Sept. 20, 1932. R. J. HOLMGREEN 1,877,873

DIAPHRAGM PUMP

Filed Jan. 9, 1931 4 Sheets-Sheet 1

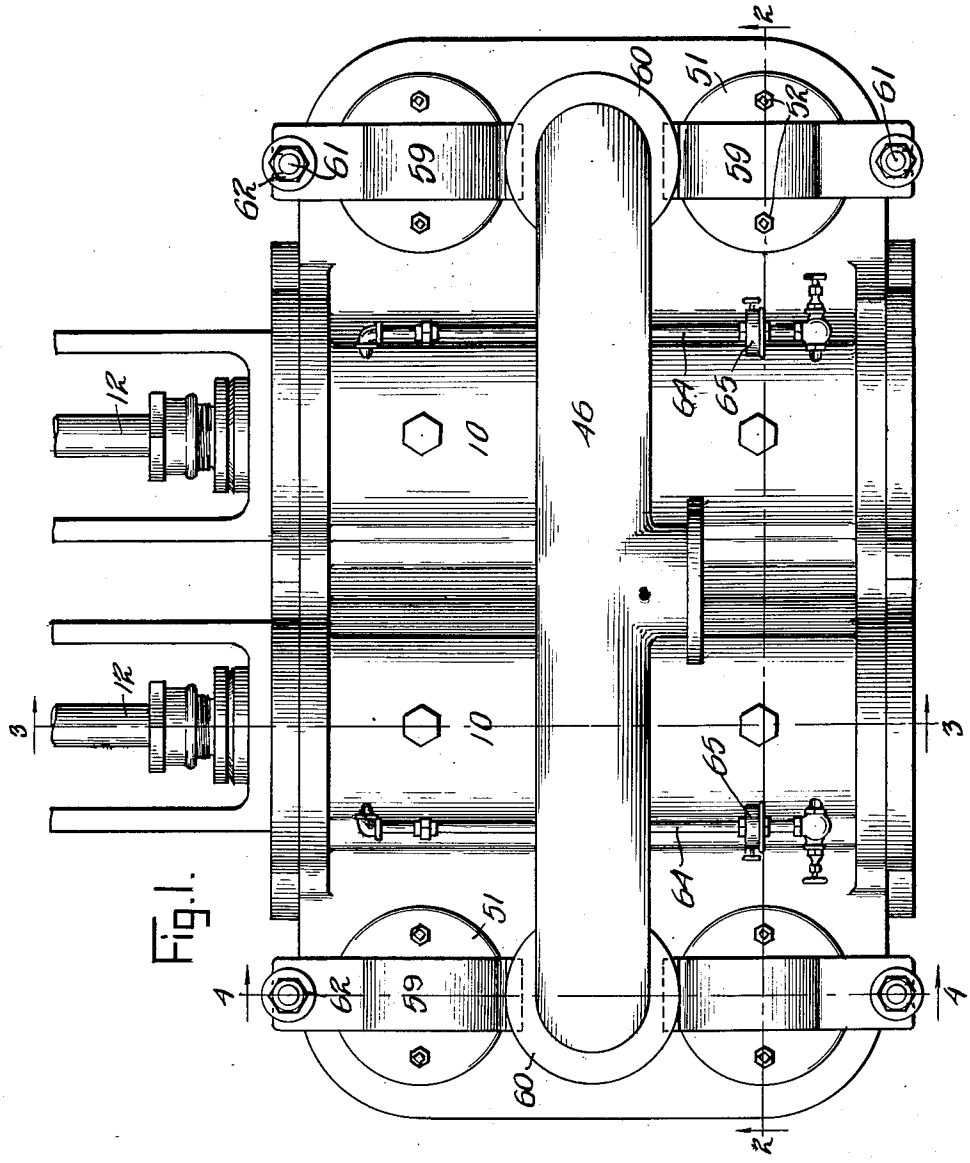


Fig. 1.

