Sept. 4, 1956 L. C. PARKER 2,761,392

ELECTROMAGNETIC PUMP

Filed Oct. 8, 1953

Fig. 1

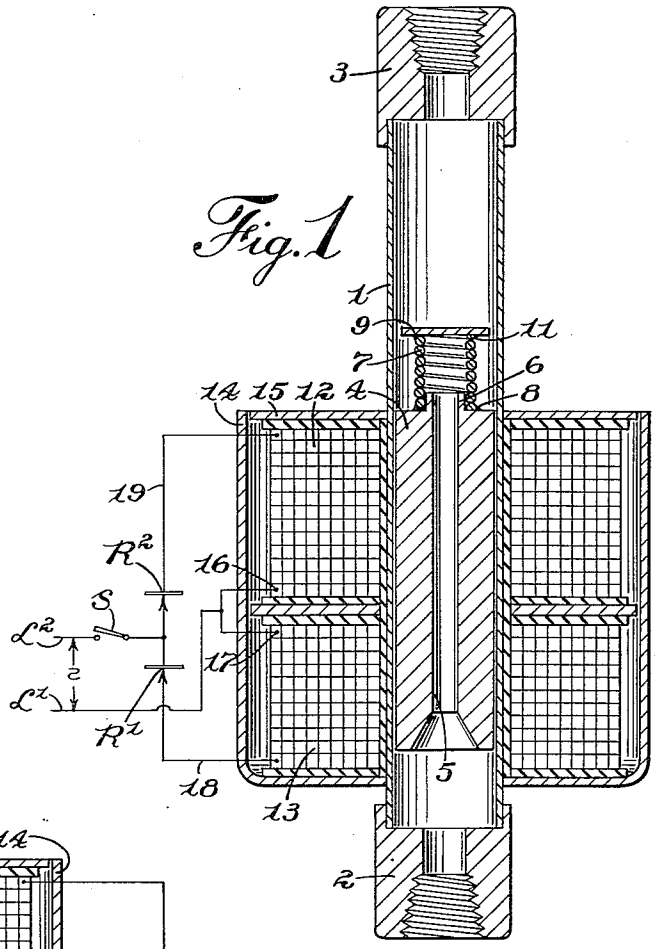
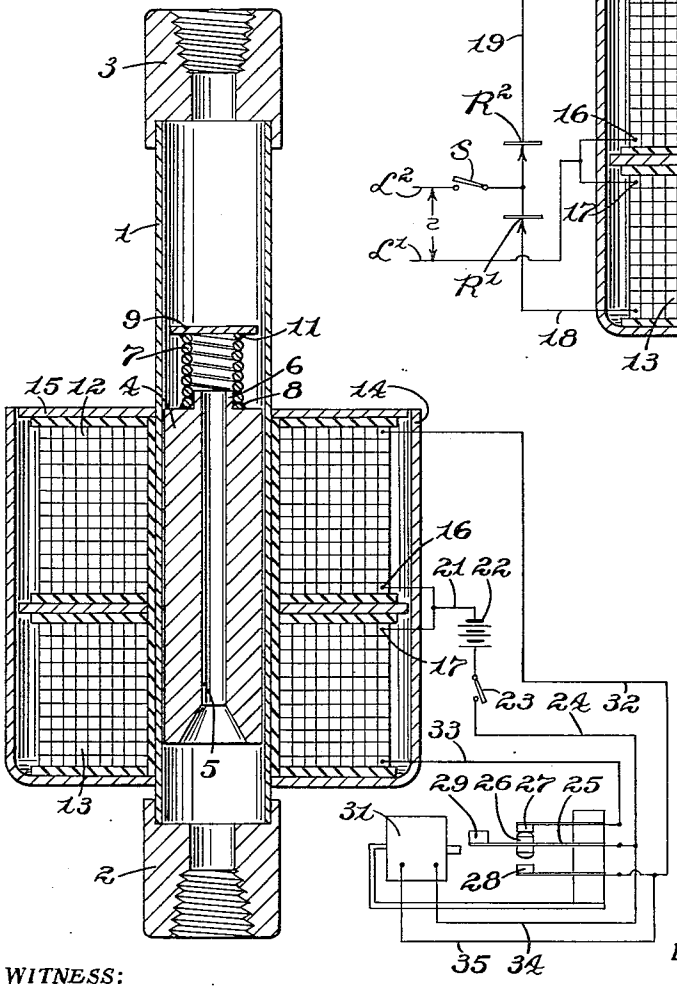


