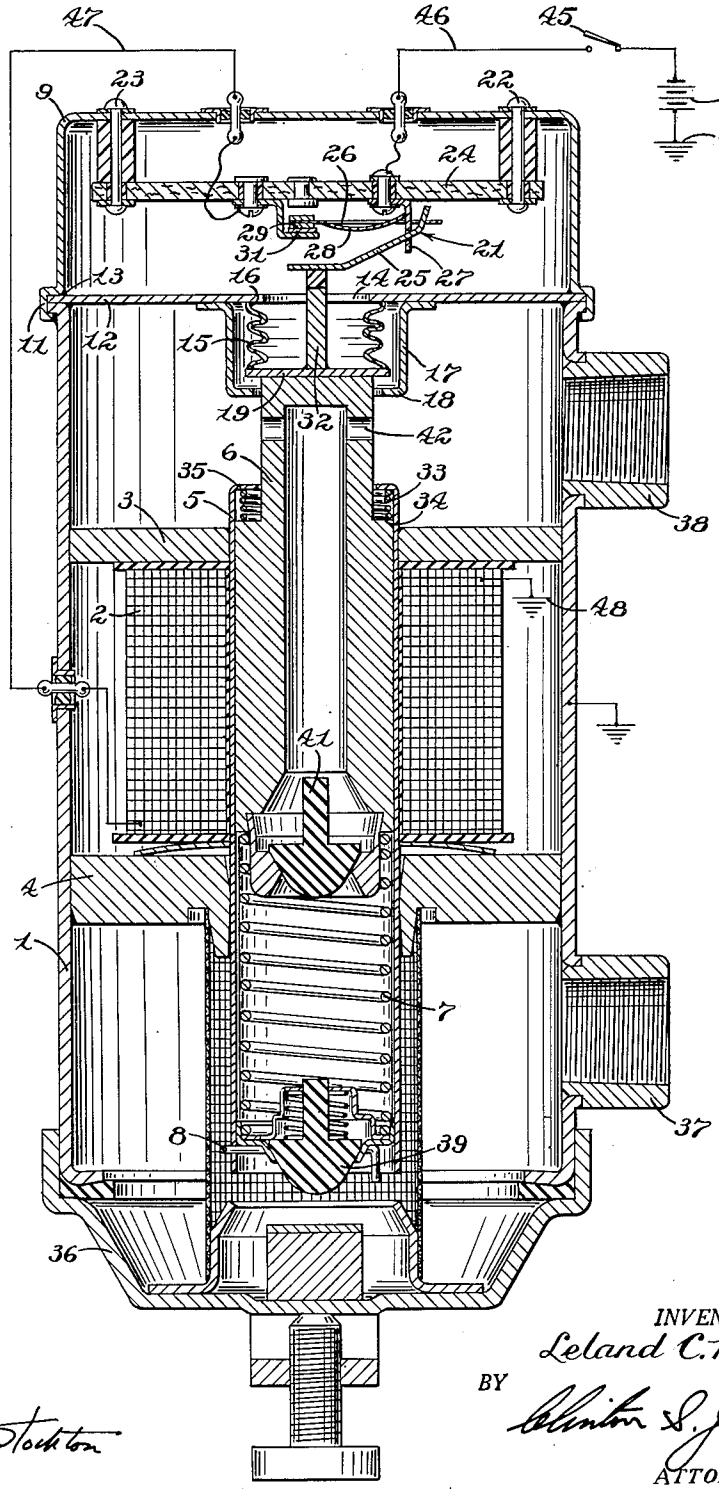
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RECIPROCATING ELECTROMAGNETIC MOTOR

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RECIPROCATING ELECTROMAGNETIC MOTOR

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The present invention relates to a reciprocating electromagnetic motor, and more particularly to an electromagnetic plunger pump.

Motors of the above general class incorporating magnetic actuation of the switch mechanism controlling the electromagnet, such for instance as illustrated in the patent to Dickey et al. 2,472,067, issued June 7, 1949, have been found to be very satisfactory for supplying liquid fuel to carburetors for internal combustion engines, stoves, space heaters etc. Some attempts have been made in the interest of economy and simplicity to substitute a direct mechanical connection for the magnetic switch actuating means, such as shown for instance in the patent to Miller 2,461,501, issued February 8, 1949, but these structures have entailed considerable alteration of the pump structure and limited the interchangeability of parts.

It is an object of the present invention to provide a novel reciprocating electromagnetic motor in which the switching mechanism controlling the operation of the motor is actuated mechanically by the reciprocating member of the motor.

It is another object to provide such a device in which the switching mechanism is located in a separate sealed chamber readily replaceable as a unit.

It is another object to provide such a device which is arranged to employ a commercial form of snap switch in the switching mechanism.

