

April 17, 1934.

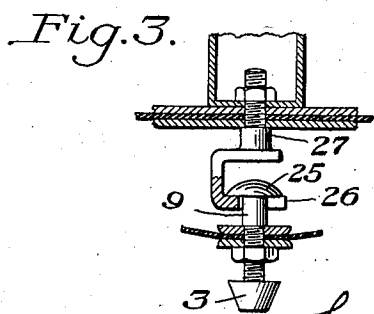
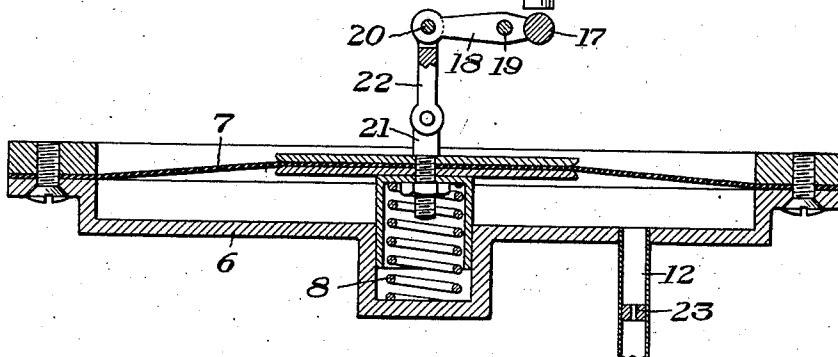
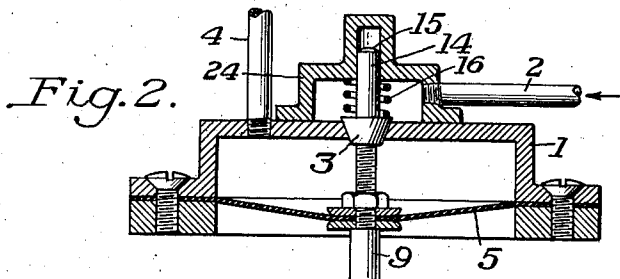
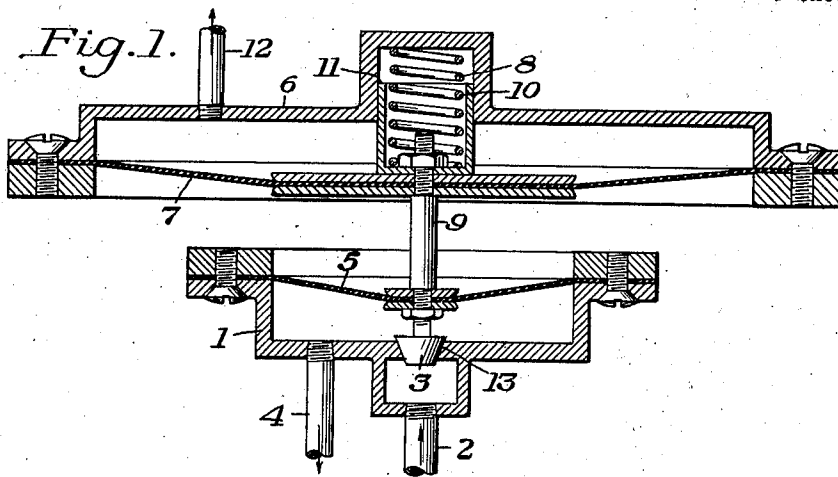
L. L. VIEL

1,955,037

DEVICE FOR CONTROLLING THE FUEL SUPPLY OF INTERNAL COMBUSTION ENGINES

Filed April 28, 1931

2 Sheets-Sheet 1



INVENTOR

INVENTOR
by Louis-Léon Viel
Byrne, Stellingma & Co.
his attorneys

April 17, 1934.

