

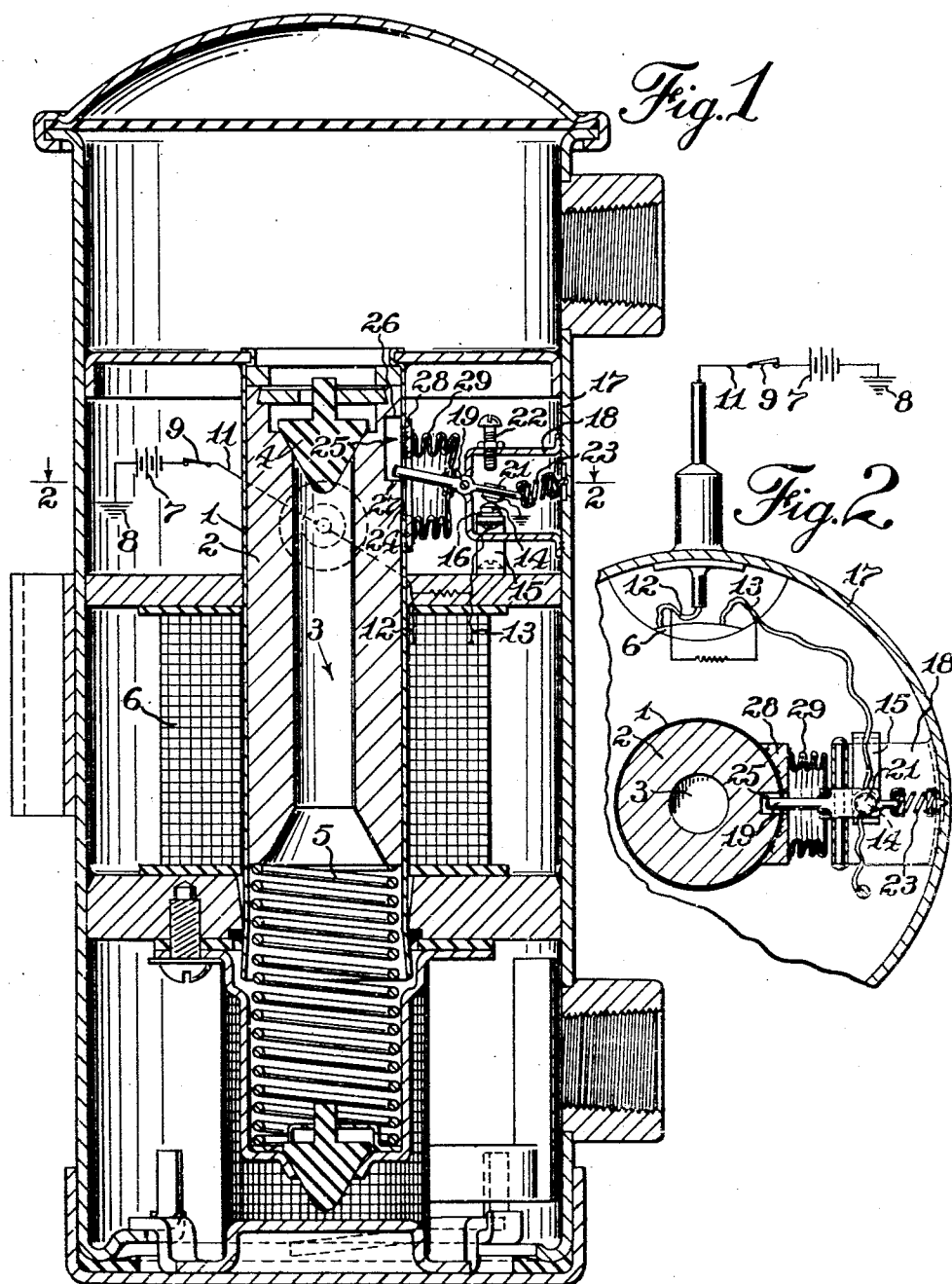
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ELECTROMAGNETIC PUMP

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WITNESS:

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ELECTROMAGNETIC PUMP

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The present invention relates to an electromagnetic pump and more particularly to a piston type of pump for moving fluids such as fuel for internal combustion engines.

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

It is another object to provide such a device in which the actuation of the piston is positively controlled by the movement of the piston itself.

It is another object to provide such a device in which the control is effected by a mechanical connection from the piston to the controlling element.

It is another object to provide such a device in which leakage of fluid from the pump chamber is prevented by a flexible packing member permanently connected to the pump cylinder and the controlling element.

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; and

Fig. 2 is a sectional detail taken substantially on the line 2-2 of Fig. 1.

