(No Model.) 2 Sheets—Sheet 1.

I. P. LAMBING.

DUPLEX ROTARY FORCE PUMP.

No. 508,574. Patented Nov. 14, 1893.

Fig. 1.

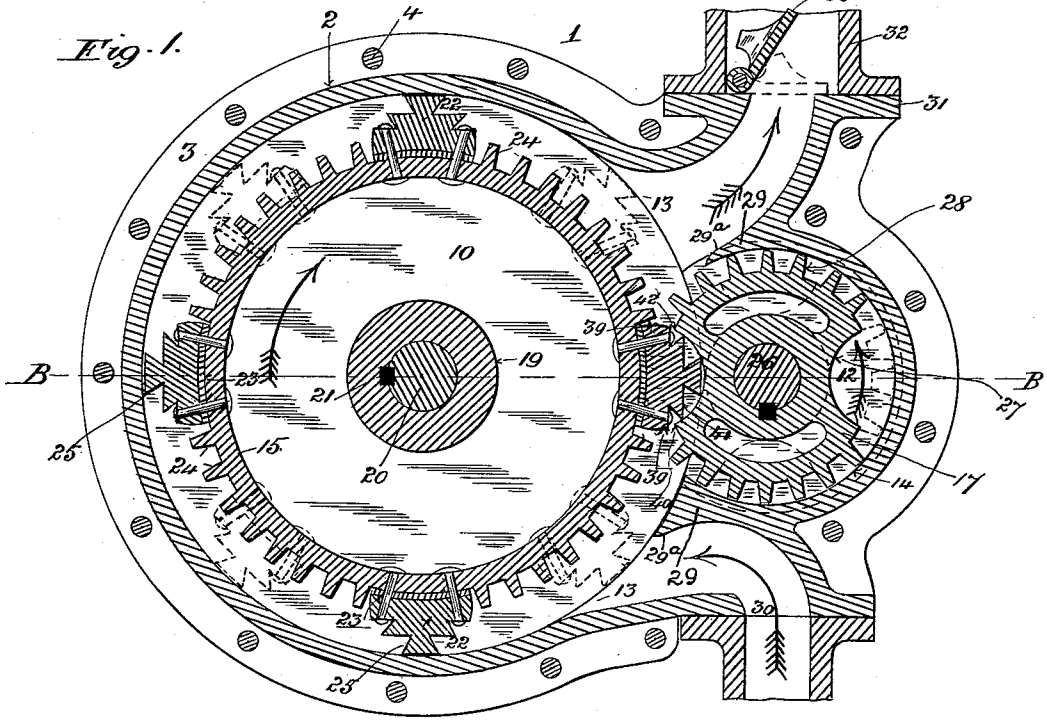
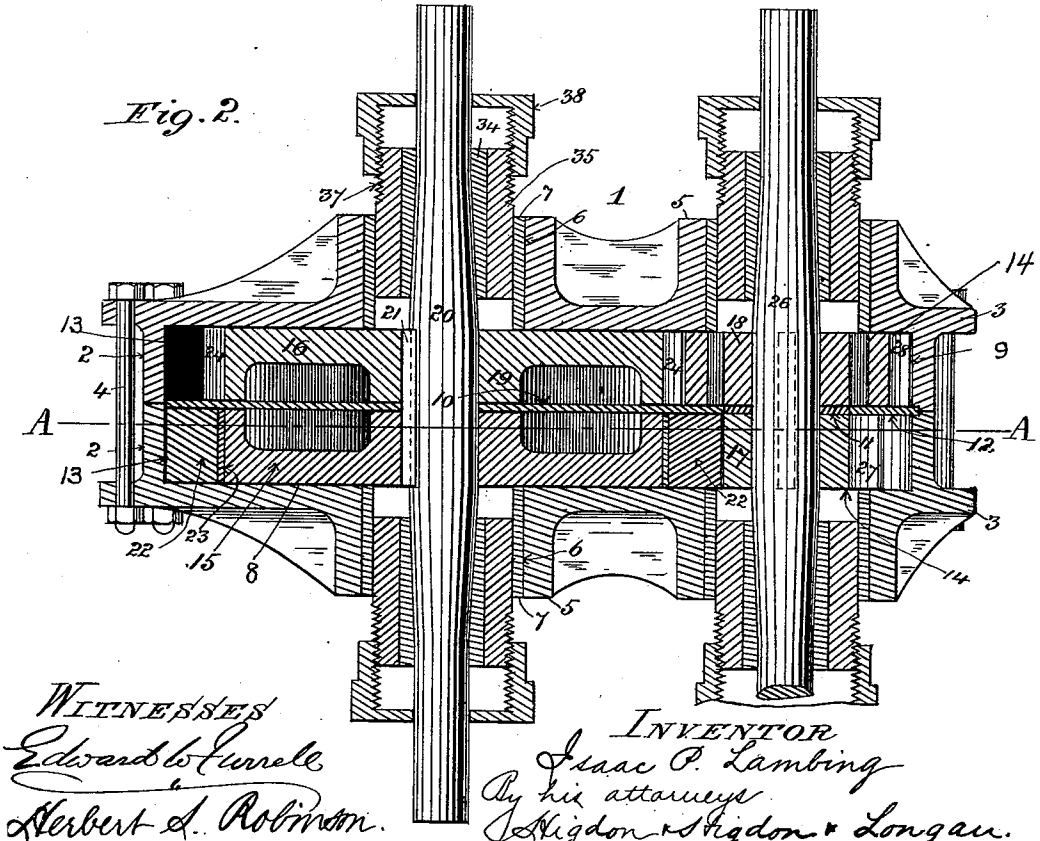


