Sept. 4, 1962 H. A. CARLSON 3,052,453

COMPOUND VALVE FOR CONTROLLING FUEL BOWL INLET OF A CARBURETOR

Filed Nov. 28, 1958 2 Sheets-Sheet 1

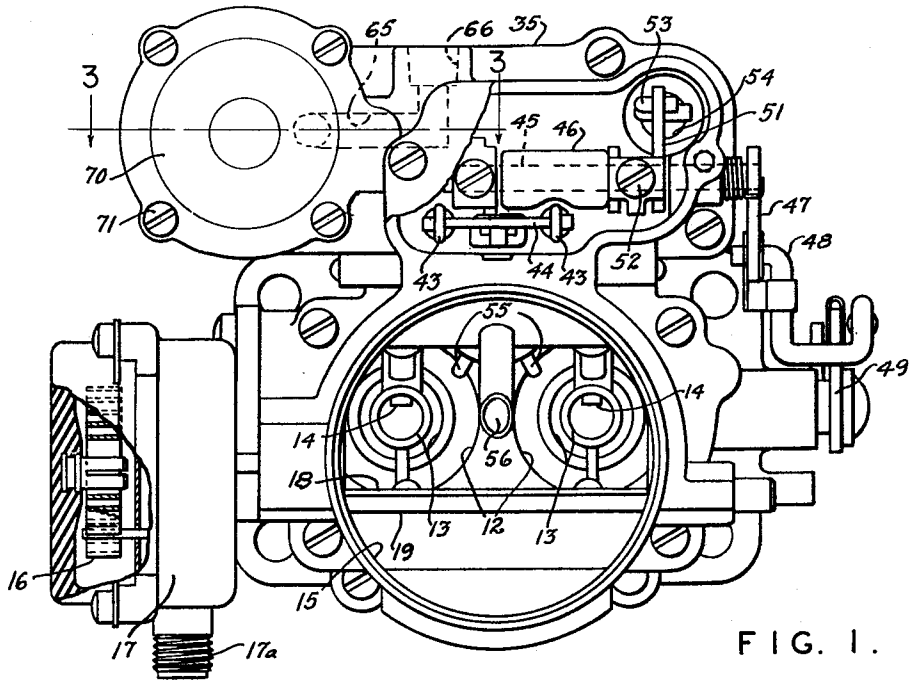


FIG. 1.

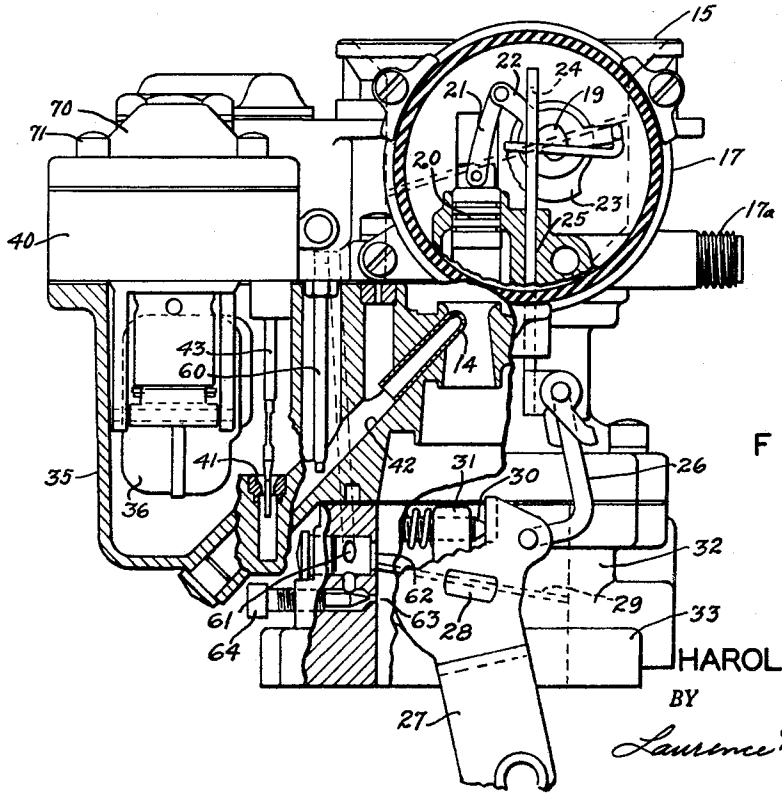


FIG. 2.

