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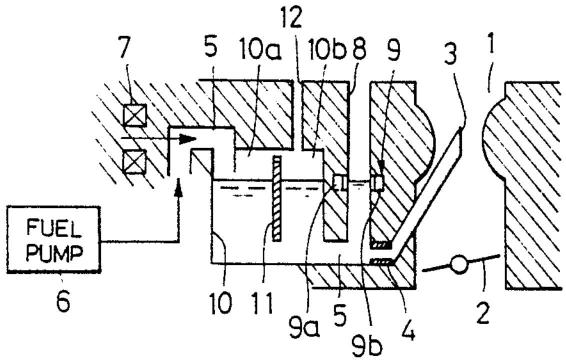
(54) **Carburetor.**

(57) A floatless carburetor provided with an air-liquid separating chamber (10) on the downstream side of a fuel flow rate control device (17), communicating with the atmosphere by a passageway (12) having a diameter smaller than that of a passageway (8) for fuel liquid level detection located on a further downstream side thereof, in order to be able to prevent positively air bubbles from being generated in fuel to be supplied and to feed continuously a proper amount of fuel to an engine.

FIG. 5



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CARBURETOR

The present invention relates to a carburetor and more particularly a floatless carburetor for internal combustion engines.

In the past, conventional carburetors have generally encountered the problem that the temperature of fuel to be supplied to be supplied rises, at high temperatures in particular, and thereby air bubbles created in the fuel causes an enormously rich mixture. For example, in conventional float type carburetors, as shown in Fig. 1, the fuel is normally supplied to a float chamber 22 through a needle valve 23 from a fuel passageway 25. Once the fuel temperature rises, however, the air bubbles will be generated at a valve seat portion 24 of the needle valve 23 (see Fig. 2). When this state develops further into the air bubbles filled in the float chamber 22 as shown in Fig. 3, the air bubbles flowing through an air vent 21 enter an intake passageway to induce the generation of a rich mixture in an extreme case and consequently the mixture introduced into the cylinder of an engine may have an air-fuel ratio beyond the range of combustibility. On the other hand, such a problem of the air bubbles may be brought about not only in the float type carburetor, but also in the so-called floatless carburetor shown in Fig. 4 as an example. That is to say, due to the increase of the fuel temperature, the air bubbles are produced on the downstream side of a fuel flow rate control device 37 opening and closing properly a fuel passageway 35, in accordance with the fluctuation of a fuel liquid level in a passageway 38 for fuel liquid level detection, supplying the fuel from a fuel tank 30 to a main nozzle 33 within an intake passageway 31 through a pump 36 and, as the result, the fuel spouts from the passageway 38 for fuel liquid level detection to generate the rich mixture.

The object of the present invention, in view of such circumstances, is to provide a floatless carburetor which prevents surely the generation of the air bubbles in the fuel to be supplied and which can properly feed the fuel.

According to the present invention, an air-liquid separating chamber is provided on the downstream side of a fuel flow rate control device and communicates with the atmosphere through a passageway with a diameter smaller than that of a passageway for fuel liquid level detection located on a further downstream side thereof. At high temperatures in particular, if the air bubbles generated in the fuel fill in the air-liquid separating chamber through the fuel flow rate control device, the pressure in the separating chamber rises, thereby causing the liquid level in the passageway for fuel liquid level detection to be elevated and, as a result, the fuel flow rate control device will cease to supply the fuel in accordance with a signal issued from a liquid level sensor disposed along the passageway for fuel liquid level detection. Accordingly, the spouting of the fuel from the passageway for fuel liquid level detection is prevented and therefore the generation of the rich mixture is assuredly blocked.

This and other objects as well as the features and the advantages of the present invention will be apparent from the following detailed description of the preferred embodiment when taken in conjuction with the accompanying drawings.

In the drawings:

Figs. 1 to 3 are sectional views for explaining the generation process of air bubbles in conventional float type carburetors;

Fig. 4 is a sectional view showing a structure of conventional floatless carburetors;

Fig. 5 is a sectional view showing an embodiment of a carburetor according to the present invention;

Fig. 6 is a graph showing the relationship between the output and the liquid level of a liquid level sensor device used for the carburetor according to the present invention; and

Fig. 7 is a view of a control circuit connected to the liquid level sensor device.

