May 8, 1934. A. E. BERDON 1,957,754

FUEL PUMPING SYSTEM FOR INTERNAL COMBUSTION ENGINES

Filed May 20, 1929 2 Sheets-Sheet 1

Fig. 1.

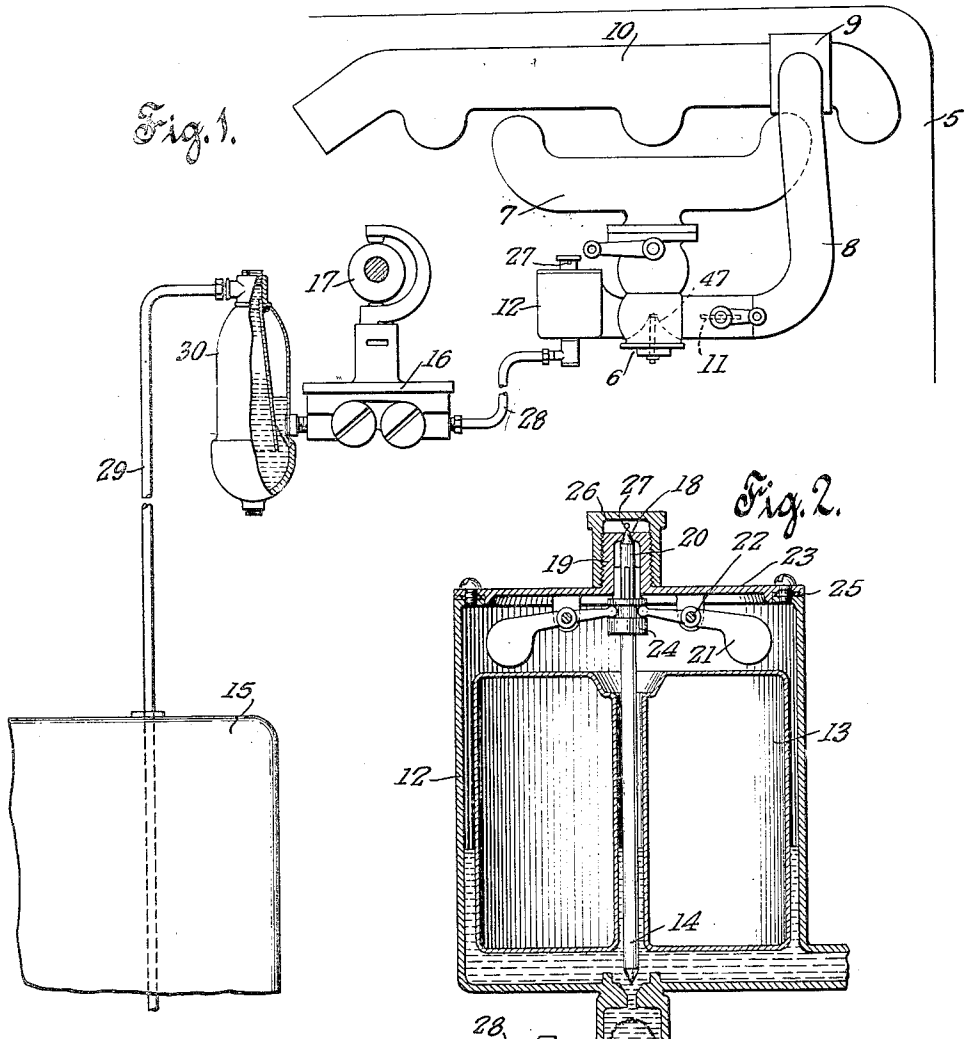
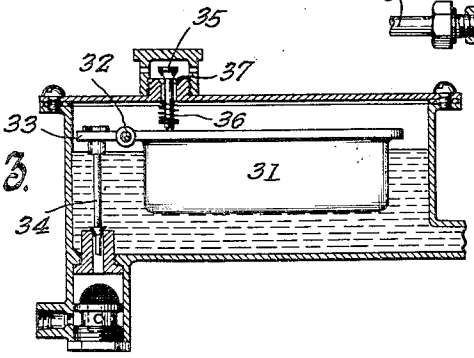



Fig. 2.




Fig. 3.




