion of the flexible member 36. A wide, flatheaded rivet 40 passes through registering openings in the stiffener plates 38 and the flexible member 36, and is held thereon by any suitable means such as offset portion 42. The rivet is provided with an operating head 44.

Body portion 28 is formed with an opening 46 communicating chamber 32F with fuel passageway 18. Chambers 32F and 30F are interconnected by an internal passageway 48 formed in body portion 28. Body portion 28 is formed with a fuel passageway 50 interconnecting chamber 30F with a conduit 52 which delivers fuel from the fuel supply system associated with the engine with which the carburetor 10 is associated. Said fuel supply system, in the case of an automobile, will include a fuel pump which will deliver fuel under pressure at all times the engine is running at conduit 52 and passageway 50.

Means are provided to control the flow of fuel from conduit 50 to passageway 18 through controller 26 by means of movement of the two diaphragm assemblies 34. To this end, a pair of similar spring-loaded valve assemblies 54 and 56 are provided, each comprising a valving member 54V and 56V, a lever arm 54L and 56L, a fixed fulcrum 54F and 56F and an operating compression spring 54S and 56S, all respectively. Some of the parts of assembly 56 do not carry their reference numerals for the sake of clarity, but it will be understood that the parts are similar to the corresponding parts of assembly 54. Valve member 54V is associated with a suitable seat, not shown, in passageway 50, and valving member 56V is associated with a suitable valve seat in internal interconnecting passageway 48. The operating head 44 of each diaphragm assembly 34 is in opposed relation to each operating compression spring 54S and 56S.

The carburetor is operative as thus far described, i.e., assuming that atmospheric pressure only is present in the chambers 30A and 32A via the nipples 30N and 32N, as follows. The velocity of air through the venturi throat 16 creates a subatmospheric or slight vacuum condition in fuel

passageway 18 which is transmitted through opening 46 into fuel chamber 32F. Drawing the fuel out of said chamber 32F tends to create a void therein, causing diaphragm assembly 34 associated therewith to move upwardly under the influence of atmospheric pressure. Operating head 44 will contact the outer end of lever arm 56L causing rotation of said lever arm in a clockwise direction about the fulcrum 56F causing a slight compression of spring 56S and corresponding opening of passageway 48 by movement of valve member 56V. It will of course be understood by those skilled in the art that the valve members and their associated valve member cages, valve seats, and/or other usual structure are provided so that increased movement of the valve away from its seat will permit increased flow through the associated passageway. Returning to the operating chain, the flow through passageway 48 from chamber 30F into chamber 32F tends to create a void in said chamber 30F. By similar means, including movement of the upper diaphragm assembly and opening of valve 54V, fuel under pressure is permitted to flow through conduit 52 and passageway 50 into chamber 30F, passageway 48, chamber 32F, passageways 46 and 18, and into the carburetor main venturi 16 wherein the fuel is atomized and simultaneously mixed with the flowing air in preparation for its combustion in the engine in the usual manner. Changes in the rate of air passage through the main venturi will change the amount of vacuum present in passageway 18 accordingly, which will cause corresponding changes in the degree of openness of the two valve members 56V and 54V, thus permitting the fuel pump to supply more or less fuel as demanded by the quantity of air flow through the venturi. The strengths of the two operating compression springs 54S and 56S are chosen so that they will both be strong enough to hold the valve member closed when there is only atmospheric pressure present in passageway 18 against the force of pressurized fuel in passageway 50, and yet resilient enough so that they will respond to the changes in vacuum pressure created by the changing air flow through the main venturi.

The carburetor of the invention as thus far described has several advantages over conventional carburetors including a fuel float and float bowl. The carburetor of the invention is relatively insensitive to position. Since the fuel controller is sealed, and all of the moving members are positively moved, the controller is substantially unaffected by angular position, inertia forces, and gravity. The provision of two valve members in cascade series yields the advantage that in the event of a foreign particle lodging on or in a valve seat, the leakage thereby resulting will be checked by the other valve member.

The invention as thus far describes has been tested and found to be operative. A carburetor which is sealed against atmosphere with all the above advantages results. However, it has been found that the time required for the carburetor as thus far described to feed fuel in response to relatively rapid changes in air flow through the main venturi 16, such as by hard acceleration of an automobile engine, is not as rapid as is most desirable. Therefore, the invention comprises means operable from the vehicle throttle linkage to positively move the two diaphragm assemblies 34 towards each other to more rapidly open the valve members 54V and 56V to improve this one operating characteristic. These positive diaphragm-moving means need not be used when the engine with which the carburetor 10 is associated is used in a relatively constant speed application, such as an engine used to drive an electric generator, but is desirable where the engine including carburetor 10 will have a broad range of performance levels demanded of it, as in an automobile. These positive diaphragm moving means override the usual cascade series mode of operation of the two diaphragm assemblies to permit a fast pressurized flow of fuel from the fuel pump through controller 26 directly into main air passageway 14.