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

The figure is a vertical mid-sectional view of a preferred embodiment of the invention, the electrical circuit elements being shown diagrammatically.

In the drawing there is illustrated a generally cylindrical casing 1 in which a solenoid 2 is coaxially mounted by means of annular pole pieces 3 and 4. A non-magnetic cylinder 5 is fixedly mounted within the solenoid 2 and a hollow magnetic piston 6 is slidably mounted in the cylinder 5 and urged toward its upper or idle position by means of a spring 7 retained in the lower end of the cylinder by suitable means including a lock ring 8.

A cap member 9 is mounted on the upper end of the casing 1 with a fluid-tight joint 11 so as to provide a closure for this end of the casing. A diaphragm 12 is rigidly attached to the rim of the cap 9 as shown at 13, and has a central orifice 14 which is closed by a flexible cup-shaped bellows 15 having a fluid-tight connection 16 to the diaphragm so that the interior of the cap 9 constitutes a hermetically sealed chamber.

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The bottom 19 of the bellows extends into proximity to the upper end of the piston 6, the expansion of the bellows being limited by a bracket member 17 fixed to the diaphragm 12 and having a flange 18 in the path of movement of the bottom of the bellows.

A snap switch indicated generally by numeral 21 is attached to the top of the cap 9 in spaced relation thereto as by means of rivets 22, 23 attached to the base 24 of the switch. An actuating lever 25 for the contact carrying arm 26 of the switch is pivotally mounted on the base 24 by means of a bracket 27 and extends into proximity to the opening 14 in the diaphragm 12. A spring 28 normally maintains the switch contacts 29, 31 open, but snaps them closed when the operating lever 25 is moved upwardly. Means are provided for actuating the switch lever 25 to close the switch contacts upon compression of the bellows 15 in the form of a plunger 32 attached to the bottom 19 of the bellows and extending into engagement with the free end of the switch lever.

The attachment of switch 21 to the top of the cap 9, free from the side wall of the cap prevents the switch from being affected by any flexure of the wall which may occur when the rim of the cap is crimped over the top of casing 1 as shown at 11.

In the normal or idle position of the motor parts, the spring 7 presses the piston 6 against the bottom 19 of the bellows 15 so as to partially compress the bellows and thereby actuate the switch lever 25 to close the switch as illustrated. The upward movement of the piston is limited by a buffer spring 33 bearing on a shoulder 34 of the piston and retained in the upper end of the cylinder 5 by a lip 35 on said cylinder.

The lower end of the casing 1 is closed by a removeable cap 36, and the casing is provided with an inlet 37 and an outlet 38. A check valve 39 is mounted in the lower end of cylinder 5, and a check valve 41 in the lower end of piston 6, whereby reciprocation of the piston causes liquid to enter the inlet 37 and to be discharged through openings 42 in the upper end of the piston to the outlet 38.

An electrical system for energizing the pump is provided comprising a battery 43 grounded at 44 and connected through a manual switch 45 and lead 46 to the moveable contact 29 of the switch 21. The fixed contact 31 of the switch

is connected by a lead 47 to one terminal of the solenoid 2, the opposite terminal of which is grounded at 48 to complete the operating circuit.

Starting with the parts in the positions illustrated, closure of the manual switch 45 causes energization of solenoid 2 which draws the piston 6 downward thus releasing the bellows 15. The expansion of the bellows releases the switch lever 25 thus allowing switch 21 to open and deenergize the solenoid. Spring 7 then expands, raising the piston to its upper position, and causing reclosure of the switch contacts. Continuous reciprocation of the piston is thus maintained as long as the switch 45 is closed and discharge of the liquid pumped through the opening 38 is permitted by the device thereby supplied with fuel.

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

I claim:

1. In an electromagnetic pump a cylindrical casing having an inlet chamber and an outlet chamber, a solenoid fixed coaxially therein intermediate said chambers, a non-magnetic cylinder fixedly mounted in the solenoid, a magnetic piston slidably mounted in the cylinder, a hermetically sealed cap closing the outlet

chamber of the casing having a diaphragm with a central orifice, a cup-shaped flexible bellows closing the orifice and extending into proximity to the adjacent end of the piston, means for energizing the solenoid including a normally-open snap switch having an operating lever extending into proximity to the orifice in said diaphragm, spring means urging the piston against the bottom of the bellows to compress the bellows, and means connected to the bottom of the bellows for actuating the switch lever to close the switch responsive to such compression of the bellows.

2. An electromagnetic pump as set forth in claim 1 including further means for limiting the expansion of the bellows.

3. An electromagnetic pump as set forth in claim 1 including further means for rigidly attaching the switch mechanism to the top of the cap free from the side wall of the cap.

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