Fig. 2



INVENTOR.
Leland C. Parker

BY
Clinton L. James
ATTORNEY

WITNESS:
Esther M. Stockton

United States Patent Office 2,761,392 Patented Sept. 4, 1956

2,761,392

ELECTROMAGNETIC PUMP

Leland C. Parker, Elmira, N. Y., assignor to Bendix Aviation Corporation, a corporation of Delaware

Application October 8, 1953, Serial No. 384,821

1 Claim. (Cl. 103—53)

The present invention relates to an electro-magnetic pump, and more particularly to a pump of the reciprocating plunger type adapted for operation by alternating current.

It is an object of the present invention to provide a novel electro-magnetic plunger type pump which is simple and economical in construction and efficient and reliable in operation.

It is another object to provide such a device incorporating a single novel form of check valve which is particularly effective for its purpose.

It is another object to provide such a device in which the plunger is magnetically actuated in both directions, and the consequent energetic reversals of motion are utilized in the functioning of the check valve.

It is another object to provide such a device in a form which requires no contacts or other moving parts to control the reciprocation of the plunger.

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 adapted for operation from an alternating current supply, the electrical circuits being shown diagrammatically; and

Fig. 2 is a similar view of an embodiment of the invention adapted for operation from a direct current source of power.

In Fig. 1 of the drawing there is illustrated a hollow cylinder 1 of non-magnetic material constituting the body of the pump and having fixed thereon in any suitable manner at its lower end an inlet fitting 2, and at its upper end an outlet fitting 3. A hollow plunger or piston 4 of magnetic material is slidably mounted in the cylinder 1, and has a passage 5 therethrough which terminates at its upper end in a nipple 6. The upper end of the passage 5 is normally closed by a check valve comprising a close wound coil 7 of elastic wire, the lower end of which surrounds and is attached to the nipple 6 by suitable means as soldering as indicated at 8. The coil 7 is so wound that its convolutions are normally pressed tightly together whereby the coil forms a tube which is a continuation of the passage 5 through the piston. The upper end of the coil is closed by means of a disc weight member 9 which is preferably soldered to the end of the coil as indicated at 11.

Means for reciprocating the piston 4 in the cylinder 1 is provided comprising a pair of similarly polarized solenoids 12 and 13 held in tandem relation on the cylinder 1 by means of a cup-shaped casing 14 and closure 15 therefor of magnetic material fixedly mounted on the cylinder 1 in any appropriate manner.

Means for alternately energizing the solenoids 12, 13 is provided comprising a source of alternating current indicated by the mains L^1 and L^2. The conductor L^1 is connected directly to the adjacent ends of both coils as shown at 16 and 17 respectively. The conductor L^2 is connected through a manual switch S to a pair of

rectifiers R^1 and R^2. Rectifier R^1 is connected by a lead 18 to the lower terminal of the solenoid 13 while rectifier R^2 is connected by a lead 19 to the upper terminal of the solenoid 12. Rectifiers R^1 and R^2 are, as illustrated, oppositely polarized with respect to the conductor L^2; rectifier R^1 permitting current to flow toward the conductor L^2 while rectifier R^2 permits flow of current away from the same.

Upon closure of the manual switch S, the solenoids 12 and 13 are energized by alternate half-waves of current from the mains L^1, L^2, and since the two solenoids are similarly polarized, they draw the piston 4 back and forth as it attempts to centralize itself first with one coil and then with the other.

