June 9, 1936. F. E. TWISS 2,043,270

PUMP

Filed Dec. 22, 1934 2 Sheets-Sheet 1

Fig. 1.

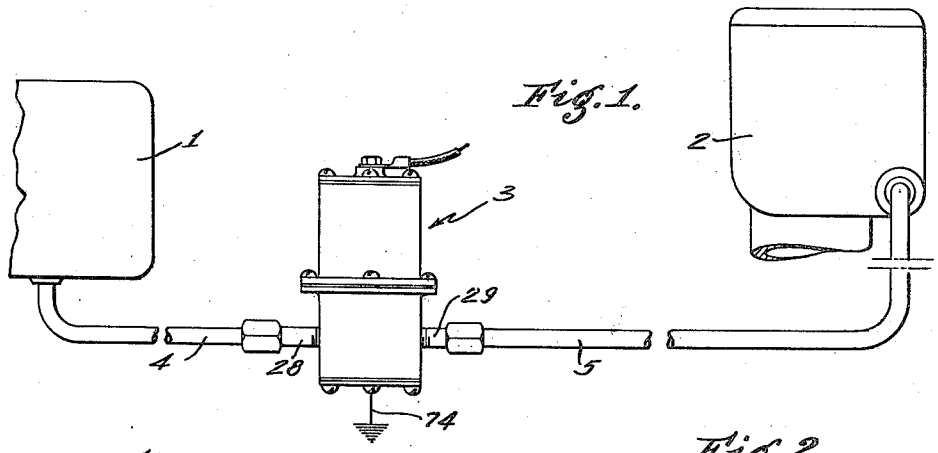


Fig. 3.

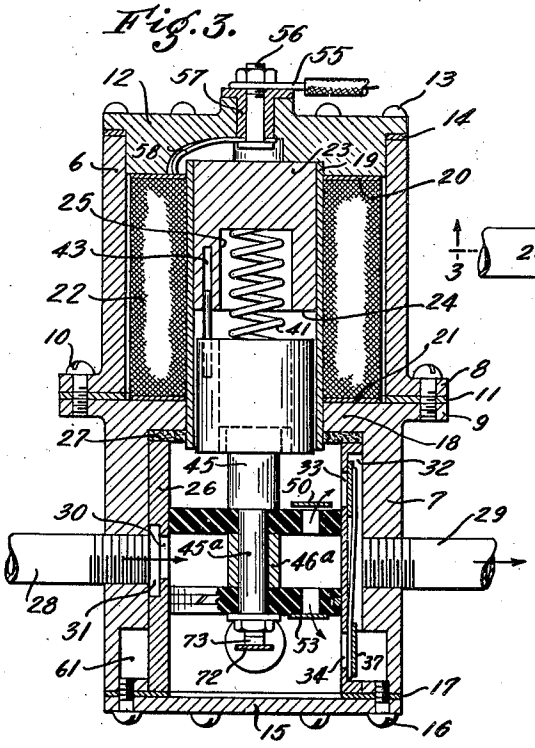


Fig. 2.

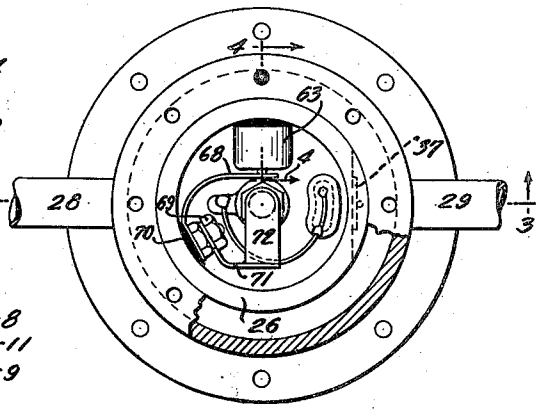


Fig. 4.

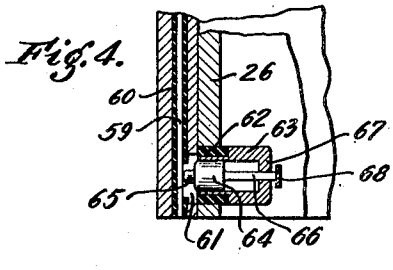
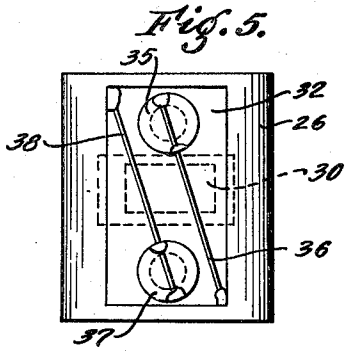


Fig. 5.



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June 9, 1936. F. E. TWISS 2,043,270

PUMP

Filed Dec. 22, 1934 2 Sheets-Sheet 2

Fig. 6.

