

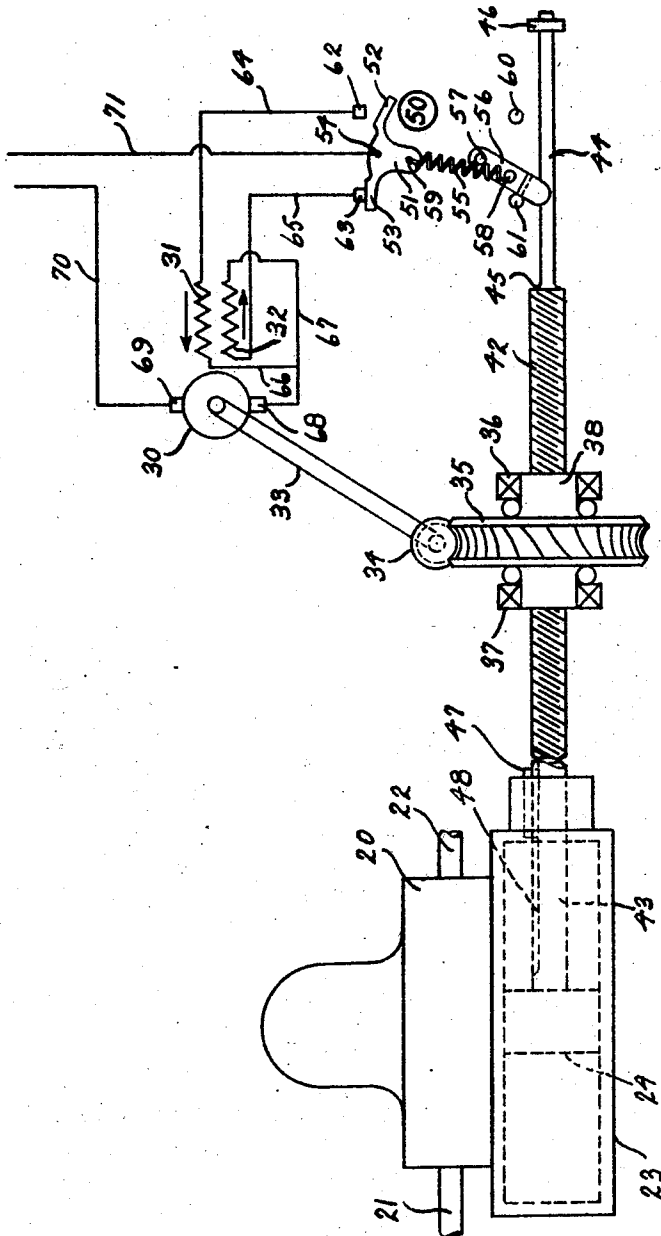
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R. L. LEE

PUMPING APPARATUS

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# UNITED STATES PATENT OFFICE.

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## PUMPING APPARATUS.

Application filed August 3, 1923. Serial No. 655,470.

*To all whom it may concern:*

Be it known that I, RALPH L. LEE, a citizen of the United States of America, residing at Dayton, county of Montgomery, and State of Ohio, have invented certain new and useful Improvements in Pumping Apparatus, of which the following is a full, clear, and exact description.

This invention relates to pumping apparatus, and more particularly to piston pumps of relatively long stroke.

Among the objects of the present invention is to operate the reciprocating member or piston of a pump in a simple and effective manner.

In order to attain this aim of the invention, the embodiment shown herein provides a reversible electric motor connected by means of suitable gearing with a nut cooperating with a screw threaded shaft connected with the pump piston. Endwise movement of the nut is restrained so that revolution of the nut in opposite directions will effect axial movement of the screw threaded shaft in opposite directions. The screw threaded shaft is prevented from rotating by means of a spline and key connection with a stationary part. Means are provided for reversing the electric motor, said means being controlled by the movement of the screw threaded shaft.

Other and further objects of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred embodiment of one form of the present invention is clearly shown.

In the drawings:

The figure of the drawings discloses diagrammatically pumping apparatus including the present invention.

Referring to the drawings, a pump 20 is provided with an inlet 21, an outlet 22 and a cylinder 23, within which a piston 24 is adapted to be reciprocated in a manner to be described. A reversible electric motor 30, including separate reversing fields 31 and 32, is provided with an armature shaft 33 connected with a worm 34. Worm 34 cooperates with a worm gear 35 supported by bearings 36 and 37 which prevent endwise movement of the worm gear hub 38. Hub 38 of the worm gear 35 is internally threaded and functions as a nut cooperating with a screw threaded shaft 42. An unthreaded

end 43 of the shaft 42 extends into the pump cylinder 23 and functioning as a piston rod is connected with piston 24. The opposite end of shaft 42 is provided with a reduced unthreaded portion 44, forming a shoulder 45. A stop member 46 is secured to said portion 44 adjacent its outer end. Rotation of shaft 42 is prevented by key 47 cooperating with a groove 48 in shaft 42.