Inventor
Richard J. Holmgreen

By E. W. Bedford

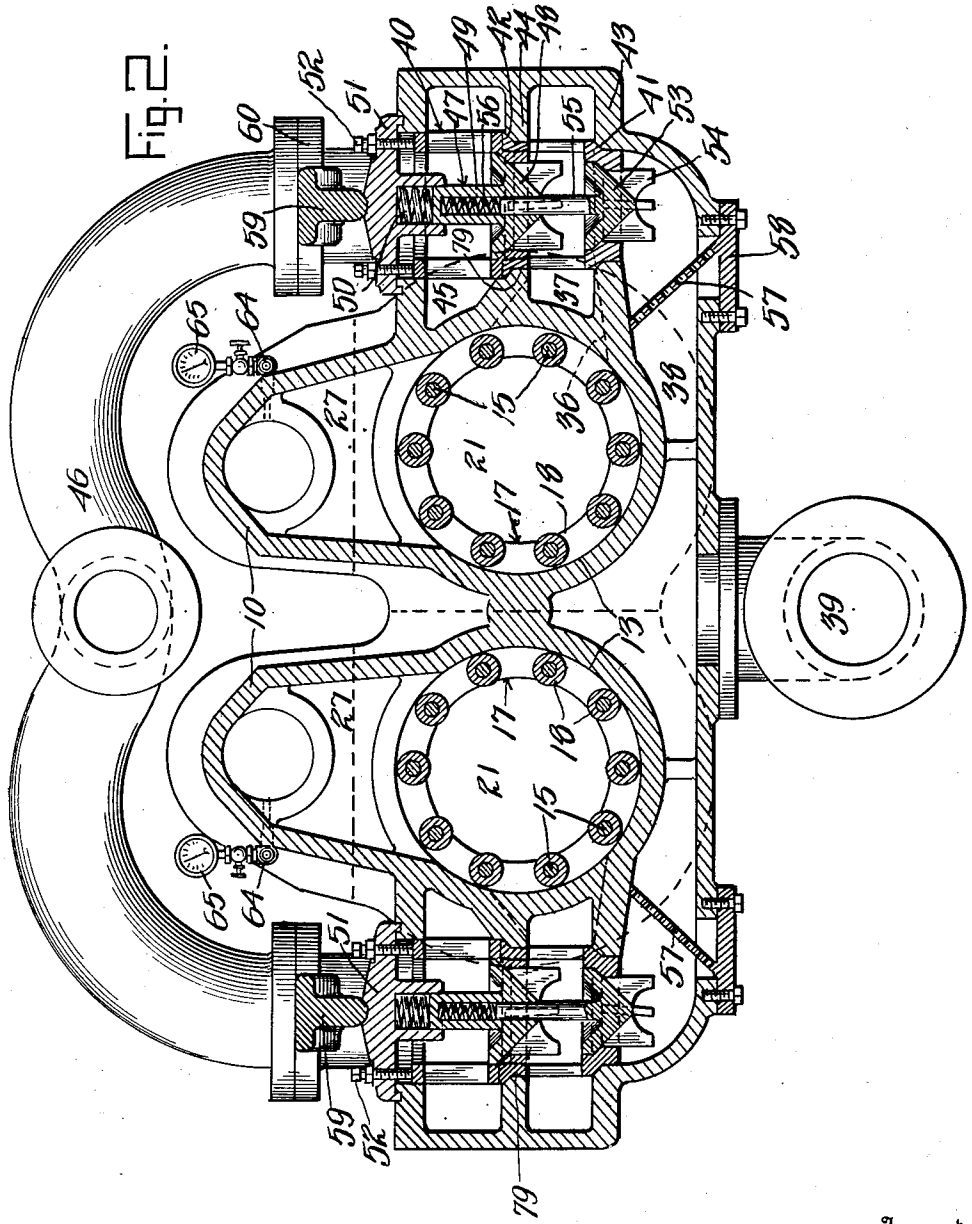
Attorney

Sept. 20, 1932. R. J. HOLMGREEN 1,877,873

DIAPHRAGM PUMP

Filed Jan. 9, 1931 4 Sheets-Sheet 2

Fig. 2.



