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TEMPERATURE SENSITIVE PUMP

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2 Sheets-Sheet 1

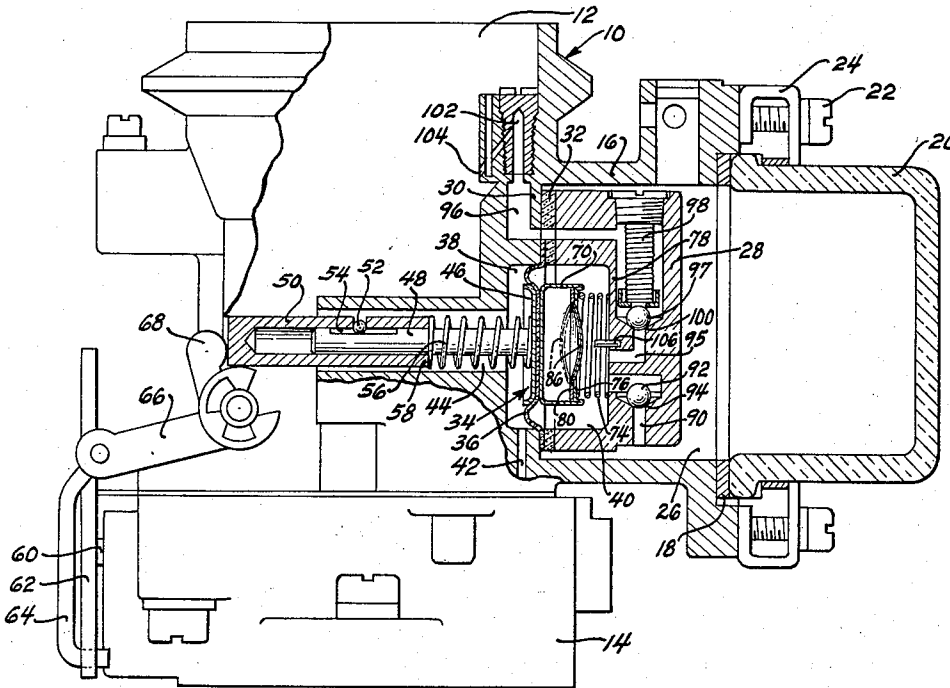


FIG. 1

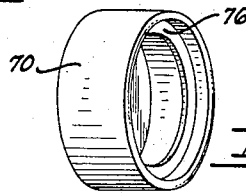


FIG. 3

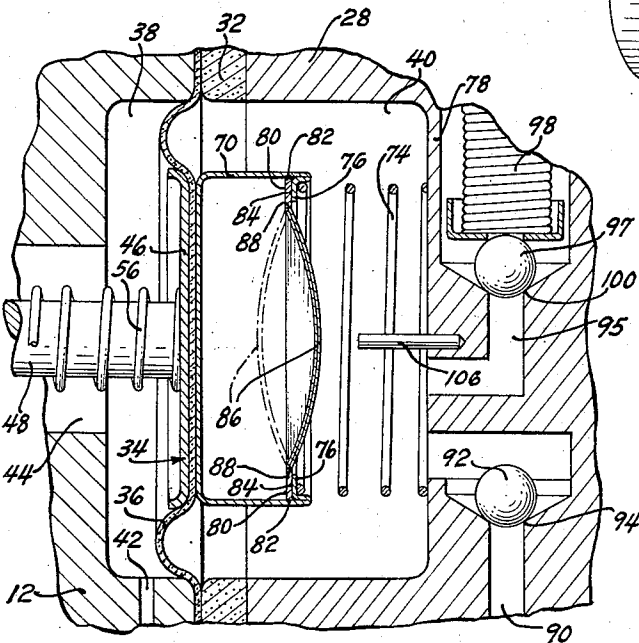


FIG. 2

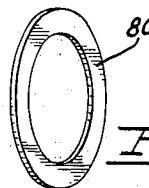


FIG. 4

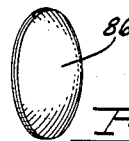


FIG. 5

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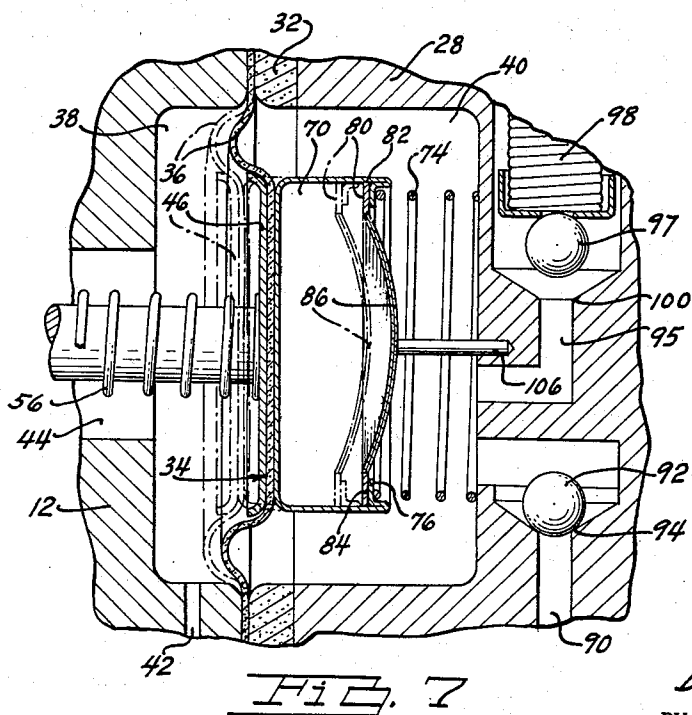
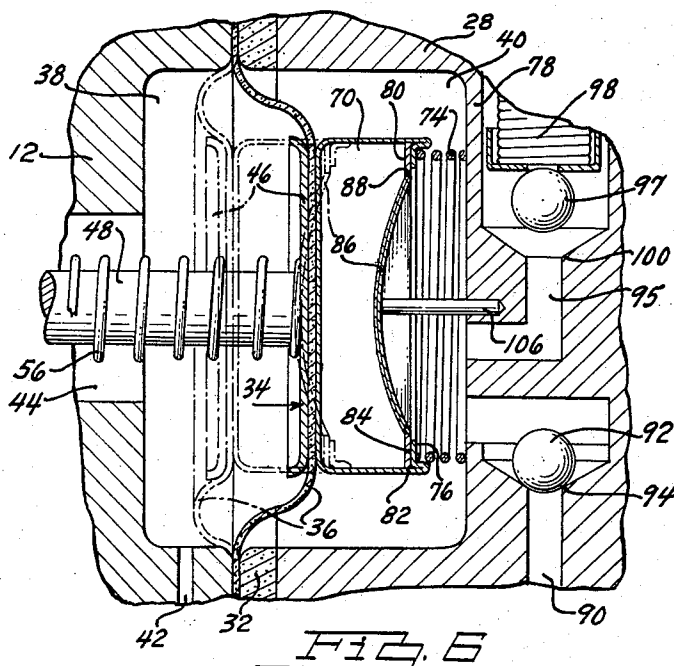
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TEMPERATURE SENSITIVE PUMP

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13 Claims. (Cl. 261—34)

This invention relates to temperature sensitive pumps, and more particularly to a temperature sensitive accelerating pump for carburetors and other fuel controls.

The main metering system of a carburetor operates on the principle of a pressure differential between the carburetor fuel bowl and the intake passage at the venturi. In other words, when the carburetor throttle is opened, the velocity of the air rushing past the venturi restriction is increased. This decreases the pressure at the main metering nozzle located near the venturi, which results in a greater amount of fuel being delivered into the intake passage from the fuel bowl.

When the throttle is opened suddenly, however, the increase in the flow of fuel lags behind that of the flow of air due to the greater inertia of the heavier fuel.

For this reason, carburetors are provided with an accelerating pump adapted to positively supply a predetermined extra amount of fuel when the throttle is opened; this helps to maintain a proper fuel ratio until the inertia of the fuel is overcome and the main metering system is back to normal operation.