Fig. 2.



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(No Model.) 2 Sheets—Sheet 2.

I. P. LAMBING.

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Fig. 3.

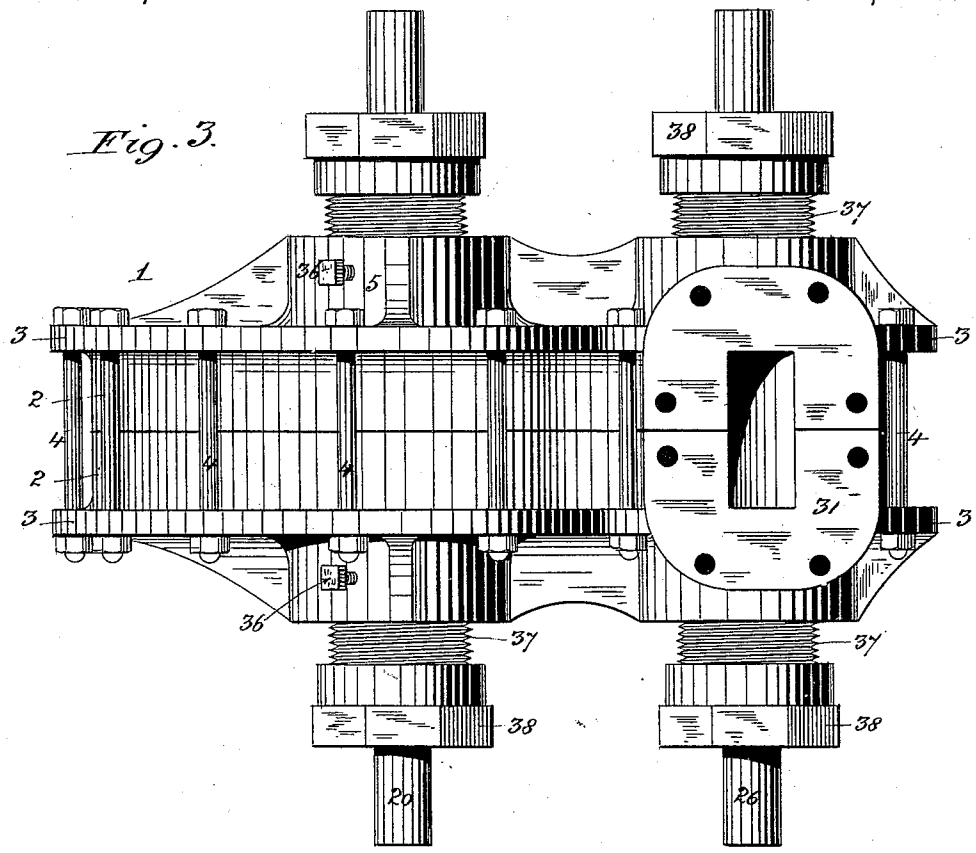
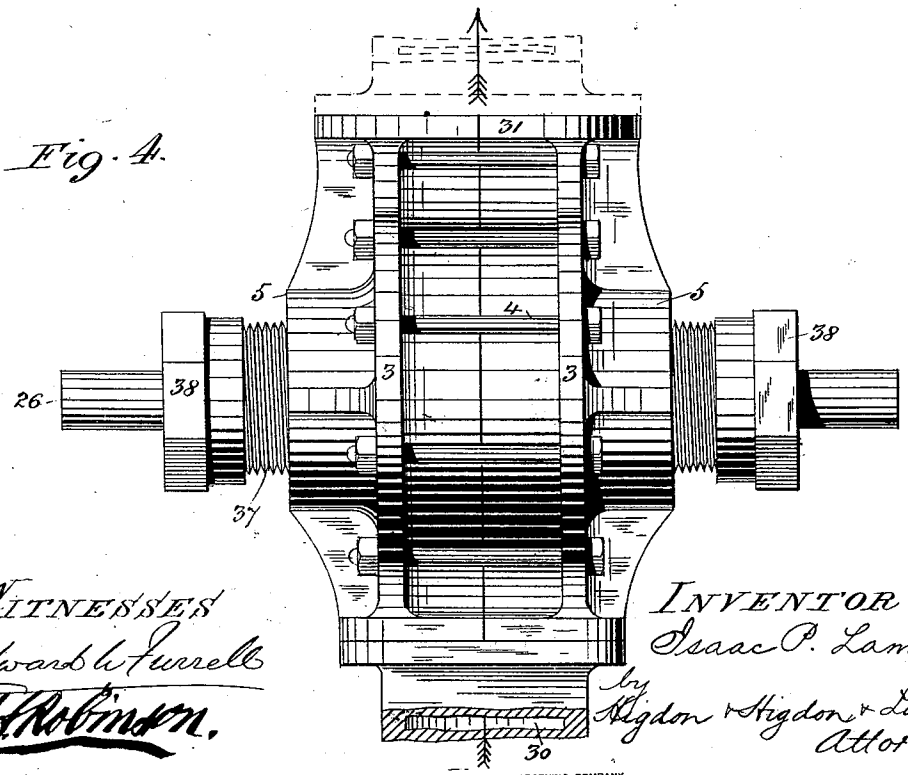


Fig. 4.



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DUPLEX ROTARY FORCE-PUMP.

SPECIFICATION forming part of Letters Patent No. 508,574, dated November 14, 1893.

Application filed October 18, 1892. Serial No. 449,281. (No model.)

To all whom it may concern:

Be it known that I, ISAAC P. LAMBING, of Golden, Jefferson county, in the State of Colorado, have invented certain new and useful Improvements in Duplex Rotary Force-Pumps, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part hereof.

My invention relates to improvements in a class of pumps commonly known as "duplex rotary force pumps," and consists in the peculiar arrangement and construction of parts, as will be more fully hereinafter described and set forth in the claims.

The object of my invention is to construct a rotary force pump which combines simplicity and durability in its construction and operation and which at the same time embodies features which render the pump especially applicable for use under any circumstances, where the water has to be thrown to a great height and in large or small quantities.

