

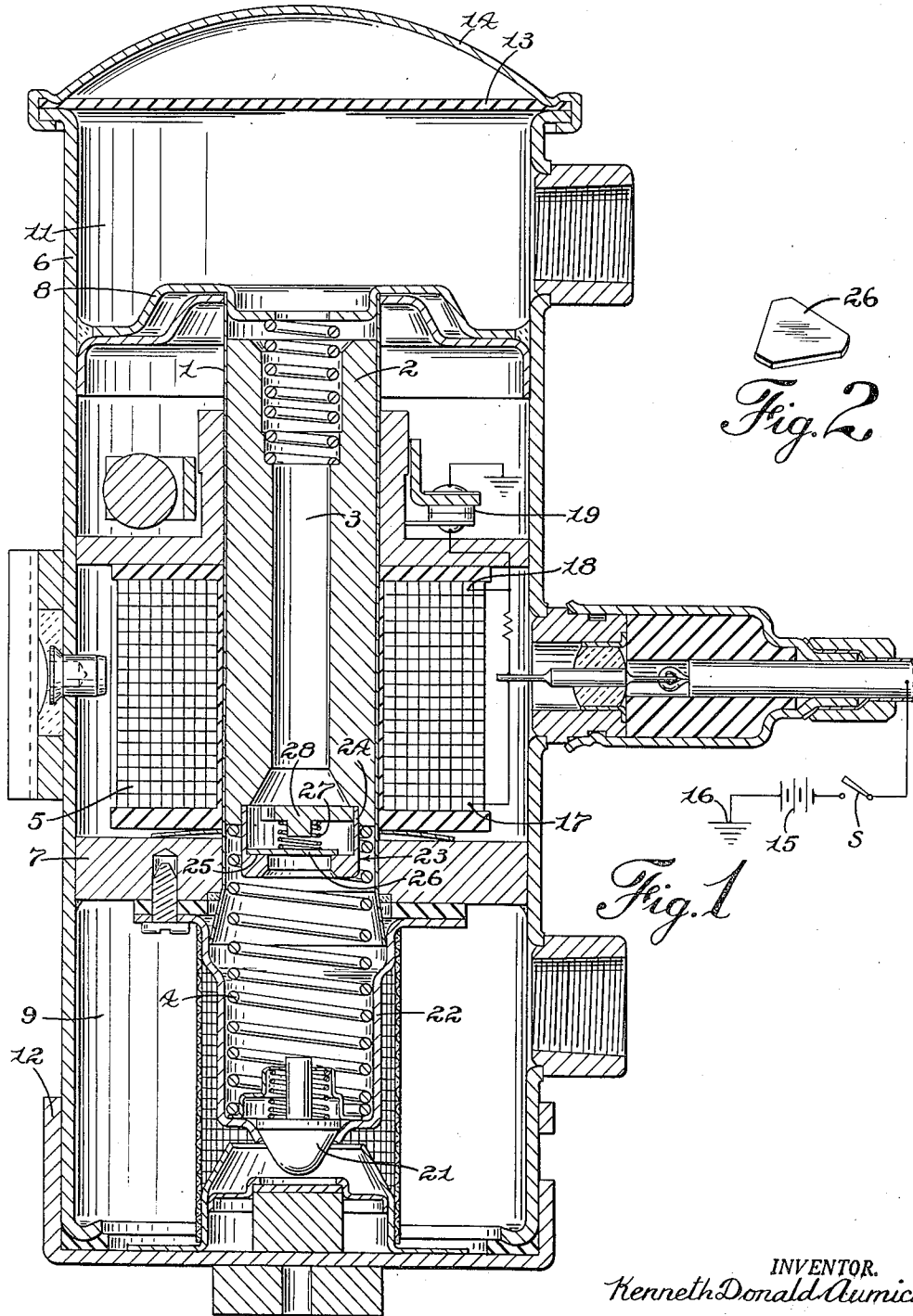
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RECIPROCATING ELECTROMAGNETIC PUMP

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WITNESS:

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## RECIPROCATING ELECTROMAGNETIC PUMP

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2 Claims. (Cl. 103-53)

The present invention relates to a reciprocating electro-magnetic pump, and more particularly to an improved kind of check valve structure for increasing the efficiency of such pumps.

The present invention is in the nature of an improvement of the structure shown in the patent to Dickey et al. 2,472,067 issued June 7, 1949.

It is an object of the present invention to provide a novel reciprocating electro-magnetic pump with increased volumetric efficiency, quietness in operation and simplicity in design.

It is another object to provide such a device incorporating a check valve which is operated in part by magnetic action.