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COMPOUND VALVE FOR CONTROLLING FUEL BOWL INLET OF A CARBURETOR

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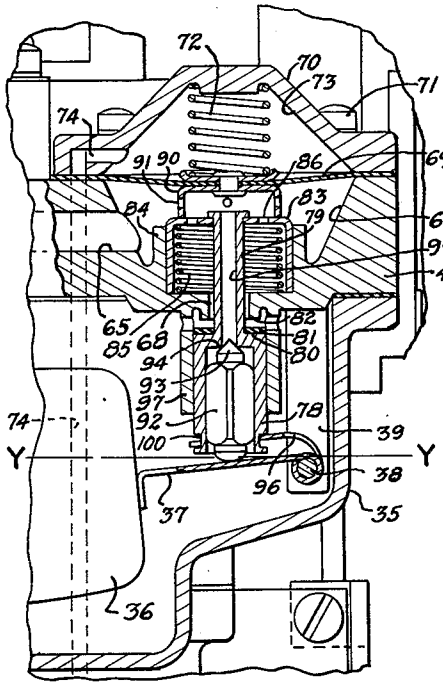


FIG. 5.

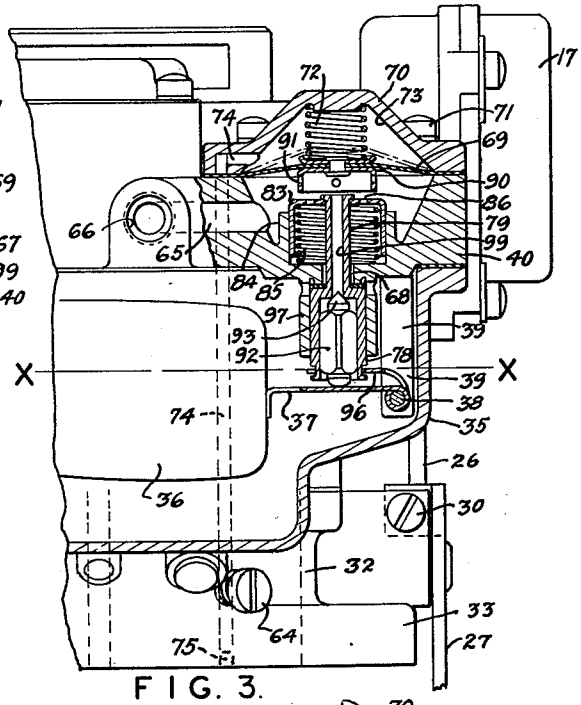


FIG. 3.

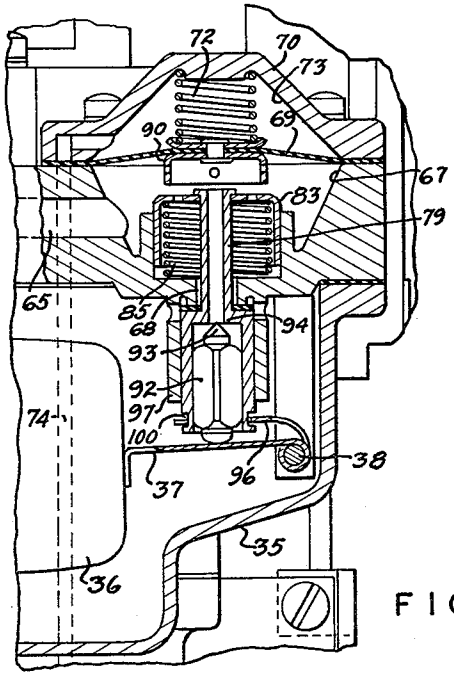


FIG. 6.