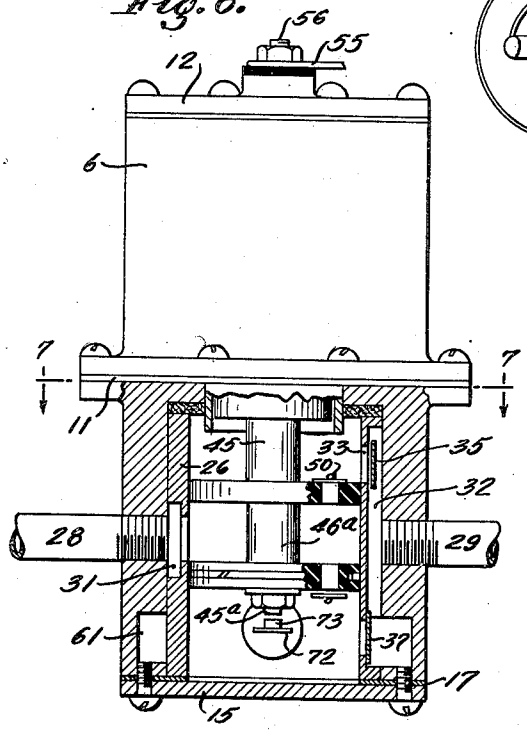


Fig. 11.

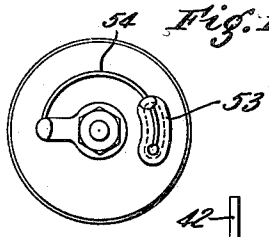


Fig. 9.

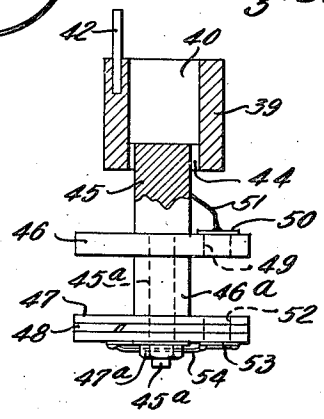


Fig. 10.

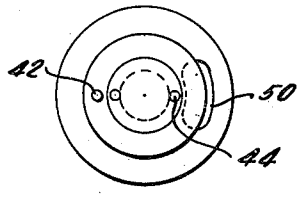


Fig. 7.

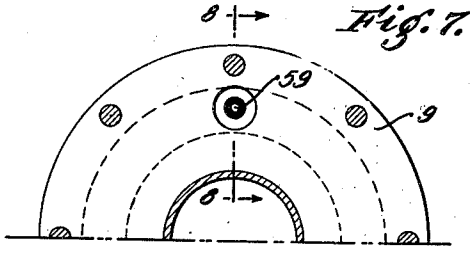


Fig. 12.

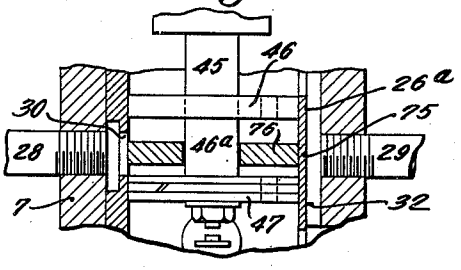
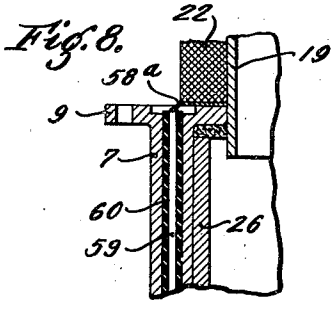


Fig. 8.



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UNITED STATES PATENT OFFICE

2,043,270

PUMP

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Application December 22, 1934, Serial No. 758,803

21 Claims. (Cl. 103—53)

This invention pertains to pumps, for example, pumps for supplying liquid fuel to internal combustion engines, and relates more particularly to an electromagnetically actuated pump of the reciprocating or vibrating type.

It has heretofore been proposed to employ a pump of reciprocating piston type for supplying gasoline to an internal combustion engine located at a level higher than that of the fuel tank, but in practice it has been found that, by reason of the high volatility of the liquid fuel, the reduction in pressure during the suction stroke of the pump results in the formation of vapor in the supply line and seriously interferes with the desired uninterrupted delivery of the liquid fuel to the carbureter. A motor supplied with fuel under such conditions tends to skip or misfire due to the interrupted fuel supply. To avoid the above difficulty it is proposed, in accordancce with the present invention, to provide a pump device so located and designed that it exerts substantially no suction effect upon the liquid fuel,—the pump being disposed with reference to the fuel tank so as to receive fuel from the latter under pressure, for instance by gravity flow, and being so constructed as at each stroke of the piston to deliver the fuel in a solid stream under positive pressure.

