

May 6, 1958

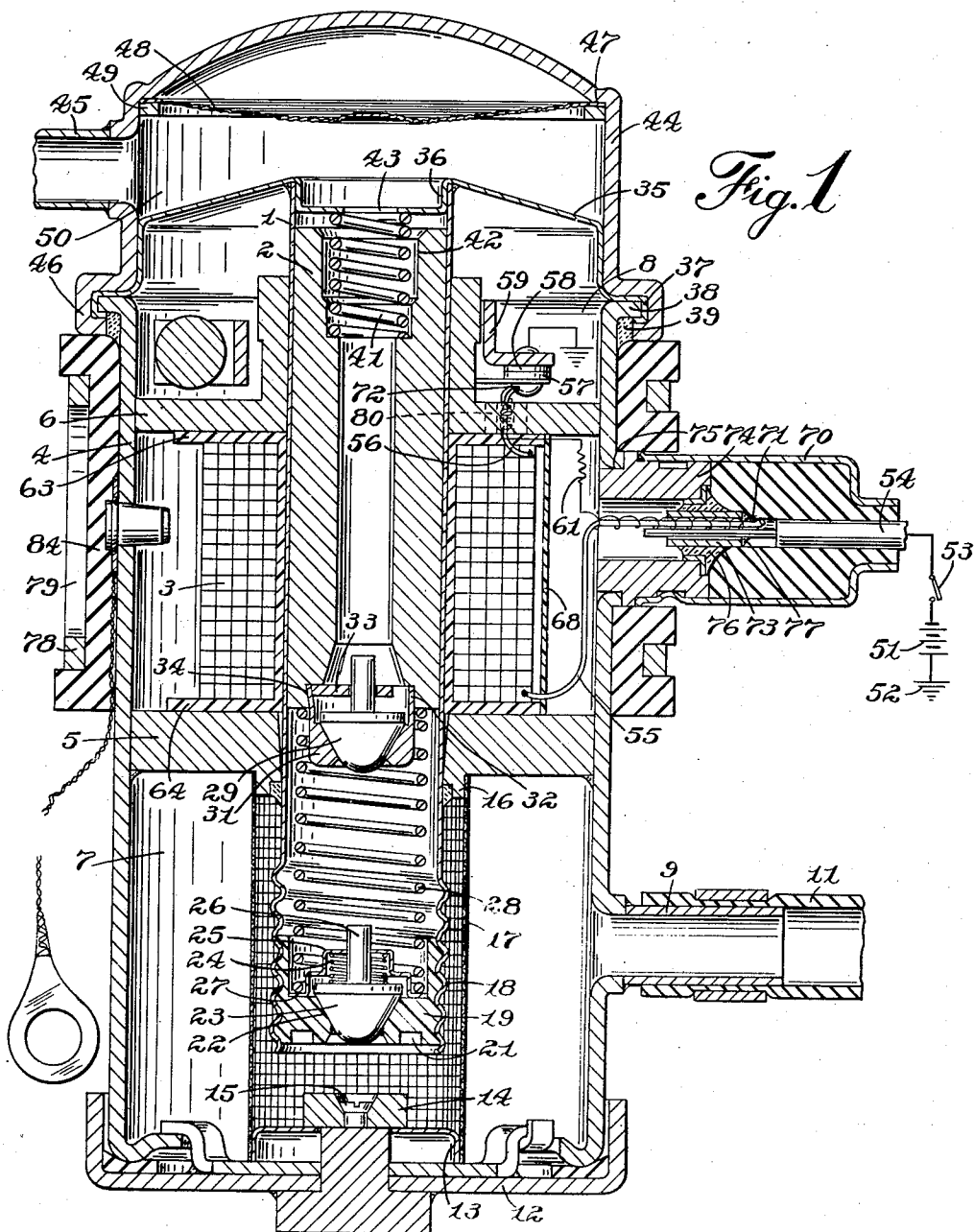
J. W. DICKEY

2,833,221

ELECTRO-MAGNETIC PLUNGER PUMP

Filed Oct. 27, 1954

2 Sheets-Sheet 1



WITNESS:

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2 Sheets-Sheet 2

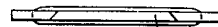
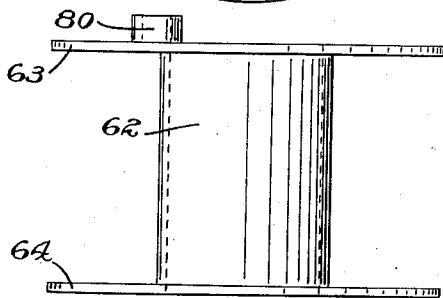
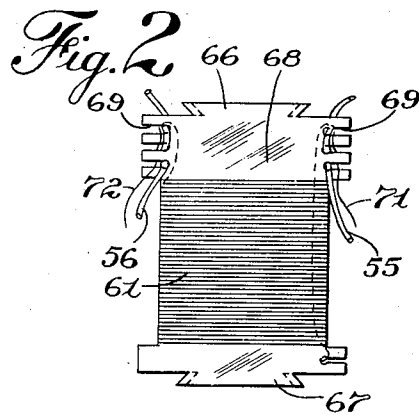
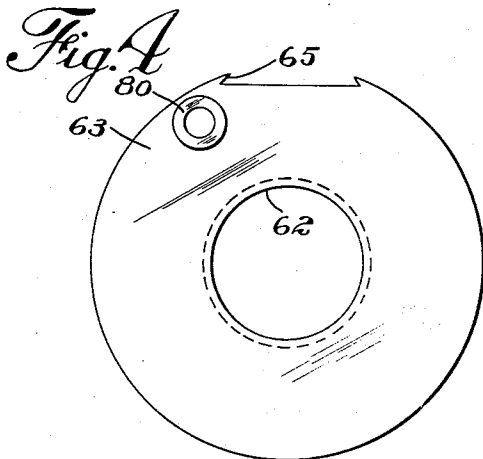
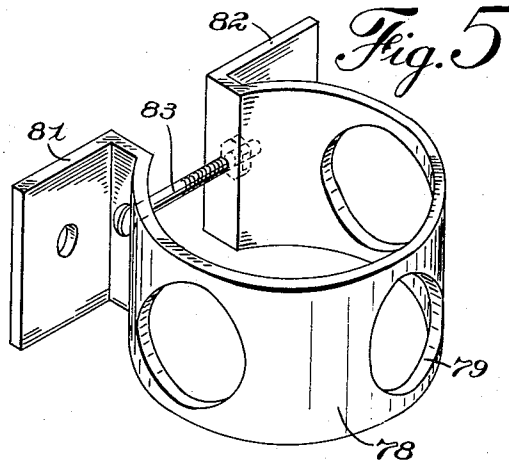
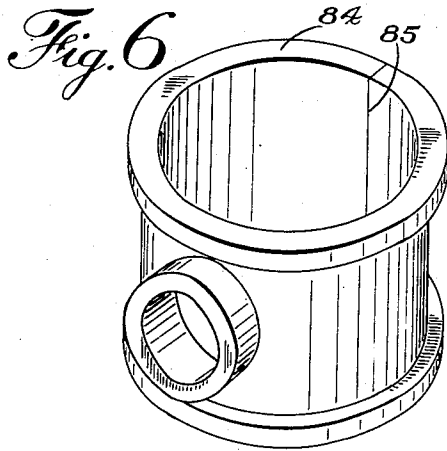


Fig. 2a

Fig. 3

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ELECTRO-MAGNETIC PLUNGER PUMP

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5 Claims. (Cl. 103—53)

The present invention relates to an electro-magnetic plunger pump and more particularly to a reciprocating spring-actuated piston pump for transferring liquids.

This invention is an improvement on the pump disclosed in the patent to Dickey et al. 2,472,067 by incorporation therein of a number of novel features which cooperate to secure the objective of a pump which is of simple and economical design, and is readily assembled by methods which insure permanently tight joints free from leakage or contamination.

It is another object to provide such a device which is adapted for easy installation in various positions and attitudes.

It is another object to provide such a device incorporating convenient means for adjusting the output pressure of the pump.

It is another object to provide such a device which is hermetically sealed by a soldering operation in which there is no possibility of solder or flux gaining access to the interior of the pump.

It is another object to provide such a device including an air dome chamber which may be sealed and tested prior to assembly on the pump.

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

Fig. 1 is a vertical substantially mid-sectional view of a preferred embodiment of the invention, parts of the electrical circuit being shown diagrammatically;

Fig. 2 is a detail in elevation of the shunt resistor element;

Fig. 2(a) is an end view of the core for the same;

Fig. 3 is a side elevation of the spool for holding the solenoid coil;

Fig. 4 is a top view of the same;

Fig. 5 is a detail in perspective of the mounting clamp for the pump; and

Fig. 6 is a perspective detail of the elastically deformable sleeve embracing the pump within the mounting bracket.

In Fig. 1 of the drawing there is illustrated a hollow cylinder 1 of suitable non-magnetic material within which a hollow magnetic piston 2 is slidably mounted. An electro-magnet 3 surrounds the cylinder and piston and is mounted coaxially within a cylindrical casing 4 of magnetic material by means of annular pole pieces 5 and 6 at the ends thereof. The casing 4 extends beyond the pole pieces 5 and 6 to provide an inlet chamber 7 and an interrupter chamber 8, and the non-magnetic cylinder 1 extends at its ends beyond the pole pieces 5 and 6 into the inlet and interrupter chambers respectively.

