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ACCELERATOR PUMP HAVING THERMOSTATIC ELEMENT

Filed May 20, 1965

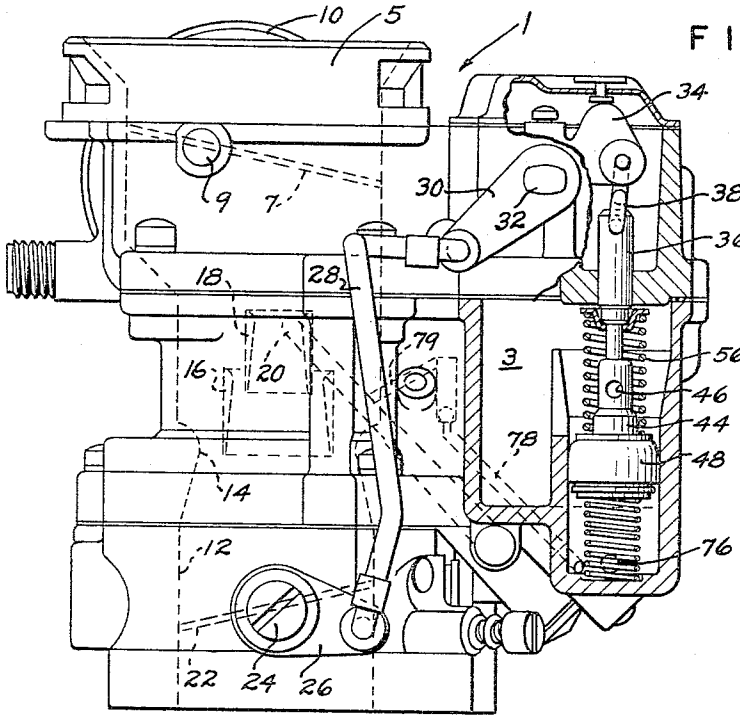


FIG. 1.

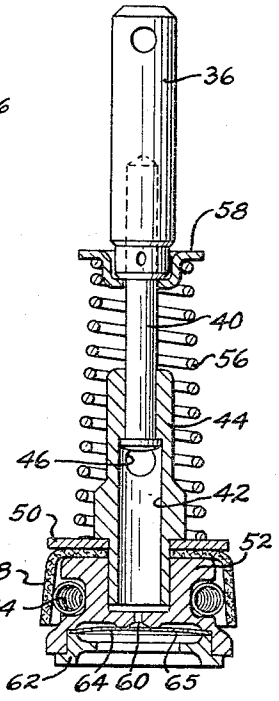


FIG. 2.

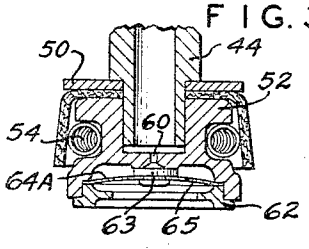


FIG. 3.

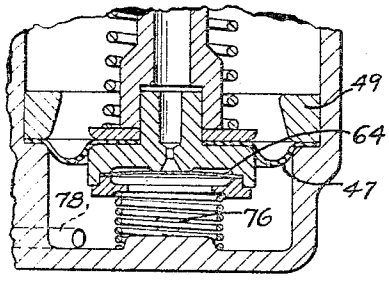


FIG. 4.

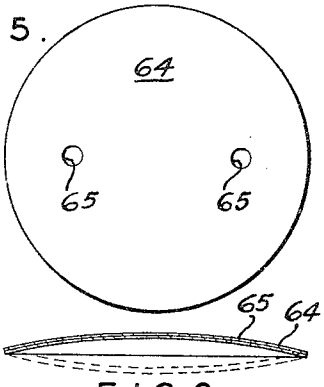


FIG. 6

FIG. 5.

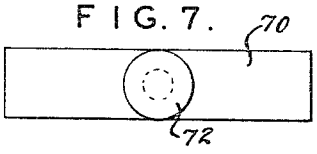


FIG. 7.

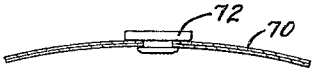


FIG. 8.