In most previous pumps of this type, the piston delivers fuel only while moving in one direction, but in accordance with the present invention the pump and associated parts are so designed that the piston forces fuel into the delivery pipe when moving in both directions. This arrangement makes it possible to deliver a given quantity of fuel by the use of apparatus of small size and compact construction, and whose moving parts are so small and light that little energy is lost in moving them.

Heretofore it has been customary to design electromagnetically operated fuel feed pumps to run at a substantially constant speed sufficient to supply fuel for maximum requirements of the engine, and thus it frequently happens, in starting or when the engine is idling, that the supply of fuel is excessive, causing flooding of the carbureter with subsequent difficulty in starting or loss of fuel after the engine starts. In accordance with the present invention the feed pump is so designed as to cease operation automatically as soon as the proper amount of fuel has been delivered to the carbureter, and automatically to resume operation when the fuel level at the carbureter drops below a predetermined point. Thus the proper supply of fuel for efficient operation of the motor, whether in starting, idling or at maximum speed is always assured.

These and other advantages and objects of the invention will be more fully set forth in the appended detailed description and by reference to the accompanying drawings in which

Fig. 1 is a diagrammatic elevation, partly broken away, illustrating the improved fuel pump in association with a fuel tank and the carbureter of an internal combustion engine;

Fig. 2 is a bottom plan view, to larger scale, of the improved pump, with certain parts removed or broken away;

Fig. 3 is a vertical section, substantially on the line 3—3 of Fig. 2;

Fig. 4 is a fragmentary vertical section substantially on the line 4—4 of Fig. 2;

Fig. 5 is a side elevation of the pump cylinder removed from the casing,—look toward the outlet side of the cylinder;

Fig. 6 is a side elevation, partly in vertical section on substantially the same plane as that of Fig. 3, but showing the pump piston in a different position;

Fig. 7 is a fragmenarry horizontal section on the line 7—7 of Fig. 6;

Fig. 8 is a fragmentary vertical section substantially on the line 8—8 of Fig. 7;

Fig. 9 is a side elevation, partly in vertical diagrammatic section, of the pump piston removed from the cylinder;

Fig. 10 is a plan view of the parts as shown in Fig. 9;

Fig. 11 is a bottom plan view of the parts shown in Fig. 9; and

Fig. 12 is a fragmentary vertical section, on substantially the same plane as Fig. 3, illustrating a modified construction.

Referring to the drawings, the numeral 1 designates a fuel supply tank, for example, that of an automobile, and the numeral 2 designates a receptacle to which the fuel is to be delivered from the tank,—for example, the carbureter of an internal combustion engine. The improved feed pump 3 is interposed between the fuel tank and the carbureter and is connected to the tank by the conduit 4 and to the carbureter by the conduit 5. As illustrated, the lower part of the pump 3 is disposed below the level of the bottom of the tank 1, so that liquid fuel will flow from the tank 1 through the pipe 4, under the action of gravity, to the intake of the pump.

The improved pump has a casing (Fig. 3) preferably comprising the upper cylindrical member 6 and the lower cylindrical member 7. These

parts are connected, for example by the provision of radial attaching flanges 8 and 9 respectively, which are united by bolts 10 preferably with an interposed packing washer 11. While this form of casing is desirable, it is contemplated that the pump parts may be housed within a casing of any other and appropriate form, as may be desired.

The upper section 6 of the pump casing is provided with a removable cover 12, secured to the casing by means of bolts or screws 13, preferably with an interposed washer 14. The lower end of the casing section 7 is normally closed by a cover member 15, removably secured in place by means of bolts or screws 16 and with interposed packing 17.

The upper part of the section 7 of the casing is preferably furnished with an inwardly directed annular flange 18 which forms a support for the magnet spool. This magnet spool preferably comprises a tubular barrel portion 19 preferably of nonmagnetic material, having spaced heads 20 and 21 between which are wound coils 22 of magnet wire. The lower head 21 of the magnet spool rests directly on the flange 18, although it is contemplated that the spool may be otherwise supported within the casing if preferred.

The barrel 19 of the magnet spool is preferably closed at its upper part by a core member 23 of magnetic material, for example, cast iron, which may be secured in position in any desired manner within the barrel, and whose lower end 24 is preferably substantially midway the length of the barrel. The lower end of this core member 23 is furnished with an axial bore 25.

The lower section 7 of the casing of the pump houses the tubular pump cylinder 26 whose upper end preferably bears against an annular packing washer 27 engaging the lower surface of the flange 18, and whose lower end rests against the packing 17 and is held in place by the cover member 15. This cylinder 26 is preferably of brass, bronze or other appropriate bearing material, suitable for sliding contact by the reciprocating piston.