While accelerating pumps now in use solve the basic problem, they have the objection that they supply the same amount of extra fuel at all engine temperatures. The volatility of the fuel varies considerably with change in temperature. Thus, an accelerating pump that is adjusted to provide just the right amount of extra fuel when the engine (fuel) is cold provides too much fuel when the engine is hot. Likewise, if it is set to provide the correct amount of additional fuel when the engine is hot, there is a deficiency of fuel when the engine is cold.

It is now proposed to provide an accelerating pump structure which responds to temperature of the fuel in a manner to automatically provide more additional fuel when the engine (fuel) is cold than when it is hot. This is accomplished by including a thermostatic element in the pump structure.

This and other objects of the invention will become readily apparent by reference to the following specification and the accompanying drawings, wherein:

Figure 1 is a side elevational view, with portions thereof cut away and in cross section, of a carburetor having an accelerating pump embodying the invention;

Figure 2 is an enlarged fragmentary view of the accelerating pump portion of Figure 1;

Figures 3, 4 and 5 are perspective views of elements of the accelerating pump shown by Figures 1 and 2;

Figure 6 is a fragmentary view similar to Figure 2, illustrating the operation of the accelerating pump embodying the invention when the engine is cold;

Figure 7 is a view similar to Figure 6 illustrating the operation when the engine is warm.