To this end, a pump 58 is provided to positively actuate the diaphragm members 34 upon the occurrence of a demand for quick acceleration. The outlet port 60 of pump 58 is

connected to the nipples 30N and 32N of the working fluid chambers 30A and 32A of controller 26 by means of a suitable conduit assembly 62 comprising a supply conduit 64, a T-connection 66, and a pair of branch lines 68 running from the T-66 to the two nipples 30N and 32N. The conduit assembly 62 may be made of copper tubing, rubber hose, or any other suitable material.

Pump 58, is generically, a pump usually already incorporated in many conventional carburetors and is known as the accelerator pump. It normally pumps fuel directly into the main air passageway 14 through a separate jet. For any given carburetor, an accelerator pump having a slightly larger capacity than the fuel accelerator pump usually will be required to pump air to positively actuate controller 26 in accordance with the invention. If the invention be modified to use a liquid as the working fluid, then a pump smaller than a conventional fuel accelerator pump could probably be used. Many styles of accelerator pumps are available, and any can be used, the pump 58 shown and described below being one usual configuration.

Pump 58 comprises a main hollow body 70 formed with an inlet port 72 adjacent its upper end and said outlet port 60 adjacent its lower end. It will be understood that the pump 58 need not be vertically disposed with a gaseous working fluid, the showing of the drawing and the terms "upper" and "lower" being used for convenience of description only. Body 70 is also formed with a clearance opening 74 to receive a pump-actuating rod 76, the clearance between which opening 74 and rod 76 need not be sealed, except for some usual dirt cover. Body 70 is formed with a fourth opening 78, which is known as a "bleed hole" the function of which will appear below.

A cup or piston member 80 is slidably mounted in the body 70 for a range of motion contained within the lower portion of the body. Cup 80 is formed with a clearance opening 82 which freely passes the lower end of operating rod 76. A "soft" compression spring 84 is interposed between the bottom wall 86 of the main pump body 70 and the lower surface of the cup 80, and is known as the return spring. The upper limit of motion of cup 80 is determined by the substantially relaxed length of said spring 84, which position is illustrated. The sliding seal between the sidewall of pump body 70 and sealing cup 80 is provided by suitable conventional means and is not shown. If the cup 80 be formed of neoprene, plastic, leather or the like material, then a snug sliding fit itself would form the seal.

Adjacent the upper end of the pump body, operating rod 76 carries a fixed spring abutment 88. Adjacent its lower end, and above cup 80, operating rod 76 has a seal member 90 slidably and sealingly mounted thereon. Constrained between seal 90 and abutment 88 is a relatively stiff compression spring 92, which is known as the "duration" or "sustaining" spring. The parts are shown in relaxed condition, in which state duration spring 92 is at its full relaxed length and positions seal 90 just above and not in contact with the upper surface of cup 80.

Operating rod 76 terminates in a mechanical transducer 94 which also contains the outer end of throttle plate operating pin 24 and the carburetor end of the throttle linkage generally indicated by rod 96. Transducer 94 is representative of any of the plurality of kinds of devices which are operative to simultaneously turn pin 24 and reciprocate rod 76 in response to control motion of rod 96 in response to the usual foot-operated throttle pedal via the throttle linkage. For example, mechanism 94 may comprise a rack and pinion, chain drive, cam, lever, or the like.

When quick engine acceleration is demanded, the rod 76 will quickly and substantially immediately move downwardly. For example, let it be assumed that the operator of the automobile with which carburetor 10 is associated suddenly and all at once "floors the gas pedal" in order to remove himself from an emergency situation, or to pass, or the like. The sequence of operation will be that first the seal 90 will close the gap and contact cup or piston 80. Up to this point,