INVENTOR.
Albert E. Berdon
BY
Philip L. McLean, ATTORNEY

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Filed May 20, 1929 2 Sheets-Sheet 2

Fig. 4.

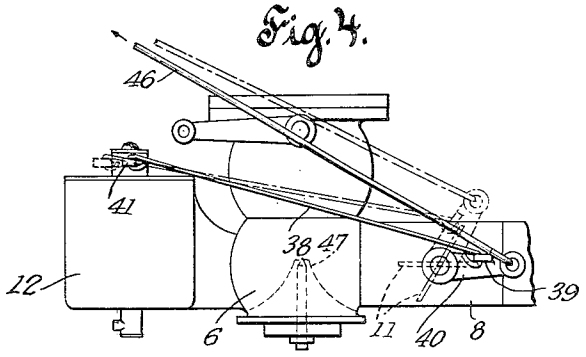



Fig. 5.

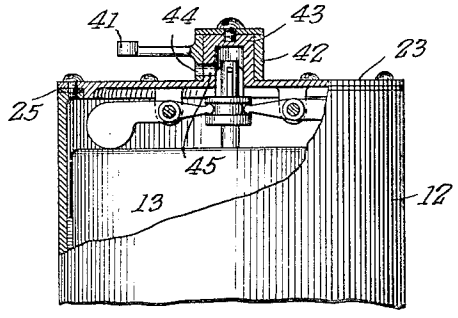
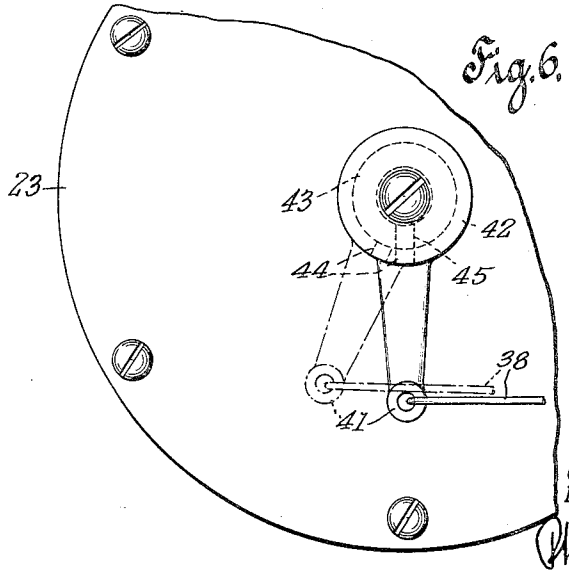



Fig. 6.




INVENTOR.
Albert E. Berdon
BY
Philip S. McLean ATTORNEY

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# UNITED STATES PATENT OFFICE

1,957,754

## FUEL PUMPING SYSTEM FOR INTERNAL COMBUSTION ENGINES

Albert E. Berdon, Detroit, Mich., assignor to A C Spark Plug Company, Flint, Mich., a company of Michigan

Application May 20, 1929, Serial No. 364,613

9 Claims. (Cl. 123—132)

In liquid fuel supply systems for internal combustion engines, it is desirable that the pump be capable of supplying the ultimate maximum demand of the engine or fuel consuming device. The usual practice is to provide a pump having a maximum pumping ability equal to or greater than the maximum demand of the consuming device.

A practical objection to this is the necessity for a larger or more powerful pump than is required for normal or ordinary operating conditions and one whose maximum functions will never be utilized if the fuel consuming device is never operated at maximum capacity.

A special object of the present invention is to enable the use of a smaller size pump than has heretofore been considered practicable, for instance, of a size just equal to supplying the normal or ordinary demands of the engine.

The attainment of this object is effected by automatically cutting into service the pumping effect of the engine, when required, to augment the efforts of the pump.

Other novel features of the invention, including details of construction, combinations and relations of parts will appear as the specification proceeds.

The drawings accompanying and forming part of this specification illustrate certain embodiments of the invention, but it should be understood that the structure may be modified and changed, without departure from the true spirit and scope of the invention as hereinafter defined and broadly claimed.

Figure 1 is a broken side elevation and partly diagrammatic view illustrating the application and operation of the invention in connection with an internal combustion engine.