The lower section 7 of the casing is furnished with a screw-threaded opening for the reception of the pipe 28 forming a part of the conduit 4 leading from the fuel tank 1, and with a second screw-threaded opening, preferably diametrically opposite that which receives the pipe section 28, for the reception of a pipe section 29 forming a part of the conduit 5 leading to the carbureter. The pump cylinder 26 is furnished with an inlet port 30, coaxial with the pipe 28. Preferably the outer surface of the cylinder has a recess 31 somewhat greater in area than the port 30, to form a chamber into which the fuel flows from the pipe 28 on its way to the port 30.

At its diametrically opposite side, the pump cylinder 26 is slabbed off to provide an outlet chamber 32 into which open a pair of ports 33 and 34 respectively, leading from the interior of the pump cylinder. A valve 35, carried by and normally held in closed position by a spring 36, cooperates with the port 33, while a valve 37, carried by and normally held in closed position by a spring 38, cooperates with a port 34.

The pump piston (Fig. 9) comprises a guide plunger 39 which is made of some magnetic material, for example, cast iron, and which constitutes the armature of the magnet comprising the windings 22 and core 23 above described. This plunger 39 preferably has an axial bore 40 at its upper end which receives the lower end of a compression spring 41 (Fig. 3) the upper end of which is housed in the bore 25 of the fixed core member 23. This spring tends to push the plunger 39 with its associated piston structure downwardly. In order to prevent the plunger from turning about its vertical axis, it is furnished with a pin 42 which slides in an elongated socket 43 in the core member 23. Preferably, the plunger is provided with one or more openings 44 (Fig. 9) leading from its lower end up into the bore 40, so as to permit free escape of any fluid which might leak into the space above the plunger.

From the lower end of the plunger extends a stem member 45 having a downward extension 45^a of lesser diameter, thus forming a shoulder against which seats the upper piston disk 46. A spacer sleeve 46^a surrounds the extension 45^a below the disk 46, and forms an abutment for a second piston disk 47 spaced from the disk 46, and which is held against the sleeve 46^a by means of a nut 47^a having screw-threaded engagement with the lower end of the extension 45^a, the latter extending slightly below the nut for a purpose hereafter to be described. The piston disks 46 and 47 are of any appropriate material, for example hard fiber, and may be furnished with packing rings of any suitable type, for example, a split expansible ring, such as shown at 48.

The upper piston disk is furnished with a valve port 49 with which cooperates a valve 50 supported by and normally held in closed position by a spring 51. The lower valve disk 47 is also furnished with a port 52 with which cooperates a valve 53 supported by and normally held in closed position by a spring 54.

An electrical conductor wire 55 (Fig. 3), leading from the storage battery of the automobile or other source of electrical current, is secured to the upper end of a binding post 56 which passes down through an insulating sleeve 57 in a bore in the cover 12. To the lower end of this binding post is connected one extremity 58 of the magnet coils 22. The opposite end 58^a (Fig. 8) of the magnet coils 22 is connected to a conductor 59 disposed within an insulating sleeve 60 arranged in a vertical bore within the thickness of the wall of the lower section 7 of the casing. The conductor 59 extends down nearly to the lower end of the casing section 7, at which point the latter is furnished with a circumferentially extending recess or channel 61 which at one point opens into the bore which receives the insulated conductor 59 and at the opposite side of the casing opens into the chamber 32. Within this recess 61 the insulation 60 is broken away to expose the conductor 59. At a point directly opposite to the exposed part of conductor 59 the cylinder member 26 is furnished with an opening which receives an insulating sleeve 62 (Fig. 4) which, in turn, supports a housing 63 having a cylindrical bore in which slides a plunger 64. At its outer end this plunger has a projection 65 normally in electrical contact with the exposed conductor 59. At its inner end the plunger 64 is furnished with an elongate stem 66 which slides in a guide opening in the head 67 of the casing 63, and bears against a spring contact member 68. This spring contact member (Fig. 2) is secured to an insulated binding post 69 which projects into the interior of the pump cylinder 26, the spring 68 being insulated from the latter by suitable insulation 70. A bracket 71 is also mounted on the binding post 69 and is in electrical circuit with the spring contact member 68. The bracket 71 carries a spring finger 72 which extends toward the center of the pump cylinder and which

supports a contact member 73 (Fig. 3) disposed in axial alignment with the projecting lower end of the extension member 45a of the piston structure. The casing of the pump device is grounded by a conductor 74 (Fig. 1) to the automobile frame, or connected directly, if desired, to the other pole of the battery or other source of electrical supply.

In Fig. 12 a slight modification of the above structure is illustrated, wherein the pump cylinder 26a is provided with a fixed septum member 76 disposed between the upper and lower piston disks 46 and 47, respectively. This septum 76 is held in fixed position against the shoulder 75, by means of screws or pins (not shown). It will be noted that the fixed septum 76 is disposed substantially midway vertically of the diameter of the inlet port 30.