there has been no compression of either spring 92 or 84 and no transmission of air pressure through conduit assembly 62. The space between the cup and seal is small, and continued motion after this first brief instant results in air pressure from under the cup 80 being supplied to the two operating chambers 30A and 32A in the controller 26 via conduit assembly 62, since seal 90 has closed off opening 82 in the cup. Further continued downward motion of rod 76 results in simultaneous compression of return spring 84 and duration spring 92 and continued pressure on the diaphragms. The relatively soft return spring 84 will compress at a relatively faster rate than the relatively stiff duration spring 92. In the hypothetical example being given it is desirable that the increased flow of fuel through the carburetor be maintained for a short period of time since the control motion is relatively instantaneous and the engine cannot accelerate instantaneously. This desirable duration of acceleration is provided by duration spring 92. After rod 76 reaches the bottom of its travel, which happens quickly, the energy stored during the compression of spring 92 is given up thereby causing cup 80 to continue in its downward motion to maintain the pressure on the diaphragm assemblies 34 even after the end of the throttle linkage stroke. Bleed hole 78 becomes functional during this duration period and acts to moderate the continued acceleration pressure. The bleed opening 78 is of relatively small cross-sectional area, so that during the period of rapid air flow insignificant quantities of air are bled off through said opening, but as the stored energy in the duration spring causes the duration stroke, the small amount of air that "bleeds" through said opening becomes more significant in relation to the total quantity of air being moved by cup 80, all in relation to the relative speeds of the various parts of the pump. Thus, in essence, the bleed hole controls the duration of the acceleration action by bleeding off or relieving the fluid pressure from the diaphragms when no further accelerating fuel is necessary, even though the "gas pedal" may remain depressed.

Now assuming that the operator removes his foot from the throttle pedal, again suddenly to illustrate the most severe condition, rod 76 will virtually instantaneously return to its fully raised position shown in the drawing. Duration spring 92 will first return to its fully extended relaxed condition and thereby lift seal 90 off of cup 80 to expose opening 82 to the atmospheric conditions existing above cup 80 via inlet 72. The return spring 84 will more slowly return cup 80 to its fully raised position. Thus, the two operating chambers will be quickly exposed to atmospheric conditions, so that the supply of fuel via passageway 18 will depend virtually solely on the quantity and speed of air flow through venturi 16. During normal operation, when rod 76 is moved up and down relatively slowly and smoothly, atmospheric conditions will exist in the chambers 30A and 32A because the speed of motion of the parts of the pump 58 will be so slow that bleed hole 78 will maintain the system at substantially atmospheric pressure. During the course of normal operation, seal 90 will occasionally lift off of cup 80 thereby assuring the existence of atmospheric conditions on the diaphragms.

In an intermediate condition, a moderate smooth acceleration, pump 58 will aid the flow of fuel through controller 26 to some degree as the cup 80 is smoothly urged downwardly, dependent upon the speed of motion of the cup, and the cross-sectional area of bleed opening 78, all of which is well understood by those skilled in this art.

The pump 58 is mounted on carburetor body 12 by means of a pair of struts 98. The struts 98 are illustrative only, since the pump 58 can be mounted at any convenient location and position around the carburetor, and by means other than struts such as by soldering to the side of the carburetor, or by being made integral with the carburetor's main body casting.

While the invention has been described in detail above, it is to be understood that this detailed description is by way of example only, and the protection granted is to be limited only within the spirit of the invention and the scope of the following claims.

I claim:

1. In combination, a carburetor comprising a main air passageway having a venturi portion, means to supply fuel under pressure to said venturi portion, controller means interposed in said fuel supply means, said controller means comprising a pair of fuel chambers each defined by flexible diaphragm means, a pair of operating chambers each associated with one of said fuel chambers and each defined by one of said flexible diaphragm means, passageway means interconnecting said first and second fuel chambers, first valve means operable by a first of said flexible diaphragm means interconnecting said fuel supply means with said first fuel chamber, second valve means operable by said second flexible diaphragm means to control the flow of fuel from said first fuel chamber to said second fuel chamber via said passageway means, whereby changes in air flow through said venturi portion will affect cascade operation of said first and second flexible diaphragm means to flow fuel from said fuel supply means via said first and second fuel chambers into said venturi portion, and pump means for selectively and simultaneously supplying pressurized fluid to both of said first and second operating chambers to simultaneously operate said first and second flexible diaphragm means to thereby simultaneously open said first and second valve means.

2. The combination of claim 1, said carburetor comprising a throttle plate mounted on an operating pin and positioned in said carburetor main air passageway, means interconnecting said throttle plate operating pin and operating means of said pump means, whereby operation of said throttle plate to rapidly increase the rate of air flow through said carburetor main air passageway will cause simultaneous actuation of said pump means to supply pressurized fluid to said operating chambers.

3. The combination of claim 1, said pressurized fluid from said pump means comprising air, and said pump means further comprising means to supply air at substantially atmospheric pressure to said operating chambers at times other than when said pump means are operated to override the normal cascade operation of said first and second valve means.

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