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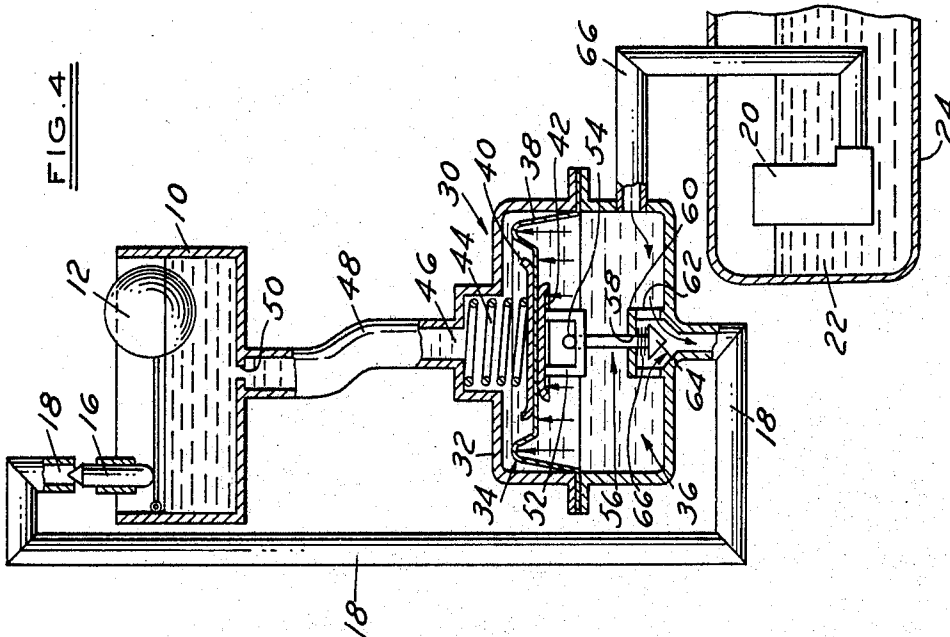
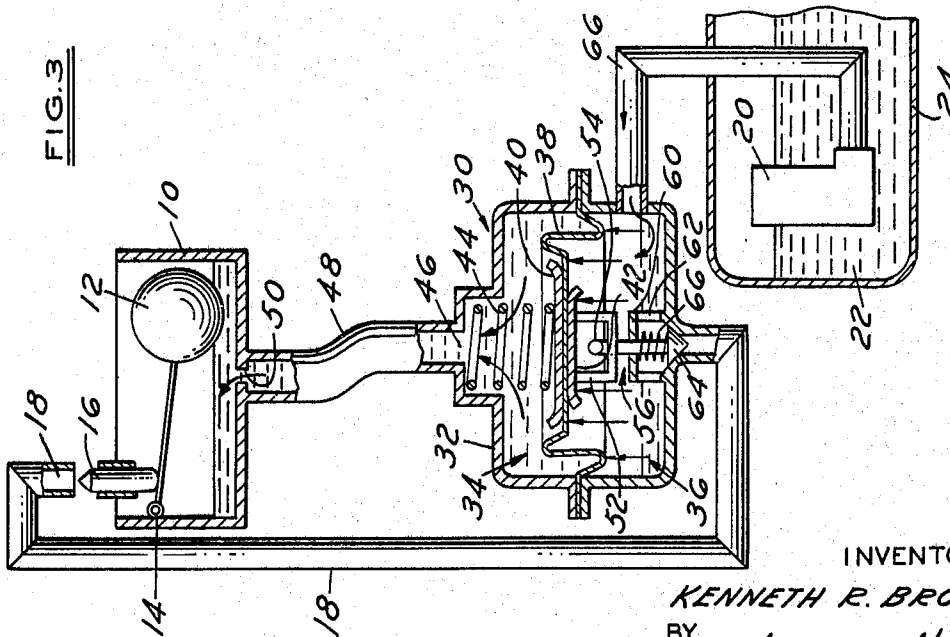
K. R. BROOKS