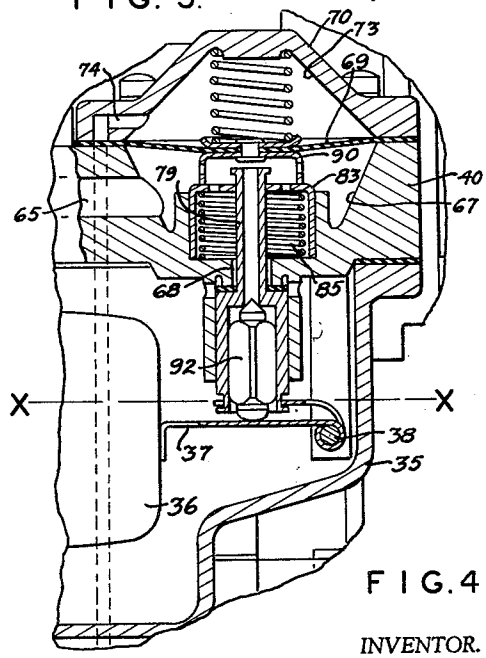


FIG. 4.

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COMPOUND VALVE FOR CONTROLLING FUEL BOWL INLET OF A CARBURETOR

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11 Claims. (Cl. 261—72)

This invention relates to fuel supply systems for internal combustion engines, and consists, particularly, in a novel compound inlet valve arrangement for a carburetor fuel bowl, including individual parts for controlling fuel supply, respectively, under normal operating conditions and under abnormal conditions, as when substantial quantities of vapor are being supplied with the fuel.

An internal combustion engine carburetor having a constant level fuel bowl with a float-controlled inlet needle valve has the disadvantage that the inlet port, ordinarily, is too small for adequately venting the fuel system in case of formation of excessive vapors in the fuel. Such vapor formation occurs when the underhood temperature becomes excessive or the fuel contains excessive light ends for the prevailing ambient temperature. Since the underhood temperature increases sharply when the engine stops, the pressure in the fuel line between the usual pump and the carburetor substantially increases at this time and tends to push the needle valve off its seat. By making the valve inlet port only large enough for maximum high speed supply of fuel, a float of reasonable size is able to resist opening of the needle valve by moderate pressure increases. However, the usual valve inlet port will not permit the escape of excessive gases which may form during idling or higher speed running conditions. Consequently, inadequate liquid fuel may be supplied at such times so that the level in the bowl will drop, resulting in leaning of the fuel mixture supplied by the carburetor and reduced fuel pressure or faulty operation of the engine or even stalling thereof.

Consequently, it is the main object of the present invention to provide a novel fuel inlet control for a carburetor constant level bowl which combines a valving arrangement for controlling the fuel supply during normal operating conditions with means which permits rapid venting of vapors from the fuel line in case of an abnormal drop in the fuel pressure and/or change in another engine-operated condition, such as intake manifold suction.

Another object is to provide a novel compound carburetor inlet valving arrangement in which a float controls a more or less conventional needle valve and seat and in which additional porting is opened under conditions indicating faulty supply of liquid fuel and/or faulty engine operations.

Another object is to provide a novel, compact, dual inlet porting and valving arrangement for carburetors having means to close both valves when fuel stands in the bowl substantially at the normal or constant fuel level, while permitting opening of one or both of the valves when the fuel level drops, depending upon the condition of the fuel supply and the operative condition of the engine.

Still another object is to provide a novel concentric valving arrangement including a first inner valve which is float controlled and a second outer valve which is controlled both by the float and by a condition indicating the operating state of the engine.

In the structure herein shown, a substantially larger inlet port than usual is provided between the constant level fuel bowl and the fuel supply line from the fuel pump. A hollow or tubular member extends through this port and has an enlarged lower part forming an external shoulder, which forms a first valve for seating against the periphery of the inlet port. A more or less conventional needle valve is received in the enlarged lower part of this hollow member and seats against an internal, seat-forming shoulder therein to control the passage through the hollow member. A spring constantly urges the hollow member in the direction for seating the external shoulder, while a float controls the needle valve so as to maintain fuel in the bowl at a substantially constant level.

