Sept. 18, 1934. H. H. COBE 1,974,262

RECIPROCATING MECHANISM

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Fig. 1

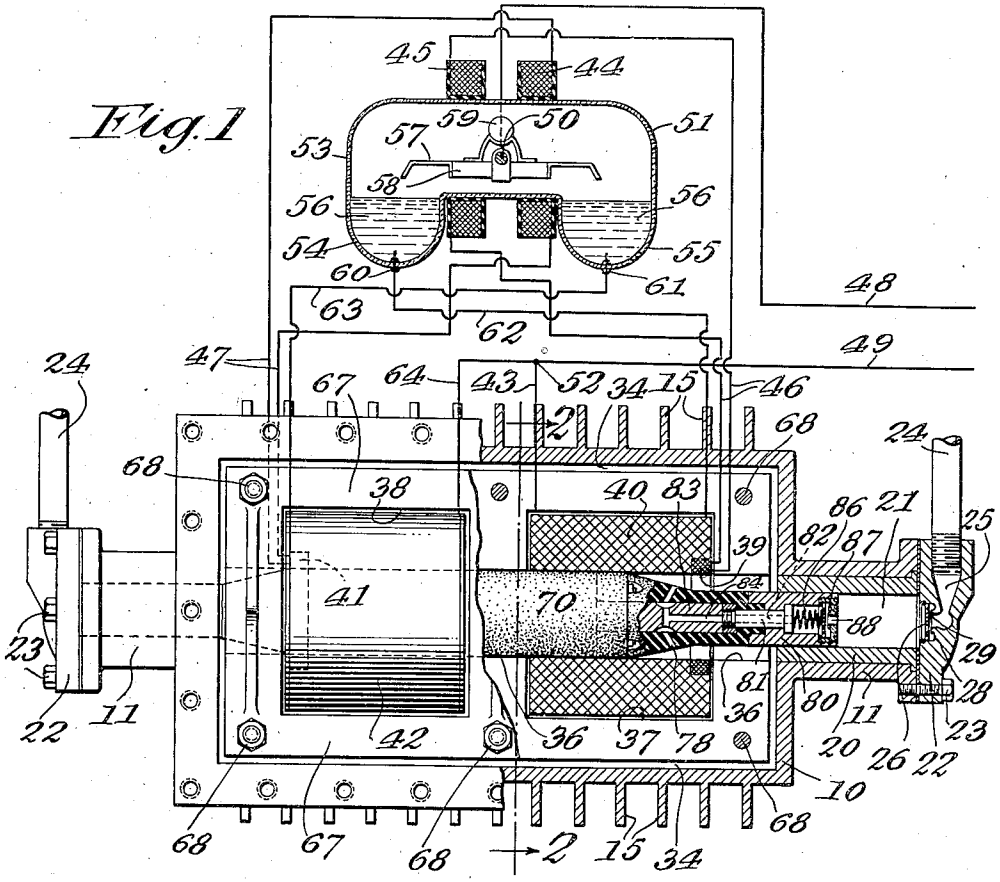


Fig. 2

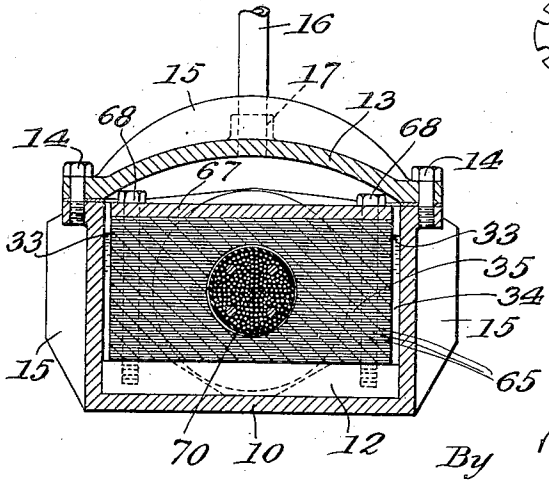


Fig. 4

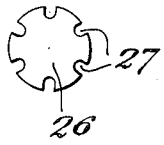
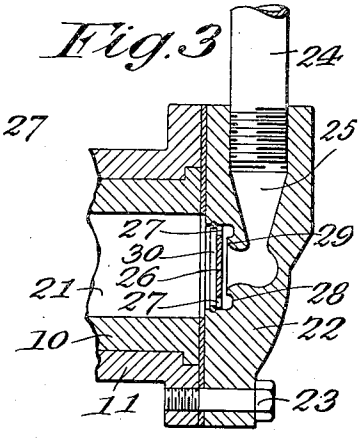


