

No. 738,101.

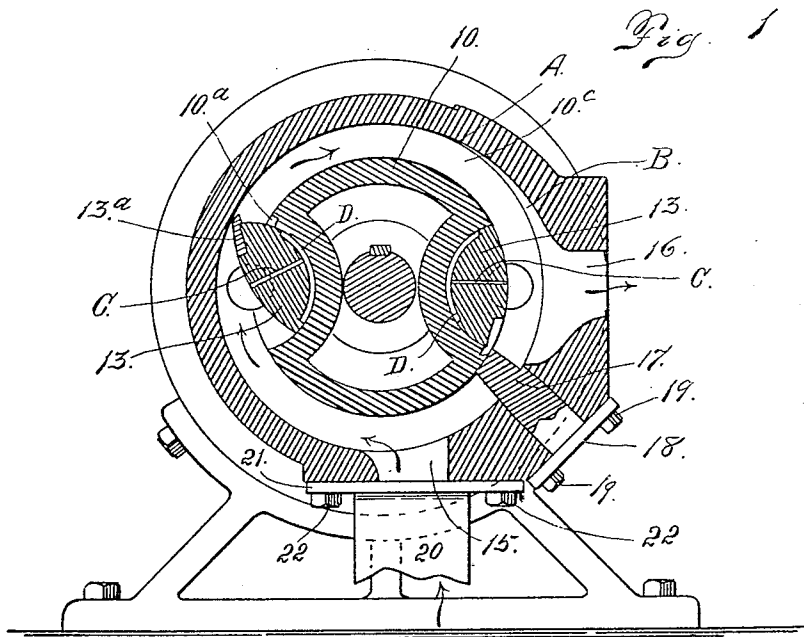
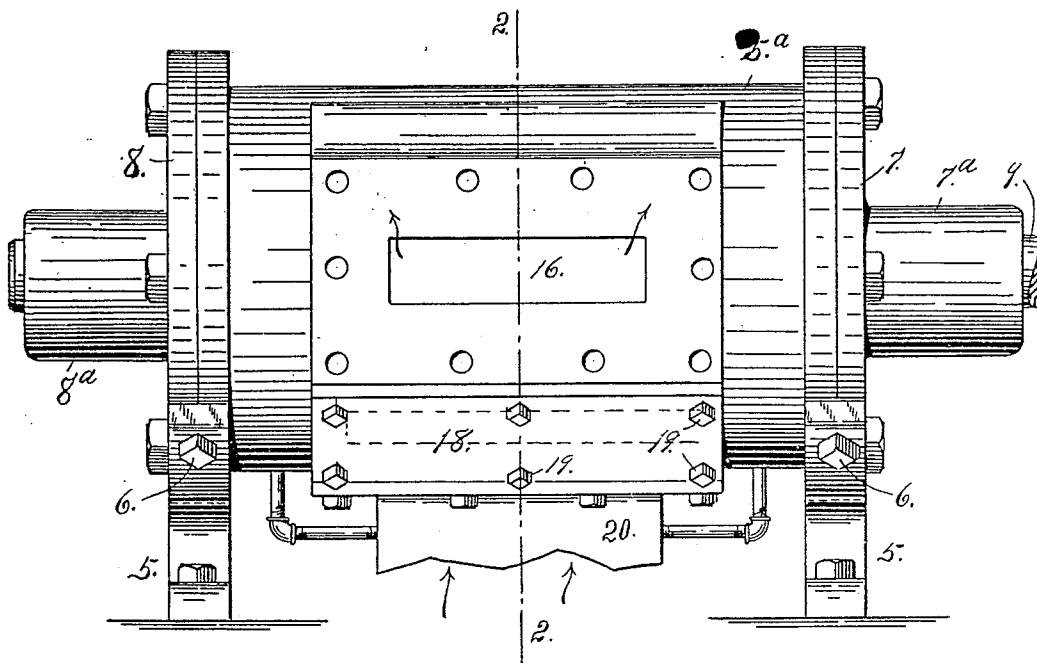
PATENTED SEPT. 1, 1903.

H. P. CURTIS.
ROTARY FORCE PUMP.

APPLICATION FILED MAR. 9, 1903.

NO MODEL.

3 SHEETS—SHEET 1.



Witnesses
Otto E. Hoddick.
Dena Nelson.

Fig. 2.

Inventor
H. P. Curtis.
 By *[Signature]*
 Attorney

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3 SHEETS—SHEET 2.