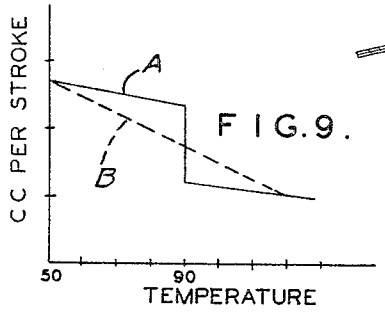


FIG. 9.

INVENTORS
JAMES T. BICKHAUS
WENFORD E. HIGHLEY
BY Edward H Casey
ATTORNEY

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ACCELERATOR PUMP HAVING THERMOSTATIC ELEMENT

James T. Bickhaus and Wenford E. Highley, St. Louis, Mo., assignors to ACF Industries, Incorporated, New York, N.Y., a corporation of New Jersey

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This invention relates to carburetors for internal-combustion engines. In one of its aspects it relates to a carburetor provided with an accelerating pump operable responsive to throttle movement to enrich the fuel mixture during acceleration. In another of its aspects the invention relates to an accelerating pump for a carburetor, which pump is responsive to temperature of the fuel being pumped to vary the quantity of fuel pumped in accordance with the temperature.

Internal-combustion engines, and particularly automotive engines, require that additional fuel be charged into the carburetor during acceleration. A cold engine requires more fuel from the accelerator pump because of inefficient vaporization, condensation upon cold surfaces, and to some extent because of distribution problems within the carburetor and manifold. After the engine has warmed up less fuel is needed from the accelerator pump because vaporization is more complete and there is no condensation. For these reasons most carburetors are equipped with an accelerator pump that is a compromise between the larger-capacity pump desirable for cold starts and the smaller-capacity pump required under normal operating temperatures. Accordingly, it is an object of the invention to provide an accelerator pump for a carburetor which is responsive to temperature changes whereby an optimum amount of fuel will be discharged by the pump at all times.

According to the invention a bimetallic element is incorporated into the plunger or moveable wall of an accelerator pump in such a manner as to close a bleed passage when the fuel is cold and to open the passage for bypassing fuel when the fuel is warm.

The details of the invention, as well as other objects and advantages will be apparent from a perusal of the following specification, claims, and the drawings in which:

FIG. 1 is a carburetor embodying an accelerator pump of the invention;

FIG. 2 is a detail, partly in section, of one form of piston for use in an accelerator pump;

FIG. 3 is a partial section of a piston employing a modified thermostatic element;

FIG. 4 illustrates the use of the invention in a diaphragm pump;

FIG. 5 is a plan view of a thermostatic element;

FIG. 6 is a cross section of the element of FIG. 5;

FIG. 7 is a plan view of an alternate type of thermostatic element;

FIG. 8 is a cross section of the thermostatic element of FIG. 7;

FIG. 9 is a plot of pump-discharge volumes versus temperature.

Referring to the drawing, and in particular to FIG. 1, there is shown generally at 1 a typical carburetor for an internal-combustion engine. The carburetor is provided with a fuel chamber 3 which normally includes a float-and-needle-valve assembly, as is customary in carburetors. The float regulates fuel level and admits, by way of the needle valve, additional fuel as required. The carburetor is provided with an air horn 5 in which is rotatably mounted a choke plate 7 on a shaft 9 and which choke is controlled by a thermostatic element 10, as is customary. The bore of the carburetor is indicated at 12. The bore has a restriction or venturi 14 and a stacked

venturi cluster 16, 18, into which a main fuel nozzle 20 discharges fuel. Downstream of the main fuel nozzle there is rotatably mounted a throttle plate 22 on a shaft 24. An arm 26 on shaft 24 is adapted to move a rod or link 28, which in turn moves another arm 30. The arm 30 is fastened to a shaft 32 journaled into the body of the carburetor. An accelerator pump arm 34 is also mounted on shaft 32 for actuating the accelerator pump. Arm 34 is connected to the stem 36 of the accelerator pump by way of an S-link 38.

The pump plunger assembly is shown in detail in FIG. 2. Attached to stem 36 is a headed pin 40, the head of which fits loosely into a passage 42 in plunger stem 44. A drilled hole 46 intersects passage 42. The plunger is provided with a cup of leather or other suitable material 48. Cup 48 is secured to the stem by retainers 50, 52. Interposed between the retainer 52 and cup 48 is a garter spring 54. Above retainer 50 there is a plunger actuating spring 56 which abuts another retainer 58. Retainer 52 may be press-fitted to the stem 54 or it may be fastened by other means, as by threads. Retainer 52 is also provided with a passageway 60. Secured to the underside of retainer 52 is a thermostatic valve element 64. The thermostatic valve element is secured in place by a retainer 62.

