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FUEL SUPPLY SYSTEM FOR INTERNAL-COMBUSTION ENGINES

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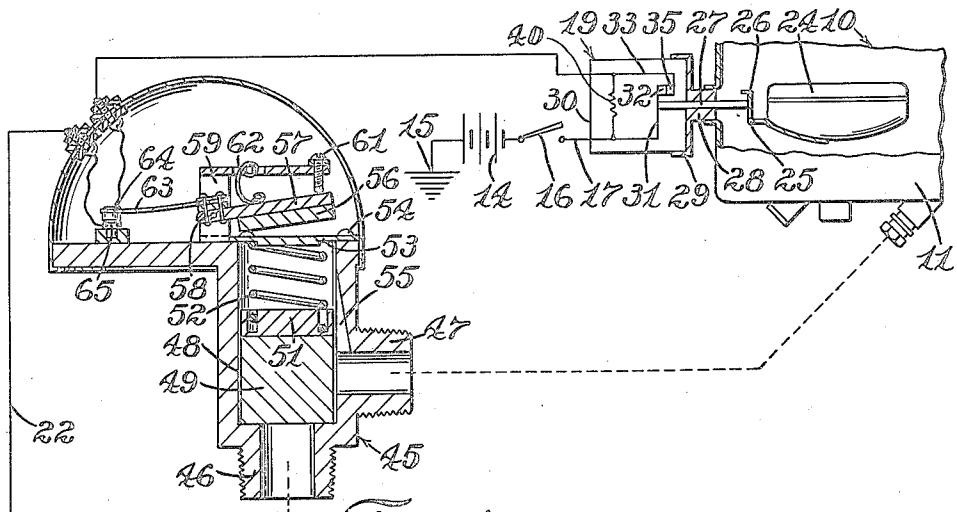
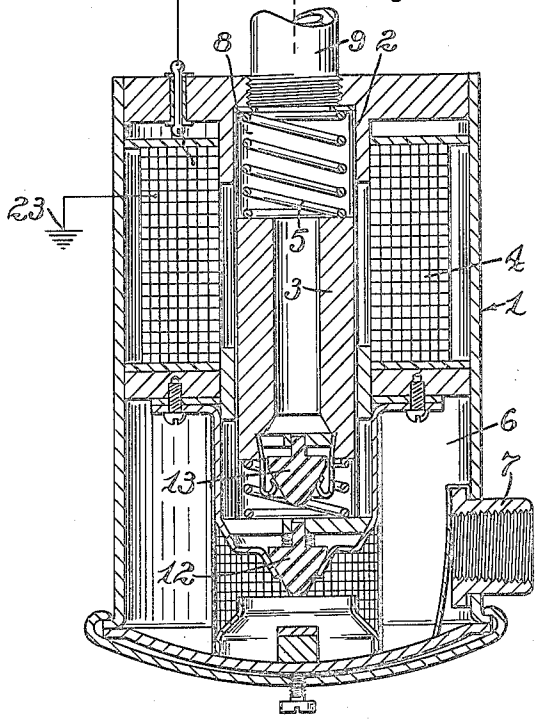


Fig. 1



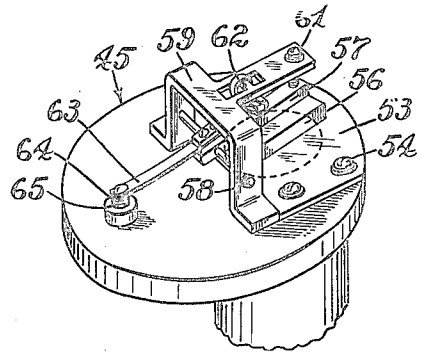


Fig. 2

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FUEL SUPPLY SYSTEM FOR INTERNAL-COMBUSTION ENGINES

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The present invention relates to fuel supply systems for internal combustion engines, and more particularly to such systems employing electromagnetic pumps.