Fig. 3



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Fig. 5

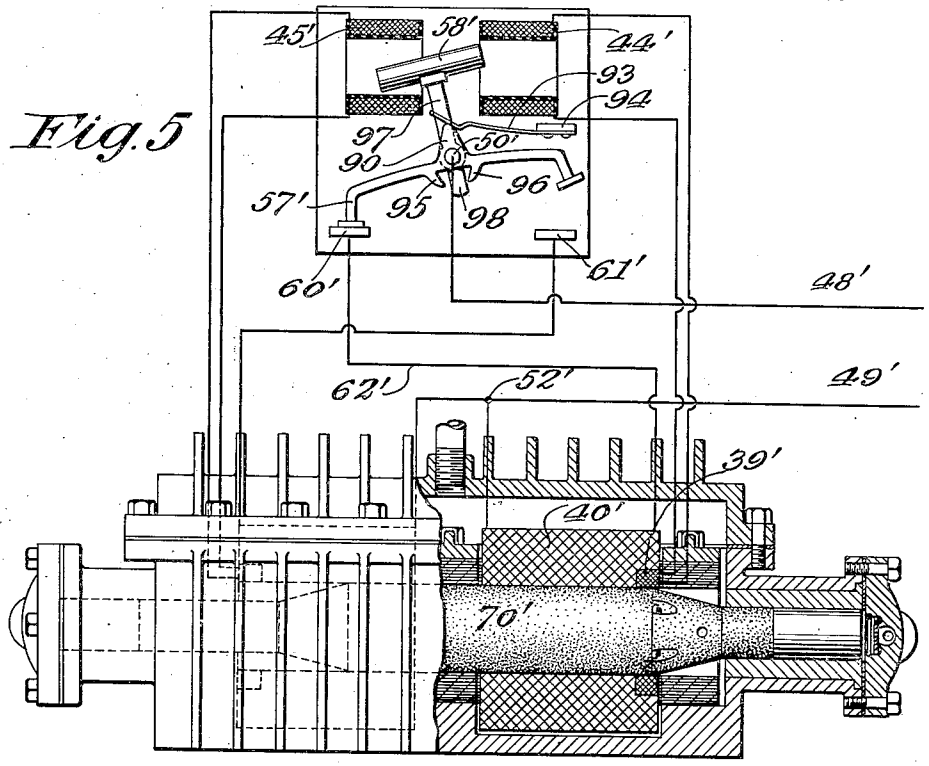


Fig. 6

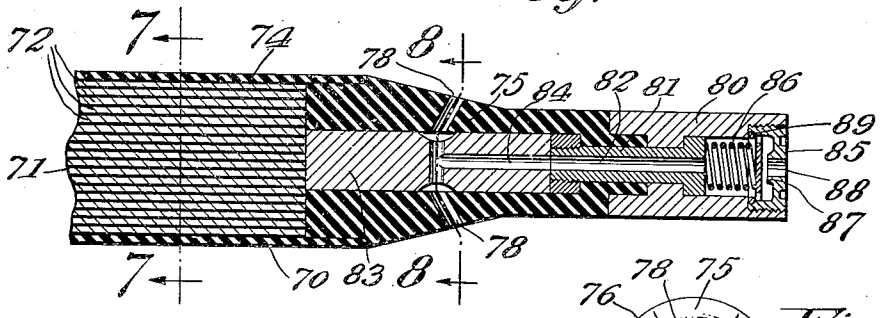


Fig. 7

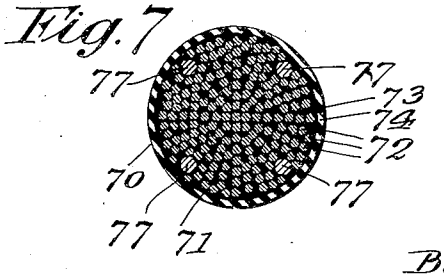
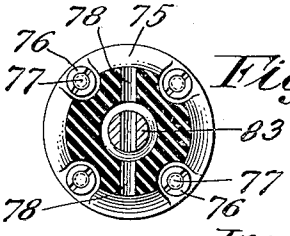


Fig. 8



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UNITED STATES PATENT OFFICE

1,974,262

RECIPROCATING MECHANISM

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Application May 4, 1931, Serial No. 535,010

4 Claims. (Cl. 172—126)

This invention relates to reciprocating mechanism and more particularly to electromagnetic reciprocating mechanism.

It is an object of the invention to provide an efficient reciprocating mechanism which can be manufactured at low cost and which is economical to operate.

Another object of the invention is the provision of an improved electric pump.

A further object of the invention is the provision of an efficient electromagnetic reciprocating mechanism, and particularly, such a mechanism in which the reciprocating element is actuated by the magnetic field produced by an alternating current.

Another object of the invention is the provision of an improved switch mechanism for directing the flow of current alternately to two solenoids.