The relative size of the rotary piston cylinder and the revolving valve is an immaterial point, which is left for decision to the circumstances and necessities under which the device is to be operated.

The revolving parts create an intense suction owing to the exactness which is used in fitting the parts together.

In the drawings: Figure 1 is a vertical transverse sectional view of my complete device, taken on a line A—A in Fig. 2, and showing in dotted lines, the relative location of the keystone pistons of the adjacent revolving piston cylinder, the view being taken from the bottom of the sheet upward. Fig. 2 is a horizontal transverse sectional view looking down from the top of the sheet, on a line B—B in Fig. 1. Fig. 3 is a top plan view of my complete invention showing all exterior parts in detail. Fig. 4 is an end elevation of my device looking from the right-hand of Fig. 3, and showing in dotted lines the pipe connecting with the discharge orifice.

Referring to the drawings: 1 indicates my complete device, consisting exteriorly of two casings 2 which are provided with extending flanges 3 by means of which the same are held together by the use of bolts 4, the inner edges of said casings 2 being provided with suitable doweling pins to hold the same in position. The casing comprises one large circular chamber, a smaller circular chamber adjoining same at one side and an upwardly projecting, and downwardly depending orifice for the reception and discharge of the liquid material, and the above described construction is adapted to be mounted upon a suitable base.

Projecting laterally from both ends of the casings 2 and at a point in alignment with the center of the circular chamber above described, are hub castings 5 which are provided with horizontal bores 6 having anti-friction linings or bearings 7 for securing the shaft bearings proper in position.

The casings 2 form two communicating, approximately circular chambers 8 and 9, respectively designed as piston and valve chambers. The chamber 8, which is of greater diameter than the chamber 9, is divided by a vertically-arranged plate 10 into two sub-chambers 13, while upon the valve-shaft is mounted a rotating circular division plate 11. The division of the chamber 9 into two sub-chambers 14 is completed by the provision of a plate 12 of such a contour as to fit into the irregular opening left by the plates 10 and 11, and thus completely divide the sub-chambers 13 and 14 at one side from the corresponding chambers at the opposite side. Within the respective chambers 8 and 9 are adapted to revolve a piston cylinder and a valve, said cylinder being composed of two sections 15 and 16, disposed in the respective sub-chambers 13, and the valve of two sections 17 and 18 disposed in the respective sub-chambers 14.

I will first proceed with the description in detail, of the rotary piston cylinder sections 15 and 16, fully setting forth their particular construction and position in relation to other parts. The piston cylinder sections 15 and 16 are secured by means of their hubs 19 to a shaft 20 by a key 21 and are adapted to revolve with the operation of said shaft 20.

In the drawings I have shown the cylinder sections as having four pistons 22 secured upon the four quadrant points of the peripheries of each section. These pistons 22 are substantially keystone-shaped in elevation and I desire to refer to them particularly as

of keystone shape. The pistons 22 are provided with a lining 23 preferably made of Babbitt or other anti-friction metal which is adapted to engage the periphery of said cylinder sections. Upon the peripheries of said cylinder sections and between the pistons 22, are provided gear teeth 24, said gear teeth 24 and pistons 22 being preferably of the same width transversely as the semi-chambers in which they are located. In this relation I desire to state that all the parts of my invention are properly fitted with a slight clearance in order to deduct the liability of the passage of air or water under certain circumstances, as well as the frictional wear of the parts. The pistons 22 are bolted or riveted to the cylinder sections 16 with the keystone shaped point 25 in close engagement with the inner curved surface of the sub-chambers 13.

The valve sections 17 and 18 are keyed upon a shaft 26 which is mounted in bearings similar to the mounting of the shaft 20, which same will be more fully hereinafter described. The valve sections 17 and 18 are provided at diametrically opposite points in their peripheries with segmentally curved recesses 27, the same being adapted for purposes more fully hereinafter set forth. The remaining portions of the peripheries of said rotary valve sections are provided with gear teeth 28 adapted to mesh into the gear teeth 24 upon the rotary cylinder sections 15 and 16.