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FUEL VAPOR EMISSION CONTROL

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INVENTOR
KENNETH R. BROOKS
BY *John R. Faulkner*
Robert E. Mc Callum
ATTORNEYS

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FUEL VAPOR EMISSION CONTROL

Kenneth R. Brooks, Dexter, Mich., assignor to Ford Motor Company, Dearborn, Mich., a corporation of Delaware

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ABSTRACT OF THE DISCLOSURE

A fuel evaporation control for an engine fuel system connected between the engine fuel pump and the carburetor float bowl to drain the bowl of fuel upon engine shutdown into a storage reservoir and resupply the bowl with the stored fuel upon startup.

This invention relates, in general, to a fuel system preferably for an internal combustion engine. More particularly, it relates to a carburetor fuel vapor emission control for controlling the evaporation of fuel to the atmosphere from the carburetor.

Most commercial motor vehicle carburetors that utilize a fuel float bowl either vent the fuel vapors from the bowl directly into the atmosphere or back into the carburetor, or a combination of both, during the soak period when the fuel pump and engine are shut down.

The invention provides a carburetor fuel supply system that automatically supplies the normal carburetor fuel requirements when the engine and fuel pump are operating, and yet drains the fuel in the float bowl to a fuel storage reservoir when the fuel pump ceases to operate to minimize the flow of fuel vapors into the atmosphere during the soak period.

It is an object of the invention, therefore, to provide a fuel vapor emission control that effectively retards the flow of fuel vapors into the atmosphere when the fuel system is inoperative and not supplying fuel to the carburetor of an internal combustion engine.

It is another object of the invention to provide a motor vehicle carburetor fuel supply system that supplies the carburetor fuel requirements at all times during normal operation of the engine to which the carburetor is connected, and drains the fuel from the carburetor float bowl into a fuel storage reservoir upon engine shutdown to control evaporation of fuel into the atmosphere.

A further object of the invention is to provide a fuel vapor emission control of the type described above in which a fluid motor is operated by the pressure of the fuel from the fuel pump to supply the necessary fuel to the carburetor float bowl, while at the same time opening the main fuel supply line to the float bowl for conventional operation; and, upon release of the pressure from the pump upon shutdown, the fluid motor operates to drain the fuel from the float bowl into the fuel storage reservoir and concurrently seal the carburetor off from the float bowl fuel inlet.

Other objects, features, and advantages of the invention will become more apparent upon reference to the succeeding detailed description thereof, and to the drawings illustrating a preferred embodiment thereof, and wherein:

FIGURE 1 illustrates, schematically, a carburetor float bowl fuel supply system embodying the invention; and,

FIGURES 2, 3, and 4 illustrate, schematically, the fuel system of FIGURE 1 during different conditions of operation.

FIGURE 1 shows, schematically, the float bowl 10 associated with a known type of carburetor, not shown, such as the downdraft type. Although not shown, the bowl would have a fuel outlet port or line leading to the carburetor venturi to supply fuel to the carburetor induc-

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tion passage as a function of the airflow through the venturi, in a known manner.

The float bowl 10 is adapted to contain fuel to a level substantially as shown during normal operation of the carburetor. The level is controlled in a known manner by a float 12 pivotally secured to the bowl wall at 14 and having a needle type inlet valve 16 secured to the float link. The tip of the needle valve is alternately or progressively seated or unseated against the open end of a fuel supply tube 18 that receives, in a manner to be described more fully later the output from a fuel pump 20. Pump 20, in this case, is illustrated as being submerged below the level of the fuel 22 in a tank 24, and can be either of the electric or mechanical type. The pump would be driven by the engine whenever the engine to which the carburetor is attached is in operation, and would automatically shutdown or be shut off upon shutdown of the engine.