Referring to Figs. 1 to 11 inclusive, and assuming that the pump device 3 is located as shown in Fig. 1 so that liquid fuel will flow from the tank 1 by gravity through the conduit 4 and pipe section 28 into the chamber 31, and further, assuming that the conductor 55 is connected to a suitable source of electrical energy, the liquid fuel will flow through the port 30 into the inlet chamber between the upper and lower piston disks. Assuming that the piston device is in the position indicated in Fig. 3, with the lower end of the member 45a in contact with the member 73, an electrical circuit is then completed from the conductor 55 through the wire 58, the coils 22 of the magnet, the wire 58a, the conductor 59, the plunger 64, the spring contact 68, the bracket 71, the contact 73, the member 45a, and thence through the metal of the plunger 39 to the cylinder and casing of the pump device and thence back through the conductor 74 to the source of electrical energy. As soon as this circuit is thus completed the magnet coils are energized and the plunger 39 is immediately drawn upwardly in opposition to the spring 41. As this movement of the piston structure is extremely rapid the inertia of the liquid fuel within the inlet chamber between the piston disks will cause some of the fuel to press against the lower valve 53, thus opening the latter so that the fuel flows down into the discharge chamber beneath the lower piston disk. As the piston rises, the contact is broken between the parts 73 and 45a so that the circuit is broken, the magnet is deenergized, and the spring 41 immediately drives the piston down again. During this down stroke the inertia of the liquid fuel in the inlet chamber between the disks causes the fuel to raise the valve 50 and flow upwardly into the discharge chamber above the disk 46. These operations are repeated until the space above the disk 46 and space below the disk 47 are substantially filled with liquid fuel whereupon at each vibration of the piston structure, in one direction or the other, fuel is forced out through the ports 33 and 34 respectively, and into the delivery chamber 32, whence it passes through the pipe 49 and conduit 5 to the carburetor. As the vibration of the piston structure is extremely rapid, and as fuel is forced out into the delivery conduit at each movement of the piston both up and down, a substantially constant stream of fuel is fed to the carbureter.

The operation as above outlined continues until the fluid level in the carbureter has reached a predetermined point corresponding to a predetermined fluid pressure within the recess 61. When this pressure is exceeded the plunger 64 is forced inward, thus immediately breaking the electrical circuit between the conductor 59 and the projection 65 of the plunger. The pump thus stops automatically and does not resume operation until the fluid pressure, resulting from the height of the liquid column above the pump, has dropped sufficiently to permit the plunger 64 to move outwardly and thus again complete the circuit between the parts 59 and 65.

Since the points at which the circuit is broken are located within chambers which are completely filled with liquid fuel, no danger need be apprehended that an explosion may be caused by sparking at these points.

While the arrangement above described is very desirable and preferable under ordinary conditions for internal combustion engine practice, and wherever the supply of fuel may be arranged above the lower part of the pump structure, there may be same instances in which it is desired to produce an actual suction effect to draw the fuel into the pump chamber. For this purpose the arrangement shown in Fig. 12 may be preferred. In this device the fixed septum 76 provides for inlet chambers of varying capacity below the piston 46 and above the piston 47, respectively. Thus as the piston structure rises, fuel contained within the space between the disk 47 and the septum 76 will be positively expelled through the port in the disk 47, while at the same time a substantial suction effect will be produced in the space above the septum 76 by reason of the increasing volume of the chamber between parts 76 and 46. The operation of this modified construction is in other respects similar to that of the arrangement heretofore described at greater length.

While I have herein illustrated a desirable embodiment of the invention and a modification thereof, together with desirable details, I wish it to be understood that the invention is not limited to this specific construction, but that it is to be regarded as including all equivalents and rearrangements of parts such as fall within the scope of the appended claims.

I claim:

1. In combination with an electrically actuated fuel pump having a rigid elongate casing with motor means fixedly secured in one end of the casing, pumping means within the other end of the casing, and a conduit arranged to lead fuel from the pump to the carbureter of an internal combustion engine, said casing having a discharge chamber in the end in which the pumping means is located, and means including relatively movable parts within the discharge chamber operative in response to a predetermined fluid pressure automatically to break the motor actuating circuit when the fluid level in the carbureter reaches a predetermined point.

2. In combination with an electrically actuated pump of the vibrator type having the rigid, substantially cylindrical casing with motor means fixedly secured in one end of the casing, pumping means within the other end of the casing and a delivery conduit arranged to lead fluid from the pump to a container, a pressure actuated piston independent af the pumping means, but disposed within the same end of the casing as the latter, said piston being operative to move automatically in response to a predetermined pressure in the delivery conduit to break the motor actuating circuit and a spring within the casing normally opposing such movement of the piston.

