

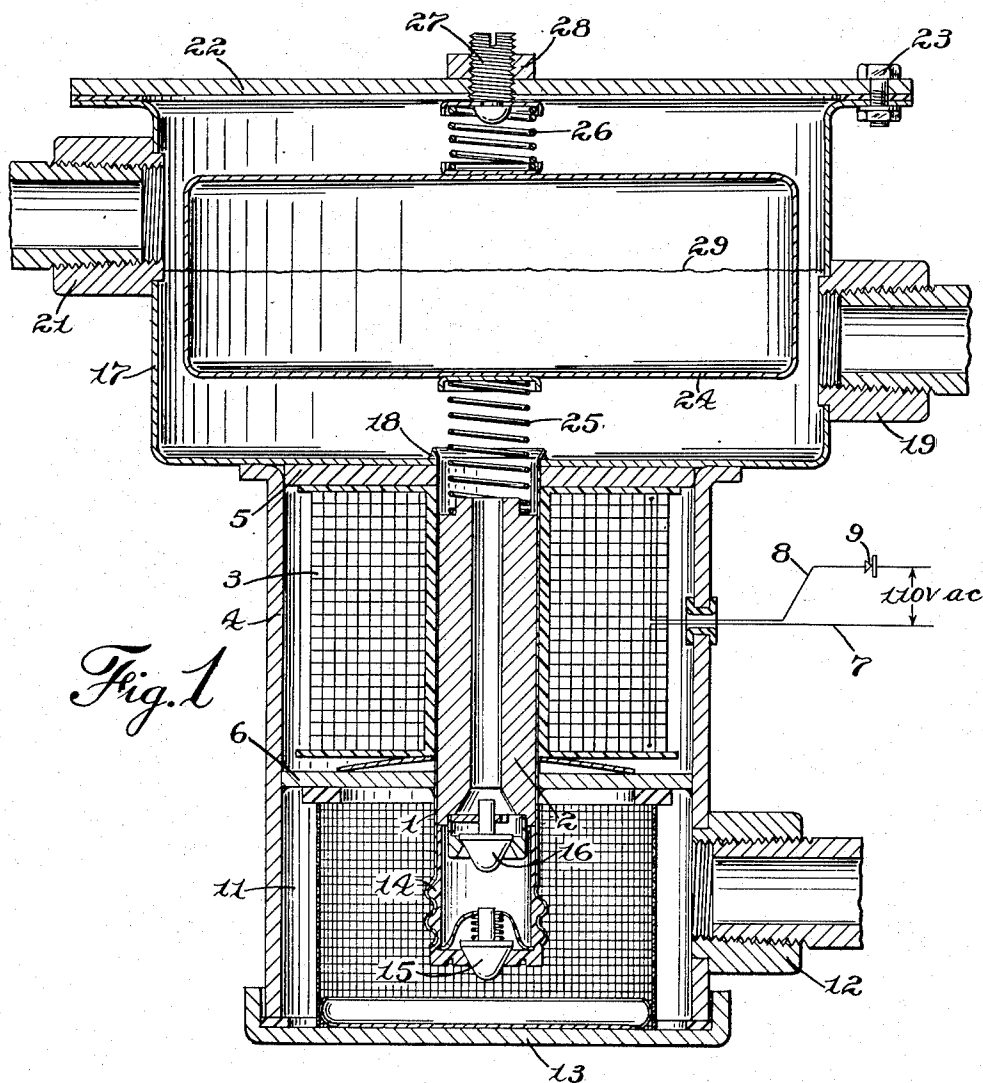
Aug. 6, 1957

L. C. PARKER
ELECTRO-MAGNETIC PUMP

2,801,591

Filed July 15, 1954

2 Sheets-Sheet 1



WITNESS:

Esther M. Stockton

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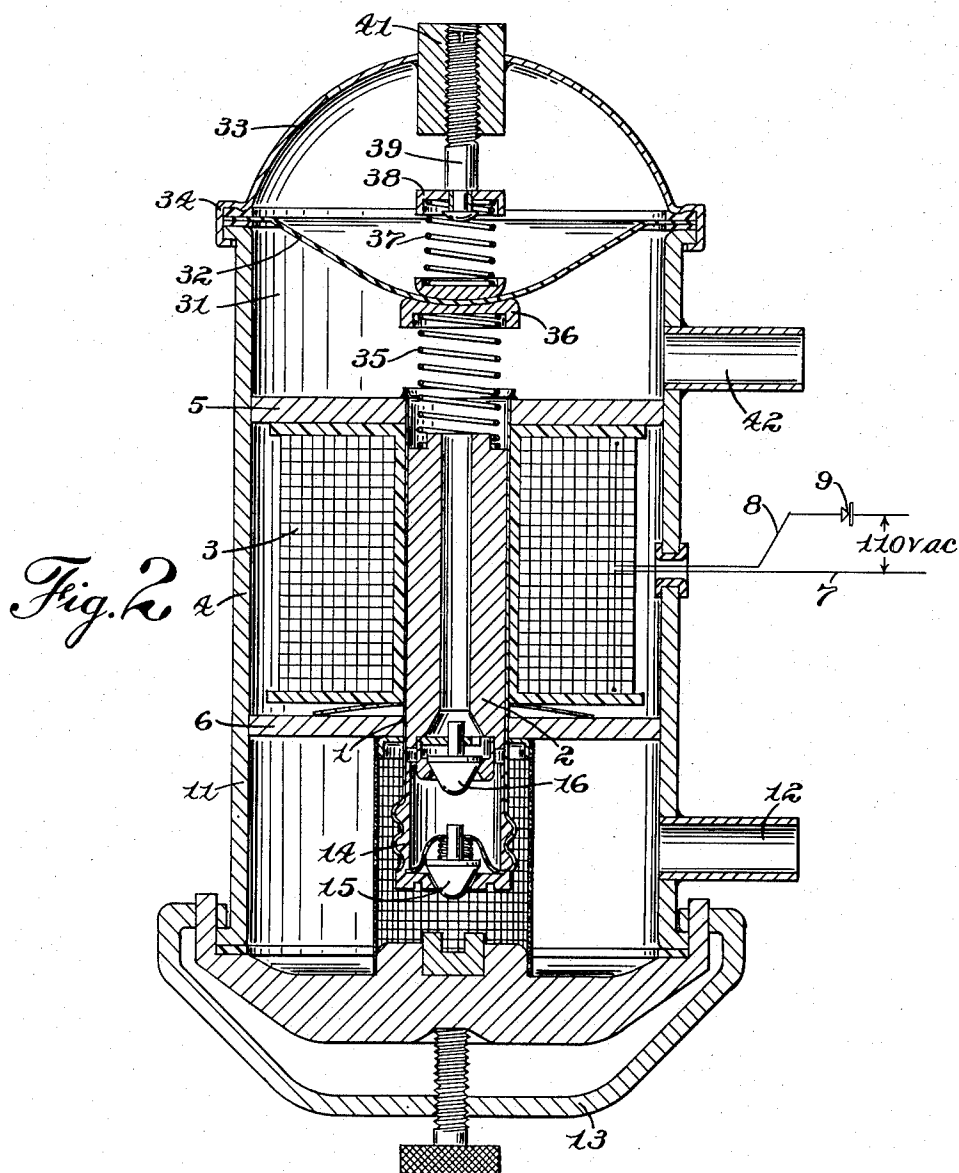
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ELECTRO-MAGNETIC PUMP

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6 Claims. (Cl. 103—38)

The present invention relates to an electro-magnetic pump and more particularly to a reciprocating pump adapted for operation by pulsating direct current to maintain an approximately constant level or head throughout a wide range of output volume.

It is an object of the present invention to provide a novel pump of the above character which is simple and economical in construction and efficient and reliable in operation.

It is another object to provide such a device having no moving contacts or other current carrying devices subject to arcing or pitting.

It is another object to provide such a device in which the control of output volume is secured by regulation of the length of stroke of the piston while its frequency is maintained constant.

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 to maintain a substantially constant level of the liquid being pumped, the electrical circuit being indicated diagrammatically; and

Fig. 2 is a similar view of an embodiment of the invention which is arranged to maintain a constant output pressure of the liquid being pumped.

In Fig. 1 of the drawing there is illustrated a non-magnetic cylinder 1 in which is slidably mounted a hollow magnetic piston 2. An electro-magnet 3 is arranged to surround the cylinder and piston, and the assembly is mounted coaxially in a cylindrical casing 4 of magnetic material by means of annular pole pieces 5 and 6 located at the opposite ends of the electro-magnet.

Means for energizing the electro-magnet 3 is provided comprising leads 7 and 8 connected to a source of alternating current such as the conventional 110 volt 60 cycle commercial power supply. In one of the leads a rectifier 9 is inserted whereby the electro magnet is supplied with pulsating direct current and is consequently activated periodically without change of polarity at the frequency of the alternating power supply.

The lower end of the casing 4 is extended to provide an inlet chamber 11 having an inlet fitting 12 and closed by a cap 13 of any suitable construction. The lower end of the cylinder 1 extends into the inlet chamber 11 and is threaded to receive a hollow externally threaded nipple 14 in the bottom of which an inwardly opening check valve 15 is mounted. The upper end of the nipple 14 forms an abutment for the piston 2, limiting its movement away from centered relation with respect to the electro-magnet 3.

A check valve 16 is mounted in the lower end of the piston 2 to prevent backward flow of liquid, whereby reciprocation of the piston draws liquid from the input chamber 11 and pumps it through the cylinder 1.

A cylindrical housing 17 forming the output chamber of the pump is suitably fixed to the upper end of the cas-

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ing 4, and is provided with a sealed connection to the upper end of the cylinder 1 as indicated at 18. The output chamber is provided with an outlet fitting 19, and an overflow connection 21, and is closed by a cap 22 suitably affixed thereto as indicated at 23.

A hollow float member 24 is located in the output chamber 17 and rests on a compression spring 25 which is seated on the upper end of the piston 2 and consequently urges the piston away from its centered relation with the electro-magnet 3, toward the input chamber 11.