I will now describe the peculiar relative position of the rotary cylinder sections 15 and 16 with each other, and the same relation of the rotary valve sections 17 and 18 to each other.

As before stated, in the attached drawings, there are four pistons such as 22, made use of upon each section, but the number is immaterial except that with an increased or diminished number of pistons, an increased or decreased number of recesses in the valves must be had in order to maintain the fixed relation. In the chamber in which the cylinder is adapted to be revolved, we will suppose that said section 15 is so located that the four pistons 22 are located at the four quadrant points of a circle with the same upon an exact vertical and horizontal line. With the section 15 in this position, the section 16 is keyed upon the shaft 20 with the pistons 22 located between the pistons 22 upon the section 15, that is, the section 15 has an eighth turn farther than the section 16. The relative relation and position of the two sections are shown by the pistons in strong and dotted lines in Fig. 1. The relative position of the two rotary valve sections 17 and 18 is the same as the cylinder sections 15 and 16, that is, with the section 15 as shown in Fig. 1, the valve section 17 must have its recess 27 in a horizontal position in order that the piston 22 will engage into said recess 27 when it reaches the horizontal line.

The casings 2 are each formed with two segmentally-curved extensions 29 describing part of the curved wall of the chamber 9. The outer contour of these extensions is such that inwardly-projecting edges 29^a are formed, which serve to determine the course of the induction and eduction of liquid material, as well as to form an inclosure substantially water and air tight.

The induction point of the pump is located below the center of the valve and adjacent the edge 29^a of the lower extensions 29 which forms a part of the valve inclosure.

The object, as before stated, of having the ingress orifice 30 located below the valve and above the lowest point of the piston cylinder, is to give the flow of water a proper curve at the point where it is caught, forced and drawn by the action of the pistons. If the water entered at a point opposite the meshing point of the cylinder and valve, it would materially retard the successful action of the pump as it would tend to force the water back instead of drawing it in.

The object of having the point of induction above the lowest point of the cylinder is to provide a downwardly-inclined plane for the water to travel. Thus the entrance of the water to the chamber 8 after leaving the inlet orifice 30 is greatly facilitated by its own specific gravity. The water also enters the chamber 8 at an acute angle to, and almost in a direct line with, the line of travel of the pistons.

The discharge orifice is located immediately above the valve, or farther out, and a flange 31 indicates the terminus of the orifice proper and a stand-pipe 32 is adapted to be bolted upon the same, or a hose may be attached thereto when used as a fire pump. Within said pipe and upon the flange 31, is pivoted an ordinary foot-valve 33 which assumes a vertical position during the pumping operation but drops and closes the orifices the instant that the pump is stopped.

During the rotation of the cylinder and valve the pistons 22 register with the recesses 27 in the valve. Owing to the peculiar shape of the pistons they are adapted to bear closely against the wall of the recesses during their passage through the latter, and thereby prevent any communication between the upper and lower parts of the sub-chambers 13 at the forward side thereof. Thus a water tight joint is maintained during the engagement of a piston with one of the valve recesses. This foot valve feature is an important one as my improved duplex rotary pump is especially designed for use where water is to be thrown to a great height and in large quantities, for if I attempted to operate without the foot valve, the moment that the pump was stopped, the volume of water in the stand-pipe, which may be hundreds of feet in length, would return and cause the device to act as a water motor running in a reversed direction.

I will now proceed to describe an improved method of mounting the shafts 20 and 26.