Adjacent the inlet port is a chambered structure which is traversed by a flexible diaphragm normally urged in the direction for abutting the mentioned hollow member to compress the spring seating the annular, valve-forming shoulder thereon. One side of this diaphragm is exposed to the fuel pressure and the other side is exposed to engine intake manifold suction and is engaged by a coiled compression spring which is calibrated to permit flexing of the diaphragm for withdrawing the same from said tubular member when both the fuel pressure and the intake manifold suction are normal. When the fuel pressure and manifold vacuum are subnormal, the diaphragm flexes oppositely so as to overcome the mentioned external shoulder seating spring. At the same time, if the fuel level in the bowl drops, both internal and external valves may open, relieving the pressure in the fuel line for venting vapors and rapidly replenishing the bowl with liquid fuel.

In the accompanying drawings which illustrate the invention:

FIG. 1 is a top view of the carburetor, with portions broken away to better illustrate the underlying structure.

FIG. 2 is a side view of the carburetor, with portions broken away and sectioned.

FIG. 3 is an enlarged detail section taken substantially on line 3—3 of FIG. 1.

FIGS. 4, 5 and 6 are views similar to FIG. 3, but showing parts in different positions.

The carburetor, as better shown in FIGS. 1 and 2, is of the dual type with downdraft mixture barrels 12, each including inner venturi tubes 13 into which discharge the main nozzles 14. At the top, the mixture conduits merge in a single air inlet horn 15 upon which the air cleaner K is mounted. An automatic choke control, including coiled, bimetal thermostat 16, is mounted in a housing 17 located at the side of air horn 15. A choke valve 18 is pivotally mounted in the air horn on a shaft 19 which extends into the choke control housing 17. The automatic choke control also includes a suction piston 20 connected to choke shaft 19 by a link 21 and crank 22 rigid with the choke shaft. A fast idle cam 23 is also received on the end of the choke shaft within the housing and cooperates with an inward shoulder on a link 24, which slides through the lower part of the housing, as at 25 and, at its lower end, is connected by a link 26 to a throttle control lever 27 rigid with a throttle shaft 28 which traverses the lower portions of both mixture conduits 12. A throttle 29 is mounted on shaft 28 in each mixture conduit. The normal idling positions of the throttle valves are determined by an idle speed adjusting screw 30 received in a boss 31 projecting from the side of the throttle valve receiving body 32. The bottom of body 32 is flanged, as at 33, for attachment to engine intake manifold, and a heat tube connects with nipple 17a on the choke housing.

Adjacent the mixture conduit structure is a constant level fuel bowl 35 within which there is a float 36 having an arm 37 projecting from one end thereof for pivotally mounting the float on a pin 38 supported in spaced arms

39, depending from bowl cover structure 40. Fuel is supplied from the bowl to each main fuel nozzle 14 through a metering orifice element 41 communicating with an upwardly-inclined main fuel passage 42. The metering orifice elements 41 are controlled by metering pins 43 supported at their tops by means of a transverse yoke 44 which is actuated by suitable throttle and/or manifold suction actuated elements to adjust the effective openings in the orifice elements and, consequently, the richness of the mixture supplied by the carburetor. Extending transversely across the top side of bowl cover structure 40 is a countershaft 45 journalled in a pillow block 46 and having an arm 47 rigidly secured to its projecting right-hand extremity. This arm is connected by a link 48 to a lever 49 rigid with the extremity of throttle shaft 28 opposite throttle-operating lever 27 previously mentioned. A small arm 51 is secured to the countershaft by means of a set screw 52 and is connected by a link 53 to an accelerating pump piston which works in cylinder 54 for injecting an extra pickup charge of fuel into the mixture barrels through nozzles 55 when the throttle valve is opened. The constant level bowl is vented into the air horn through a balance tube 56.

Fuel for idling is supplied through the idling systems, each including a metering tube 60 communicating through cross and down passages, shown in part at 61, with ports 62 and 63 opening into each mixture conduit adjacent and slightly posterior to the throttle valve therein. Each port 63 is adjusted by means of an idle mixture adjusting screw 64.

Fuel is supplied to the constant level bowl through an inlet passage 65 formed in bowl cover structure 40 and having a fitting element 66 for attachment to a tubing leading from a fuel pump to the carburetor. Passage 65 extends into an enlarged, chambered portion 67 of the cover structure and thence through a port 68 into the bowl. The top wall of chambered structure 67 is formed by a flexible diaphragm 69 which is clamped in position by a cover member 70 and machine screws 71. A coiled compression spring 72 within chamber 73 formed in cover member 70 constantly urges diaphragm 69 downwardly. Chamber 73 is connected by a passage 74 to a port 75 into one or both of the carburetor mixture conduits posterior to the throttle therein.