Figure 2 is an enlarged vertical sectional view of the carburetor bowl, float valve and automatically closing vent valve for sealing the carburetor bowl and bringing the motor into action as a pump in series with the fuel pump.

Figure 3 is a similar sectional view of a form of the invention embodied in another form of carburetor float valve construction.

Figures 4, 5 and 6 are broken side, vertical sectional and top plan views respectively of a quicker and more positively acting form of the invention.

In Figure 1, the motor block of an internal combustion engine is indicated at 5 and a carburetor for the same is shown at 6, connected with the intake manifold 7. This carburetor is indicated as of typical construction, having an air intake 8 connected with the "stove" 9 on the exhaust manifold 10 and containing a "choke" valve 11. The jet 47 on the carburetor is supplied from the well of liquid in the chamber 12, having the float 13 therein controlling the fuel inlet valve 14.

The fuel is transferred from the supply tank 15 to the float chamber of the carburetor by a pump 16. This pump is indicated as a diaphragm pump positively driven by a cam or eccentric 17 on the cam shaft of the motor, and it is intended that the same be of a size and capacity equal to supplying the normal operating requirements of the engine, but less than equal to the maximum ultimate requirements—that is, a relatively small size fuel pump which will answer all the usual power demands of the engine, but may not be capable of answering the full "choke" requirements of the engine.

To meet the maximum fuel demands, the motor is automatically cut into service as a fuel pump in the first form of the invention by causing the lowering of the float in the fuel chamber to close a vent in the top of said fuel chamber and thus cause the suction of the motor through the medium of the carburetor jet to be applied directly to the fuel line. This vent is indicated in Figure 2 as a valve seat 18 in a hub 19 on the top of the fuel chamber 12 and it is shown as controlled by a valve 20 on the upper end of the stem of the float valve 14. This valve stem which is common to the two valves is shown controlled by the float through levers 21 pivoted at 22 on the under side of the top or cover 23, said levers having radially extending inner ends engaging a collar 24 on the valve stem and outer ends weighted as shown to lift the valve stem and positioned so as to be raised by the float.

The cover 23 is shown secured to the body of the chamber in air tight relation as by means of an interposed gasket 25 and the air vent 18 is shown as protected from dust and moisture by a cap 26 screwed over the hub 19 and having a sufficient number of air passages 27 in the sides of the same.

The float chamber is shown connected with the delivery side of the pump by a pipe line 28 and the intake side of the pump is connected with the supply tank by a feed line 29, in which there may be interposed, a regulator 30 of the type similar to that disclosed in my application, Serial No. 243,781, filed December 31, 1927, for relieving the pump of the inertia of the liquid in the feed line.

Under ordinary or average running conditions, the pump is fully capable of supplying all the fuel

required by the motor and the float therefore operates in the usual way to control the valve 14 and keep the reservoir chamber 12 plentifully supplied with fuel for the carburetor. During these average operating conditions, the float will not fall low enough to close the vent 18, and consequently, the chamber 12 will be open to atmosphere with a resulting free flow of liquid thereinto from the pump, governed, of course, by the float valve and a free flow therefrom to the carburetor. Under severe or maximum fuel requirements, such as result from starting in cold weather with the choke closed, the liquid level in the float chamber will be lowered, as indicated in Figure 2, so as not only to open the float valve, but also to close the air vent. The float chamber under these severe conditions, therefore, is automatically sealed to atmosphere and the suction created in the intake manifold by the pistons is therefore applied indirectly by the carburetor jet to the fuel line, extending from the float chamber back to the delivery side of the pump. The engine, therefore, is made to draw indirectly on the pump. Under the added impetus of suction thus applied to the delivery side of the pump, a greater volume of liquid is passed than would otherwise be possible by the pump action alone, and the additional pumping effort thus applied serves to provide a fluid flow fully equal to the maximum fuel requirements. On return to normal or average fuel requirements, the float again rises until it opens the air vent, automatically relieving the motor suction on the fuel stream and cutting the motor out of series pumping relation with the pump.

The invention is adaptable to different carburetor and pump constructions. As an illustration, in Figure 3 there is shown a float 31 of the lever type pivoted in the float chamber at 32 and having a lever arm 33 positioned to pick up and open the float valve 34 as the float drops. The vent valve 35 in this case is shown as resting directly on the float close to the pivot and as acted on by a light spring 36 so that it will surely follow the float and will close off the air vent at 37 when the float is lowered beyond a predetermined liquid fuel level.