The fuel system contains a fuel vapor emission control valve indicated in general at 30 between fuel pump 20 and float bowl 10. More specifically, valve 30 comprises a two piece housing 32 divided into a fuel storage reservoir 34 and a fuel pressure chamber 36 by an annular flexible diaphragm 38. The diaphragm is sealingly mounted between the housing portions, as shown, and has a pair of cup-shaped retaining or backing members 40 and 42 secured to the diaphragm central portion by rivets or other suitable means, not shown.

The upper backing plate 40 serves as a retainer for one end of a spring 44 seated at its opposite end against a stepped diameter portion of housing 32. This portion of the housing has a fuel port 46 connected by a hose or conduit means 48 to the bottom of the float bowl 10, and through the orifice 50 to the hollow interior of the bowl. The bottom diaphragm retainer plate 42 has fixed to it a substantially U shaped valve actuator 52. The latter provides a lost motion or one-way connection with the bent over end 54 of a control valve 56.

Valve 56 is slidably guided in a vertical direction through an aperture 58 in a U shaped spring retainer 60 attached to the bottom portion of housing 32. The retainer has spaced side ports or openings 62 that freely communicate the fuel in chamber 36 with the end of the fuel inlet tube 18 opening into chamber 36 when valve 56 is in the position shown. The valve has a conical end 64 that is biased downwardly by a spring 66 to seat against the matingly formed junction between tube 18 and the wall of housing chamber 32. An additional fuel line 66 connects chamber 36 to the output of fuel pump 20.

OPERATION

FIGURE 1 shows the fuel vapor control parts in the position they attain during normal operation, that is, when the engine and fuel pump are operating over the complete load and speed range to automatically supply fuel in the desired quantities in a known manner to the carburetor induction passage. In this case, the output pressure of the fuel from pump 20 acting through line 66 against diaphragm 38 has raised the diaphragm to the position shown against the force of the spring 44 to move valve 56 upwardly to the position shown and permit fuel flow from the pump into inlet tube 18 past inlet valve 16 to maintain the level of fuel in the float bowl at the desired point. A portion of the fuel that was in storage reservoir 34 prior to operation of fuel pump 20 has, therefore, been forced upwardly through the hose 48 and orifice 50 into the float bowl 10 to fill it to the level indicated.

So long as fuel pump 20 continues to operate, therefore, the float bowl will be maintained with fuel at the desired level by reciprocation of the fuel inlet valve 16

upon lowering and rising of float 12, in a known manner, to admit fuel from inlet tube 18 to the bowl.

FIGURE 2 illustrates the positions of the parts when the engine has been shutdown and fuel pump 20 shut off. Immediately upon shut off of pump 20, the pressure in fuel line 66 and chamber 36 decreases so that the force of spring 44 will become sufficient to move diaphragm 38 downwardly. The lost motion connection between valve 56 and bracket 52 permits valve spring 66 to close the fuel inlet tube 18. The downward movement of diaphragm 38 will displace fuel back into the fuel tank and simultaneously permit a drain of fuel from the float bowl through the orifice 50 and connecting hose 48 into fuel storage chamber 34. This action will continue until the fuel in the float bowl has been drained, as indicated in FIGURE 2.

The fuel vapor emission control valve 30, in this case, would be located away from the engine so that it would be cooler and therefore less susceptible to evaporation of the fuel producing emission of fuel vapors into the atmosphere. The orifice 50 further minimizes the fuel evaporation from the storage reservoir 34 out through the empty float bowl into the atmosphere.

FIGURE 3 shows the position of parts when pump 20 again begins to operate after being shutdown, or after the soak period of the engine. More specifically, the delivery of fuel under pressure to the parts as positioned in FIGURE 2 immediately moves the diaphragm upwardly, as indicated in FIGURE 3, against the tension of spring 44. This initially forces the drained fuel in storage reservoir 34 upwardly through hose 48 and orifice 50 into the fuel float bowl. When the diaphragm has moved upwardly sufficiently for the bracket 52 to engage the bent end of valve 56, continued upward movement of the diaphragm will unseat the valve, as shown in FIGURE 4. This permits the normal flow of fuel from the passage through inlet tube 18 to the float bowl, to be controlled by the needle valve 16 in the conventional manner. The upward stroke of diaphragm 38 will be chosen so that the volume of fuel flowing upwardly into the float bowl will be exactly the correct amount to fill the bowl but not enough to overflow the float bowl, while at the same time provide sufficient movement to unseat the inlet tube control valve 64.

