

[54] ELECTROMAGNETIC PLUNGER PUMP

[76] Inventor: **Tadashi Nakamura**, 3-7,
Minanizawa 3-chome,
Higashikurume-shi, Tokyo,
Japan

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Primary Examiner—William L. Freeh

Attorney, Agent, or Firm—Wenderoth, Lind & Ponack

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417/317, 566, 416, 284, 280, 456, 457

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ABSTRACT

An electromagnetic plunger valve which does not require an electromagnetic valve, and at the same time, which is low in cost, and in which the discharge passage is closed automatically as soon as the pump is stopped, and opened as soon as the pump is started, and the movable valve is actuated by the electromagnetic coil provided for the actuation of the electromagnetic plunger.

5 Claims, 2 Drawing Figures

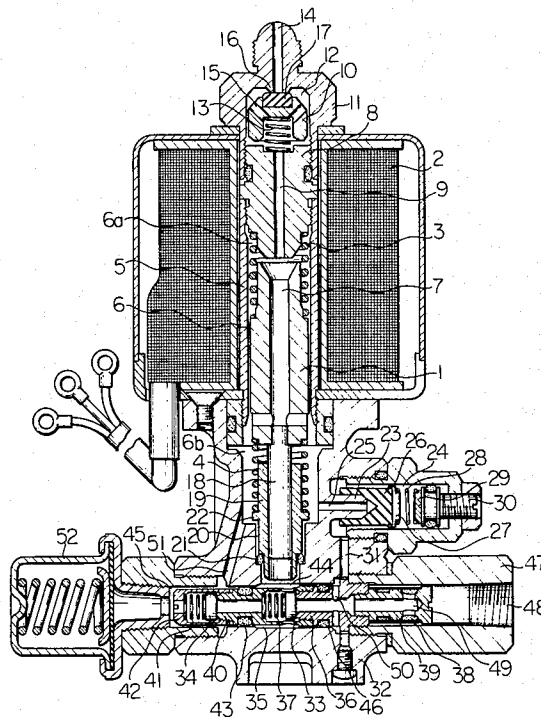


Fig. 1

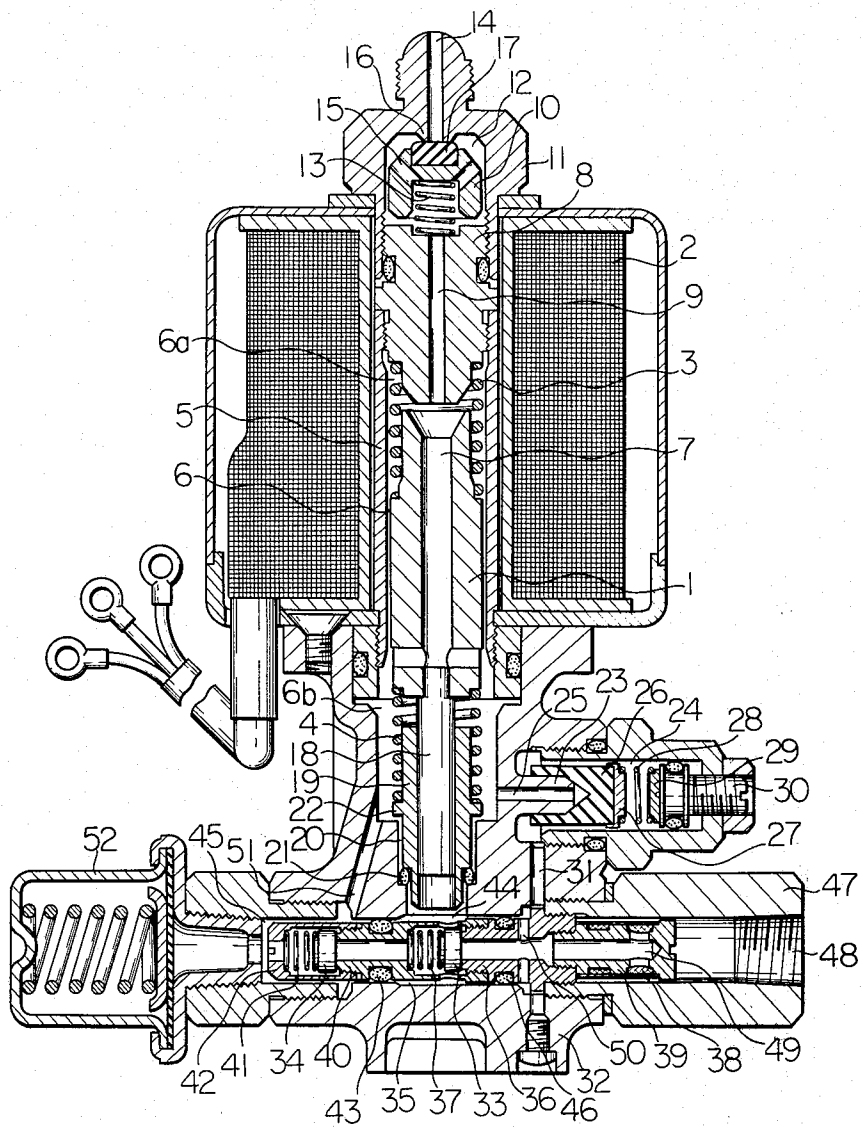
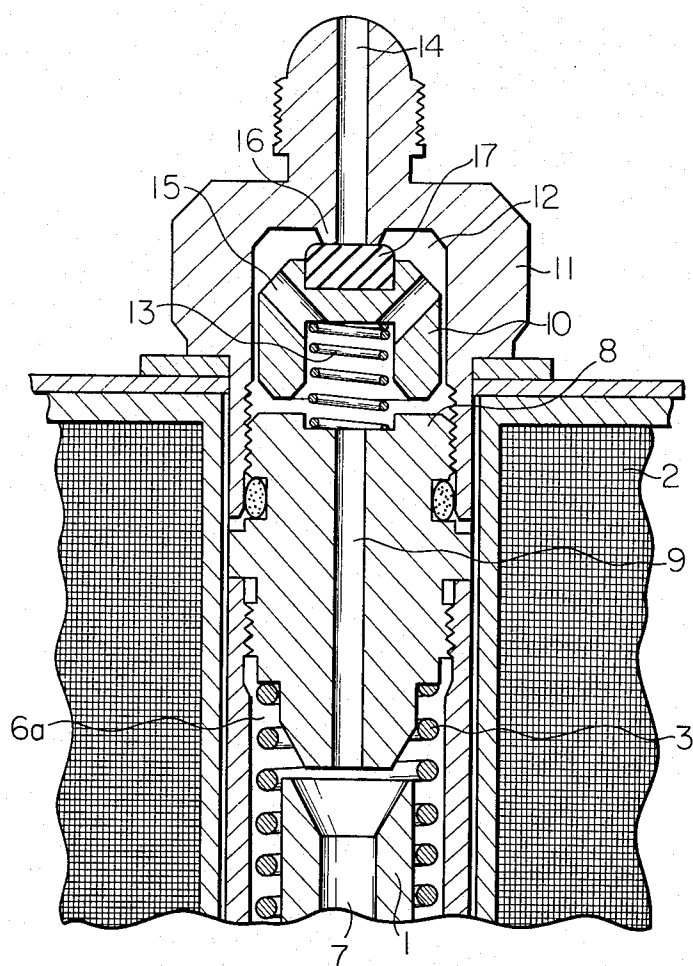


Fig. 2



ELECTROMAGNETIC PLUNGER PUMP

BACKGROUND OF THE INVENTION

The present invention relates to an electromagnetic plunger pump, and more particularly to an electromagnetic plunger pump having such a construction that the flow of fluid discharged from the pump discharge port is completely shut off upon interruption of the supply power.

Generally, in an electromagnetic plunger pump, because the liquid accumulated in it could escape even when the pump was stopped, an electromagnetic valve had to be installed on the discharge side flow line, in order to prevent such an escape flow.

However, because this use of an electromagnetic valve causes a cost increase, it has been desired to provide an electromagnetic plunger pump that did not require an additional electromagnetic valve.

SUMMARY OF THE INVENTION

A first object of the present invention is to provide an electromagnetic plunger pump which does not require an electromagnetic valve, and at the same time, which is low in cost.