In the form of the invention illustrated in Figures 4, 5 and 6, the closing of the air vent in the float chamber is automatically effected by a direct connection from the choke valve. This connection is shown as a link 38, extending from an eye 39 on the operating arm 40 of the choke valve to a lever arm 41 on a sleeve valve 42 journaled on the hollow boss 43 on top of the float chamber and having a port 44 to register with the vent port 45. It will be noted the parts are related so that when the choke rod or wire 46 is pulled to give the engine the benefit of the "choke", the vent valve will be thrown back, as indicated in the broken lines in Figure 4, so as to change the ports from the registered relation indicated in Figure 5 to the non-registering condition illustrated in the broken lines in Figure 6, thus closing the air vent and enabling the motor to act as a pump, assisting the fuel pump.

A special advantage of the latter form of the invention is that the action is more positive than the float controlled operation and that the ability to furnish a greater fuel supply in effect anticipates the demand. The choking increases the fuel consumption very materially and the arrangement described makes the extra fuel required immediately available without waiting on the lowering of the float in the float chamber. The abnormal demands of the engine are therefore immediately answered and by a relatively simple inexpensive construction which is adaptable to vacuum tank fuel pumping systems, as well as the pump system disclosed.

It will be seen that with this invention, abnormal or maximum fuel demands of the engine are met without "flooding" the carburetor, the amount of fuel drawn into the bowl by the carburetor jet 47, practically equaling that withdrawn by the jet, causing the fuel level in the bowl to continue substantially constant and limited by the jet capacity under influence of the increased draft produced by choking the carburetor air supply or, in an alternative form of the invention, by increasing the jet capacity instead of choking the air. The manual adjustment which thus meets the increased fuel demands of the engine by making the carburetor capable of passing more fuel thus also causes the carburetor to act as an adjunct to the pump so as in conjunction with the pump to furnish as much fuel to the bowl as is withdrawn by the jet. In place of mechanically connecting the choke with the vent valve, the vent might have a pipe connection over to the choke valve which would be automatically closed off in the act of closing the choke valve.

What is claimed is:

1. A liquid fuel pumping system for internal combustion engines, comprising in combination, an internal combustion engine, a liquid fuel supply tank, a feed line extending from the tank to the engine, an engine driven pump in said feed line, a carburetor having a draft passage connected with the intake of the motor and a fuel chamber in communication with said draft passage, said fuel chamber being connected with the delivery side of the pump, a float in the fuel chamber, a valve controlled by said float to govern admission of fuel to the fuel chamber, the fuel chamber having a vent to atmosphere and valve means controlled by the float to automatically close said vent as the liquid level is lowered in the fuel chamber to thereby automatically apply the pumping effort of the engine in series relation with the pump.

2. A liquid fuel pumping system for internal combustion engines, comprising in combination, an internal combustion engine, a liquid fuel supply tank, a feed line extending from the tank to the engine, an engine driven pump in said feed line, a carburetor having a draft passage connected with the intake of the motor and a fuel chamber in communication with said draft passage, said fuel chamber being connected with the delivery side of the pump, a float in the fuel chamber, a valve controlled by said float to govern admission of fuel to the fuel chamber, the fuel chamber having a vent to atmosphere and valve means controlled by the float to automatically close said vent as the liquid level is lowered in the fuel chamber to thereby automatically apply the pumping effort of the engine in series relation with the pump, said pump having a pumping capacity equal to the normal demands of the engine and the engine augmenting the action of the pump when automatically coupled in the series relation described to supply the ultimate maximum fuel demands of the engine.

3. A liquid fuel pumping system for internal combustion engines, comprising in combination, an internal combustion engine, a liquid fuel supply tank, a feed line extending from the tank

to the engine, an engine driven pump in said feed line, a carburetor having a draft passage connected with the intake of the motor and a fuel chamber in communication with said draft passage, said fuel chamber being connected with the delivery side of the pump, a float in the fuel chamber, a valve controlled by said float to govern admission of fuel to the fuel chamber, the fuel chamber having a vent to atmosphere and valve means controlled by the float to automatically close said vent as the liquid level is lowered in the fuel chamber to thereby automatically apply the pumping effort of the engine in series relation with the pump, the carburetor having an air intake and a choke valve for closing said air intake, whereby to apply the full suction force of the engine when automatically coupled in series pumping relation with the pump as described.