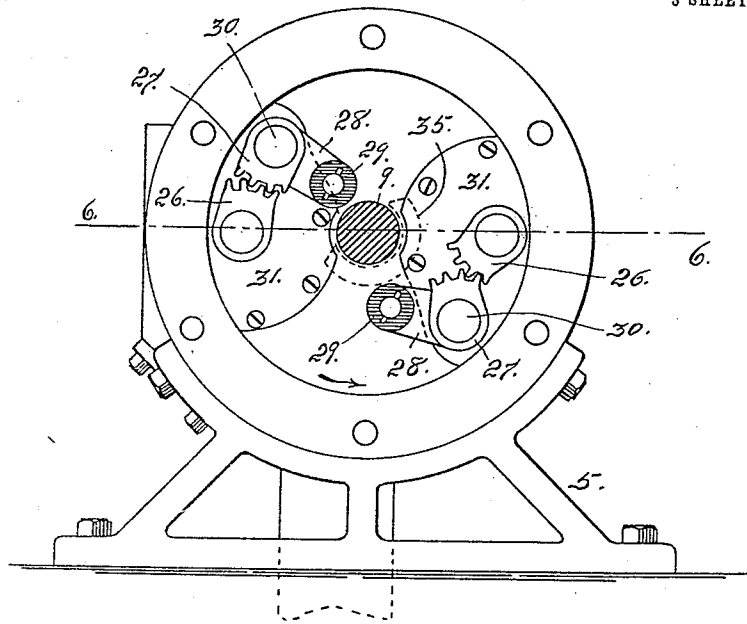


Fig. 3.

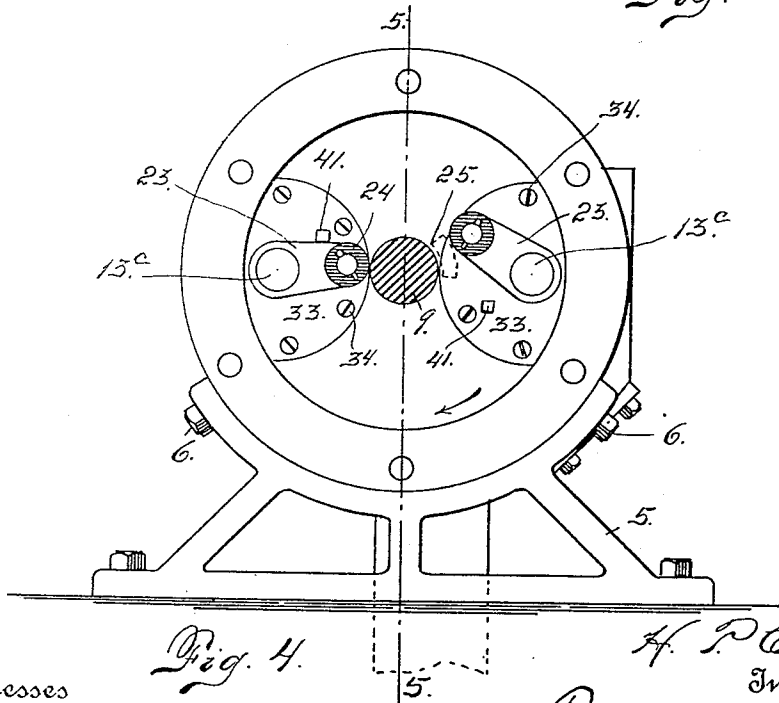


Fig. 4.

Witnesses
Otto C. Hoddick.
Dena Nelson.

H. P. Curtis.
Inventor

By [Signature]
Attorney

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3 SHEETS—SHEET 3.