In Fig. 1 of the drawing, there is illustrated a pump cylinder 1 of non-magnetic material such as brass in which is slidably mounted a piston 2 of magnetic material such as soft iron having a passage 3 therethrough controlled by a check valve 4. A spring 5 is arranged to urge the piston in a direction to eject fluid from the cylinder 1, and a solenoid 6 surrounding the cylinder 1 is so positioned that when energized it retracts the piston 2 against the force of the spring 5.

Means for energizing the solenoid 6 is provided comprising a battery 7 grounded at 8 and connected through a switch 9 and leads 11 and 12 to one terminal of the solenoid 6. The other terminal of the solenoid is connected by a lead 13 to a fixed contact 14 mounted on a stationary bracket 15 but insulated therefrom as indicated at 16.

A casing 17 is arranged to enclose and support the pump mechanism, and a bracket 18 fixedly mounted in the interior of the casing is arranged to pivotally support a control member in the form of a lever 19, one end of which carries a movable contact 21 adapted to cooperate with the fixed contact 14.

The swinging movement of the lever 19 in the

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direction away from the fixed contact 14 is preferably limited by an adjustable stop 22; and in order to secure a snap action of the control member, a compression spring 23 is located between the end of the control lever and the side of the casing in such manner as to urge the control lever away from the mid-position between its contact-opened and contact-closed positions.

The side of the pump cylinder is provided with an opening 24 adjacent the control lever permitting the end of the control lever to enter the cylinder, and the piston 2 is provided with an elongated notch or recess 25 adapted to receive the end of the control lever 19, the shoulders 26 and 27 formed by the ends of said recess being arranged to engage and move the control lever, as the piston reciprocates. It will be understood that the recess 25 is so dimensioned as to secure the desired length of stroke of the pump piston.

In order to prevent escape of fluid from the pump cylinder 1, through the opening 24, a collar 28 is fixed to the cylinder around said opening in any suitable manner as by soldering, and a flexible packing member in the form of a bellows 29 of suitable elastic material is fixedly mounted at one end on the collar 28 in such manner as to provide a fluid type joint. The other end of the bellows is similarly connected as by soldering to the control lever 19 adjacent its pivot whereby the opening 24 is hermetically sealed while permitting the vibratory motion of the control member.

In operation, starting with the parts in the positions illustrated in Fig. 1, with the piston at the top of its stroke and the control contacts 14, 21 closed, closure of the switch 9 causes solenoid 6 to draw the piston down against the action of the spring 5 until the shoulder 26 on the piston engages the control lever 19 and swings it in a counter-clockwise direction, opening contacts 14, 21 and thereby deenergizing solenoid 6. The momentum of the piston 2 carries the control lever 19 beyond its dead center position whereby the spring 23 is effective to hold the contact 21 against the stop 22.

Spring 5 is thereupon effective to raise the piston 2 and thereby eject the fluid above the piston into the upper part of the casing 17. When sufficient fluid has been permitted to leave the casing through the outlet, the shoulder 27 of the piston 2 engages the control lever 19 and moves it in the direction to close the contacts 21, 14, such closure taking place by a snap action by virtue of the toggle compression spring 23 where-

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upon the actuation of the piston by the solenoid is repeated.

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

What is claimed is:

1. In an electromagnetic pump a cylinder of non-magnetic material, a piston of magnetic material slidably mounted thereon, spring means for moving the piston in a direction to eject fluid from the cylinder, said piston having a fluid passage therethrough, means preventing backward flow of fluid through said passage, a solenoid surrounding the cylinder adapted when energized to draw the piston back against the action of said spring means, magnetic pole pieces surrounding the cylinder at the ends of the solenoid, a cylindrical casing of magnetic material surrounding and connecting the pole pieces, a bracket fixed to one of the pole pieces, a fixed contact on said bracket, a second bracket fixed to the interior of the casing, a lever pivoted on the second bracket, a movable contact mounted on one end of the lever in position to cooperate with the fixed contact, a lost motion mechanical connection be-

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tween the other end of the lever and the piston arranged to swing the lever to close the contacts when the piston approaches the end of its discharge stroke and to open the contacts when the piston approaches the end of its charging stroke, and means including said contacts for energizing the solenoid.

2. An electromagnetic pump as set forth in claim 6 in which the cylinder has an opening through which the lever projects to engage the piston, and including further a flexible bellows rigidly attached at one end to the lever adjacent the pivotal mount thereof, and to the exterior of the cylinder at its opposite end to seal the opening in the cylinder while permitting pivotal movement of the lever.

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