Based on Figs. 5 to 7, the present invention will be explained below in accordance with an embodiment applied to a floatless carburetor. In these figures, reference numeral 1 designates a suction bore, 2 a throttle valve placed in the suction bore 1, 3 a nozzle disposed in a venturi portion within the suction bore 1, 4 a metering jet 5, a fuel passageway for supplying the fuel from a fuel feed system comprising a fuel pump 6 to the nozzle 3, 7 a fuel flow rate control device composed of a solenoid valve arranged midway in the fuel passageway 5 between the metering jet 4 and the fuel pump 6, 8 a passageway for fuel liquid level detection connected to a portion between the fuel flow rate control device 7 in the fuel passageway 5 and the metering jet 4 at the lower end and communicating with the atmosphere at the upper end, 9 a liquid level sensor device disposed in the passageway 8 for fuel liquid level detection, 10 an air-liquid separating chamber divided into chambers 10a and 10b by a partition wall 11 disposed in the middle of the fuel passageway 5 lying on the downstream side of the fuel flow rate control device 7, and 12 a passageway having a diameter smaller than that of the passageway 8 for fuel liquid level detection and connecting the air-liquid separating chamber 10 to the atmosphere. Also, in this embodiment, the liquid level sensor device 9 comprises, for example, a light emitting element 9a and a light receiving element 9b and a circuit for detection, not shown, connected to these elements, and is adapted to be actuated so that when the fuel liquid level in the passageway 8 for fuel liquid level detection is lower than the position of a preset height, the output of the circuit for detection according to the output of the light receiving element 9b is reduced, while on the other hand, when the fuel liquid level is above the preset height, the output is increased (refer to Fig. 6). Further, the liquid level sensor device 9 of the type, connected to such a control circuit 13 as shown in Fig. 7, is adapted to operate so that when the liquid level in the passageway 8 for fuel liquid level detection is lower than the preset position of height, that is when the output of the liquid level sensor device 9 is lower than a reference voltage E_G, the output of an operational amplifier COP becomes "H" to conduct a transistor Tr, thereby the fuel flow rate control device 7 opens the fuel passageway 5, and the increase of the fuel flow rate causes the liquid level to be raised, while on the other hand, when the liquid level is higher than the preset position of height, that is, when the output of the liquid level sensor device 9 is higher than the reference voltage E_G, the output of the operational amplifier COP becomes "L" to cut off the conduction of the transistor Tr, thereby the fuel flow rate control device 7 closes the fuel passageway 5, and the decrease of the fuel flow rate causes the liquid level to be lowered.

Since the carburetor according to the present invention is constructed as mentioned above, with respect to the basic operation thereof, when the liquid level in the passageway 8 for fuel liquid level detection is positioned below the preset height, the fuel flow rate control device 7 is operated by the control circuit 13 (Fig. 7) to cause the liquid level to be raised, whereas, when the liquid level is above the preset height, it is lowered. Such operations are repeated alternately and thereby the liquid level is maintained at the preset height, that is, a reference liquid level is formed. Also, in such a case, both the air-liquid separating chamber 10 and the passageway 8 for fuel liquid level detection communicate with the atmosphere, so that theoretically their liquid levels are the same in height.

As stated above, the air bubbles are generated in the fuel on the downstream of the fuel flow rate control device 7, at high temperatures in particular, and if the amount of the air bubbles is considerably small, the fuel is first introduced from the chamber 10a side into the air-liquid separating chamber 10. Therefore, the flow of the air bubbles into the chamber 10b is almost completely blocked by the partition wall 11, so that the chamber 10b is filled with pure fuel which does not include any of the air bubbles. Further, as a result, the reference liquid level is formed by virtue of the chamber 10b and the passageway 8 for fuel liquid level detection, and a fuel supply to the nozzle 3 through the metering jet 4 can properly be controlled. Also, in the event that a large number of air bubbles are produced, the air bubbles flow into the chamber 10b beyond the partition wall 11 and thereby the air-liquid separating chamber 10 is filled with the air bubbles. In such a case, as a result of the rise of the pressure in the chambers 10a, 10b, the liquid level in the passageway 8 for fuel liquid level detection will be raised. Thus, the output of the liquid level sensor device 9 is increased and, in accordance with the signal of the output, the fuel supply to the air-liquid separating chamber 10 is stopped immediately by the fuel flow rate control device 7 through the control circuit 13, so that the fuel will not be spouted from the passageway 8 for fuel liquid level detection and the passageway 12. That is to say, the supply of an extraordinarily rich mixture to the engine is surely prevented. Since the diameter of the passageway 12, in this case, is set to be at least smaller than that of the passageway 8 for fuel liquid level detection, even when the air-liquid separating chamber 10 is filled with the air bubbles, not only the amount of the air bubbles flowing through the passageway 12 is minimized, but also the atmosphere is introduced into the air-liquid separating chamber 10 to compensate a pressure rising function caused by the air bubbles in the air-liquid separating chamber 10 and, as a result, a proper formation of the reference liquid level in the passageway 8 for fuel liquid level detection can be realized. Furthermore, the fuel and air components of the air bubbles once generated are progressively absorbed into the fuel in the air-liquid separating chamber 10 or into the atmosphere through the passageway 12 and, after this, the pressure within the air-liquid separating chamber 10 returns to a state of the atmospheric pressure. Thus, a proper fuel supply can always be performed without bringing about the rich mixture attributable to the air bubbles generated in the fuel to be supplied.