The bearing provided by the Babbitt lined bore 6, is much larger than the periphery of the shaft, the object of which is to give space to locate the Babbitt lined bushing truly and securely by running Babbitt or other metal around it, as at 7, Fig. 2, when same is in proper position. From a point exterior of the casings 2 and upon both sides of the same, said shafts 20 and 26 are tapered to a desired point and from thence to the ends of the shafts are regular in outline. The object of this will be seen from the description wherein an anti-friction metal bushing 34 having its inner bore tapered to correspond to the taper of the shaft, upon which it is adapted to fit. The tapering bushing 34 may be adjusted upon said shaft to compensate for wear in the bearing. Secured exterior of the bushing 34 the outer periphery of which is regular, is a bushing 35 having a portion of its outer surface exteriorly screw-threaded, while the remaining portion of its length is regular in outline to fit into the Babbitt bearing 7.

Set screws 36 are provided in the hubs 5 to secure the determinate position of the bushing construction upon the tapered portion of the shaft, and upon the screw-threaded end 37 is a stuffing-box cover 38, the object of which is to prevent the escape of water and the admittance of air.

The inwardly-tapering bushing 34 is made of anti-friction metal and can readily be renewed when worn, and its exterior covering 35 is preferably made of brass. The necessary wear in the bearing, owing to the weight of the water when being forced to a great height, is thus taken up by the adjustable position of the construction just described, as when the same is worn the adjustable bushing may be moved inwardly toward the casing, and held in a determinate position by the set screws 36 located in the hub 5, and at any time the anti-friction metal when worn, may be renewed in the usual mechanical way. The bushing has a circumferential movement as well as a horizontal one, in order that the alignment of the piston cylinders can be maintained by its adjustment. The advantage of this improved adjustable bushing will readily be seen, as it guarantees the ready and true operation of the device without any uneven wearing of the interior parts of same, and also renders the liability and cost of repairs much less than in former pumps of the rotary duplex pattern. The clearance of the interior revolving parts is very slight in order that the least amount of air will enter the pump.

The pump is adapted to be operated by power applied to either the revolving cylinder or of the valve shaft.

By reference to the drawings the direction of the passage of the suction and water can be traced by the arrows, and by the revolving of the cylinder and valve in opposite directions, the impulse given to both the cylinder and valve creates a suction which is capable of drawing the water from a considerable depth, though it is designed more especially for force pumps. The gearing of the cylinder with the valve guarantees a certain relative speed which the parts will acquire, whether the power is applied to the cylinder or valve-shaft, and in this adaptation lies one of the points of my invention. The peculiar shape of the piston and its operation in the semi-circular recess, guarantees the suction of the water whether the pump is rotated slow or fast. By the keystone shape of the extremity 25 of the piston 22, with its sharp corners and recessed portions, the water is more readily drawn into the pump, while any sand or solid matter will be attracted away from the face of the casing and held in the recessed parts of the piston, thus preventing the frictional wear of the piston and the inside of the casing.

I now wish to particularly describe the operation and function of the keystone piston 22 in the semi-circular recess 27. Taking for example the portion of Fig. 1 wherein the piston is shown in the recess, we will premise that the piston is turned back with the cylinder and also the valve turned over in an opposite direction, which same would bring the corner 39 of the piston in contact with the corner 40 of the recess 27. Now as the revolution of both the cylinder and the valve continues, the point 39 necessarily leaves the recess and to continue the function, the corner 41 comes into position and serves the same purpose, in preventing the packing of the water and the passing through the valve of same. Next comes the extreme end 25 with its sharp corners which exactly fits into the face of the recess 27, and as the piston continues in its downward course, the opposite corner 39 of the piston 22 comes into contact with the corner 42 of the recess and then comes the meshing of the gear teeth 24 and 28, which fit tight preventing the escape of the water down between the valve and piston cylinder.

The operation of the pistons are similar, and the advantages gained by the same will be apparent, as it positively prevents the water from jamming in the parts, and thereby checking each revolution of the piston cylinder and diminishing the life of the pump.