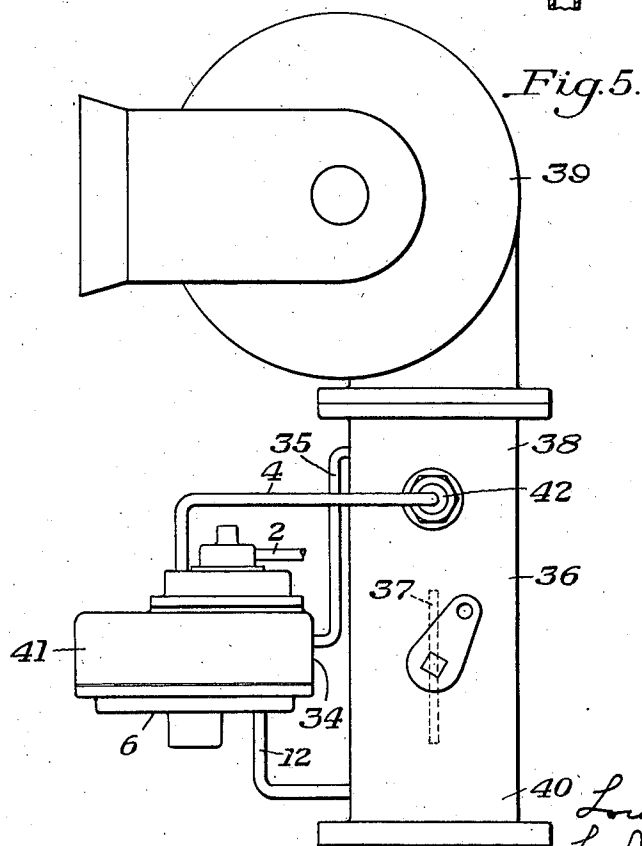
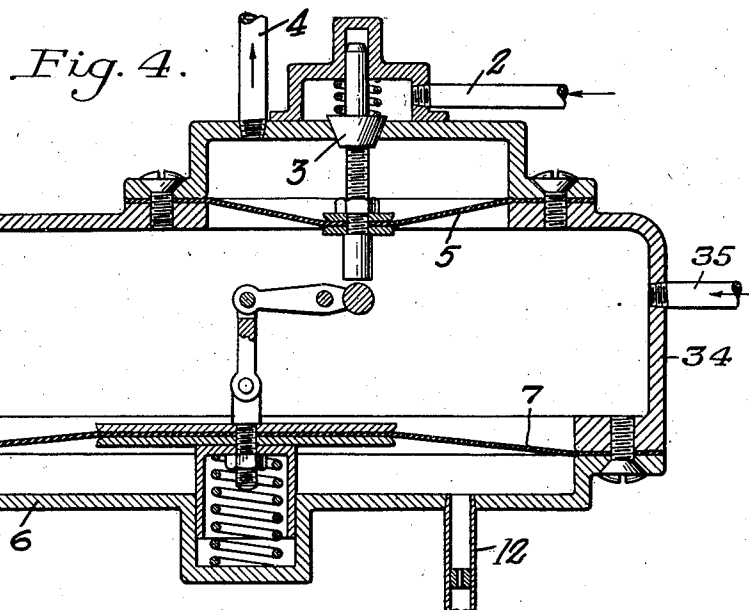
L. L. VIEL

1,955,037

DEVICE FOR CONTROLLING THE FUEL SUPPLY OF INTERNAL COMBUSTION ENGINES

Filed April 28, 1931

2 Sheets-Sheet 2



INVENTOR

Louis Leon Viel
by *Byrnes, Steffens,
Parker & Blum*
his attorneys

UNITED STATES PATENT OFFICE

1,955,037

DEVICE FOR CONTROLLING THE FUEL
SUPPLY OF INTERNAL COMBUSTION
ENGINESLouis Léon Viel, Ville d'Avray, France, assignor
to Societe Generale des Carburateurs Zenith,
Levallois-Perret, FranceApplication April 28, 1931, Serial No. 533,455
In Belgium May 1, 1930

7 Claims. (Cl. 123-119)

The present invention relates to controlling devices for the fuel for internal combustion engines in which the fuel supply is controlled by the pressure existing at a suitable point of the engine or of one of its adjuncts, this pressure assuming a different value when the engine is working or when it is stopped. This pressure is for example the pressure of the oil or the pressure which exists in the admission piping of the engine. In the apparatuses which are intended, the said pressure is utilized so as to maintain a fuel valve in the closed position when the engine is not working, and to open this valve when the engine is working.

Apparatuses of this kind are known in which a valve placed at a suitable point of the fuel supply circuit is connected to a membrane constituting a portion of the wall of the fuel chamber in which moves the said valve. The fall of pressure which exists in the admission piping of the engine or also the pressure of the oil being transmitted to the external face of the said membrane.

Such a device is not without drawbacks. It is known, as a matter of fact, that it is difficult to obtain membranes which are impermeable to liquid fuels and such membranes are always somewhat delicate. A membrane in the conditions which have just been described runs the risk of deteriorating rapidly. At slow speeds of the engine, as a matter of fact, the fall of pressure existing in the admission piping is very large and the difference of pressure then existing between the internal face of the membrane bathed by the fuel and the external face of this membrane subjected to the said fall of pressure, is unfavorable to the preservation of the fluid tightness. This difference of pressure is still greater when it is the oil pressure which is utilized for controlling the membrane.