In fuel supply systems as presently used to furnish liquid fuel to the carburetors of internal combination engines, it is customary to employ a pump which is either mechanically or electrically operated to draw fuel from the storage tank and force it under pressure into the carburetor, the level of the fuel in the carbureter bowl being regulated by a float which controls a needle valve in the carburetor inlet.

In order to secure uniform operation of the carburetor it is desirable to maintain the level of fuel in the carburetor bowl as constant as possible. Since, however, the needle valve opens gradually as the float sinks responsive to consumption of fuel by the engine, it is necessary for the pump to be designed to supply to maximum volume of fuel required by the engine at a pressure sufficient to force this volume through the small opening provided by the partially open needle valve. This high pressure, however tends to unseat the needle valve when there is little or no demand for fuel by the carburetor, thus causing the carburetor to flood.

It is an object of the present invention to provide a novel fuel supply system for internal combustion engines which is efficient in operation, economical in construction, and arranged to maintain the level of the fuel in the carburetor bowl with a high degree of accuracy irrespective of variations in the volume of fuel delivered.

It is another object to provide such a device incorporating an electromagnetic pump, and float-actuated means for controlling the energization of the pump.

It is another object to provide such a device in which the supply line from the pump to the carburetor bowl is at all times open and free from obstructions which restrict the flow of fuel therethrough, so that the pump is not required to force the fuel into the carburetor bowl through a small orifice.

It is another object to provide such a device in which the volume of fuel delivered by a stroke of the pump is normally sufficient to actuate the float-operated controlling means, so that during normal operation, actuation of the pump is controlled solely by the float means.

It is another object to provide such a device including further an extraneous controlling means operative to insure continuous reciprocation of the pump at such times as the supply of

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fuel in the carburetor bowl is depleted, such as prior to the initial operation of the engine.

It is a further object to provide such a device in which the extraneous controlling means for causing reciprocation of the pump may be located remote from the pump, at any convenient point along the conduit connecting the pump to the carburetor.

Further objects and advantages will be apparent from the following description taken in connection with the accompanying drawing in which:

Fig. 1 is a semi-diagrammatic illustration of a fuel supply system forming a preferred embodiment of the present invention, the pump and the controlling means being shown broken away and in vertical section; and

Fig. 2 is a detail in perspective of the extraneous controlling means for the pump shown in Fig. 1.

In Fig. 1 of the drawing there is illustrated an electromagnetic pump indicated generally by numeral 1 and comprising a cylinder 2 in which a magnetic piston 3 is arranged to be reciprocated by the successive action of an electromagnet 4 and a return spring 5. The pump 1 is provided with an inlet chamber 6 having an inlet fitting 7 adapted to be connected to a storage tank and an outlet 8 adapted to be connected by a conduit 9 to the bowl 11 of a carbureter indicated generally by numeral 10.

Check valves 12 and 13 are provided within the pump casing and on the piston 3 respectively in order to cause fuel to flow through the pump when the piston is reciprocated.

Means for energizing the electromagnet 4 to cause the piston 3 to discharge fuel from the outlet 8 into the carburetor bowl 11 is provided comprising a battery 14 grounded at 15 and connected through a manual switch 16 and lead 17 to one terminal of a controlling device indicated generally by numeral 19 mounted on the side of the carburetor bowl 11. A second terminal of said control device is connected by a lead 22 to one terminal of the electromagnet 4, the opposite terminal thereof being grounded at 23 to complete the energizing circuit.

Means for controlling the actuation of the pump 1 so as to maintain a constant level of fuel in the carburetor bowl 11 is provided comprising a float 24 hinged at 25 for vertical movement in the bowl, and provided with an arm 26 engaging a pin 27 slidably mounted in a bearing nipple 28 threaded into the carburetor bowl and forming part of the cap 29 of the controlling device 19.

Within the controlling device a spring blade

31 is connected at one end to the battery lead 17 and at its other end carries a contact 32. A second spring blade 33 is rigidly fixed to the interior of the casing 30 of the controlling device and carries on its free end a contact 35 arranged to cooperate with the contact 32. The spring blade 31 is in the path of the end of the pin 27 so that when the pin is moved to the left in the figure by upward movement of the float 24, contact 32 is moved away from the contact 35. A resistor 40 of suitable value, is preferably connected across contacts 32, 35 to reduce sparking between the contacts.