Extending through inlet port 68 is a hollow member including an enlarged lower portion 78 and a reduced stem 79, portion 78 forming an external annular shoulder 80 mounting an annular gasket 81. This shoulder and gasket form a valve for cooperating with an annular valve seat ring 82 surrounding port 68 on the bowl side of cover structure 40. Snugly but slidably received about stem 79 is an inverted cup 83 which telescopes in cup structure 84 on the upper face of cover structure 40 about port 68. Cup 83 is urged upwardly by a coiled compression spring 85 received within cup structure 83. The spring and cup normally urge valve means 80, 81 into seating engagement with valve seat 82 for sealing port 68 exteriorly of stem 79. Cup 83 is provided with apertures 86 for balancing the fluid pressures on opposite sides thereof and for directing fluids from fuel passage 65 through cup 83 and port 68, as will be described hereafter.

A cuplike washer 90 having peripheral openings 91 is secured to the under face of diaphragm 69 and is positioned to abut cup 83, when diaphragm 69 is flexed downwardly, so as to compress spring 85 and relieve hollow member 78, 79 from the influence of spring 85. Slidably received in enlarged lower part 78 of the hollow member is a polygonally-sectioned needle valve 92 having a pointed upper extremity 93 for cooperating with an internal, valve seat-forming shoulder 94 at the lower extremity of stem 79. The lower end 95 of the needle valve rests upon float lever 37 which also has a tongue 96 loosely received in a groove 100 in the lower extremity of portion 78 of the hollow member for insuring movement of the hollow member with the float. The hollow member is guided for vertical reciprocation by a cup-like projection 97, with annular holes, on the underside of cover structure 40. Thus, port 68 about stem 79 and passage 99 within stem 79 form, in effect, a pair of ports or passages connecting fuel supply passage 65 with the constant level bowl. These ports are controlled, respectively, by external valve means 80, 81 and internal needle valve 92, 93. Diaphragm 69 is controlled by the resultant of three forces, namely, the fuel pressure in passage 65 and chambered structure 67, the force of spring 72, and the fluid pressure in chamber 73 which communicates with the engine air supply conduit posterior to the throttles therein.

The novel fuel inlet control device operates as follows: FIGS. 3 and 4 show the parts of the device in different positions they would assume with liquid fuel standing in the fuel bowl, substantially, at the normal or constant level X—X. FIG. 3 shows a condition when the engine is stopped, and FIG. 4 shows a condition occurring when the engine is stopped or running. In FIG. 3, sufficient pressure exists in fuel supply line 65 to flex diaphragm 69 upwardly, compressing spring 72 and permitting spring 85 to expand and, through cup 83 to urge external valve means 80, 81 against seat 82. The pressure in chamber 73 is assumed to be atmospheric, since the engine is not in operation. Chambered structure 67, being expansible due to flexible wall-forming diaphragm 69, provides means for accommodating a certain amount of expansion in fuel line 65 due to the effect of heat upon the volatile fuel.

In FIG. 4, on the other hand, spring 72 is shown expanded, as would be the condition when insufficient pressure exists in fuel line 65 to counteract this spring. Cup washer 90 has abutted spring cup 83 so as to compress spring 85 withdrawing the cup from the collar shown at the upper end of stem 79 and, thus, eliminating the effect of spring 85 upon hollow member 78, 79. Under these conditions, the hollow member is controlled entirely by float 36 acting through arm 37 and tongue 96 and/or needle valve 92. If, as shown, the fuel stands substantially at the constant level, float 36 and needle valve 92 will be supported in position to tightly close inner valve seat 94 and outer valve seat 82, notwithstanding the downward flexing of diaphragm 69, thus cutting off the bowl from the fuel supply.