An object of the invention is to reduce the part played by the membrane, connected to the fuel valve and constituting a portion of the wall of the fuel chamber in which moves the said valve, to a simple part of fluid tightness, the said membrane being only subjected to very small pressures.

Other and further objects and advantages of the invention will be hereinafter set forth.

Instead of exerting directly on the external face of the membrane the pressure which is utilized for controlling the valve, the displacements of the membrane and of the valve depending therefrom are controlled by an independent manometric device itself utilizing the said controlling pressure. The external face of the membrane is preferably subjected to the atmospheric pressure, or, more generally to a pressure which

is never very different from the pressure of the fuel bathing the internal face of the said membrane.

Generally, the difference between the pressures which exist at two points of the engine or of one of its adjuncts is utilized for the control of the said manometric device, this difference taking different values when the engine is stopped and when it is working.

The difference between the pressure at a point situated inside the engine and that at a point of the atmosphere will be frequently utilized, but this is only a particular case of the more general principle which has just been stated. An example of this particular case consists in utilizing the difference between the pressure existing in the admission neck and atmospheric pressure, difference which is nothing when the engine stops and which is negative when working for engines without supercharge. An example of the application of the more general principle consists, in the case of a supercharged engine, in utilizing the difference between the pressures which exist in the admission neck (down-stream of the throttle) on the one hand, and at the outlet of the air compressor supercharging the engine on the other hand. This difference is nothing when the engine stops and is negative while it is working.

The invention comprises also improvements having for their purpose to avoid the hammering of the fuel valve.

The description which will follow with reference to the appended drawings given as an example will cause the manner in which the invention may be carried out to be well understood.

In the drawings:

Fig. 1 represents diagrammatically in longitudinal section a device embodying the invention, in which the fuel valve is controlled by the fall of pressure existing in the admission piping.

Fig. 2 represents diagrammatically an improved manner of construction of the apparatus of Fig. 1.

Fig. 3 represents a variation in a detail of the apparatus of Fig. 1.

Fig. 4 represents a variation of the device of Fig. 2 applied to a supercharged engine.

Fig. 5 is an elevational view of the device shown in Fig. 4 fitted to a carburetor fed by a supercharger.

The apparatus represented in Fig. 1 comprises a chamber 1 receiving the fuel by the passage 2, the fuel passage being controlled by the valve 3, and the issue of the fuel taking place by the passage 4. The direction of the circulation of the fuel is besides of little importance, the passages 2 and 4 may be interchanged.

The valve 3 is carried by a deformable membrane 5 which constitutes a portion of the wall of the chamber 1. Instead of subjecting the external face of the membrane 5 to the fall of pressure existing in the suction neck of the engine, as is done usually, this external face is subjected to atmospheric pressure or to a pressure which is in its neighbourhood. In the case of the figure, this external face is bathed by atmospheric air. The membrane 5 is in this manner subjected to very small forces since the pressures on its two faces are differing very little, which constitutes a guarantee for the preservation of its fluid tightness.

The displacements of the valve 3 are controlled by an independent manometric device from the membrane 5. This device can be obtained in any known manner. On the figure, a manometric chamber has been shown comprising a chamber 6 closed by a deformable membrane 7 loaded by a spring 8. The membrane 7 is connected to the stem 9 of the valve 3, the whole of the displacements being guided by the piston 10 moving in the cylinder 11. A passage 12 connects the chamber 6 to the admission piping of the engine.

When the engine is stopped and the fall of pressure in the admission piping is nothing, the spring 8 maintains the valve 3 against its seat. When the engine is working, the fall of pressure is transmitted to the membrane 7 which is depressed and compresses the spring 8, causing the opening of the valve 3 controlling the orifice 13.

Generally, the spring 8, which simply acts as a returning spring, is designed with respect to the membrane 7 in such a way that the smallest depressions, which exist in the admission piping for the different working conditions, are capable of opening wide the valve 3, the piston 10 coming then to butt against the bottom of the cylinder 11.

The device represented in Fig. 1 may be placed at any point of the fuel supply circuit.

The pressure of the fuel takes place on the valve 3 and when this valve is open it takes place also on the membrane 5. If this pressure is great, it tends to open the valve 3 with a certain force independently from the pressure transmitted by the passage 12 on the membrane 7.