A second object of the present invention is to devise an electromagnetic plunger pump in which the discharge passage is closed automatically as soon as the pump is stopped, and opened as soon as the pump is started.

Furthermore, a third object of the present invention is to devise an electromagnetic plunger pump in which the movable valve is actuated by the electromagnetic coil provided for the actuation of the electromagnetic plunger.

In order to achieve these objects, in the electromagnetic plunger pump based on the present invention, wherein pumping is effected by the reciprocating motion of a pressure plunger coupled to an electromagnetic plunger, a movable valve is provided on the discharge side of the fluid passage. The valve blocks the passage when pushed in one direction and opens the discharge passage by being pulled in the opposite direction by the attraction of an electromagnetic coil when said electromagnetic coil is energized.

BRIEF DESCRIPTION OF THE DRAWINGS

An embodiment of the present invention will be explained in the attached drawings as well as in the detailed description that follows, in reference to an example.

It should be understood, however, that many minute modifications and variations on the details of the construction are possible within the scope of the claims given hereunder.

FIG. 1 is a vertical sectional view of an electromagnetic plunger pump representing an embodiment of the present invention, and

FIG. 2 is an enlarged sectional view of an essential part of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

In an electromagnetic plunger pump representing a preferred embodiment of the present invention shown in FIG. 1 and FIG. 2, an electromagnetic plunger 1 actuated by an electromagnetic coil 2 is supported, within an electromagnetic plunger actuation chamber 6 com-

posed of a hollow guide case 5, between an upper spring 3 and a lower spring 4, the electromagnetic plunger actuation chamber 6 is divided into an upper spring chamber 6a and a lower spring chamber 6b by said electromagnetic plunger 1.

Said electromagnetic plunger 1 is provided with an axial passage hole 7 connecting said upper spring chamber 6a and said lower spring chamber 6b.

Above said electromagnetic plunger 1, there is provided a magnetic force adjusting rod 8, being threadedly engaging in the upper part of said guide case 5. Through this magnetic force adjusting rod 8, an axial passage hole 9 is provided.

A movable valve 10 made of an easily magnetizable material is disposed within a variable chamber 12 provided inside a discharge fitting 11 that is screwed over said magnetic force adjusting rod 8.

The movable valve 10 is normally biased by a spring B in such a way that a discharge passage 14 is closed by said movable valve. This movable valve 10 is provided with a pair of oppositely positioned passage holes 15 and is also provided with an elastic member 17, made of rubber or synthetic resin where it makes a contact with valve seat 16 of said discharge passage 14.

As soon as the electromagnetic coil 2 is energized, driving the electromagnetic plunger in motion, said movable valve 10 is also attracted by the electromagnetic force of the electromagnetic coil 2 to open the discharge passage 14, but as soon as the electromagnetic coil is deenergized, the downward attraction on the movable valve 10 disappears and the valve is forced against the valve seat by the spring 13 so that it blocks the discharge passage 14.

A pressure plunger 18 is firmly connected to said electromagnetic plunger 1 and is positioned in a cylinder 19.

Said cylinder 19 is disposed within a cylinder insertion hollow space 20, that communicates with said lower spring chamber 6b, in a spaced relationship, being supported by an elastic member 21.

A portion of said cylinder 19 forms a spring seat 22 for seating said lower spring 4, in such a way that said cylinder 19 is tensioned of said spring.

A nozzle 23 projecting into a relief valve chamber 24 is provided with a central passage hole 25 that is in communication with said lower spring chamber 6b.

Said nozzle 23 is covered by a relief valve 26 made of an elastic material.

Said relief valve 26 is held in its place by a relief valve holding cap 27, and a spring 28 is disposed between this cap 27 and an adjusting screw 30 with a thrust spring seat 29 inserted therebetween.

A relief fluid outlet hole 31 is drilled through a pump body 32 providing a relief fluid outlet passage from said relief valve chamber 24 to the suction side.