The thermostatic valve element of the plunger assembly of FIG. 2 is illustrated in detail in FIGS. 5 and 6. As shown here, the thermostatic valve element is a bimetallic disc 64 which has been curved or dished slightly. The thermal characteristics of such a bimetallic disc are that, when the disc is cold, it will be arched in one direction but when the disc is heated it will snap through to become arched in the opposite direction. By proper selection of disc size and curvature, the "snap" can be made to occur through a rather narrow range of temperatures. Moreover, by proper selection of the materials of construction and the thickness of the two layers of metal used, the disc can be made to snap at any desired temperature within reasonable limits.

Disc 64 is provided with one or more holes 65 to permit passage of fuel. During assembly of the plunger, the disc is fitted into retainer 52 and held in place by retainer 62 in such a manner as to close off the passage 60. This may be by close fit or the disc may be compressed slightly during assembly, if desired. It is not absolutely necessary that valve disc 64 make a perfect seal with passage 60 because slight seepage is not harmful. It is desirable to control the volume of fuel bypassed through the pump plunger. This is accomplished by utilizing the passage 60 or the holes 65 as metering elements, or metering can be achieved by selecting a disc that has a relatively small movement on snapping.

A slightly modified thermal disc is illustrated in FIG. 3. As shown in FIG. 3, a thermal disc 64*a* is provided with a resilient button 63 for closing off the passage 60. The button 63 can be made of fuel-resistant plastic or other material, as desired.

FIG. 4 illustrates the adaptation of the thermal disc to a diaphragm-type pump. All elements of the assembly are identical to the plunger described earlier, excepting that the plunger cup is replaced by a diaphragm of flexible material shown at 47. The diaphragm is held to the plunger assembly as heretofore described and is retained at its outer periphery by a retainer 49.

In FIGS. 7 and 8 there is shown another embodiment of the invention. Instead of a bimetallic disc, an arched strip is shown. The strip 70 is provided with a button or valve member 72 which can be of resilient material such as a fuel-resistant plastic. The button is inserted in a hole in the strip 70 and a head is formed on the underside thereof. The strip of FIGS. 7 and 8 will not have the "snap"-through feature of the disc, but instead

will only tend to straighten somewhat with rise in temperature. In all other respects the strip 70 will operate much as does the disc earlier described.

FIG. 9 illustrates the fuel-pumping characteristics of a pump provided with a bimetallic bypass element according to the invention. Volume discharge by the pump per stroke is plotted against temperature. In curve A it is noted that because of a slight amount of creep there is some leakage past the valve member with increase in temperature until a temperature of approximately 90 degrees is reached. At that time the disc snaps and there is a large reduction in volume pumped. At temperature above 90 degrees the volume remains relatively constant, with a slight loss due to additional creep. The curve marked B is representative of the performance that can be expected from the embodiment of FIGS. 7 and 8.

In operation, fuel is drawn into the pump chamber by way of a passage **76** which communicates with the float bowl of the carburetor. Upon depressing the accelerator pedal, throttle shaft **24** is rotated counterclockwise (see FIG. 1), causing arm **26** to raise lever **28** which, by way of the linkages shown, forces the stem **36** downwardly. If the movement is rapid the head of stem **40** drops downwardly in passage **42** and spring **56** is compressed. Discharge of the pump, then, is by way of expansion of spring **56**. The fuel is discharged from the pump chamber by way of a passage **78** that terminates in an accelerator jet **79** for spraying fuel into the bore of the carburetor.

On cold start the bimetallic element will substantially close off the passage **60** in the pump piston. This is desirable for cold starts because of the inefficient vaporization of fuel in the manifold and because of a tendency for the fuel to condense on the cold surfaces. However, as the engine warms up, vaporization becomes more efficient and there is reduced tendency for any condensation. At temperatures above approximately 85 degrees Fahrenheit, the carburetor no longer requires the large volume of fuel and the thermal element of the invention is adapted to open up the bypass passage **60** to bypass a substantial portion of the fuel at that temperature. It is understood, of course, that the temperature at which the thermostatic element opens to bypass can be varied to suit conditions and can be selected as desired. As illustrated, however, the bypass passage will be fully open at approximately 85 to 90 degrees Fahrenheit and the capacity of the pump will be at the level desired for warm operation. It has been found that the fuel requirement on acceleration for a warm engine may be only 60 to 40% or even less of the requirement for a cold engine. A fuel pump constructed according to the invention satisfies this requirement.