Having fully described my invention, what I claim is—

1. An improved rotary duplex force pump comprising a casing having a piston chamber and a valve chamber communicating therewith, said chambers being each divided vertically into two sub-chambers, a drum consisting of two sections respectively located in the piston sub-chambers, two or more pistons carried by each of said drum sections and of substantially a double-keystone form, the pistons of the respective drum sections being located alternately in the plane of the drum, and a valve consisting of two sections located in the respective valve sub-chambers, said

valve sections having peripheral recesses registering with and adapted to receive the pistons of the respective drum sections; substantially as set forth.

2. An improved rotary duplex force pump, having a piston drum comprising two sections separated by a division wall, each of said sections carrying pistons each comprising two outwardly-flaring portions, the outer one of the latter being smaller than the inner portion, the pistons of the respective drum sections being located alternately in the plane of the drum, and a rotary valve provided with peripheral recesses adapted to register with the pistons; substantially as set forth.

3. An improved rotary duplex force pump, having a piston drum, a number of pistons located upon the periphery of said piston drum, the points of each of said pistons substantially of the form of a double key stone, substantially as set forth.

4. An improved rotary duplex force pump, having a piston drum, pistons located upon the periphery of said drum, said pistons constituting castings projecting beyond the line of the gear teeth, and the points of said castings being substantially in the form of a double keystone, substantially as set forth.

5. An improved rotary duplex force pump, having a piston drum provided with pistons located at determinate distances upon its periphery said pistons being substantially in the form of a double keystone, substantially as set forth.

6. An improved rotary duplex force pump, comprising a rotary drum, a rotary valve provided with peripheral recesses, and pistons carried by said drum and consisting of a base portion and two outwardly-flaring portions, the outer one of the latter being contracted, from its periphery to where it joins the inner one substantially as and for the purpose set forth.

7. An improved rotary duplex force pump, comprising a rotary drum and valve, said valve being provided with peripheral recesses, and pistons carried by said drum and consisting of three sections decreasing in size from the inner to the outer section, the corners of said sections lying in an arc of a circle; substantially as and for the purpose set forth.

8. An improved rotary duplex force pump, comprising a rotary drum, a rotary valve geared therewith and provided with peripheral recesses, and pistons carried by said drum and adapted to engage said recesses, said piston being of a double-keystone shape; substantially as and for the purpose set forth.

9. An improved rotary duplex force pump, comprising piston and valve chambers, an inwardly and downwardly extending inlet channel located below the valve and above the lower end of the piston chamber, a rotary drum and valve respectively located in the piston and valve chambers, said valve being provided with peripheral recesses, and pistons carried by the drum and adapted to register with said recesses, said pistons being substantially of a double-keystone form; substantially as set forth.

10. An improved rotary duplex force pump, comprising piston and valve chambers, an outwardly and upwardly extending outlet channel having its inner end located essentially below the upper end of said piston chamber, a rotary drum and valve respectively located in the piston and valve chambers, said valve being provided with peripheral recesses, and pistons carried by the drum and adapted to register with said recesses, said pistons being substantially of a double-keystone form; substantially as set forth.

11. An improved rotary duplex force pump, comprising piston and valve chambers, inlet and outlet channels located between the upper and lower ends of the piston chamber, a rotary drum and valve respectively located in the piston and valve chambers, said valve being provided with peripheral recesses, and pistons carried by the drum and adapted to register with said recesses, said pistons being substantially of a double-keystone form; substantially as set forth.

12. An improved rotary duplex force pump, comprising piston and valve chambers, tapered shafts passing centrally through said chambers, a rotary drum and valve mounted respectively on said shafts, pistons carried by said drum, said pistons each comprising two outwardly-flaring portions, the outer of which being contracted, anti-friction bushings having inwardly-tapering bores to receive the shafts, and metallic bushings exterior of said anti-friction bushings, said metallic bushings being adapted to be adjusted inwardly in a metal-lined bearing provided in the casing; substantially as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

ISAAC P. LAMBING.

Witnesses:

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