Yielding means for varying the pressure of the spring 25 on the piston 2 is provided in the form of a spring 26 bearing on the upper side of the float 24 with a pressure which is adjustable by means of an anchoring stud 27 threaded through the cap 22 and maintained in adjusted position by a lock nut 28.

In use, it is intended that the pump maintain a constant level of liquid in the output chamber such as indicated by the line 29, with little variation throughout the range of output volume. When the power is first applied to the pump, if the liquid in the output chamber 17 is below the desired level, the weight of the float 24 plus the force of the adjusting spring 26 is applied to the piston 2 through the spring 25 whereby the piston is moved to a substantially decentered relation with respect to the electro-magnet 3 during the interval between each periodic energization of the electro-magnet. The piston therefore is caused to vibrate throughout substantially its full stroke as limited by its engagement with the nipple 14. Liquid is consequently pumped rapidly into the output chamber 17, causing the liquid to rise toward the desired level 29. The buoyancy of the float 24 is thus caused to relieve the pressure on the spring 25 until, when the desired level 29 is reached, there is little or no pressure on the piston and its decentering movement between the pulses of the electro-magnet 3 is insufficient to operate the check valves 15, 16 so that no further liquid is pumped.

Thereafter, as liquid is drawn off through the output fitting 19, it is constantly and immediately replaced by the pump, the stroke of which automatically conforms to the volume of liquid being drawn from the output chamber.

Any desired adjustment of the height of the liquid level in the output chamber is secured by adjustment of the pressure on spring 26. The overflow fitting 21 is provided merely as a factor of safety.

In the embodiment of the invention illustrated in Fig. 2, the operative elements of the pump are the same as shown in Fig. 1 and are similarly numbered. In this case however, instead of maintaining a constant level of liquid in the output chamber it is intended to maintain a constant output pressure.

For this purpose, the output chamber 31 of the pump is closed by a flexible diaphragm 32 which is mounted thereon by means of a cap 33 suitably affixed to the upper end of the pump casing as indicated at 34.

The center of the diaphragm 32 bears on a spring 35 which is seated on the upper end of the piston 2, a thimble 36 being preferably interposed therebetween. Yielding means for applying pressure to the diaphragm 32 is provided in the form of a compression spring 37 bearing on the diaphragm and seated at its upper end in a thimble 38 mounted on a stud 39 threaded within a sleeve 41 fixed in the cap 33. Adjustment of the stud 39 consequently varies the pressure applied through the spring 35 to urge the piston 2 away from its centered position with respect to electro-magnet 3, toward the input chamber 11.

In the operation of this embodiment of the invention, application of pulsating power to the electro-magnet 3 causes the piston 2 to be reciprocated through substantially its full stroke, whereby liquid is pumped into the

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output chamber 31, developing pressure on the under side of the diaphragm 32 tending to move it upwardly against the force of the spring 37, thereby relieving the pressure of the spring 35 on the piston 2.

When the desired amount of output pressure, as determined by adjustment of the stud 39, has been built up in the output chamber 31, the diaphragm 32 will have been raised to a point where the spring 35 is ineffective to decenter the piston 2 sufficiently to cause further liquid to be pumped into the output chamber. In other words, the piston remains in a substantially centered relation to the electro-magnet 3 with little or no vibratory movement.

When liquid is withdrawn through the output fitting 42, the diaphragm 32 is thereby permitted to move downwardly under the force of the spring 37, thus applying pressure through the spring 35 to the piston 2, causing it to vibrate with an amplitude corresponding to the volume of liquid withdrawn from the output chamber.

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:

1. In an electromagnetic reciprocating pump a non-magnetic cylinder, a hollow magnetic piston slidably mounted therein, an electromagnet surrounding the cylinder and piston, a source of continuously pulsating current for energizing the electro-magnet to cause a continuous reciprocatory movement of the piston, a casing enclosing the cylinder and electromagnet and providing input and output chambers at the opposite ends of the cylinder, yielding means continuously urging the piston away from its centered relation with respect to the elec-

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tromagnet toward the input end of the cylinder, valve means for preventing backward flow of liquid through the cylinder, and means for varying the force of said yielding means on the piston responsive to variations in flow from the output chamber.

2. An electromagnetic pump as set forth in claim 1 including further means for limiting the decentering movement of the piston responsive to said yielding means.

3. An electromagnetic pump as set forth in claim 2 in which the yielding means is in the form of a compression spring, and the means for varying the force of the yielding means comprises a buoyant member floating in the output chamber of the pump and resting on said spring.

4. An electromagnetic pump as set forth in claim 3 including further adjustable means for applying a yielding pressure on said floating member.

5. An electromagnetic pump as set forth in claim 1 in which said yielding means is in the form of a compression spring, and the means for varying the force of said yielding means comprises a flexible diaphragm forming one wall of the output chamber of the pump, and yielding means for moving the diaphragm to apply pressure to said spring.

6. An electromagnet as set forth in claim 5 including means accessible from the exterior of the pump to vary the pressure of said yielding means on the diaphragm.

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