Before explaining in detail the present invention, it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practised or carried out in various ways. Also it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation, and it is not intended to limit the invention beyond the terms of the several claims hereto appended as considered in view of the prior art and the requirements thereof.

The invention will be more clearly understood from the following description in conjunction with the accompanying drawings: in which,

Fig. 1 is a plan view partly in section of an electric pump embodying the invention and diagrammatically showing the electrical connections from the solenoids of the pump to one type of switch mechanism which is shown in sectional elevation;

Fig. 2 is a sectional view taken upon the line 2—2 of Fig. 1;

Fig. 3 is an enlarged sectional view of a portion of the pump;

Fig. 4 is a plan view of one of the parts;

Fig. 5 is a sectional elevational view of the pump shown in Fig. 1 and showing diagrammatically the electrical connections from its solenoids to a switch mechanism of modified construction which is shown in sectional elevation;

Fig. 6 is an enlarged sectional view of a portion of the pump;

Fig. 7 is a sectional view taken on the line 7—7 of Fig. 6; and

Fig. 8 is a sectional view taken on line 8—8 of Fig. 6.

The invention is illustrated in the accompanying drawings as applied to an electric pump comprising a box-like casing 10 having a hollow cylindrical portion 11 extending from each end. The bottom of the casing 10 is provided with a plurality of transversely extending ribs 12. The top of the casing 10 is closed by a cover 13 which is secured to the casing by screws 14 passing through the cover and engaging the casing. The cover 13 and the sides of the casing 10 are provided with spaced outwardly extending fins 15. A pipe 16 is secured in an exhaust opening 17 in the cover 13. A sleeve 20 is fixed within each projection 11 to provide a cylinder 21 which is closed at its outer end by a head 22 secured to the projection 11 as by screws 23. A pipe 24 is secured in an intake passage 25 in the head 22. A valve 26 in the form of a disc having a plurality of notches 27 on its periphery is positioned in a recess 28 in the head 22 to move axially therein toward and away from its seat 29. The valve 26 when open is adapted to engage an abutment 30.

A body 35 rests upon the ribs 12 and is spaced from the interior surface of the casing 10 to provide a reservoir 34 therebetween which may be partially filled with lubricant 33. The body 35 is provided with a longitudinal passage 36 which communicates with spaced annular passages 37 and 38. Solenoids 39 and 40 are positioned in the passage 37 and solenoids 41 and 42 are positioned in the passage 38. Electrical supply lines 48 and 49 from a source of alternating current are connected to one terminal 50 of a switch 51 and a terminal 52 respectively. The switch 51 comprises a casing 53 extending between solenoids 44 and 45 and having pockets 54 and 55 filled with mercury 56. The solenoids 44 and 45 are connected with solenoids 41 and 39 by conductors 46 and 47 respectively. The terminal 50 is fixed in suitable insulation within the casing 53 and serves as a bearing for rotatably receiving an arm 57. A solenoid core 58 is positioned on the arm 57 below the terminal 50 and a counterweight 59 is supported above the terminal 50. Terminals 60 and 61 electrically connect the mercury in the pockets 54 and 56 respectively. Conductors 62 and 63 connect the terminals 60 and 61 with one end of the solenoid coils 40 and 42 respectively. The other end of each of the solenoids 40 and 42 is connected to the terminal 52 by conductors 43 and 64 respectively.

In the embodiment of the invention illustrated the body 35 is composed of a plurality of superposed strips 65 of magnetic material coated with suitable insulation. Preferably, the strips 65 are high silicon iron, the surface of which has been oxidized to provide a coating of insulating oxide. A plate 67 is positioned upon the strips 65 and in order to hold the strips in engagement is secured to the ribs 12 by screws 68 passing through the plate 67 and each of the strips 65.

A plunger 70 is positioned in the longitudinal passage 36 and comprises a core 71 of suitable magnetic material. In the form illustrated the core 71 is formed by embedding a plurality of small wires 72 of magnetic material in a body 73 of insulating wax. The core 71 is enclosed by a sleeve 74 of suitable insulating material, such as bakelite. A hollow cap 75 of suitable insulating material, such as bakelite, is secured upon each end of the core 71 by nuts 76 engaging rods 77 which extend through the core. Each cap 75 is provided with one or more passages 78 connecting its interior with the passage 36. A hollow piston 80 is secured upon the outer end of each cap 75 by a bolt 81 having a longitudinal passage 82 connecting the interior of the piston and cap. The other end of the cap is closed by a plug 83 having a passage 84 connecting the passages 78 and 82. A valve 85, constructed the same as the valve 26, normally is held by a spring 86 against a valve seat 87 so as to close a passage 88 in the head of the piston 80. When the valve 85 is open it may engage an abutment 89.