FIGS. 4 and 5 also represent a condition of parts which would occur during running of the engine when intake manifold suction is insufficient to compress spring 72, as when the engine is operating slowly with the throttles substantially opened, or in case of faulty operation of the engine which might be occasioned by an insufficient fuel supply, for instance. Under the latter condition, the fuel level would drop, say to the line Y—Y of FIG. 5, moving hollow member 78, 79 and needle valve 92 downwardly for opening port 68 about stem 79. The resultant increased inlet port capacity permits venting of gases trapped in fuel line 65 and the more rapid supply of liquid fuel so as to again bring the fuel therein to the constant level X—X.

FIG. 6 represents a normal running condition in which the resultant of the pressures in chambered structure 67 and chamber 73 causes compression of coil spring 72 to disengage cup washer 90 from spring cap 83, permitting expansion of spring 85. This, in turn, urges hollow member 78, 79 upwardly so as to seat external valve element 81 on valve seat 82, thus cutting off port 68 exteriorly of stem 79. Needle valve 92 is shown slightly opened permitting a normal supply of liquid fuel through inner passage 99 in stem 79 to supply the normal requirements of the engine.

The calibration of springs 72 and 85 with respect to the exposed area of diaphragm 69 and the differential fuel and intake manifold pressures encountered determines when valve means 80, 81 will be opened, as in FIG. 5. These

parts may be designed so that port **68** around stem **79** will open only when the suction in chamber **73** is very low, as say not more than a few inches of water, and the fuel pressure is also substantially reduced from its normal running pressure. The confluence of such conditions would indicate that the engine is operating improperly and that a stall may be imminent. If such improper functioning is due to the presence of substantial quantities of gaseous material in the fuel line, float **36**, of course, will drop permitting opening of venting port **68** to relieve such gases. On the other hand, the mentioned parts may be designed to cause opening of external port **68** for the supply of additional fuel under high power requirements when the pressure in fuel line **65** and the suction in chamber **73** would be lower than normal, but greater than in the first case described.

The invention may be modified in these and other respects as will occur to those skilled in the art and the exclusive use of all modifications as come within the scope of the appended claims is contemplated.

I claim:

1. In a fuel system for an internal combustion engine, said system comprising a fuel supply therefor, a carburetor including a fuel bowl, means forming a fuel passage connecting said bowl to said supply, a valve in said fuel passage controlling a flow of fuel through said fuel passage to said bowl, means including a float in said bowl operatively connected to said valve to open said valve, a first means to render said valve inoperative by said float, and a second means to render said first means inoperative whereby said valve is rendered responsive to said float.

2. In a fuel system for an internal combustion engine, said system comprising a fuel supply therefor, a carburetor including a fuel bowl, means forming a fuel passage connecting said bowl to said supply, a valve in said fuel passage controlling a flow of fuel through said fuel passage to said bowl, means including a float in said bowl operatively connected to said valve for actuating said valve, a spring biasing said valve into a closed position and to render said valve inoperative by said float, and means to compress said spring to a valve releasing position.

3. In a fuel system for an internal combustion engine, said system comprising a fuel supply therefor, a carburetor including a fuel bowl, means forming a fuel passage connecting said bowl to said supply, a valve controlling a flow of fuel through said fuel passage to said bowl, means including a float in said bowl operatively connected to said valve for opening said valve, means to render said valve inoperative by said float including a first spring biasing said valve into a closed position, and means including a second spring positioned adjacent to said first spring and structure to release said second spring to bias said first spring to a valve releasing position whereby said valve is rendered responsive to said float.

4. In a fuel system for an internal combustion engine, said system comprising a fuel supply therefor, a carburetor including a fuel bowl, means forming a fuel passage connecting said bowl to said supply, a valve controlling a flow of fuel through said fuel passage to said bowl, a float in said bowl operatively connected to said valve for actuating said valve, means to render said valve inoperative by said float including a first spring biasing said valve into a closed position, means including a second spring positioned adjacent to said first spring to bias said first spring to a valve releasing position, and a movable wall in said fuel passage connected to said second spring and responsive to an increase in the pressure of the fuel in said passage to render said second spring inoperative.