Inventor
Richard J. Holmgreen

By

Attorney

Sept. 20, 1932. R. J. HOLMGREEN 1,877,873

DIAPHRAGM PUMP

Filed Jan. 9, 1931 4 Sheets-Sheet 3

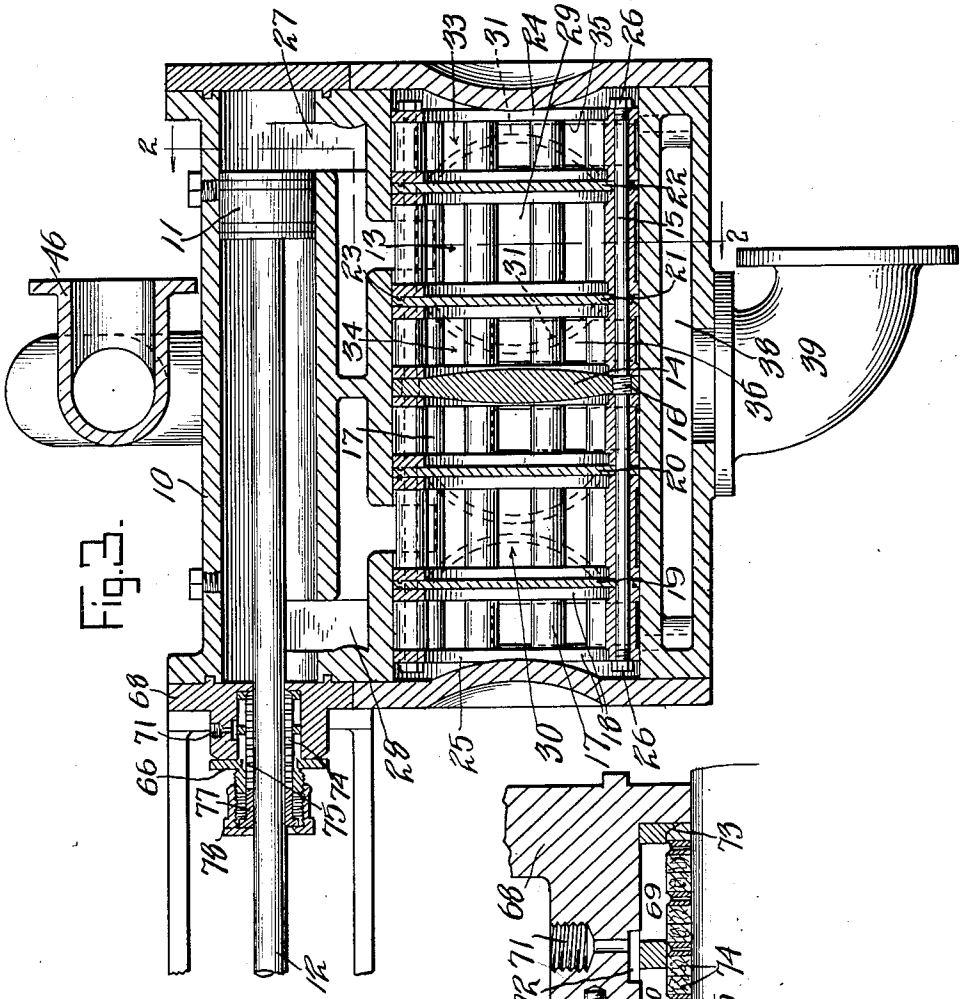


Fig. 3.

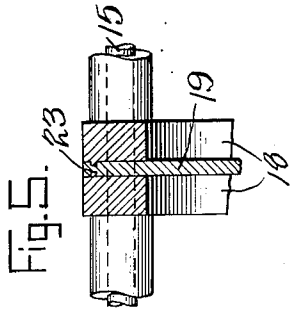


Fig. 5.

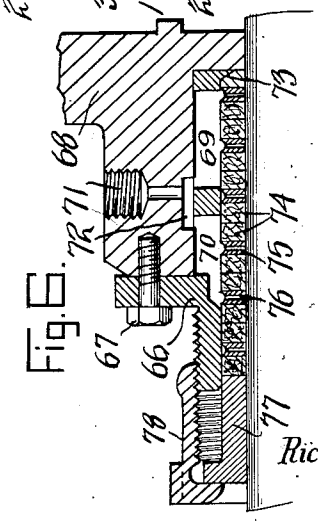


Fig. 6.