The disc weight member 9 is so dimensioned that its inertia prevents it from following the rapid reciprocations of the piston 4. Consequently, as the piston moves downward it travels ahead of the weight member 9 and draws the convolutions of the spring valve 7 apart, thus permitting escape of liquid up through the passage 5 of the piston into the upper portion of the cylinder 1. As the piston rises, the convolutions of the spring come together, preventing return of the liquid through the piston, and thereby causing the liquid to be ejected through the outlet fitting 3.

Preferably the disc 9 extends radially beyond the coil 7 so that it forms a fluid brake which augments the effect of its inertia and assists the valving action of the spring 7.

In Fig. 2 of the drawing there is illustrated an embodiment of the invention in which the pulsating current for reciprocating the pump plunger is generated from a source of direct current such as a storage battery instead of from an alternating current source. As there shown, the pump structure itself is the same as illustrated in Fig. 1 and the parts are similarly numbered. In this case, however, the contiguous terminals 16, 17 of the coils 12, 13 are connected by a lead 21 to one terminal of a battery 22, the opposite terminal of which is connected through a manual switch 23 and a lead 24 to a vibrating reed 25. Reed 25 carries a double contact 26 which is arranged to engage alternately with spring mounted contacts 27, 28, normally engaging contact 27 as shown. The free end of the reed 25 carries an armature 29 which is arranged to be attracted by an electro-magnet 31 which when energized draws the contact 26 away from contact 27 into engagement with contact 28.

The remote terminals of coils 12 and 13 are connected respectively by leads 32 and 33 to the spring mounted contacts 28 and 27, and the electromagnet 31 is bridged across contacts 26 and 28 by means of leads 34 and 35, respectively.

In the operation of this embodiment of the invention, closure of manual switch 23 causes current from the battery to flow through contacts 26 and 27 and lead 33 through the coil 13 and back to the battery, thus energizing coil 13 and drawing the plunger 4 downward. At the same time a circuit is completed through lead 34, electromagnet 31, leads 35 and 32 and coil 12 back to the battery. The resistance of the electromagnet 31 is several times greater than the resistance of coil 12 so that electromagnet 31 is energized and attracts the armature 29 to draw contact 26 away from contact 27 and into engagement with contact 28. During this time, however, the current flowing through the coil 12 is insufficient to cause appreciable energization thereof.

When contacts 26, 27 open, coil 13 is deenergized, and when contacts 26, 28 close, the coil 12 is connected directly to the battery 22 and thus becomes fully energized and draws the plunger 4 upward on its discharge stroke. At the same time, the closing of contacts 26, 28 short circuits the electromagnet 31 causing it to be deenergized, whereby the armature 29 is released and the reed 25 op-

erates to move the contact **26** back into engagement with contact **27**, upon which the cycle is repeated. It will thus be seen that the coils **12, 13** are alternatively energized by the pulsations of current generated by the action of the vibrating reed **25**.

It will be understood that the term "pulsating current" as used in the specification and claim is equally applicable to both systems here described, whether the sequential pulsations are in opposite directions as in Fig. 1 or are in the same direction as in Fig. 2.

Although but two embodiments of the invention have 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:

In a pulsating current plunger pump, a non-magnetic cylinder, a hollow piston of magnetic material slidably mounted in the cylinder, a pair of solenoids arranged in tandem on the cylinder, a source of pulsating current, means for selectively energizing the solenoids with like polarity by alternate pulsations of the pulsating current; and a check valve controlling the passage through the piston comprising a cylindrical coil of close-wound elastic wire mounted on the discharge end of the piston, and a disc weight member fixed on and forming a closure for the free end of the coil, said disc member extending radially beyond the valve coil to form a fluid brake which hinders the adjacent end of the valve coil from following the vibrations of the piston, thereby forcing the coil tightly closed during the discharge stroke of the piston and drawing the coil open during the retraction stroke of the piston.

References Cited in the file of this patent

UNITED STATES PATENTS

125,937	Cowles	Apr. 23, 1872
181,288	Shaw	Aug. 22, 1876
2,006,592	Freeman	July 2, 1935
2,090,127	Keegan	Aug. 17, 1937