3. In combination in an electrically actuated pump of the vibrator type having an elongate

rigid enclosing casing, motor means fixed within one end of the casing, pumping means within the opposite end of the casing, said latter end of the casing being provided with a delivery chamber for the reception of fluid delivered by the pumping means, a movable pressure responsive part within the casing, said pressure responsive part being movable independently of the pumping means and being exposed to the pressure in the delivery chamber, means actuable by said pressure responsive member, when the pressure in the delivery chamber rises to a predetermined value to break the motor actuating circuit, and spring means opposing movement of said pressure responsive means.

4. A fuel feed pump for delivering liquid fuel from a supply tank to the carbureter of an internal combustion engine, said pump having an elongate, substantially cylindrical rigid casing having fuel inlet and delivery openings at substantially the same distance from one end of the casing, an electromagnetic coil fixed within the other end of the casing, pumping means within the first named end of the casing, said pumping means including a reciprocating piston, an armature connected to the piston and arranged to be actuated by the fixed coil, circuit making and breaking means mechanically connected to and moving with the pump piston and arranged automatically to break the coil circuit when the piston nears one end of its stroke, other circuit making and breaking means including a pressure responsive element movable independently of the pump piston and disposed within the casing, said pressure responsive element being operative, when the fuel attains a predetermined level in the carbureter, automatically to break the circuit through the coil and to reestablish the current when the fuel at the carbureter has fallen to a predetermined level.

5. In combination in an electrically actuated pump of the vibrator type having a rigid enclosing casing, motor means fixed therein, pump mechanism which as a whole always occupies the same position in the casing, said pump mechanism including a reciprocating piston structure, the casing having therein a delivery chamber, a conductor forming a part of the motor actuating circuit exposed within a part of said chamber, a contact member normally engaging said exposed conductor, and a movable pressure responsive element exposed to the pressure of the fluid in the delivery chamber and operative, when the pressure therein attains a predetermined value, to separate the movable contact from the conductor thereby to break the motor circuit.

6. A self-contained pump of the class described comprising a substantially fluid-tight enclosing casing having therein all of the essential parts of the pump including a pump cylinder closed at its ends, a reciprocating piston arranged to slide in the cylinder, said piston having spaced ends and having an inlet chamber between its ends to which fluid is admitted through a port in the cylinder wall, the spaces between the ends of the cylinder and the respective ends of the piston constituting discharge chambers, valved ports arranged to admit fluid to flow from the inlet chamber to the respective discharge chambers but not in the reverse direction, valved ports arranged to permit fluid to flow outwardly from the respective discharge chambers but not in the reverse direction, electromagnetic motor means within the casing, said motor means including an armature forming a part of the piston structure, and a circuit making and breaking device, within the enclosing casing, including a part mechanically connected to and movable with the piston structure.

7. A self-contained pump of the class described comprising an enclosing casing having therein all of the essential parts of the pump including a pump cylinder closed at its ends, a reciprocating piston arranged to slide in the pump cylinder, said piston having spaced ends and having an inlet chamber between its ends to which fluid is admitted through a port in the cylinder wall, the spaces between the ends of the cylinder and the respective ends of the piston constituting discharge chambers, valved ports arranged to admit fluid to flow from the inlet chamber to the respective discharge chambers but not in the reverse direction, valved ports arranged to permit fluid to flow outwardly from the respective discharge chambers but not in the reverse direction, and motor means within the enclosing casing normally operative to reciprocate the piston structure with great rapidity.

8. A self-contained pump of the class described comprising an enclosing substantially fluid-tight casing having therein all of the essential parts of the pump including a pump cylinder closed at its ends, a reciprocating piston structure, said structure including a pair of axially spaced disks having sliding contact with the cylinder wall, the space between the disks constituting an inlet chamber to which fluid is admitted through a port in the cylinder wall, the spaces between the ends of the cylinder and the respective disks constituting discharge chambers, valved ports arranged to admit fluid to flow from the inlet chamber to the respective discharge chambers but not in the reverse direction, valved ports arranged to permit fluid to flow outwardly from the respective discharge chambers but not in the reverse direction, an electromagnet having a tubular barrel closed at one end by a fixed core, a plunger sliding within the other end of the barrel, said plunger constituting a part of the piston structure and also forming the armature of the magnet, and means within the enclosing casing operative automatically to make and break the electrical circuit through the magnet.