Inventor
Richard J. Holmgreen

By

Attorney

Sept. 20, 1932. R. J. HOLMGREEN 1,877,873

DIAPHRAGM PUMP

Filed Jan. 9, 1931 4 Sheets-Sheet 4

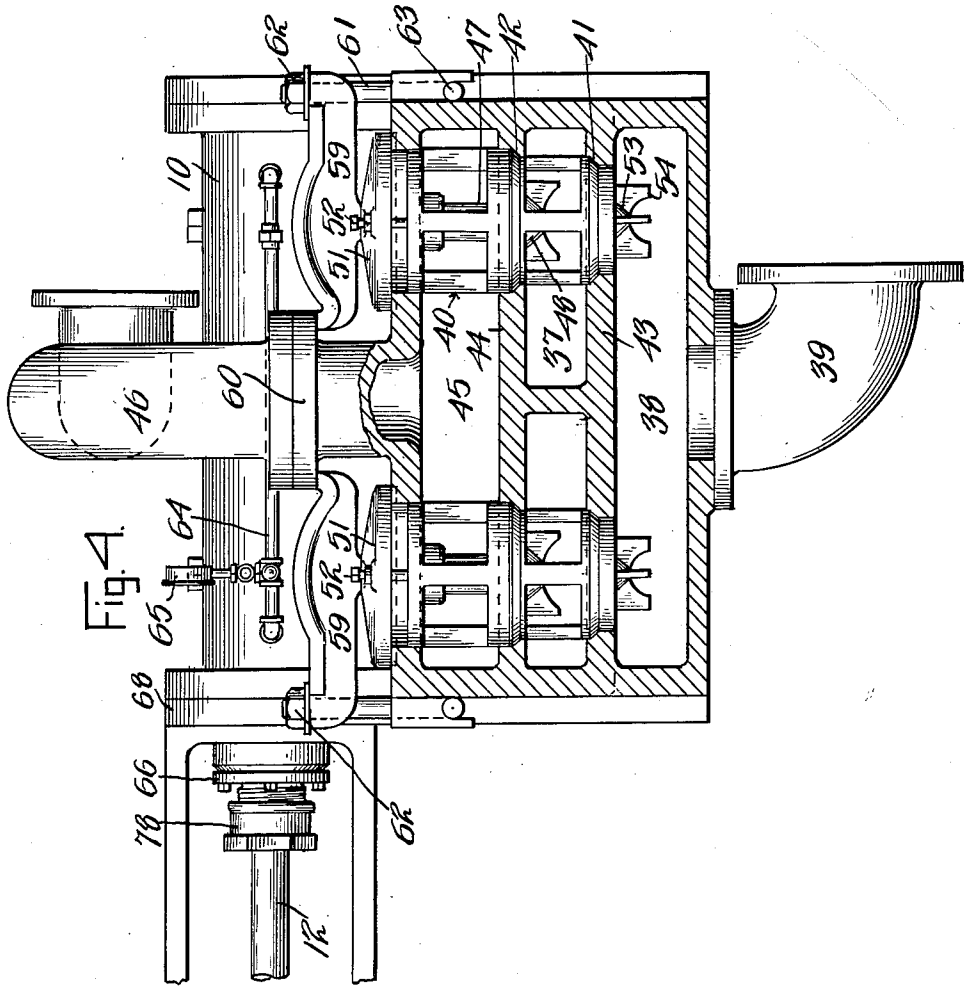


Fig. 4.

Inventor
Richard J. Holmgreen

By

Attorney

Patented Sept. 20, 1932 1,877,873

UNITED STATES PATENT OFFICE

RICHARD J. HOLMGREEN, OF SAN ANTONIO, TEXAS

DIAPHRAGM PUMP

Application filed January 9, 1931. Serial No. 507,671.

This invention relates to pumps of the flexible disk or diaphragm type in which the diaphragm is given its motion by a liquid which in turn is actuated by a solid piston.

An object of the invention is to provide a pump of this type adapted particularly for use in pumping a damaging or gritty liquid and to provide for preventing injury to the cylinder and piston of the pump.

A further object is to provide a pump which may be easily assembled to remove and restore injured parts.

A further object is to provide new lubricating means for moving parts of the pump.

Further objects and advantages will become apparent as the description proceeds.

Referring to the accompanying drawings, which are made a part hereof and on which similar reference characters indicate similar parts,

Figure 1 is a top plan view of the pump,

Figure 2, a section on line 2—2 of Figure 1,

Figure 3, a section on line 3—3 of Figure 1,

Figure 4, a section on line 4—4 of Figure 1,

Figure 5, an enlarged view of a detail showing features of the diaphragms, and

Figure 6, a section showing the lubricating means for the piston rod.