It is then necessary to sufficiently increase the force of the spring 8 in order that the fuel pressure may be in all cases incapable of producing the opening of the valve. The force of the spring 8 being increased, the dimensions of the membrane 7 are consequently also increased. However, whatever may be the pressure of the fuel, it will be always possible to select a spring 8 and a membrane 7 capable of ensuring correctly the control of the needle valve 3.

In the known devices, on the contrary, where the fall of pressure of the engine is exerted directly on the external face of the membrane 5, the dimension of the membrane subjected to the fall of pressure is not available, and if the pressure of the fuel exceeds a certain value, the device is incapable of working and of ensuring the closure of the valve when the engine stops. It is a serious drawback which is remedied by the invention.

In the apparatus described in Fig. 1, when the engine is stopped, the whole of the pressure of the spring 8 is transmitted to the valve 3 and presses this valve on its seat. This pressure is capable of causing the hammering of the valve and so to be detrimental to its fluid tightness. This drawback is obviated by providing a unilateral control between the manometric device

and the valve, the manometric device being only able to cause the opening of the valve, the return of the valve to the closed position taking place by independent means.

Fig. 2 represents an example of the carrying out of this improvement. On this figure, the fuel is brought by the passage 2 to a chamber 24. The fuel outlet, controlled by the valve 3, takes place by the chamber 1 and the passage 4. The valve 3 is provided on the side opposite to the diaphragm 5 with a stem 14 guided in the cylinder 15. The valve 3 is loaded with a light spring 16. The rod 9 connected to the valve 3 and to the diaphragm 5 is not solid with the membrane 7 as in Fig. 1, but ends opposite a push 17 at the end of a lever 18 pivoted about an axis 19. The opposite end 20 of the lever 18 is connected to a piece 21, solid with the membrane 7, by means of a small connecting rod 22.

When the membrane 7 is lowered by the fall of pressure transmitted by the passage 12, the end 20 of the lever 18 descends and the end 17 rises, pushing the rod 9 and causing the rise of the valve 3.

When the engine stops, the membrane 7 returns to its place and the push 17 descends without bringing down with it the valve 3. This valve is brought back in the closed position by the spring 16 which is weak, this valve not being pressed on its seat as in Fig. 1 by the whole pressure of the spring 8, which avoids the hammering of the valve 3.

At the stopping of the engine, there exists a certain play between the push 17 and the end of the rod 9. The closure of the valve is then complete and the fuel supply is cut off.

For the purpose of safety, the membrane 5 and the valve 3 will be so disposed that the fuel pressure tends to close this valve as it is done in Fig. 2. It is sufficient for this that the opening of the valve 3 corresponds to a decrease in the volume of the chamber 1 and its closure to an increase of volume. This result is obtained by disposing the valve 3 in such a way that its lifting takes place on the opposite side to the rod which connects this valve to the membrane 5. In this manner, the closure of the valve 3 may take place in case of accidental breakage of the spring 16 or of the rod connecting the valve to the membrane 5.

Besides, as the pressure of the fuel does not tend, as in Fig. 1, to cause the opening of the valve 3, it is useless to increase the strength of the spring 8 and the dimensions of the membrane 7 in the case where the pressure of the fuel may become considerable. This pressure makes itself felt on the entering side of the valve and if this valve be open, it exerts itself also on the membrane 5. The lifting of the valve may then require a rather considerable force. In order to avoid the increase beyond measure of the dimension of the membrane 7, a reduction of the control of the valve 3 is provided by giving to the lever 18 unequal arms, the arm carrying the push 17 being shorter than the opposite arm.

One will preferably avoid that the pulsations which take place in the admission passage are transmitted to the membrane 7 and from it to the valve 3, by giving to the passage 12 which connects the manometric chamber 6 to the admission piping a considerable resistance to the passage of gases. For example a restricted orifice 23 or a series of such orifices will be placed in the passage 12.

The unilateral connection between the diaphragm 7 and the valve 3 may be obtained in many other ways. For example, the rod 9 of Fig. 1 may be interrupted and terminated by a head 25 engaged in a fork 26 carried by a rod 27 solid with the membrane 7, as shown in Fig. 3.

The arrangement of Fig. 2 is not applicable to supercharged engines in which an air compressor placed up-stream of the carburetter ensures the supercharging. In these engines, in fact, it happens that the pressure in the admission neck may be greater than atmospheric pressure. In such circumstances the opening of the fuel needle valve of Fig. 2 would be impossible.