4. A liquid fuel pumping system, comprising in combination with an internal combustion engine and a liquid fuel pump operated thereby but of lesser pumping capacity than would ordinarily be provided to meet the maximum fuel requirements of such engine, a carburetor designed to supplement the fuel feeding action of the pump under maximum fuel requirements of the engine and having a draft passage connected with the intake of the motor, an air intake which may be closed off to bring the draft created by the motor to a maximum, a liquid fuel chamber in communication with said draft passage, a valve controlling communication between said fuel chamber and the supply flow from the pump, a float in said fuel chamber arranged to open said valve as the level of liquid is lowered in the chamber, said fuel chamber having a vent which is open to atmosphere when the liquid level in said chamber is normal and a valve controlled by the float to close said vent when the float lowers below a predetermined level in said chamber.

5. In combination with an internal combustion engine and a liquid fuel pump therefor, said pump being operated by said engine and of a size equal to supplying the normal or average fuel requirements but unequal to the ultimate maximum fuel requirements of the engine and means for automatically augmenting the fuel supply to meet the ultimate maximum fuel requirements of the engine, comprising a carburetor for the engine having a draft passage connected with the intake of the motor, a liquid fuel chamber in communication with said draft passage, a valve arranged to control communication between the pump and said fuel chamber, a float in said fuel chamber arranged to open said valve as the liquid lowers in the fuel chamber, said fuel chamber having a vent but otherwise closed to atmosphere and a valve operated by said float to close said vent when the liquid lowers below a predetermined level in the chamber, whereby to completely seal said chamber and thereby to couple the pumping effort of the motor in tandem with the pumping action of the pump.

6. In combination with an internal combustion engine and a liquid fuel pump therefor, said pump being operated by said engine and of a size equal to supplying the normal or average fuel requirements but unequal to the ultimate maximum fuel requirements of the engine and means for automatically augmenting the fuel supply to meet the ultimate maximum fuel requirements of the engine, comprising a carburetor for the engine having a draft passage connected with the intake of the motor, a liquid fuel chamber in communication with said draft passage, a valve arranged to control communication between the pump and said fuel chamber, a float in said fuel chamber arranged to open said valve as the liquid lowers in the fuel chamber, said fuel chamber having a vent but otherwise closed to atmosphere and a valve operated by said float to close said vent when the liquid lowers below a predetermined level in the chamber, whereby to completely seal said chamber and thereby to couple the pumping effort of the motor in tandem with the pumping action of the pump, the fuel inlet valve and the air vent controlling valve being on the opposite ends of the same valve stem and oppositely faced so that movement of the valve stem in each direction will open one valve and close the other.

7. In combination with an internal combustion engine, a continuously operating fuel pump therefor and actuated thereby, a fuel feeding line from the pump to the engine, said line including a fuel chamber having a vent therein and valve mechanism simultaneously operable to automatically close said vent and admit fuel to said fuel chamber.

8. In combination with an internal combustion engine, a carburetor having a fuel jet, a float chamber for supplying said fuel jet and means for increasing the flow at the fuel jet, pump means for furnishing fuel to the float chamber in accordance with the normal or usual demands of the jet, the float chamber having a vent open to the atmosphere during normal operation of the carburetor and means for closing said vent when the flow at the jet is increased beyond the normal capacity of the pump means to thereby enable the pump means to keep the float chamber supplied at substantially the rate at which the jet is withdrawing the fuel.

9. In liquid fuel supply systems, an internal combustion engine, a carburetor therefor, said carburetor having a constant level supply chamber and a jet supplied therefrom, means for increasing the flow at the jet, pump means for furnishing fuel to the supply chamber sufficient to meet the ordinary fuel demands of the engine, said supply chamber having a vent open to the atmosphere during normal fuel demands of the engine and means for automatically closing said vent when the flow at the jet is increased beyond the normal capacity of the pump means to meet abnormal fuel demands of the engine.

ALBERT E. BERDON.