Briefly stated this invention consists of a suitable piston operated in a cylinder by any suitable motive power. The cylinder and piston provide a pump having a pumping chamber at each end of the piston. A body of relatively clean liquid fills the pumping chamber and this liquid acts against a plurality of diaphragms which diaphragms are caused to flex back and forth and serve as the pumping means for the damaging liquid to be pumped. Since no reciprocating metal parts contact with the gritty liquid, injury to the pump cylinder and piston is avoided.

In the drawings numeral 10 indicates pumping cylinders having pistons 11 reciprocably mounted therein, the pistons being operated through piston rods 12 connected to any suitable means for actuating them. In order to simplify the structure and to secure the maximum output with a minimum of pumping elements a pair of cylinders and pistons is provided, each of which is alike so that a duplex pump having opposite sides of exactly similar structure is provided. This being true it will be necessary to describe only one pumping side in order to simplify the description. Preferably made integral with the pump cylinder 10 is a chamber 13 in which the pumping diaphragms which constitute the actual pumping elements about to be described are positioned. These pumping units are built up as follows:

Through a central plate 14, rods 15 are screw threaded, these rods having an enlarged threaded portion 16 at which they are threaded in the plate 14. Lantern rings 18 having spacing posts 17 between them are provided for holding diaphragms 19, 20, 21 and 22 in place. As shown the rings 18 and posts 17 are integral, however, the posts may be made separate and held between opposite rings 18. In order to hold the diaphragms securely in position when being flexed the rings 18 are provided with annular beads 23 which are pressed into the edges of the diaphragms when the rings and diaphragm are secured in position. After the sets of rings and diaphragms have been put in position they are secured together by means of nuts 26 on the rods 15. All of the units are screwed down tightly in position. As may be seen from Fig. 3 a chamber 27 is provided at the right of the piston 11 and a chamber 28 at the left of the piston. These chambers are filled with relatively clean pumping liquid. The chamber 27 communicates with a chamber 29 formed between the diaphragms 21 and 22 and the chamber 28 communicates with a chamber 30 formed between diaphragms 19 and 20. It will be understood that upon reciprocation of the pistons 11 the diaphragms will be caused to flex. When the piston moves to the right the diaphragms will be flexed to the positions show in dotted lines at 31 and the diaphragms 19 and 20 will be flexed to the positions shown in dotted lines at 30. Chambers 33 and 34 are in communication through ports 35 and 36 with chamber 37. A common intake cham-

ber 38 is connected to an inlet pipe 39. A valve assembly shown as a whole at 40 consists of two valve cages screw threaded together at 79. The cages provide valve seats 41 and 42 for valves 48 and 53. The valve seat 42 is larger than valve seat 41 so as to accommodate a larger outlet than inlet valve. The valves are positioned in the partition 43 separating the suction chamber 37 from the intake chamber 38 and in the partition 44 separating the chamber 37 from the discharge chamber 45. The outlet valve 47 consists of a cone shaped portion 48 and a valve stem 49 against the upper end of which presses a spring 50, to hold the valve on its seat. The spring 50 is seated in a suitable socket in a cap 51 which closes the valve chamber. Screws 52 threaded through the cap 51 seat against the upper end of the valve assembly 40 and hold the valve in place. The intake valve consists of a cone shaped valve portion 53 guided by a plurality of wings 54. A valve stem 55 extends up within a bore in the valve stem 49 of the valve 47 and a spring 56 rests against the upper end of the valve stem 55 to hold this valve on its seat. The spring 50 is stronger than the spring 56 so that the valve 47 will remain seated when the valve 53 opens. A screen plate or sieve 57 is secured to or made integral with a cover 58. The purpose of the screen is to prevent injurious grit and gravel from entering the intake portion of the pump. The cover plate 51 is held in position by means of a latch 59 which has one end positioned beneath the flange 60 and has its other end slotted to receive a locking bolt 61 which has a nut 62 on its outer end, the bolt being pivoted at 63 so that it may be swung out to release the latch 59 when the nut 62 is loosened.

Since the area at the right face of the piston 11 is necessarily greater than the area at the left face of this piston due to the piston rod 12 an equalizing pipe 64 connects the chambers at the front and the rear of the piston 11. In this line may be placed a pressure gauge 65.