Referring now to Figure 1, a carburetor 10 having an air intake portion 12 and a throttle body portion 14 may be formed with an open housing 16 extending from the air intake portion 12. A sealing gasket 18 and a

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cover member 20 are secured to the housing 16 by any suitable means such as the screws 22 and clamps 24 to provide a closed float chamber 26. The float chamber 26 contains liquid fuel maintained at a desired level by means of the well known float controlled fuel inlet valve which forms no part of the invention and is thus not shown or described.

A suitably formed block 28 containing various passages and check valves to be later described, is secured to the inner wall 30 of the float chamber by any suitable means with a sealing gasket 32 being interposed between the block 28 and inner wall 30.

The accelerating pump system 34 is based upon the flexible diaphragm 36 secured between the gasket 32 and the inner wall 30 of the housing 16, the diaphragm providing a common flexible wall between the opposing chambers 38 and 40 formed in the inner wall 30 of the housing and the adjacent side of the block 28 respectively.

The chamber 38 is vented to atmosphere through the passage 42 and has connected therewith an axially extending passage 44 formed in the air intake portion 12 of the carburetor. The usual annular washer member 46 supporting the central portion of the diaphragm 36 is provided with a rod 48 extending through the passage 44. The hollow cylindrical member 50 receiving the rod 48 is positioned within the passage 44 for free movement along the rod 48 and within the passage 44, within the limits of travel of the ball 52 in the recess 54 formed in the rod 48. A compression spring 56 is disposed over the rod 48 between the washer member 46 and the end 58 of the hollow cylindrical member 50.

The throttle body portion 14 of the carburetor 10 contains the usual throttle shaft 60 having a throttle lever 62 secured for rotation therewith. A link 64 pivoted to the throttle lever 62 and to the accelerating pump lever 66 causes the end 68 of the accelerating pump lever 66 to force the hollow cylindrical member 50 to the right in Figure 1 when the lever 62 is pivoted so that the throttle is opened, thus compressing the spring 56 to urge the diaphragm 36 to the right.

When the throttle is closed, the end 68 of the accelerating pump lever 66 rotates counter-clockwise in Figure 1 permitting the spring 56 to push the hollow cylindrical member 50 to the left to follow the end 68 of the accelerating pump lever 66.

A hollow cylindrical member 70 is formed to provide an axially extending flange 72 for locating the spring 74 extending between the radially extending flange 76 and the adjacent wall 78 of the chamber 40. The resilient ring member 80 is bonded at 82 along its outer periphery to the inner periphery of the cylindrical member and at 84 part of the way between the right hand side of the ring member 80 and the adjacent side of the flange 76. In other words, part of the inner portion of ring member 80 is not bonded to the flange 76, in order that the unbonded portion may be flexed radially free of the flange 76. A bi-metallic thermostatic button 86 is bonded at its outer periphery 88 to the inner periphery of the ring member 80.

The block 28 is formed to provide a passage 90 between the chamber 40 and the float chamber 26. The passage 90 contains an ordinary gravity-operated ball check valve 92 normally engaging the seat 94. When the diaphragm 36 is moved to the left by the spring 74 on closing of the throttle, the check valve 92 is opened by the flow of fuel from the float chamber 26 into the chamber 40. A second passage 95 is formed in the block 28 extending between the chamber 40 and the accelerating fuel outlet passage 96 formed in the air intake portion 12 of the carburetor. The passage 95 contains

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a check valve 97 normally urged by the spring 98 to engage the seat 100. When the throttle is opened and the diaphragm 36 is urged to the right, the check valve 92 is closed and the check valve 97 is opened by the flow of fuel from the chamber 40 through the passages 95 and 96, the jet 102 and the orifice 104.

It is apparent that the particular structure of the throttle linkage is not important to the invention and that a piston rather than a diaphragm 36 could be employed. Also, the accelerating pump 34 could be positioned to operate in a vertical or some other direction.

As previously explained, opening of the throttle plate immediately admits a greater amount of air to the engine. This changes the fuel-air ratio momentarily because the inertia of the liquid fuel is greater than that of the air so that increased flow of fuel lags behind the increased flow of air. For this reason, accelerating pumps are provided to introduce an extra charge of liquid fuel to adjust the fuel-air ratio to the proper value until the inertia of the liquid fuel is overcome and the fuel-air ratio adjusts itself to the proper value.

