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G. B. KLABER

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FLOAT VALVE

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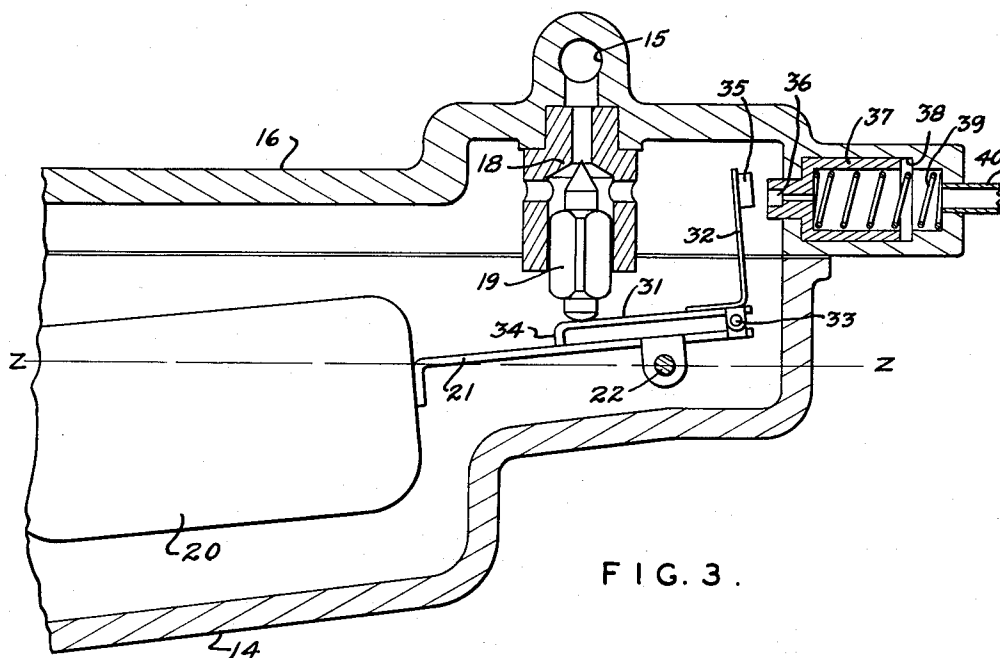


FIG. 3.

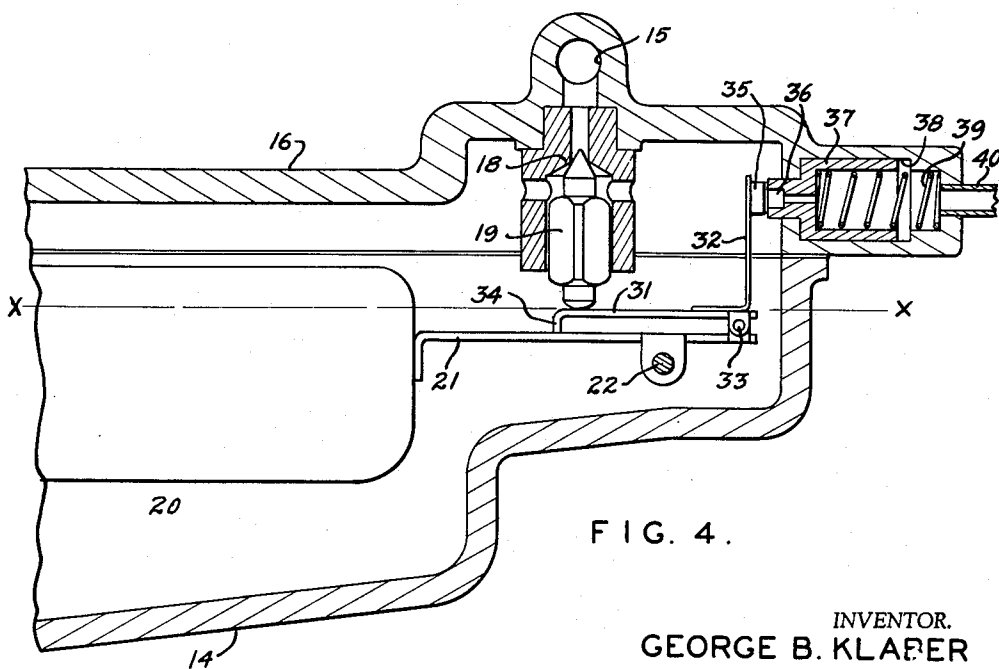


FIG. 4.

INVENTOR.
GEORGE B. KLABER

BY

Laurence M. Goodridge

ATTORNEY

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2,937,014

FLOAT VALVE

George B. Klaber, Normandy, Mo., assignor to ACF Industries, Incorporated, New York, N.Y., a corporation of New Jersey

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This invention relates to fuel supply systems for internal combustion engines and consists particularly in a carburetor having a novel constant level chamber with a fuel inlet control which provides substantial resistance to abnormal pressures in the fuel supply line without the necessity of utilizing an excessively large float.