Figure 6 shows means for lubricating the piston rod 12. A cage 66 is secured on the pump head 68 by means of bolts 67. The inner end of the cage is channeled at 69 and 70. An oil channel 71 is provided in the head. A channel 72 connects channels 69 and 70. The inner end of the cage is given a lip 73 which assists in withdrawing the packing when the cage is withdrawn. Within the cage and surrounding the piston rod 12 are packing material 74 and packing rings 75. The packing rings have radial channels 76 for delivering lubricant to the center of the rings to the piston rod 12. The packing material and rings are compressed into fluid contact by a gland 77 held on by a nut 78.

In operation power is applied to the piston rods 12 and these are reciprocated. Pressure applied to the liquid in the chambers 27 and 28 causes the diaphragms to flex to the dotted line positions shown in Figure 3. For example as the piston moves to the right the diaphragms 21 and 22 will be flexed to the dotted line positions shown. Fluid therefore is forced out of the pumping chambers 33 and 34 through the outlet ports 35 and 36 into the common outlet chamber 45 through which it passes through the outlet conduit 46. Upon the suction stroke the diaphragms are flexed in the opposite direction at which time fluid is drawn in through the valve 53 into the chamber 37 from which it is forced on the pressure stroke out through the valve 47 into the chamber 45. On the return stroke diaphragms 19 and 20 are flexed outwardly to force fluid through the valves on the opposite end of the pumping chamber. By having pumping chambers on both strokes of the piston and by having a pair of pistons a steady stream of fluid is delivered through the outlet passage 46. It will be readily seen from the description given that the piston 11 and the cylinder 10 do not come in direct contact with the gritty abrasive liquid which is being pumped. When worn out the diaphragms may be readily removed and new diaphragms supplied.

It will be obvious to those skilled in the art that various changes may be made in my device without departing from the spirit of the invention and therefore I do not limit myself to what is shown in the drawings and described in the specification, but only as indicated by the appended claims.

Having thus fully described my said invention, what I claim as new and desire to secure by Letters Patent, is:

1. A pump comprising a casing having a cylinder and a piston movable therein, a chamber having a plurality of flexible diaphragms therein, said diaphragms separating the piston from the fluid to be pumped, a body of liquid contained between said piston and the said diaphragms, the said fluid acting as an operating medium between the piston and the diaphragms, substantially as set forth.

2. A diaphragm pump comprising a chamber having inlet and outlet passages thereto, a plurality of diaphragms in said chamber, a body of liquid confined at one side of each diaphragm, and means for applying pressure to said liquid to flex the diaphragms, substantially as set forth.

3. A duplex pump comprising a plurality of chambers each having a pair of diaphragm partitions therein, some of said chambers being in communication with a fluid to be pumped, other chambers being filled with an actuating liquid, and a plurality of pistons for actuating said liquid to flex the diaphragms, substantially as set forth.

4. A duplex pump comprising a chamber, a cage secured in said chamber, said cage comprising a plurality of diaphragms secured in spaced apart relation, a cylinder, a piston movable in said cylinder, pulsating chambers formed by the piston and the diaphragms, pumping chambers formed on the opposite sides of the diaphragms, said pumping chambers being in communication with fluid to be pumped, substantially as set forth.

5. A duplex pump comprising a chamber having a plurality of diaphragms positioned therein, a cylinder, a piston movable in said cylinder, a liquid filled pulsating chamber formed at each side of the said piston, said chambers communicating each with a chamber between a pair of diaphragms, chambers formed on the opposite sides of said diaphragms, said last-named chambers being in communication with fluid to be pumped, substantially as set forth.

6. A duplex pump comprising a pair of chambers having a common fluid inlet thereto, each chamber having a set of pumping diaphragms positioned therein, a pair of cylinders having pistons movable therein, pulsating chambers formed at each side of the cylinders, said pulsating chambers communicating with the chambers between a pair of diaphragms, pumping chambers on the opposite sides of said diaphragms in communication with fluid to be pumped, substantially as set forth.

7. A duplex pump comprising a pair of chambers having a common fluid inlet thereto, each chamber having a set of pumping diaphragms therein, a pair of cylinders having pistons movable therein, pulsating chambers formed at each side of the pistons and a fluid passage connecting the chambers at each side of the pistons to permit fluid to pass from one chamber to the other to compensate for the difference in volume due to the presence of the piston rod in one of the chambers, substantially as set forth.

In witness whereof, I have hereunto set my hand at San Antonio, Texas, this 31st day of Dec., A. D. nineteen hundred and thirty.

RICHARD J. HOLMGREEN.