It is apparent that a greater additional charge of fuel is desirable when the engine is cold than when the engine is warm because of the greater volatility of the fuel when the engine is warm. In other words, with present accelerating pump structures, if the additional charge is sufficient for cold engine operation it is excessive for warm engine operation. Likewise, if the additional charge is sufficient for warm engine operation it is deficient for cold engine operation.

The proposed structure overcomes the above objections to present accelerating pump structures in a manner now to be described.

The bi-metallic thermostatic button member 86 is designed so that at some predetermined temperature it will snap over from its convex position shown in solid lines in Figure 2 to its concave position shown in dotted lines in Figure 2. More specifically, the thermostatic element 86 is positioned in the pump 34 so that it will assume the dotted line position when the engine is cold and the solid line position when the engine is warm. It will thus be seen that when the diaphragm 36 is moved by the spring 74 to the position shown in Figure 2 to fill the chamber with fuel, more fuel will be admitted to the chamber when the element 86 is in its concave position than when it is in its convex position.

Figure 6 illustrates in dotted lines the normal position of the diaphragm 36 shown by Figure 2, at which time the chamber 40 is filled with fuel and the accelerating pump is ready for operation. In this figure, the thermostatic element 86 is shown in its concave position when the engine is cold.

When the throttle plate is opened, the hollow cylindrical member 50 is urged to the right by the end 68 of the accelerating pump lever 66 to compress the spring 56 an amount dependent upon the extent to which the throttle plate is opened. The spring 56 then urges the diaphragm 36 to the right until the center portion of the thermostatic element 86 engages the stop pin 106. It will thus be seen that the amount of fuel passing the check valve 100 and thus being discharged to the engine is proportional to the axial movement of the thermostatic element 86 and the diaphragm 36 from their dotted line positions to their solid line positions, assuming that the throttle is held open a sufficient time for all of the fuel to pass through the orifice 104. As soon as the throttle is released, whether or not the accelerating pump 34 has completely discharged, the diaphragm 36 will be moved to the left and the chamber 40 reloaded with fuel.

Figure 7 is similar to Figure 6 except that the thermostatic element 86 is shown in its convex or warm engine condition. It will now be seen that less fuel is initially drawn into the chamber 40 and that the total fuel discharged to the engine when the diaphragm 36 is moved

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to the right on opening of the throttle is again proportional to the axial movement of the thermostatic element 86 and the diaphragm 36 from their dotted line positions to their solid line positions, the latter again being determined by the engagement of the center portion of the thermostatic element 86 with the stop pin 106.

Comparing Figure 6 and Figure 7, it is apparent that more fuel will be discharged when the engine is cold than when the engine is warm, the difference depending upon the difference in shape of the element 86 and the location of the free end of the stop pin 106. These variables may be adjusted as desired to provide the desired result.

While one modification of the invention is disclosed, it is apparent that the invention may be applied to systems other than accelerating pumps and that various modifications may be made without exceeding the scope of the invention and as defined in the appended claims.

What is claimed is:

1. In a fuel control having an air intake passage controlled by a throttle valve, an accelerating pump actuated by said throttle valve for charging an additional quantity of fuel into said intake passage when said throttle valve is opened, said accelerating pump having a fuel chamber with a throttle positioned movable wall, said wall including thermostatic means arranged to vary the capacity of said pump in accordance with fuel temperature.

2. In a fuel control having an intake passage controlled by a throttle valve, an accelerating pump actuated by said throttle valve for charging an additional quantity of fuel into said intake passage when said throttle valve is opened, said accelerating pump having fixed internal stop means and cooperating variably positioned thermostatic means in contact with said fuel for varying the amount of said additional fuel with the temperature of said fuel.

3. In a fuel control having an intake passage controlled by a throttle valve, an accelerating pump including a fuel chamber having a movable wall actuated by said throttle valve for charging an additional quantity of fuel into said intake passage when said throttle valve is opened, said accelerating pump having thermostatic means forming a portion of said movable wall for increasing the amount of said additional fuel at fuel temperatures below a predetermined temperature and decreasing the amount of said additional fuel at fuel temperatures above said predetermined temperature.

4. A fuel control for an internal combustion engine, comprising an intake passage having a throttle valve therein and an accelerating pump for introducing an additional charge of fuel into said intake passage when said throttle valve is opened, said accelerating pump including a chamber having a movable wall connected with said throttle valve in a manner to discharge fuel from said chamber when said throttle valve is opened, said movable wall having a hollow member connected thereto within said chamber and adapted to vary the volume of said chamber with changing temperature of the fuel in said chamber, and fixed stop means opposite said hollow member for limiting the travel of said movable wall and said hollow member sooner when said fuel is hot than when said fuel is cold.