On some occasions during idling and low speed operation of automotive engines, when the cooling effect of the fan and cooling water is reduced, the temperature of the engine compartment, including the fuel pump and fuel feed lines, may rise sufficiently to excessively increase the pressure in the fuel line between the pump and carburetor. In fact, this fuel line high pressure may push the float-actuated needle valve inwardly, spilling excessive fuel into the float bowl which, in turn, dribbles through the carburetor main nozzle into the intake manifold. The fuel mixture, accordingly, becomes excessively rich and the engine will lode, firing unevenly and reducing the power output or even stall. One way to prevent such spilling of excess fuel into the bowl and intake manifold would be to increase the size and, therefore, the buoyancy of the float. However, this expedient, usually, is not practical due to space and cost limitations.

Accordingly, the main object of the present invention is to provide novel means for increasing the resistance to opening of the fuel inlet valve due to pressure in the fuel line.

Another object is to provide means for increasing the resistance to unseating of the fuel inlet valve during periods of idling and low speed operation.

Another object is to provide means for increasing the resistance to unseating of the float-controlled fuel inlet valve, while utilizing a float of normal or even less than normal size.

Still another object is to provide means for increasing the resistance to unseating of the fuel inlet valve when the fuel stands in the fuel bowl within a predetermined range of the normal constant level.

These objects and other more detailed objects hereafter appearing are attained by the structure illustrated in the accompanying drawings in which—

Fig. 1 is a schematic, vertical, transverse sectional view showing a carburetor and float bowl structure embodying the invention.

Fig. 2 is an enlarged, vertical, transverse section showing a detail of Fig. 1.

Figs. 3 and 4 are views similar to Fig. 2, but showing the inlet valve control in different positions.

The carburetor in Fig. 1 includes a downdraft mixture conduit 6 including an air inlet horn portion 7 at the upper end, controlled by a butterfly choke valve 8 with suitable controls (not shown). At the lower end of the conduit, there is provided a throttle valve 9 pivotally mounted on a shaft 10. A suitable control lever (not shown) will be mounted rigidly on one exposed end of throttle shaft 10 for attachment in the usual way to

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the accelerator pedal in the driver's compartment. Venturi tubes 11 and 12 are located centrally in the mixture conduit.

Adjacent the mixture conduit is the constant level chamber or bowl, generally indicated at 14, having an inlet 15 formed on the cover 16 thereof for connection to the usual fuel pump (not shown). An atmospheric vent 17 is provided in top 16. Mounted in bowl cover 14 beneath inlet 15 is a needle valve seat element 18 which receives a polygonally-sectioned needle-type inlet valve 19. The float 20 within the constant level bowl is supported by means of a lever 21 pivotally mounted on a pin 22 secured in opposite walls of the bowl.

Fuel is supplied to the mixture conduit through a main metering orifice element 24 located in the bottom of the bowl and controlled by a metering rod 25 which may be actuated in any suitable way. Orifice element 24 communicates by means of an upwardly-inclined main fuel passage 26 and nozzle 27 with the throat of primary venturi tube 12. An idling metering tube 28 depends from bowl cover 16 into main fuel passage 26 and communicates by means of passage 29 with ports 30 and 31 adjacent and posterior to the edge of throttle valve when closed. An idle mixture adjustment screw is shown at 132.

A bell crank lever, having arms 31 and 32, is pivotally mounted at 33 on the end of float lever 21 remote from float 20, and slightly spaced oppositely of the float from lever pivot pin 22. Arm 31 directly engages the lower extremity of needle valve 19 and at its turned-down free end 34 bears against lever 21. Arm 32 of the bell crank is of leaf spring construction and at its free end carries a valve element 35 for cooperating with a bleed port 36 formed in the head portion of a cup-shaped piston 37 which works in a cylinder 38. The piston is constantly urged leftwardly by a coiled spring 39. Cylinder 38 communicates by means of tube 40 and a port 41 with the mixture conduit posterior to the throttle 9 so as to expose the piston to intake manifold suction.