It is another object to provide such a device in which the check valve is controlled by the electro-magnet which actuates the pump piston.

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 pump constituting a preferred form of the invention; and

Fig. 2 is a detail in perspective of the novel movable check valve member.

In Fig. 1 of the drawing there is illustrated a cylinder 1 of non-magnetic material in which is slidably mounted a magnetizable piston 2 having a flow passage 3 there-through.

Means for reciprocating the piston is provided comprising a spring 4 which is operative to move the piston in the direction of flow of the fluid to be pumped, and an electro-magnet 5 surrounding the cylinder 1 and operative when energized to retract the piston and cock the spring 4.

The cylinder 1 is mounted coaxially in a cylindrical housing 6 by means of partitions 7 and 8 which define inlet and outlet chambers 9 and 11 respectively in the casing, inlet chamber 9 being closed by a removable cap 12, and outlet chamber 11 being closed by a flexible diaphragm 13 fixed to the casing by an air dome member 14.

Means for reciprocating the piston 6 is provided comprising a battery 15 grounded at 16 and connected to one terminal 17 of the electro-magnet 5 the other terminal 18 of the electro-magnet being grounded through a pair of contacts 19 which are controlled magnetically by the movement of the piston 2 in such manner that when the piston reaches the end of its downward or idle stroke under the influence of the electro-magnet 5, the contacts open and permit the spring 4 to actuate the piston through its pumping stroke. Since the contact actuating structure is illustrated and described in the patent to Dickey et al. above cited and forms no part of the present invention, further description thereof is deemed unnecessary.

In order that reciprocation of the piston 2 may be effective to transfer fluid from the inlet chamber 9 through the piston to the outlet chamber 11, check valve 21 is mounted in a tubular extension 22 of the cylinder 1, and a second check valve indicated generally by the numeral 23 is mounted on the piston 2 at the entrance of its flow passage 3.

According to the present invention the piston actuated check valve 23 comprises a tubular member 24 of non-

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magnetic material fixedly attached to the piston and having a valve seat here shown as a flat surface 25 facing toward the piston. A movable valve member 26 is slidably mounted in the member 24 and is urged against the seat 25 by a compression spring 27 seated on a spider member 28 located in a counterbore in the end of the piston 2.

The movable valve member 26 is made of magnetic material, and is located by its seat member 24 slightly beyond the end of the piston 2 whereby, when the piston is magnetized by the electro-magnet 5, it will attract the valve member 26 and raise it from its seat 25 against the action of the spring 27. When the electro-magnet 5 is deenergized, the spring 27 is effective to promptly return the valve member 26 to its seat.

In operation, energization of the solenoid 5 by closure of the switch S draws the piston 2 downward, and at the same time causes the piston to attract and raise the movable valve member 26 from its seat whereby the passage through the piston is completely open and any fluid in the lower end of the cylinder and tubular extension 22 thereof can pass freely through said passage. At the end of the idle stroke of the piston, the electro-magnet 5 is deenergized by the opening of the contacts 19, whereupon the spring 27 becomes effective to immediately return the valve member 26 to its seat, closing the passage 3 through the piston so that the upward stroke of the piston as actuated by the spring 4 is effective to transfer fluid from the cylinder 1 into the outlet chamber 11. It will be readily appreciated that this method of actuating the check valve increases the efficiency of the pump in comparison with those types in which the opening and closing of the check valve is dependent entirely on its inertia and that of the fluid which is being pumped. Actually, it has been found entirely practicable to omit the lower check valve 21 in pumps constructed in accordance with the present invention thereby making the pump self-priming even under adverse conditions.

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 design and arrangement of the parts without departing from the spirit of the invention.

I claim:

1. In a reciprocating electro-magnetic pump a non-magnetic cylinder, a magnetic piston having a flow-passage therethrough slidably mounted in the cylinder, means for reciprocating the piston including a spring operative to move the piston in the direction of flow of the fluid, and an electro-magnet operative to retract the piston and cock said spring, and a check valve mounted on the piston adjacent the entrance to its flow-passage, said valve including a seat of non-magnetic material spaced from the end of the piston, and a movable valve member of magnetic material cooperating with the seat to close said passage said movable member being so positioned as to be drawn away from its seat by the attraction of the piston when the piston is magnetized by energization of the electro-magnet.

2. An electro-magnetic pump as set forth in claim 1 in which the check valve structure includes a tubular extension of non-magnetic material fixedly attached to the piston and having a valve seat facing toward the piston, and including further a spring effective to return the movable valve member to its seat upon deenergization of the electro-magnet.

References Cited in the file of this patent

UNITED STATES PATENTS

2,472,067 Dickey et al. June 7, 1949