A suction side check valve 33 and a discharge side check valve 34 are disposed within an integrally connected pair of valve seat members 36 and 40, which in turn are inserted within a valve insertion hole 35 in the pump body 32. The suction side check valve 33 is forced by a spring 37 against the suction side valve seat member 36. On one end of said suction side valve seat member, a member 39 having a strainer 38 is connected, and on the other end is connected the discharge side valve seat member 40. The discharge side check valve 34 is pushed against this discharge side valve seat member 40 by a spring 41, and a valve cylin-

der 42 for holding said spring 41 is screwed onto valve seat member 40.

An O ring 43 is disposed around said valve seat member 40 and engages the valve insertion hole 35 tightly to separate a pressure chamber 44 from a discharge chamber 45. Another O ring 46 is disposed around said valve seat member 36.

Through a suction port 48 provided through a suction side fitting 47 that is connected to said pump body 32 with a screw engagement, fluid is introduced, and, over the strainer 38 and through a duct 49, is led into said pressure chamber 44. This duct 49 is provided with a connecting passage 50 that is connected with said relief fluid outlet hole 31.

Said discharge chamber 45 is connected to the lower spring chamber 6b via a connection passage 51 and at the same time is provided with an accumulator 52 for smoothing out the discharge pressure.

Below an exemplary functioning of the present invention is described.

During the time the electromagnetic coil 2 is in an energized condition, the electromagnetic plunger 1 is constantly moving in a vertical reciprocating manner to effect the pumping function so that fluid is sucked in through the suction port 48.

The fluid is sent through the suction side check valve 33 and discharge side check valve 34, and further through the discharge chamber 45 and the connection passage 51 into the lower spring chamber 6b. The fluid sent into the lower spring chamber 6b is then sent through the axial passage hole 7 in the electromagnetic plunger 1 into the upper spring chamber 6a. At this time, the variable valve 10 in the movable chamber 12 is kept in the lowered position by the attraction of the electromagnetic coil 2, thus keeping the discharge passage 14 open, and thereby allowing the fluid filling the upper spring chamber 6a to flow into the chamber 12 and thence through the passage holes 15 and further through the discharge passage 14 to the outside.

Furthermore it should be noted that because the electromagnetic coil 2 is supplied with a half-wave rectified current from the commercial 60 Hz AC supply, the movable valve 10 is maintained in its downward displaced position against the tension of the spring 13.

As soon as the coil 2 is deenergized, the movable valve 10 is pushed up by the tension of the spring 13 so that the discharge passage 14 is closed and outflow through the discharge passage 14 is completely stopped.

What is claimed is:

1. In a reciprocating electromagnetic pump including a cylinder, a magnetic piston having a flow-passage therethrough and having inlet and outlet ends and slidably mounted in the cylinder, said cylinder defining a pumping chamber surrounding the inlet end of said piston and receiving fluid therein, means for reciprocating the piston including an electromagnetic coil coaxial to said magnetic piston, a power source coupled to said electromagnetic piston for selective activation thereof, and a check valve mounted on the piston in the fluid flow-passage and including a fixed valve seat 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 electromagnetic coil during operation of the pump to allow fluid flow, the improvements which comprise said check valve being mounted adjacent the outlet end of said piston flow-passage and said power source being half-wave rectified current, whereby the flow of fluid discharged from the pump is completely halted upon interruption of the power supply.

2. An electromagnetic plunger pump according to claim 1, in which an elastic member is attached to the movable valve where it comes in contact with the valve seat portion of the discharge passage.

3. An electromagnetic plunger pump according to claim 1, in which said movable valve is provided with holes for allowing fluid to pass through.

4. The improved reciprocating electromagnetic pump of claim 1, further comprising a relief valve means communicating with said pumping chamber.

5. The improved reciprocating electromagnetic pump of claim 4, further comprising a pump body having a passageway therein, one end of said passageway being a fluid inlet and an accumulator mounted at the other end thereof, a suction side check valve and a discharge side check valve positioned within said passageway and normally biased closed, said passageway communicating with said pumping chamber in the vicinity of said suction side check valve whereby the suction stroke of said piston opens said suction side check valve and draws fluid into said passageway, said fluid forcing open said discharge side valve chamber, said pumping chamber also communicating with said passageway in the region thereof between said discharge side check valve and said accumulator, fluid being drawn into said pumping chamber therefrom.

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