The device operates as follows: Fig. 2 shows fuel standing in the constant level bowl at the level Y—Y which is slightly below the normal constant level X—X shown in Figs. 1 and 4. Float 20 is dropped somewhat below its Fig. 1 position, but needle valve 19 is maintained firmly seated against seat element 18 by means of bell crank 31, 32. This is due to the fact that valve element 35 on the end of spring arm 32 seals air bleed port 36 so that the suction transmitted to the interior of cylinder 38 through tube 40 will tend to maintain valve element 35 snugly seated against the piston head. At the same time, manifold suction causes piston 37 to be shifted rightwardly against spring 39 so as to rotate bell crank 31, 32 clockwise with respect to lever 21 and place spring arm 32 of the bell crank under bending stress such that the spring arm 32 will be bent or deformed into the configuration illustrated in Fig. 2. At the same time the valve element 35 will slide upwardly along the adjacent surface of the air bleed port 36, which too can be seen from a consideration of Fig. 2. Thus, the force of suction acts through the suction motor including piston 37, resilient arm 32, and rigid arm 31 of the bell crank upon the needle valve intending to maintain the valve seated against the pressure of fuel supplied through inlet 15.

As the fuel level drops, a predetermined distance to the line Z—Z of Fig. 3, valve element 35 travels upwardly a sufficient distance to open air bleed port 36 to the substantially atmospheric pressure within the fuel bowl 14 thereby reducing the force of manifold suction upon the valve element 35 which will spring away from the bleed port 36 under the influence of spring arm 32 re-

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turning to its normal position, thereby permitting the bleeding of atmosphere into cylinder 38. The consequent reduction of suction on the piston permits leftward shifting of piston 37, as shown in Fig. 3. At the same time, needle valve 19 drops under the influence of its own weight as well as the fuel pressure applied to its conical seating extremity. Thus, additional fuel drops into the constant level chamber to replenish the supply therein and again lift the fuel level and the float.

Fig. 4 shows the fuel level again standing at the normal constant level X—X. Bell crank 31, 32 has rotated with float lever 21 to bring arm 31 thereof into engagement with the needle valve, for closing the same, while causing valve element 35 to come adjacent to air bleed port 36 where, under the influence of manifold suction, the gap between such valve member and the bleed port will be bridged so that the valve member 35 will again seat against and seal air bleed port 36 in the piston of the suction motor. This again permits building up of suction within cylinder 38 with resultant shifting of piston 37 rightwardly, provided sufficient suction is transmitted from the intake manifold to overcome spring 39, and stressing of resilient bell crank arm 32, as shown in Fig. 2.

Thus, as long as the fuel level is within a predetermined distance of its constant level position or, in other words, within a certain range of departure from this position, intake manifold suction will act through the suction motor to tend to stabilize the needle valve even against excessive fuel line pressures. The slight play in float level permitted, while valve element 35 remains seated, maintains the inlet valve closed even during slight jiggling or tilting of the constant level bowl. Preferably, spring 39 in the suction motor is strong enough to maintain piston 37 shifted leftwardly until it is exposed to intake manifold suction incident to idling or part throttle operation so that there will be no restriction in the fuel inlet under greater fuel demand conditions. Suction motor 37, 38 senses the differential pressure between atmosphere and that in the induction pipe posterior to the throttle, commonly understood as intake manifold suction, as a measure of the rate of power demand upon the engine and, accordingly, the fuel requirement which generally follows power demand. The inlet valve, float suction motor spring, and bell crank arm 32 are designed to permit adequate fuel supply to the bowl under all running conditions to maintain the fuel substantially at the normal constant level indicated. At the same time, the inlet valve is sensitive only to the float position, the effect of fuel pressure on the valve being substantially counteracted by the suction motor.

Various details of the carburetor as shown are not essential as are the suction motor details. These and other features may be modified 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 supply apparatus for an internal combustion engine, a fuel chamber having an inlet, a valve in said inlet, and float means controlling said valve substantially in accordance with engine fuel demand comprising a device sensitive to the rate of power output of the engine and an operative connection actuated by said float means and said device and directly engaging said valve for applying restrictive force to said valve when the engine is operating at a low output rate.

2. In a fuel supply apparatus for an internal combustion engine, including a fuel chamber having an inlet, a valve controlling said inlet, a float in said chamber operatively connected to said valve for maintaining fuel in said chamber at a substantially constant level, a device sensitive to the rate of power output of the engine, and an operative connection mounted on said float and engaged by said device to actuate said valve for applying

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restrictive force to said valve when the engine is performing at low power output rate.

3. Fuel supply apparatus for an internal combustion engine comprising a fuel chamber having an inlet, a valve in said inlet, a float in said chamber, a device sensitive to the rate of power output of the engine, and control means actuated by said float and said device to move said valve for controlling the delivery of fuel to said chamber in accordance with the liquid level in said chamber and the rate of power output of the engine.

4. Fuel supply apparatus for an internal combustion engine comprising a fuel chamber having an inlet, a valve in said inlet, a float in said chamber, a device sensitive to the rate of power output of the engine, and control means mounted on and movable responsive to movements of said float and actuated by said device to move said valve for maintaining liquid fuel at a substantially constant level in said chamber and for restricting the delivery of fuel to said chamber when the surface of liquid in said chamber is substantially at said level or the engine is operating at a low rate of power output.