As mentioned above, the carburetor according to the present invention has an excellent advantage in practical use that barriers to the fuel supply which are caused by the air bubbles generated in the fuel at high temperatures in particular are positively eliminated and a proper fuel supply can always be carried out.

Claims

1. A carburetor provided with a fuel flow rate control means disposed in the middle of a fuel passageway between a fuel feed means and a

metering jet; a liquid level sensor device disposed in a passageway for fuel liquid level detection communicating with said fuel passageway between said fuel flow rate control means and said metering jet; and a control circuit driving said fuel flow rate control means in accordance with output delivered from said liquid level sensor device and establishing a reference liquid level, the improvement comprising an air-liquid separating chamber disposed in said fuel passageway lying on the downstream side of said fuel flow rate control means, said air-liquid separating chamber being connected with the atmosphere through an atmosphere communicating passageway having a diameter smaller than that of said passageway for fuel liquid level detection.

2. A carburetor according to Claim 1, wherein said air-liquid separating chamber has a first chamber lying on the upstream side and a second chamber lying on the downstream side of a partition wall by which said air-liquid separating chamber is divided so that said first and second chambers communicate with each other by the upper and lower portions of said partition wall, and said atmosphere communicating passageway is provided in said second chamber.

3. A carburetor according to Claim 1 or 2, wherein said fuel flow rate control means comprises a solenoid valve.

4. A carburetor according to one of Claims 1 to 3, wherein said liquid level sensor device comprises a light emitting element and a light receiving element arranged on opposite sides of said passageway for fuel liquid level detection at a position of the reference liquid level.