Fig. 4 represents a variation of Fig. 2 in which the external face of the membrane 7 is subjected not to the pressure of the atmosphere but to the pressure existing at the outlet of the air compressor which supercharges the engine. This pressure is transmitted inside the chamber 34 by the passage 35 connected to the outlet of the compressor. The said pressure makes itself felt then equally on the external face of the membrane 5 instead of the atmospheric pressure, the effect of which is generally to decrease the difference of pressure between the two faces of the membrane 5 which is bathed internally by the fuel on its way to the engine.

In Fig. 5 the carburetor is indicated at 36 and is provided with a throttle valve 37 and an air intake 38. The air intake 38 is fed by a supercharger 39. The mixture formed in the carburetor passes to the motor (not shown) through the admission conduit 40. The whole of the device shown in cross section in Fig. 4 is designated in Fig. 5 by reference numeral 41. The fuel enters through pipe 2 and is delivered through pipe 4 which leads to the outlet or nozzle structure 42 opening into the mixing chamber. Pipe 35 connects the chamber 34 with the air intake 38, while pipe 12 connects the chamber 6 with the admission conduit 40.

The controlling device according to the invention is not necessarily situated in the immediate vicinity of the engine. It can be remote from the engine, and it will be for example within reach of the pilot.

Further, in the engines comprising several groups of cylinders supplied respectively by separate carburetters, there is provided a control of the feel of the whole of the carburetters by a single device.

What I claim is:

1. In a device for controlling the fuel supply of an internal combustion engine, a fuel chamber, a fuel passage in the said fuel chamber, a valve for controlling said fuel passage, a membrane being a part of the wall of the said fuel chamber, a connection between said valve and said membrane, manometric means having a unilateral connection with said membrane and said valve for operating the opening of the valve only, a light spring loading said valve for causing the return of the latter to the closed position, a predetermined play existing in the said unilateral connections when the engine stops.

2. In a device for controlling the fuel supply of an internal combustion engine comprising a suction manifold and a fuel supply line, a fuel chamber inserted in said fuel supply line, a fuel passage in the said fuel chamber, a valve for controlling said fuel passage, a membrane being a part of the wall of the said fuel chamber, a connection between said valve and said membrane, manometric means distinct from said membrane

and actuated by the pressure in said suction manifold and having a connection with said membrane and said valve.

3. In a device for controlling the fuel supply of an internal combustion engine comprising a suction manifold and an air intake, a fuel chamber, a fuel passage in the said fuel chamber, a valve for controlling said fuel passage, a membrane being a part of the wall of the said fuel chamber, a connection between said valve and said membrane, manometric means actuated by the difference between the pressure which exists in said suction manifold and the pressure which exists in the said air intake and having a connection with said membrane and said valve.

4. In a device for controlling the fuel supply of a supercharged engine comprising a suction manifold, a carburetter with an air intake and a supercharger supplying the said air intake, a fuel chamber, a fuel passage in the said fuel chamber, a valve for controlling said fuel passage, a membrane being a part of the wall of the said fuel chamber, a manometric means actuated by the difference between the pressure which exists in said suction manifold and the pressure which exists in the said air intake and having a connection with said membrane and said valve.

5. In a device for controlling the fuel supply of an internal combustion engine comprising a suction manifold, a fuel chamber, a fuel passage in the said fuel chamber, a valve for controlling said fuel passage, a membrane being a part of the wall of the said fuel chamber, a connection between said valve and said membrane, manometric means comprising a manometric chamber, a passage connecting said manometric chamber and said suction manifold and adapted to oppose a great resistance to the passage of the gases, a connection between said manometric means and said membrane and said valve.

6. In a device for controlling the fuel supply of an internal combustion engine comprising a suction manifold, a chamber, two membranes in said chamber dividing the latter in three compartments, an air passage to the middle compartment comprised between the two said membranes, a fuel passage in another compartment, a valve for controlling said fuel passage, a fuel inlet and a fuel outlet connected to the said other compartment on either side of the said valve, a passage for connecting the third compartment with the said suction manifold, a spring for loading the membrane separating the said middle compartment and the said third compartment, connections between said membranes and said valve.

7. In a device for controlling the fuel supply of a supercharged engine comprising a suction manifold, a carburetter with an air intake and a supercharger supplying the said air intake, a chamber, two membranes in said chamber dividing the latter in three compartments, a passage for connecting the middle compartment comprised between the two said membranes with said air intake, a fuel passage in another compartment, a valve for controlling said fuel passage, a fuel inlet and a fuel outlet connected to the said other compartment on either side of the said valve, a passage for connecting the third compartment with the said suction manifold, a spring for loading the membrane separating the said middle compartment and the said third compartment, connections between said membranes and said valve.

LOUIS LÉON VIEL. 180