In operation, and starting with the parts in the positions illustrated, with contacts 32, 35 closed, closure of the manual switch 16 completes the circuit from battery 14 through contacts 32, 35, and lead 22 to the electromagnet 4, and from thence through the ground connections 23 and 15 back to the battery. The consequent energization of the electromagnet causes the plunger 3 to rise, compressing the spring 5, and pumping a charge of fuel through the conduit 9 into carburetor bowl 11. This discharge of fuel from the pump is normally sufficient to raise the float 24 in the carburetor bowl sufficiently to move the contact 32 away from the contact 35, thus deenergizing the electromagnet 4 and permitting the spring 5 to return the plunger to its lower position. When this added fuel has been used by the engine so that contact 32 again engages contact 35, the action is repeated, thus maintaining accurately the level of fuel in the carburetor bowl.

If, when the device is initially placed in operation, the carburetor bowl should be empty or substantially depleted of fuel, the single discharge of the pump will be insufficient to raise the float 24 so as to open contacts 32, 35. Means are therefore provided for securing repeated action of the pump in order to initially fill the carburetor bowl with fuel comprising a separate set of contacts actuated by the flow of the fuel from the pump to the carburetor.

As shown, a control element generally designated by numeral 45 is provided comprising an elbow fitting, the inlet 46 of which is connected to the conduit 9, while the outlet 47 is connected to the carburetor bowl 11. The interior of the control element 45 is cylindrical in form, as shown at 48, and a piston 49 is slidably mounted therein. The body of the control member 45 is formed of non-magnetic material, and the piston 49 may be of magnetic material or may, as illustrated, have an armature 51 of magnetic material suitably attached to its upper end.

Yieldable means for normally maintaining the piston 49 in its lower position as illustrated, is provided in the form of a spring 52 of suitable non-magnetic material bearing at its lower end on the piston and at its upper end against a closure plate 53 of non-magnetic material which is suitably attached to the upper end of the cylinder as shown at 54.

The location of the outlet 47 is arranged as illustrated so that when the piston 49 rises, it uncovers the outlet so as to permit substantially unrestricted flow of fuel there-through. A bypass 55 from the upper end of the cylinder 48 to the outlet is provided so as to permit free movement of the piston 49 within the cylinder.

A permanent magnet 56 is suitably mounted on an arm 57 of non-magnetic material which is hinged as shown at 58 to the top of the control element 45. The hinge 58 is mounted in a bracket 59 carrying an adjustable stop member 61 for engaging the free end of the arm 57, and a spring 62 connects the arm and the bracket for yieldably holding said arm against the stop 61. The arm 57 has fixed thereon a blade 63, the free end of which carries a contact 64 which is arranged to engage a fixed contact 65 when the arm 57 is in its normal position against the stop 61. Contacts 64, 65 are connected in series between the float controlled contacts 32, 35 and the lead 22 from electromagnet 4.

In the operation of this device to secure repeated operation of the pump, starting with the parts in the positions shown in Fig. 2, closure of the manual switch 16 completes the circuit through contacts 32, 35 and contacts 64, 65 whereby the electromagnet 4 is energized and draws plunger 3 upward to discharge fuel through the control element 45 into the carburetor bowl 11. The piston 49 is thereby caused to move upward in the cylinder 48, thus bringing the armature 51 into proximity with the permanent magnet 56. The attraction therebetween causes the permanent magnet to swing the arm 57 on its hinge 58 in a clockwise direction thus opening contacts 64, 65 and deenergizing electromagnet 4. Plunger 3 is then returned to its lower position by the spring 5, and since the piston 49 is also returned to its lower position by the spring 52, the magnet 56 is released and the spring 62 recloses contacts 64, 65, thus repeating the actuation of the pump. This operation continues until the level of the fuel in the carburetor bowl is restored to normal whereupon the float 24 opens contacts 32, 35 and thereafter the pump is operated only as fuel is required to maintain the level in the carburetor 8.