5. Fuel supply apparatus for an internal combustion engine comprising a constant level fuel chamber having an inlet, a valve controlling said inlet, a float in said chamber, a device sensitive to the rate of power output of the engine, a bell crank lever pivotally mounted on said float, one end of said lever engaging said valve and the other end being engaged by said device for restricting opening of said valve when liquid fuel stands in said chamber substantially at the constant level and the engine is operating at a relatively low rate of power output.

6. Fuel supply apparatus for an internal combustion engine comprising a fuel chamber having an inlet, a valve controlling said inlet, a float in said chamber, a vacuum responsive device sensitive to the rate of power output of the engine, a bell crank lever pivotally mounted on said float, one end of said lever engaging said valve and the other end being engaged by said device for maintaining liquid in said chamber at a substantially constant predetermined level and applying restrictive force to said valve when the engine is operating at relatively low output rate, and a control valve on said lever for rendering said device operative to apply said restrictive force only when the liquid level in said chamber is in a predetermined range relative to said level.

7. Fuel supply apparatus for an internal combustion engine comprising an induction conduit and a constant level chamber having an inlet, a valve controlling said inlet, a float controlling said valve, a movable wall device sensitive to suction conditions in said conduit, and a bell crank lever pivotally mounted on said float for engagement by said device to actuate said valve for applying closing force to said valve when relatively high suction conditions prevail in said conduit.

8. Fuel supply apparatus for an internal combustion engine comprising an induction conduit and a constant level chamber having an inlet, a valve controlling said inlet, a float controlling said valve, a suction motor mounted in the wall of said chamber and responsive to suction conditions in said conduit, an operative connection between said motor and said valve for applying closing force to said valve when relatively high suction conditions prevail in said conduit, and a control valve element for said motor and operatively connected to said float for rendering said motor ineffective to apply said inlet valve closing force when said float drops a predetermined distance below its valve closing position.

9. Fuel supply apparatus for an internal combustion engine comprising an induction conduit, having a throttle, a constant level chamber having an inlet, a valve controlling said inlet, a float controlling said valve, a suction motor having a movable wall mounted adjacent said chamber and communicating with said conduit posterior

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to said throttle, a bleed port in said movable wall, a valve controlling said bleed port, and operative connections between said bleed valve and said float and said inlet valve for moving said bleed valve into bleed port closing position, when said float is in its constant level position, whereby the force of said suction motor is applied to said inlet valve for tending to close the same.

10. Fuel supply apparatus as described in claim 9 in which said bleed valve is shifted to open said bleed port, when said float drops a predetermined distance below its constant level position, for rendering said suction motor ineffective to apply closing force to said inlet valve.

11. Fuel supply apparatus for an internal combustion engine comprising an induction conduit having a throttle, a constant level fuel bowl having an inlet, a valve controlling said inlet and a float controlling said valve, and stabilizing means for said valve comprising a chamber having a movable wall adjacent said bowl, a duct for exposing said chamber to induction conduit suction posterior of said throttle, an operative connection between said movable wall and said inlet valve capable of applying closing force to said inlet valve when the induction conduit suction is relatively high, a bleed port in a wall of said chamber, and a valve controlling said bleed port and operatively connected to said float for closing said port to cause the application of closing force to said inlet valve only when said float is within a predetermined range of positions in the vicinity of the constant level position.

12. In a carburetor, an induction conduit having a throttle, a fuel chamber having an inlet, a valve controlling said inlet, a float in said chamber, an element on said float for applying closing force to said inlet valve when liquid in said chamber stands substantially at the constant level, a suction motor in the wall of said fuel chamber and communicating with said conduit posterior

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of said throttle, and a member constituting an operative connection between said motor and said inlet valve for applying closing force to said inlet valve when relatively high suction exists in said conduit, said member being interposed between said float element and said valve and being actuated by said float.

13. In a carburetor, an induction conduit having a throttle, a fuel chamber having an inlet, a valve controlling said inlet, a float in said chamber, a lever projecting from said float and pivotally mounted in said chamber, a second lever pivotally mounted on said first lever and having an arm for engaging and closing said inlet valve when liquid stands in said chamber substantially at the constant level, a suction motor mounted in a wall of said chamber and having a movable wall with a bleed port, a second valve for controlling said port and carried by said float lever, said second valve being shifted, upon movement of said float to the constant level position, to close said port and to form, in effect, a part of said movable wall and for applying closing force to said inlet valve, said second valve being held by suction in its closed position and maintaining said closed position through a predetermined range of departures of said float from said constant level position for stabilizing said inlet valve against fuel pressures applied thereto.

14. A carburetor as described in claim 13 further including resilient means acting on said suction motor in opposition to the suction force thereon.

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