The inlet chamber 7 is provided with an inlet nipple fitting 9 for attachment of hose 11, and is closed by a detachable cap 12 which carries a mounting cup member 13 on which a permanent magnetic collector element 14 is suitably fixed as indicated at 15. The pole piece 5 is formed with a shoulder 16 having the same diameter as the mounting cup 13, and a cylindrical filter

17 is frictionally mounted at its ends on said cup member and shoulder to thereby filter the incoming liquid prior to its entry into the pump cylinder 1.

The input end of the cylinder 1 is internally threaded as shown at 18, and a valve nipple 19 is threaded into the cylinder for longitudinal adjustment therein, which may be facilitated by the provision of spanner sockets 21 in its lower end. Nipple 19 is formed with a tapered valve seat 22 against which a check valve plunger 23 is pressed by a valve spring 24 which is maintained under slight compression by a cup-shaped spider member 25 forming a guide for the valve stem 26 and having a flange 27 seated in a counter-bore in the nipple 19.

A compression spring 28 is located within the lower end of the pump cylinder 1, resting on the flange 27 of spider 25 and bearing at its upper end on the lower end of the piston 2 whereby said spring biases the piston toward the discharge end of the cylinder as illustrated. A second check valve 29 is retained on the lower end of the piston 2 by means of a seat member 31 having a skirt 32 which is expanded into an undercut counter-bore in the end of said piston. This is conveniently accomplished by introducing a spider guide member 33 which is originally of dished formation, and flattening it out in order to expand said skirt at circumferentially spaced points as illustrated at 34.

A cup-shaped partition member 35 is provided with a centrally located cylindrical shoulder 36 which is forced into the upper end of the cylinder 1 and preferably soldered or brazed thereon in order to form a tight seal. The rim 37 of the partition member 35 is spun over a lip 38 on the upper end of the casing member 4 and is soldered thereto as indicated at 39 to form a closure for the interrupter chamber 8. A buffer spring 41 is preferably located in a counter-bore 42 in the upper end of piston 2 and bears against the partition member 35 adjacent a central opening 43 therein, to cushion the reciprocation of the piston at times when it may be operated while the pump is empty.

A domed cap member 44 provided with an outlet nipple fitting 45 is mounted on the outlet end of the casing 4 by bending its rim 46 over the lip 38 of the casing and soldering the joint as shown at 39 simultaneously with the attachment of the partition member 35. The cap 44 is formed with an annular shoulder 47, and an impervious circular flexible diaphragm 48 is seated on said shoulder and maintained in sealed connection therewith by means of a sealing ring 49 having a press fit against said shoulder, thereby forming an output chamber 50 in said cap between the partition 35 and diaphragm 48.

In the manufacture of the pump, the diaphragm 48 is mounted and sealed in the cap member 44 prior to assembly of the cap, so that the tightness of the seal may conveniently be tested while disassembled. Assembly is then accomplished by seating the partition member 35 and cap 44 in nested relation on the lip 38 of casing 4, and crimping the edges thereof around said lip as shown. This operation makes a tight joint even without the solder seal, whereby any possibility of solder or flux entering the pump during the soldering operation is prevented.

Means for energizing the solenoid 3 intermittently to cause reciprocation of the plunger 2 is provided comprising a battery 51 which is grounded at 52 and connected through a switch 53 and cable 54 to one terminal lead 55 of the solenoid. The other terminal lead 56 is connected to a fixed contact 57 which cooperates with a movable grounded contact 58 mounted on a cradle 59 carrying a permanent magnet which causes the cradle to tilt and closes said contacts when the piston 2 approaches the upper end of its stroke. This interrupter mechanism is the

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same in structure and operation as that shown and described in Patent 2,472,067 above referred to, so that further description thereof is deemed unnecessary.

The terminal wires 55 and 56 of solenoid 3 are shunted by a resistor 61 which is preferably constructed as best shown in Fig. 2. The solenoid 3 is mounted on a spool 62 (Figs. 3 and 4) of suitable insulating material having terminal flanges 63, 64 provided with dove-tail notches 65 receiving the complementarily formed ends 66 and 67 of a strip of insulating material 68 forming the core on which the resistor 61 is coiled. The upper end of the mount 68 is preferably provided with slotted recesses 69 forming convenient anchorages for the terminal wires 55 and 56 of the solenoid, as well as for the ends 71 and 72 of the resistor which are wound around said terminal wires and soldered thereto.