It will be appreciated that since the control element 45 is actuated by the flow of fuel through the conduit during the discharge stroke of the pump, said element may be located at any convenient point in said conduit where it is readily accessible for inspection or replacement.

Although but one embodiment of the invention has been shown and described in detail, it will be understood that other embodiments are possible and various changes may be made in the design and arrangement of the parts without departing from the spirit of the invention.

I claim:

1. A fuel supply system for internal combustion engines including a carburetor, a reciprocating electromagnetic pump, a source of electrical energy for actuating the pump and means for controlling the actuation of the pump to maintain a constant level of fuel in the carburetor including a conduit connecting the pump to the carburetor, an electrical circuit including said source and a pair of contacts located adjacent said conduit and in series with said source so that closure of the contacts causes actuation of the pump, and means responsive to flow of fuel through said conduit for opening said contacts; in which the means for opening said contacts includes a cylinder forming part of the conduit, a piston in the cylinder movable by the flow of fuel therethrough, a magnetic member exterior and adjacent to the cylinder, a second magnetic member movable by the piston into proximity with the first magnetic member, and means whereby movement of the first magnetic member by the attraction of the second magnetic member when so moved into proximity thereto causes the first magnetic member to open said contacts.

2. In a fuel supply system for internal combustion engines, a carburetor including a storage

bowl, a float mounted in said bowl with freedom for vertical movement, means including an electromagnetic pump for supplying fuel to the bowl, means for energizing the pump including a pair of contacts, and means so connecting one of said contacts to the float that downward movement of the float caused by subnormal level of fuel in the bowl causes closure of the contacts, and the consequent discharge of fuel into the bowl by the pump normally restores the level of fuel in the bowl and causes the contacts to open, in which the means for supplying fuel to the carburetor bowl includes a conduit connecting the pump to the bowl, and including in series with said pair of contacts, a second pair of contacts located adjacent said conduit which are normally closed, and means for periodically opening and closing said latter contacts so as to cause continuous actuation of the pump as long as the first pair of contacts remains closed, the means for opening and closing the second pair of contacts including an element movable by the flow of fuel through the conduit to open said contacts.

3. In a fuel supply system for internal combustion engines, a carburetor including a storage bowl, a float mounted in said bowl with freedom for vertical movement, means including an electromagnetic pump for supplying fuel to the bowl, means for energizing the pump including a pair of contacts, and means so connecting one of said contacts to the float that downward movement of the float caused by subnormal level of fuel in the bowl causes closure of the contacts, and the consequent discharge of fuel into the bowl by the pump normally restores the level of fuel in the bowl and causes the contacts to open, in which the means for supplying fuel to the carburetor

bowl includes a conduit connecting the pump to the bowl, and including in series with said pair of contacts, a second pair of contacts located adjacent said conduit which are normally closed, and means for periodically opening and closing said latter contacts so as to cause continuous actuation of the pump as long as the first pair of contacts remains closed, the means for opening and closing the second pair of contacts including a cylinder forming part of the conduit from the pump to the carburetor bowl, a piston in the cylinder movable by the flow of fuel therethrough, a magnetic member exterior and adjacent to said cylinder, a magnetic member movable with the piston into proximity to the first magnetic member, and means whereby movement of the first magnetic member caused by the attraction of the second magnetic member when so moved into proximity thereto causes said second pair of contacts to open.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,367,454	Braselton	Feb. 1, 1921
1,631,984	Redmond	June 14, 1927
1,653,885	Van Guilder	Dec. 27, 1927
1,693,114	Heany	Nov. 27, 1928
1,742,948	Chryst	Jan. 7, 1930
1,751,975	Carter	Mar. 25, 1930
1,853,811	Hewitt	Apr. 12, 1932
2,012,005	Hammerly	Aug. 20, 1935