When the pistons 80 are moving out of the cylinders 21 a depression is created in the cylinders causing the valves 26 to open and permit fluid to enter the cylinders from the intake passages 25. As the pistons 80 move into the cylinders 21 the fluid therein is compressed until its pressure is equal or greater than the pressure in the reservoir 34, whereupon the valve 85 is forced open against the action of spring 86.

The switch arm 57 is adapted to swing upon the pivot 50 so that its opposite ends alternately engage the mercury in the pockets 54 and 56 so as to direct the current alternately from the lines 48 and 49 to the solenoids 40 and 42. When the arm 57 is immersed in the mercury in the pocket 55 alternating current is supplied from the lines 48 and 49 to the solenoid 42. This causes the plunger 70 to move to the left as viewed in Fig. 1 to compress fluid in the cylinder 21 at the left. As the core 71 advances into the solenoid coil 42 the magnetic field surrounding the latter is increased to an extent sufficient to induce a current in the solenoid coil 41 thereby energizing the solenoid coil 44 of the switch 51. As a result the core 58 carried by the arm 57 is attracted and caused to swing about the pivot 50 to bring the end of the arm 57 into the mercury in the pocket 54.

As the core 71 moves to the left as viewed in Fig. 1 the current induced in the solenoid coil 41 gradually increases so that its magnetic field also gradually increases until a point is finally reached where the magnetic fields of the solenoids 41 and 42 are balanced thus bringing the core to a position of rest. When the arm 57 becomes immersed in the mercury in the pocket 54 the flow of current from the lines 48 and 49 is directed through the solenoid coil 40 thus causing the plunger 70 to move to the right as viewed in Fig. 1 thereby compressing fluid in the cylinder 21 at the right.

In the modified form of switch construction illustrated in Fig. 5, the arm 57′ is mounted upon the pivot 50′ so that its ends may engage either of the contacts 60′ and 61′. A projection 90 extends upwardly from the arm 57′ above the pivot 50′ and engages an inclined leaf spring 93 fixed upon a support 94. Lugs 95 and 96 depend from the arm 57′ on opposite sides of the pivot 50′. The solenoid plunger 58′ is carried by an arm 97 pivotally mounted at an intermediate point upon the pivot 50′. A finger 98 near the other end of the arm 97 is adapted to engage either of the lugs 95 and 96.

The arm 57′ is shown in Fig. 5 in engagement with the contact 60′ thereby connecting the solenoid coil 40′ with the feed lines 48′ and 49′ thereby energizing the solenoid 40′ to cause the plunger 70′ to move to the right as viewed in Fig. 5. In so doing a current is induced in the solenoid coil 39′ to energize the solenoid coil 44′ and attract the plunger 58′ to move the arm 57′ into engagement with the contact 61′ thereby directing the current from the feed lines 48′ and 49′ to the solenoid coil 42′. Thus, the flow of current from feed lines 48′ and 49′ is alternately directed to the solenoids 40′ and 42′.

The laminated structure of the body 35 and the core 71 prevents the magnetic field of the solenoids from inducing a current therein flowing circumferentially of the axis of the plunger, thus avoiding the generation of an excessive amount of heat and utilizing the electrical energy in an efficient manner. The lubricant 33 in the reservoir 34 is continuously forced under pressure between the pistons 80 and the walls of cylinders 21. Any excess accumulation of oil between the pistons and the cylinder heads is returned to the reservoir through the passage 82 in the head of the pistons.

I claim:

1. In an electromagnetic reciprocating mechanism, in combination, a magnetic plunger, electromagnetic means for reciprocating said plunger, a switch for controlling the flow of current to said electromagnetic means, and means actuated in response to a current induced by the magnetic field of said electromagnetic means for operating said switch.

2. In an electromagnetic reciprocating mechanism, in combination, a magnetic plunger, two solenoids for reciprocating said plunger, a separate electrical conductor positioned in the magnetic field of each solenoid adjacent the path of travel of the plunger, and means actuated by the current induced in said conductors when said solenoids are energized for directing the flow of current to said solenoids alternately.

3. In an electromagnetic reciprocating mechanism, in combination, a magnetic plunger, two solenoids for reciprocating said plunger, a separate electrical conductor positioned near the outer region of the magnetic field of each solenoid adjacent the path of travel of the plunger, and means actuated by the current induced in said conductors when said solenoids are energized for directing the flow of current to said solenoids alternately.

4. In an electromagnetic reciprocating mechanism, in combination, a body, a magnetic plunger, two solenoids embedded in said body for reciprocating said plunger, a separate electrical conductor positioned in the magnetic field of each solenoid adjacent the path of travel of the plunger, and means actuated by the current induced in said conductors when the solenoids are energized for directing the flow of current to said solenoids alternately, said body comprising insulated members of magnetic material extending parallel to the path of travel of the plunger.

HARRY H. COBE.