5. In a fuel system for an internal combustion engine, said system comprising a fuel supply therefor, a carburetor including a fuel bowl and means forming a fuel passage connecting said bowl to said supply, valve means controlling flow of fuel through said fuel passage to said bowl, and a float in said bowl for actuating said valve means to maintain a normal supply of fuel in said bowl, said valve means including a pair of valve members within said fuel passage, one of said valve members having a portion of said fuel passage therethrough and a valve seat in said fuel passage portion, the other one of said valve members being positioned within said fuel passage portion for cooperation with said valve seat, and means operatively connecting said valve members to said float.

6. In a fuel system for an internal combustion engine, said system comprising a fuel supply therefor, a carburetor including a fuel bowl and means forming a fuel passage connecting said bowl to said supply, valve means controlling flow of fuel through said fuel passage to said bowl, and a float in said bowl for actuating said valve means to maintain a normal supply of fuel in said bowl, said valve means including a pair of valve members within said fuel passage, means operatively connecting said valve members to said float, and means to render one of said valve members inoperative by said float when fuel pressure in said fuel passage is greater than a predetermined amount.

7. In a fuel system for an internal combustion engine, said system comprising a fuel supply therefor, a carburetor including a fuel bowl and means forming a fuel passage connecting said bowl to said supply, valve means controlling flow of fuel through said fuel passage to said bowl, and a float in said bowl for actuating said valve means to maintain a normal supply of fuel in said bowl, said valve means including a pair of valves in said fuel passage, means operatively connecting said valves to said float, means rendering one of said valves inoperative by said float, and means responsive to pressure in said fuel passage to render said one valve operative by said float.

8. In a fuel system for an internal combustion engine, said system comprising a fuel supply therefor, a carburetor including a fuel bowl and means forming fuel passage connecting said bowl to said supply, valve means controlling flow of fuel through said fuel passage to said bowl, and a float in said bowl for actuating said valve means to maintain a normal supply of fuel in said bowl, said valve means including a pair of valves in said fuel passage, means operatively connecting said valves to said float, a spring biasing one of said valves into a closed position inoperative by said float, and means responsive to pressure in said fuel passage to render said one valve operative by said float.

9. In a fuel system for an internal combustion engine, said system comprising a fuel supply therefor, a carburetor including a fuel bowl and means forming fuel passage connecting said bowl to said supply, valve means controlling flow of fuel through said fuel passage to said bowl, and a float in said bowl for actuating said valve means to maintain a normal supply of fuel in said bowl, said valve means including a pair of valves coaxially mounted in said fuel passage, means operatively connecting said valves to said float, a spring biasing one of said valves into a closed position inoperative by said float, and means responsive to pressure in said fuel passage to render said one valve operative by said float.

10. In a fuel system for an internal combustion engine, said system comprising a fuel supply therefor, a carburetor including a fuel bowl and means forming fuel passage connecting said bowl to said supply, valve means controlling flow of fuel through said fuel passage to said bowl, and a float in said bowl for actuating said valve means to maintain a normal supply of fuel in said bowl, said valve means including a pair of valves in said fuel passage, means operatively connecting said valves to said float, a spring biasing one of said valves into a closed position inoperative by said float, and means responsive to pressure in said fuel passage to render said one valve operative by said float, said one valve having a portion of said fuel passage therethrough, the other of said valves being mounted within said one valve to control fuel flow through said fuel passage portion in response to the position of said float.

11. In a fuel system for an internal combustion engine, said system comprising a fuel supply therefor, a carburetor including a fuel bowl and means forming fuel passage connecting said bowl to said supply, valve means controlling flow of fuel through said fuel passage to said bowl, a float in said bowl for actuating said valve means to maintain a normal supply of fuel in said bowl, said valve means including a pair of valves in said fuel passage, means operatively connecting said valves to said float, a spring biasing one of said valves into a closed position inoperative by said float, and means responsive to fuel pressure in said fuel passage to render said one valve operative by said float, said one valve having a portion of said fuel passage therethrough, the other of said valves being mounted within said one valve to control fuel flow through said fuel passage portion in response to the position of said float, said fuel pressure responsive means including a movable diaphragm forming

a wall portion of said fuel passage and a second spring biasing said diaphragm against said first spring to render said first spring inoperative upon the drop of fuel pressure in said fuel passage below a predetermined amount.

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