In order to form a hermetically sealed connection to the battery cable 54 a metallic tube 73 is sealed within a nipple 74 suitably mounted in a fluid tight manner in an opening 75 in the side of the casing 4. This sealing connection is preferably formed by means of a fused vitreous material as indicated at 76 forming a permanent rigid and leak-proof joint which also insulates the tube 73 from the casing. The end of the cable 54, and the terminal wire 55 with the end 71 of the resistor wound around it are passed through the tube 73 in overlapping relation, and are rigidly sealed together by a single soldering operation as shown at 77. The junction of the battery cable to the pump leads is preferably covered by a weather-proof enclosure 70 in the form of a metallic sleeve with a core of rubber or the like formed around the junction. The opposite terminal wire 56 of the solenoid with the end 72 of the resistor wire wound about it is led through a nipple 80 formed on one end flange 63 of the spool 62, traversing the pole piece 6 and attached by a single soldering operation to the fixed contact 57.

Means are provided for mounting the pump conveniently in the most advantageous relation to the inlet and outlet conduits of any particular installation. For this purpose a clamping bracket 78 (Fig. 5) is formed as a band for surrounding the body of the pump having a plurality of openings 79 for alternatively receiving the nipple 74 to thereby permit three optional orientations of the pump. The bracket 78 is formed with laterally extending feet 81, 82 for attachment to a fixed support in any suitable manner, and is clamped to the pump by a bolt 83 or the like.

In order to insure quietness of operation a flanged split bushing 84 of elastically deformable material is preferably interposed between the bracket 78 and the body of the pump.

In installing the device, the bracket 78 is applied to the pump with the cushioning sleeve 84 contained therein, in such position as to orient the pump most conveniently to the input and output conduits, thus reducing the necessity for angular pipe fittings. It will be understood that the bracket is sufficiently elastic to be expanded as necessary for the insertion of the nipple 74 in the selected opening 79. The sleeve 84 may be sufficiently elastic to be applied by stretching but if desired may be slit as indicated at 85 to permit its application to the pump.

After the pump has been mounted and the tubular and electrical connections completed, closure of switch 53 causes energization of electro-magnet 3 which accordingly draws the plunger 2 downwardly compressing the spring 28 until the contact 58 is permitted to move away from the fixed contact 57. The spring 28 then actuates the piston on its discharge stroke, at the end of which contacts 57, 58 are again closed. The fluctuations of pressure in the output chamber 50 are cushioned by the air dome provided by the diaphragm 48.

Adjustment of the output pressure is readily effected by removing the cover 12 and rotating the nipple 19 by means

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of an appropriate spanner. By this means, the pressure of the spring 28 is adjusted to provide the desired output pressure of the pump.

Although but one embodiment of the invention has been shown and described in detail it will be understood that 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 cylinder of non-magnetic material, a hollow magnetic piston slidably mounted therein, an electromagnet surrounding the cylinder and piston, a cylindrical casing of magnetic material, annular pole pieces at the ends of the electromagnet supporting the magnet and cylinder assembly coaxially in the casing, said casing extending beyond both said pole pieces to provide an inlet chamber at one end and an interrupter chamber at the other end formed with a terminal radial lip, said cylinder extending into both said chambers; a cup-shaped partition member formed with a centrally located cylindrical shoulder having a sealed connection to the outlet end of the pump cylinder, and having its rim tightly embracing said lip on the end of the casing, thereby forming a closure for the interrupter chamber, a domed cap member having a rim tightly embracing the rim of the partition member and the lip of the casing and externally sealed to the casing, cooperating with said partition member to form an output chamber, means for yieldingly biasing the piston toward the output chamber, means for intermittently energizing the electromagnet to draw the piston toward the input chamber and valve means for transferring liquid from the input chamber to the output chamber responsive to reciprocation of the piston; including further a flexible impervious diaphragm and means for hermetically sealing the rim of the diaphragm to the interior of the cup in spaced relation to the dome, to thereby provide an expansible dome chamber partitioned off from the output chamber.

2. An electromagnetic pump as set forth in claim 1 in which the means for energizing the electro-magnet comprises a source of current, a conductor connecting said source to one terminal wire of the electromagnet, an insulating nipple sealed in the wall of the casing, said conductor and wire traversing the nipple in opposite directions in overlapping relation, and a fused metallic seal closing the nipple and uniting said conductor and wire.

3. An electromagnetic pump as set forth in claim 2 including further a resistor connected in parallel with the electromagnet, one terminal lead of the resistor also traversing said nipple and being united with the conductor from the power source and the terminal wire of the electromagnet by said fused metallic seal.

4. An electromagnetic pump as set forth in claim 1 in which the end of the cylinder which extends into the input chamber is internally threaded, and the means for biasing the piston toward the output chamber comprises a compression spring bearing at one end on the piston, and a nipple threaded in the input end of the cylinder carrying an input check valve and forming an adjustable abutment for the other end of said spring.

5. An electromagnetic pump as set forth in claim 1 in which the inlet chamber of the casing is provided with an inlet nipple fitting, and the domed cap member is provided with an outlet nipple fitting, and including further a mounting bracket embracing the pump casing with freedom for rotary adjustment, and clamping means for holding the pump in adjusted position.

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