FIG. 1

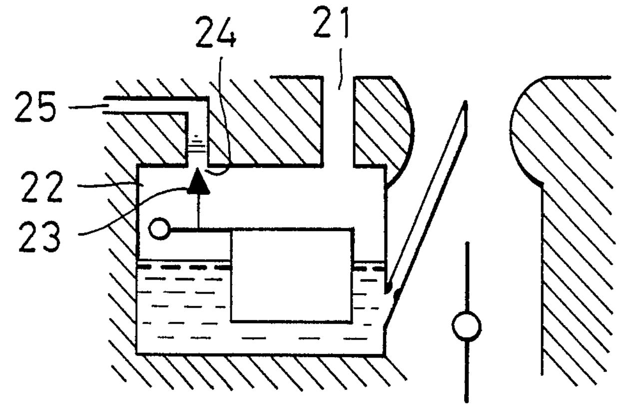

FIG. 2

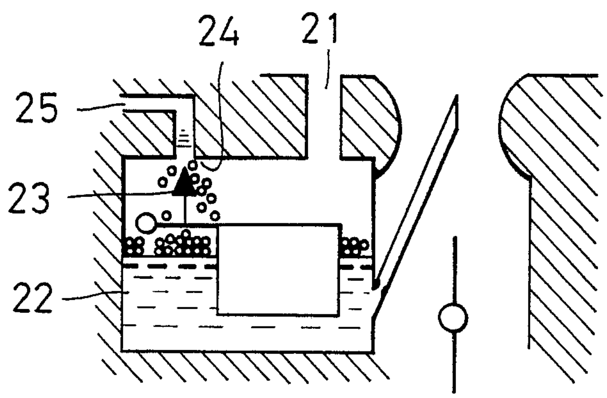

FIG. 3

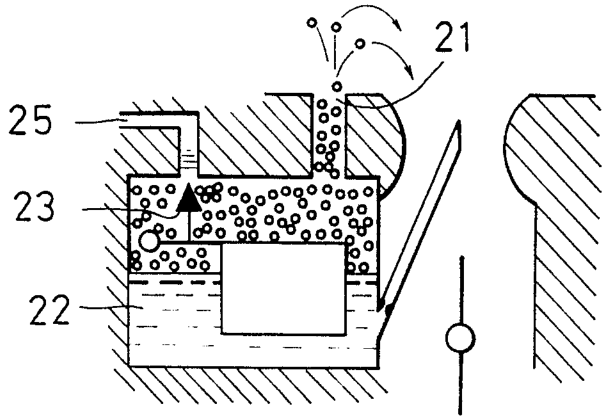

FIG. 4

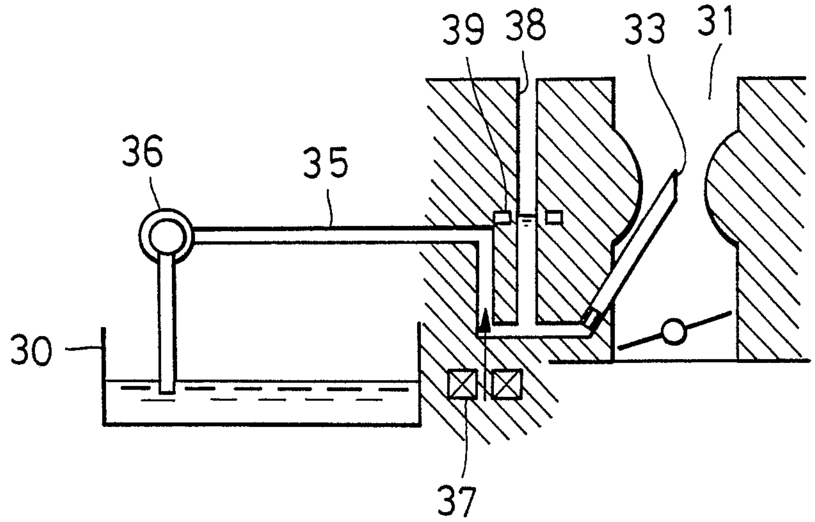
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FIG. 5

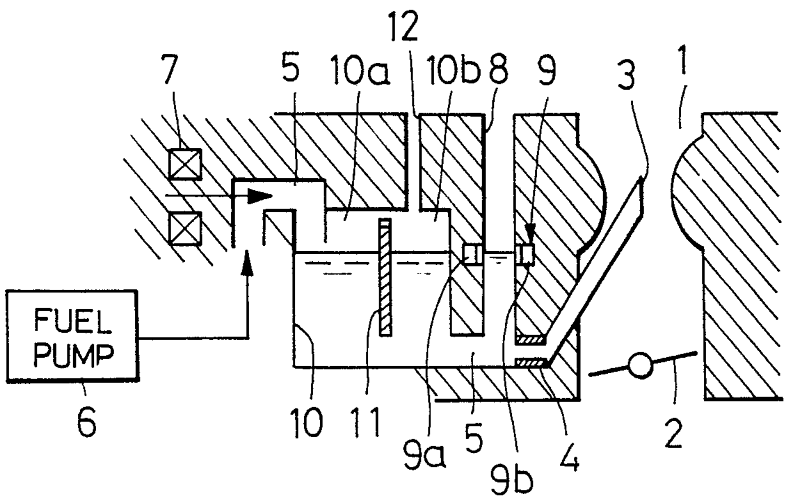

12
7
5
10a
10b
8
9
3
1
FUEL
PUMP
6
10
11
9a
5
9b
4
2

FIG. 6

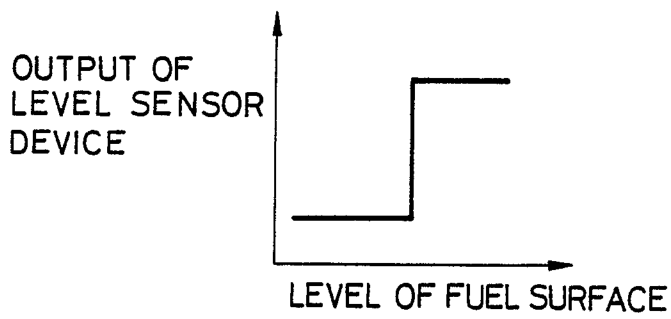
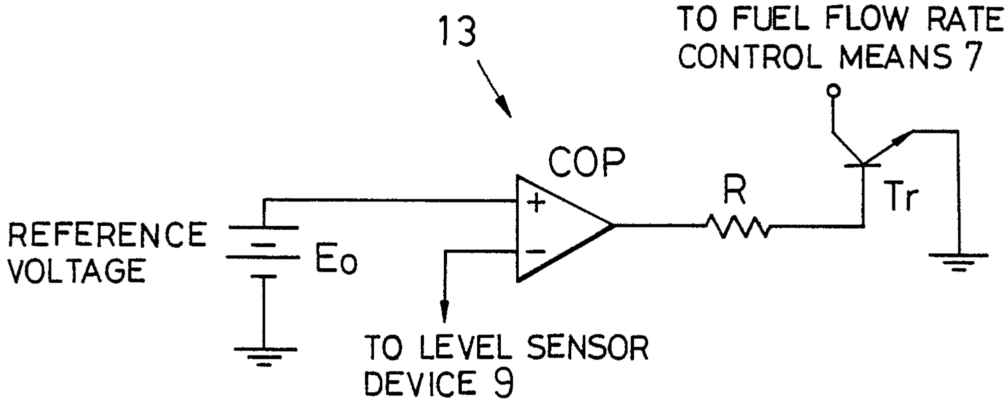

OUTPUT OF
LEVEL SENSOR
DEVICE
LEVEL OF FUEL SURFACE

FIG. 7


13
TO FUEL FLOW RATE
CONTROL MEANS 7
COP
R
Tr
REFERENCE
VOLTAGE
Eo
TO LEVEL SENSOR
DEVICE 9