9. A self-contained pump of the class described comprising a substantially cylindrical and substantially fluid-tight enclosing casing having therein all of the moving parts of the pump, a pump cylinder within the casing, means closing the ends of the cylinder, a reciprocating piston structure, said structure including a pair of axially spaced disks having sliding contact with the cylinder wall, the space between the disks constituting an inlet chamber to which fluid is admitted through a port in the cylinder wall, the spaces between the ends of the cylinder and the respective disks constituting discharge chambers, valved ports arranged to admit fluid to flow from the inlet chamber to the respective discharge chambers but not in the reverse direction, valved ports arranged to permit fluid to flow outwardly from the respective discharge chambers but not in the reverse direction, an electromagnet fixed within the casing and having a tubular barrel supporting conductor coils, a core member disposed within one end of the barrel, a plunger sliding within the other end of the barrel, a compression spring interposed between the core and plunger and tending to force the plunger away from the core, the plunger constituting an armature for the magnet and also

being a part of the piston structure, and means within the enclosing casing operative automatically to make and break the electrical circuit through the magnet coils.

10. A self-contained pump of the class described comprising substantially fluid-tight enclosing casing having therein all of the operative parts of the pump including a pump cylinder closed at its ends, a reciprocating piston structure, said structure including a pair of axially spaced disks having sliding contact with the cylinder wall, the space between the disks constituting an inlet chamber to which fluid is admitted through a port in the cylinder wall, the spaces between the ends of the cylinder and the respective disks constituting discharge chambers, valved ports arranged to admit fluid to flow from the inlet chamber to the respective discharge chambers but not in the reverse direction, valved ports arranged to permit fluid to flow outwardly from the respective discharge chambers but not in the reverse direction, an electromagnet comprising a spool having a tubular barrel coaxial with the pump cylinder, conductor coils wound upon the spool barrel, a fixed core of magnetic metal disposed within one end of the barrel, a plunger sliding within the other end of the barrel, said plunger constituting an armature for the magnet and also being a part of the reciprocating piston structure, a normally fixed contact, in electrical circuit with the magnet coils, disposed in the path of a movable contact actuated by the piston structure, and means normally operative to supply electrical energy to said magnet coils when the contacts are engaged.

11. A self-contained fuel feed pump for delivering liquid fuel from a supply tank to the carbureter of an internal combustion engine, said pump comprising an enclosing casing having therein all of the moving parts of the pump, an electromagnet in one end of the casing, said magnet having an axial guideway, a pump cylinder in the other end of the casing, a piston structure in the cylinder, said piston structure including a guide member sliding in the guideway in the magnet, a circuit making and breaking element carried by the piston structure, a resilient contact engageable by said circuit making and breaking element as the piston nears one end of its path of reciprocation in the cylinder, said circuit making and breaking element and the contact, when in engagement, completing an electrical circuit through the magnet coils, and auxiliary means within the casing operative to break the magnetic circuit under predetermined conditions independently of the position of the piston structure in the cylinder.

12. The combination with the carbureter of an internal combustion engine and a fuel tank located at a point below the level of the carbureter, of a self-contained electromagnetic force pump of the vibratory piston type located at such a point as to receive fuel from the tank solely by the action of gravity, said pump having a substantially fluid tight elongate casing, motor means fixed within one end of the casing, pumping mechanism disposed within the other end of the casing, said pumping mechanism including a reciprocating piston normally operative to deliver fluid under pressure to the carbureter, and movable means, independent of said piston, disposed within the casing and operative, in response to a predetermined fluid pressure at the discharge of the pump, automatically to stop the operation of the pump actuating motor means.

13. In combination with a fuel supply tank and a container located at a level higher than that of the tank, a self-contained fuel pump device located to receive fuel by gravity flow from the supply tank and to deliver it to the container, said pump having a substantially fluid-tight enclosing casing housing all of the operating parts of the pump including a reciprocating piston structure comprising a pair of piston disks spaced to provide an inlet chamber between them into which fluid flows freely from the supply tank, each disk having a valved port through which fluid from the inlet chamber may flow outwardly but not in the reverse direction, means to conduct fluid, which flows through said ports, to the container, motor means within the casing operative rapidly to vibrate the piston structure, and pressure responsive means within the casing operative automatically, when the fuel level reaches a predetermined height in the carburetor, to stop the delivery of fuel to the carburetor.

14. In combination with a fuel supply tank and a container located at a level higher than that of the tank, a self-contained fuel pump device located to receive fuel by gravity flow from the supply tank and to deliver it to the container, said pump having an enclosing substantially fluid-tight casing having therein a reciprocating piston structure comprising a pair of piston disks spaced to provide an inlet chamber between them into which fluid flows freely from the supply tank, each disk having a valved port through which fluid from the inlet chamber may flow outwardly but not in the reverse direction, means defining discharge chambers into which flows fluid which passes through said ports, a valved outlet passage for each discharge chamber through which fluid may flow outwardly but not in the reverse direction, means for conducting fluid which flows outwardly through said passages to the container, and piston motor actuating means within the enclosing casing operative rapidly to reciprocate the piston structure, and motor control means carried by the piston structure.