Where a diaphragm-type of fuel pump is used, the operation is substantially identical to that of the piston-type pump. Accordingly, in the appended claims where the term "movable wall" is used, it is intended that this cover either the piston-type pump or a diaphragm-type pump.

Another advantage exhibited by the accelerator pump of the invention is that the pump is inherently capable of venting vapors that may form under the piston or diaphragm. At elevated temperatures vapors can form in the pump cavity and this may force the fuel out of the cavity out through the accelerator jet into the carburetor barrel. Prior-art pumps have attempeted to solve the problem thus created by installing check valves or similar mechanisms in the pump plunger. The use of a check-valve is no longer necessary since the bimetallic element will open the bypass whenever vapors could be formed and the vapors will then pass upwardly and be vented into the fuel bowl. Accordingly, the pump of the invention is capable not only of reducing the quantity of fuel pumped at elevated temperatures, as is desirable, but also vents the undesirable vapors that are formed at the same elevated temperatures.

We claim:

1. In a carburetor, a mixture conduit for supplying a mixture of fuel and air to an engine, a throttle valve in said conduit, a fuel bowl, a fuel system for supplying fuel from said bowl to said mixture conduit, an accelerating pump chamber, a reciprocable movable wall in said cylinder movable in one direction to discharge fuel from said cylinder into said mixture conduit, and movable in the other direction to draw fuel from said fuel bowl into said cylinder, a mechanical linkage interconnecting said throttle valve and said movable wall, said mechanical linkage being adapted to allow the movable wall to discharge fuel through a jet into said conduit when moved in one direction, and to draw fuel into said pump chamber when moved in the opposite direction, a fuel bypass passageway incorporated in said movable wall, and a thermostatic valve means immersed in said fuel for closing said passageway when said movable wall is cold and for opening said bypass passageway when said movable wall is warm.

2. A carburetor according to claim **1** wherein said movable wall is a piston.

3. A carburetor according to claim **1** wherein said movable wall is a diaphragm.

4. In a carburetor having a mixture conduit for supplying a mixture of fuel and air to an engine, a throttle valve in said conduit, a fuel bowl, a fuel system for supplying fuel from said bowl to said mixture conduit, an accelerating pump adapted to draw fuel from said bowl and to discharge fuel into said conduit, said accelerating pump being mechanically linked to the said throttle valve whereby when said throttle valve is opened for acceleration, the said accelerating pump will be actuated to discharge additional fuel into said conduit, a piston for said accelerating pump, a piston stem, a fuel bypass passage in the stem of said piston, said bypass passage being adapted to communicate the region above the said piston with the region below the said piston, a bimetallic valve means immersed in said fuel and secured to the bottom of said piston in such a manner as to close off the said bypass passage when the said bimetallic valve means is at a low temperature, and adapted to open the bypass passage when said bimetallic valve means is warm, and means permitting fuel below said thermostatic element.

5. A carburetor according to claim **4** wherein said bimetallic valve means is a disc.

6. A carburetor according to claim **4** wherein a resilient sealing member is secured to said bimetallic valve means to effect the sealing of said bypass passage.

7. A piston for the accelerating pump of a carburetor comprising a hollow elongated stem, a shoulder on said stem, a cross passage intersecting the hollow portion of said stem, a washer abutting said shoulder, flexible sealing material for sealing said piston to the cavity within which it operates, said flexible sealing material being adjacent to said washer and beneath the same, a retainer beneath said flexible sealing material secured to said stem whereby said flexible sealing material and said washer are also secured to said stem, a fuel bypass passage in said retainer, a recess in the bottom of said retainer, a bimetallic closure member for sealing off said bypass passage when said bimetallic member is at a low temperature and for opening said bypass passage when said bimetallic member is at a higher temperature, said bimetallic element being positioned in said recess, and securing means for securing said bimetallic member in said recess.

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HARRY B. THORNTON, *Primary Examiner.*
T. R. MILES, *Assistant Examiner.*