It should be noted that storage volume in reservoir 34 would be chosen as to provide exactly the correct initial charge of fuel to the fuel float bowl, and that the tension of spring 44 would be chosen so that minimum fuel pressure from pump 20 would be fully capable of charging the float bowl and subsequently the carburetor to which it is connected.

From the foregoing, it will be seen that the invention provides a fuel flow control system that draws fuel out of the carburetor float bowl when the fuel pump ceases to produce pressure, and that it stores the fuel until it is again needed. It will also be seen that the carburetor is sealed off from the fuel inlet tube to the float bowl when the fuel system is shut down so that initial flooding of the carburetor is prevented upon start up of the engine and fuel pump.

What I claim is:

1. A fuel vapor emission control for use in a carburetor having a float bowl having a fuel inlet and a fuel inlet control valve and adapted to contain liquid fuel to a level controlled by said a fuel inlet control valve that is operably connected to a float means movable in said bowl, a selectively operable fuel pump, and conduit means connecting the fuel from said pump to said fuel inlet, the control comprising,

a float bowl fuel flow and bowl drain control device in said conduit means between said pump and said inlet valve, said device including other control valve means movable between positions blocking and unblocking fuel flow from said pump to said inlet, and

fuel pressure responsive means connected to and moving said other valve means between said positions in response to the operability of said fuel pump, said latter means comprising a fluidmotor device having a variable area fuel storage reservoir connected to said float bowl below said bowl for the drain of fuel from said bowl to said reservoir to essentially empty said bowl during shutdown of said pump, movable means responsive to the pressure of the fuel from said pump acting thereon upon operation of said pump to force fuel back into the said bowl from said reservoir, and means connecting said other valve means to said movable means for moving said other valve means between its positions.

2. A control as in claim 1, said movable means comprising a flexible diaphragm defining one portion of said reservoir, and spring means biasing said diaphragm towards a valve means flow blocking position in opposition to the pressure of fuel acting thereon from said pump.

3. A control as in claim 1, including conduit means connecting said float bowl and reservoir, and flow restricting means in said conduit means retarding fuel evaporation from said fuel storage reservoir through said float bowl when said bowl is drained of fuel.

4. A fuel vapor emission control for use in a carburetor having a float bowl having a fuel inlet and a fuel inlet control valve and adapted to contain liquid fuel to a level controlled by said fuel inlet control valve that is operably connected to a float means movable in said bowl, a selectively operable fuel pump, and conduit means connecting the fuel from said pump to said fuel inlet, the control comprising,

a fluid motor device including a hollow housing, a flexible diaphragm mounted in said housing dividing said housing into a fuel storage reservoir and a fuel pressure actuating chamber, said conduit means having a fuel supply portion connecting said pump and said chamber and a second portion connecting said chamber to said fuel inlet valve, valve means connected to said diaphragm and movable therewith into and out of said second portion to block or unblock fuel flow therethrough as a function of the movement of said diaphragm, spring means biasing said valve means to a fuel flow blocking position, said device being located below said float bowl, other conduit means connecting said bowl and said fuel storage reservoir for the flow of fuel from said bowl into said reservoir when the fuel pressure in said chamber is indicative of the inoperability of said pump, the operability of said pump creating a fuel pressure in said chamber sufficient to move said diaphragm initially to force fuel from said reservoir to said float bowl and subsequently move said valve means to unblock flow of fuel into said second portion of said conduit means.

5. A control as in claim 4, said other conduit means containing a flow restricting orifice retarding evaporation of fuel from said reservoir to said bowl when said bowl is empty of fuel.

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WILLIAM F. O'DEA, Primary Examiner

D. R. MATTHEW, Assistant Examiner

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