5. A fuel control for an internal combustion engine, comprising an intake passage having a throttle valve therein and an accelerating pump for introducing an additional charge of fuel into said intake passage when said throttle valve is opened, said accelerating pump including a chamber having a movable wall connected with said throttle valve in a manner to discharge fuel from said chamber when said throttle valve is opened, said movable wall having a member connected thereto within said chamber and adapted to vary the volume of said chamber with changing temperature of the fuel in said chamber, and fixed stop means opposite said mem-

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ber for limiting the travel of said movable wall and said member sooner when said fuel is hot than when said fuel is cold.

6. A reciprocating fluid pump for discharging more fluid when the fluid is relatively cold and less fluid when the fluid is relatively warm, comprising a body formed to provide a chamber having a movable wall, outward movement of said movable wall with respect to said chamber causing fluid to be drawn into said chamber and inward movement of said movable wall causing fluid to be discharged from said chamber, the chamber side of said movable wall having means responsive to fluid temperature for increasing the volume of said chamber at lower fluid temperatures, and stop means to limit the inward travel of said movable wall on the discharge stroke thereof.

7. A fluid pump for discharging more fluid when the fluid is at one temperature and less fluid when the fluid is at another temperature, comprising a body formed to provide a chamber having a movable wall, movement in one direction of said movable wall with respect to said chamber causing fluid to be drawn into said chamber and movement in the other direction of said movable wall causing fluid to be discharged from said chamber, the chamber side of said movable wall having resiliently mounted thereon means responsive to fluid temperature for increasing the volume of said chamber at one of said fluid temperatures, and stop means to limit the inward travel of said movable wall on the discharge stroke thereof.

8. A reciprocating fluid pump for discharging more fluid when the fluid is cold and less fluid when the fluid is warm, comprising a body formed to provide a chamber having a movable wall, outward movement of said movable wall with respect to said chamber causing fluid to be drawn into said chamber and inward movement of said movable wall causing fluid to be discharged from said chamber, the chamber side of said movable wall having means responsive to fluid temperature for decreasing the volume of said chamber at higher fluid temperatures, and stop means to limit the travel of said movable wall on the discharge stroke thereof.

9. An accelerating pump for internal combustion engine fuel systems, comprising a chamber having a movable wall, said movable wall causing fuel to be drawn into or discharged from said chamber depending on the direction of movement of said wall, and means within said chamber for varying both pump capacity and discharge stroke according to the temperature of said fuel.

10. An accelerating pump for internal combustion engine fuel systems, comprising a chamber having a movable wall, said movable wall causing fuel to be drawn into or discharged from said chamber depending on the

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direction of movement of said wall, and means within said chamber for varying the volume of fuel delivered with changing temperatures of said fuel, said means being arranged to control both pump capacity and discharge stroke according to said fuel temperature.

11. An accelerating pump for internal combustion engine fuel systems, comprising a chamber having a movable wall, said movable wall causing fuel to be drawn into or discharged from said chamber depending on the direction of movement of said wall, and temperature responsive means forming a portion of said movable wall of said chamber cooperating with a fixed stop member in said chamber for varying the charged volume of said chamber and discharge stroke of said wall according to the temperature of said fuel.

12. A fluid pump for discharging more fluid when the fluid is relatively cold and less fluid when the fluid is relatively warm, comprising a body formed to provide a chamber having a movable wall, outward movement of said movable wall with respect to said chamber causing fluid to be drawn into said chamber and inward movement of said movable wall causing fluid to be discharged from said chamber, the chamber side of said movable wall having mounted thereon means responsive to fluid temperature for increasing the volume of said chamber at lower fluid temperatures, and fixed stop means to limit the inward travel of said temperature responsive means and said movable wall on the discharge stroke thereof.

13. A fluid pump for discharging more fluid when the fluid is relatively cold and less fluid when the fluid is relatively warm, comprising a body formed to provide a chamber having a movable wall, said chamber having an inlet and an outlet for said fluid, outward movement of said movable wall with respect to said chamber causing fluid to be drawn into said chamber and inward movement of said movable wall causing fluid to be discharged from said chamber, and separate cooperating fixed and temperature responsive stop means within said chamber arranged to variably limit the inward travel of said movable wall on the discharge stroke thereof, said stop means permitting further inward travel when said fluid is cold than when said fluid is warm.

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