A reversing switch 50 comprises a switch arm 51, provided with contacts 52 and 53 and pivoted at 54. A coil spring 55 is attached to a lever 56, pivoted at 57, by a pin 58 and to switch arm 51 by a pin 59. Stops 60 and 61, spaced equally distant from the pivot point 57, limit the throw of lever 56. Contacts 52 and 53 cooperate with contacts 62 and 63, respectively, which are connected with the motor fields 31 and 32, respectively, by wires 64 and 65, respectively. Fields 31 and 32 are wound so as to produce opposite magnetic effects with respect to the motor armature to cause it to rotate in opposite directions as the fields are successively and alternately connected with a current source. The opposite ends of these fields 31 and 32 are connected with motor brush 68 by wires 66 and 67, respectively. Motor brush 69 and switch arm 51 are connected with a suitable source of electrical current through wires 70 and 71, respectively.

### *Mode of operation.*

Assuming that the circuit connections are in the position shown in the drawings, the circuit from the source of current includes wire 70, brush 69, the motor armature, brush 68, wire 67, the field 32, wire 65, contact 63, contact 53 and wire 71. The motor 30 will rotate the shaft 33, causing the worm 34 to drive the worm gear 35 and the hub 38, to move the screw shaft 42 endwise to the right, as viewed in the drawings, thus moving the piston 24 in the same direction, drawing fluid into the pump 20 through inlet 21 and forcing it out through outlet 22, in the usual manner. As the shaft 42 moves to the right, the shoulder 45 will come in contact with the lever 56, shifting it on its pivot 57. As soon as the lever 56 passes its dead center, the spring 55 will snap the switch arm 51 over, through its pivotal connection 54, causing contacts 63 and 53 to be quickly broken and contacts 62 and 52 to be quickly brought together, thus exciting the

field 31 and causing the motor 30 to rotate in the opposite direction. The circuit connections will then include wire 71, switch arm 51, contact 52, contact 62, wire 64, field 31, wire 66, wire 67, brush 68, motor armature, brush 69, and wires 70 and 71 being connected with a current source.

When the direction of rotation of the motor is reversed, the shaft 33 will be rotated in the reverse direction, thus causing worm 34 to rotate the worm gear 35 in a reverse direction thereby moving the screw shaft 42 and piston 24 endwise to the left as viewed in the drawing. As the shaft 42 moves to the left, the stop 46 will come in contact with the lever 56, shifting it on its pivot 57. As soon as the lever passes its dead center, the spring 55 will snap the switch arm 51 over, through its pivotal connection 54, causing contacts 52 and 62 to be quickly broken and contacts 63 and 53 to be quickly brought together to produce a repetition of the cycle of operations heretofore described.

One advantage of the present invention is the application of the full power of the prime mover substantially at the beginning of each stroke of the piston and the continuance of that application of full power until substantially the end of the stroke. This is an effect which cannot be produced by the usual crank operated piston.

Another advantage is that the space requirements are less than required for crank mechanism especially when the stroke of the piston is relatively great.

While the form of mechanism herein shown and described constitutes a preferred embodiment of one form of invention, it is to be understood that other forms might be adopted and various changes and alterations made in the shape, size, and proportion of the elements therein without departing from the spirit and scope of the invention.

What is claimed is as follows:

1. Pumping apparatus comprising, in combination, a pump including a piston and a piston rod provided with a screw threaded portion; a nut for operating said piston rod; an electric motor for driving the nut and including separate motor reversing fields; a switch for rendering either of the fields

operative; and connections between said switch and piston rod whereby said field may be successively and alternately rendered operative automatically to reverse the motor.

2. Pumping apparatus comprising, in combination, a pump including a reciprocating piston; an electric motor having separate motor reversing fields and an armature shaft with a worm cut thereon; a worm gear cooperating with said worm and provided with an internally threaded hub; a screw shaft extending through said hub and cooperating therewith but held against rotary movement, one end of the screw shaft connecting with said piston; a switch for rendering either of the fields operative; and provisions carried by said screw shaft whereby said fields may be successively and alternately rendered operative automatically to reverse the motor.

3. Pumping apparatus comprising, in combination, a pump including a reciprocating piston and a piston rod provided with a screw threaded portion; a nut cooperating with the threaded portion for reciprocating said piston rod; an electric motor for driving the nut and having separate motor reversing fields; of a switch for rendering either of the fields operative; and connections between said switch and piston rod whereby said fields may be successively and alternately rendered operative automatically to reverse motor.

4. Pumping apparatus comprising, in combination, a pump including a reciprocating piston; an electric motor having separate motor reversing fields and an armature shaft with a worm cut thereon; a worm gear cooperating with said worm and provided with an internally threaded hub; a screw shaft extending through said hub and cooperating therewith to effect endwise movement of said screw shaft, one end of the screw shaft connecting with said piston; a switch for rendering either of the fields operative; and provisions carried by said screw shaft whereby said fields may be successively and alternately rendered operative automatically to reverse the motor.

In testimony whereof I hereto affix my signature.

RALPH L. LEE.