15. A self-contained fuel pump of the class described comprising a substantially fluid-tight enclosing casing having therein all of the operative parts of the pump, a cylinder in one end of the casing, a piston structure sliding therein, said piston structure comprising a pair of spaced disks, each disk having a port therethrough, a valve normally closing each of said ports, the cylinder having an inlet opening through its wall at a point intermediate said disks through which fluid may flow into the space between the disks, the cylinder having outlet ports adjacent to its opposite ends, outwardly opening valves normally closing each of said outlet ports, motor means, including a part fixed in the other end of the casing, operative to reciprocate the piston, and control means moving with the piston for controlling the motor means.

16. A self-contained fuel pump of the class described comprising a substantially fluid-tight enclosing casing having therein a cylinder having an inlet port at a point substantially midway of its length, a piston structure comprising a pair of axially spaced pistons arranged to slide in the cylinder, the inlet space between the pistons always communicating with the inlet port, means closing the ends of the cylinder thereby to define discharge chambers between such ends and the piston disks respectively, the cylinder having a delivery port leading from each of said discharge

chambers, each piston disk having a port therethrough, a valve cooperating with each of the latter ports, said valves opening by movement away from the inlet space between the disks and normally closed valves cooperating with the respective delivery ports, said latter valves opening by movement outwardly from the respective discharge chambers, motor means within the enclosing casing for moving the piston, and means mechanically connected to and moving with the piston structure for controlling the motor means.

17. In a self-contained pump of the class described including an enclosing, substantially fluid tight casing having therein piston actuating motor means, a cylinder, a piston structure sliding in the cylinder and comprising a pair of axially spaced piston disks, each disk having a valve port therethrough, a valve cooperable with each of said ports, the valves being disposed at the outer faces of the respective disks, and a spring supporting each valve and urging its respective valve toward port closing position, a conduit extending through the wall of the enclosing casing and communicating with the space between the pistons, the enclosing casing having a delivery chamber therein, valved ports leading from the opposite ends of the cylinder into said delivery chamber, and a conduit leading from the latter chamber out through the wall of the enclosing casing.

18. In a pump of the class described a pump cylinder having an inlet port disposed substantially midway between its ends, the outer surface of the cylinder, diametrically opposite to the inlet port, being slabbed off to provide a substantially flat surface, the cylinder having a pair of delivery ports, adjacent to its opposite ends, respectively, at its slabbed-off portion, a valve cooperable with each of said delivery ports, said valves normally engaging the aforesaid flat surface, and spring means urging the respective valves toward port-closing position.

19. A self-contained fuel feeding pump mechanism for delivering liquid fuel from a supply tank to the carbureter of an internal combustion engine, said pump mechanism comprising a substantially fluid-tight enclosing casing having therein all of the essential operating parts of the pump mechanism including motor means, a reciprocating piston structure and inlet and outlet valves, the piston structure comprising axially spaced disks, and a fixed septum interposed between the disks, the parts being so constructed and arranged as to exert both a suction and a forcing action upon the liquid as the piston structure moves in each direction, motor control means within the casing including a part which moves with the piston structure, and other motor control means within the casing operative under predetermined conditions to stop the motor independently of the position of the piston.

20. A self-contained electromagnetically actuated pump comprising a substantially fluid-tight enclosing casing having therein all of the essential parts of the pump including a cylinder and a vibrating piston structure, the latter comprising a pair of axially spaced piston disks, valves for controlling the flow of fluid through the pump, and means within the enclosing casing for vibrating the piston structure, the parts being so constructed and arranged that the piston structure exerts both suction and forcing action upon the fluid while moving in each direction in the cylinder.

21. A self-contained fuel pump of the class described having a substantially fluid-tight casing enclosing all of the essential parts of the pump, said casing having therein a cylinder and means closing each end of the cylinder, a fixed transverse annular septum substantially midway of the length of the cylinder, a piston structure comprising a pair of spaced disks having sliding contact with the cylinder wall, the disks being disposed at opposite sides of the septum, a stem member passing through the septum and uniting the disks, means providing for inlet of fluid into the inlet chambers defined between the steptum and the respective disks, each disk having a valved port through which fluid may flow outwardly from the respective inlet chamber but not in the reverse direction, valved ports leading from the discharge chambers defined between the respective disks and the adjacent ends of the cylinder, said latter ports permitting fluid to flow out from the discharge chambers but not in the reverse direction, a common delivery chamber into which fluid flowing through said latter ports is delivered, a conduit leading from the delivery chamber, means within the enclosing casing operative to reciprocate the piston structure in the cylinder, and means within the casing operative automatically to stop the delivery of fluid when the pressure in the delivery chamber reaches a predetermined amount.

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