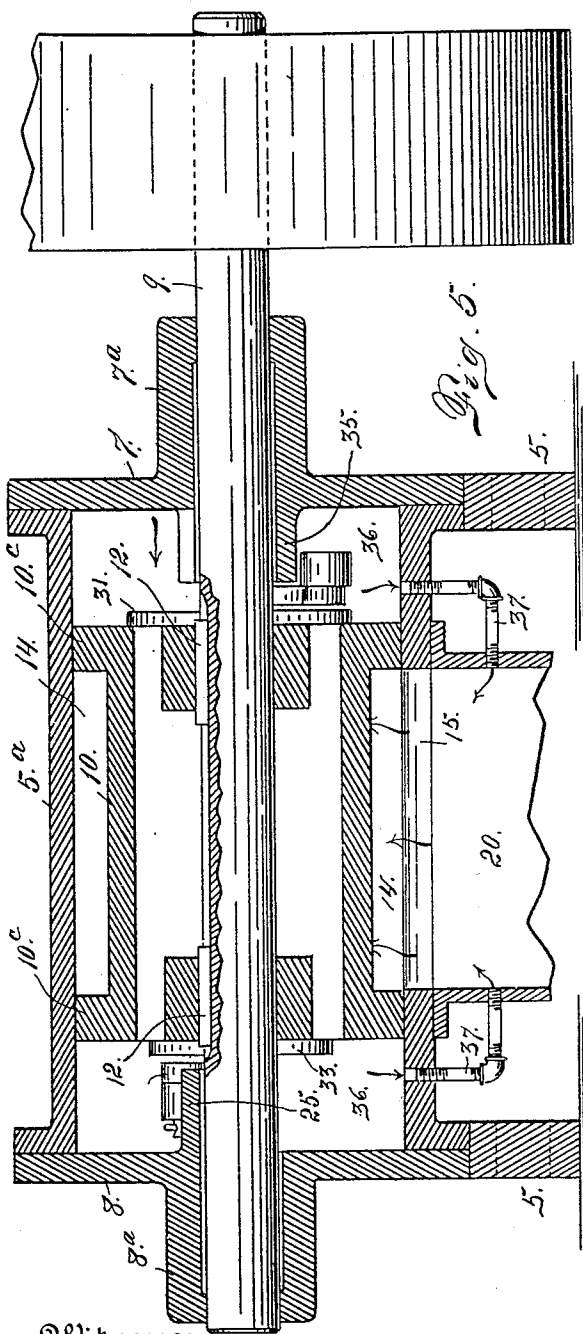


Fig. 5.

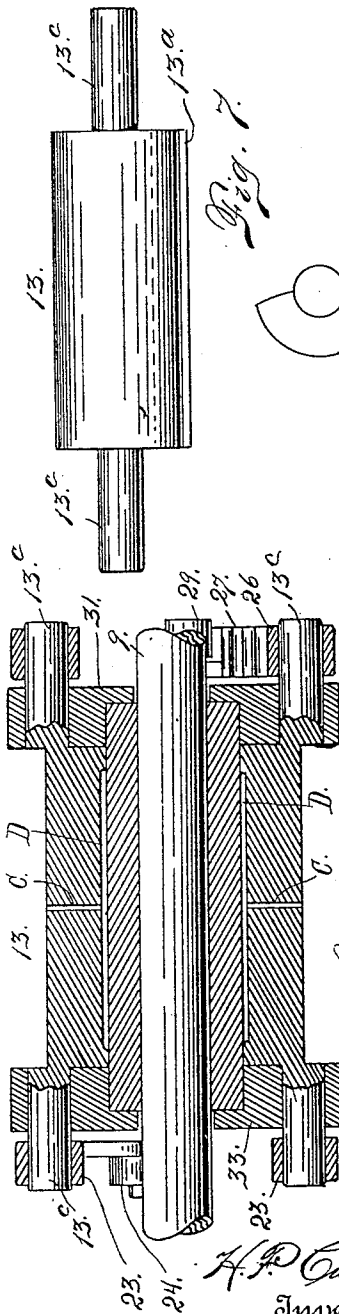


Fig. 7.

Fig. 8.

Witnesses

Otto E. Hoddick.
Dena Nelson.

H. P. Curtis
Inventor

By A. J. Mein

Attorney

UNITED STATES PATENT OFFICE.

HOMER P. CURTIS, OF DENVER, COLORADO, ASSIGNOR OF ONE-FOURTH TO
GLYNN B. STANNARD AND JOHN B. WATERBURY, OF DENVER, COLORADO.

ROTARY FORCE-PUMP.

SPECIFICATION forming part of Letters Patent No. 738,101, dated September 1, 1903.

Application filed March 9, 1903. Serial No. 147,004. (No model.)

To all whom it may concern:

Be it known that I, HOMER P. CURTIS, a citizen of the United States of America, residing in the city and county of Denver and State of Colorado, have invented certain new and useful Improvements in Rotary Force-Pumps; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

My invention relates to improvements in rotary force-pumps, my object being to provide an apparatus of this class which shall be simple in construction, economical in cost, reliable, durable, and efficient in use; and to these ends the invention consists of the features, arrangements, and combinations hereinafter described and claimed, all of which will be fully understood by reference to the accompanying drawings, in which is illustrated an embodiment thereof.

In the drawings, Figure 1 is a side elevation of my improved rotary pump. Fig. 2 is a vertical cross-section taken on the line 2 2, Fig. 1. Fig. 3 is an end view of the pump with one head removed, the shaft being shown in section and the position of the cam indicated by dotted lines. This view is in the direction of the arrow looking toward the left in Fig. 5. Fig. 4 is a similar view looking toward the right in Fig. 5—that is to say, with the left head of the cylinder removed and the impeller-closing cam indicated by dotted lines. Fig. 5 is a section taken on the line 5 5, Fig. 4. Fig. 6 is a longitudinal section taken through the rotary piston on the line 6 6, Fig. 3. Fig. 7 is a detail face view of one of the impellers carried by the rotary piston. Fig. 8 is an end elevation of the same.

The same reference characters indicate the same parts in all the views.

Let the numeral 5 designate a suitable base, upon which the body part 5^a of the cylinder is secured by bolts 6. To the opposite ends of the cylinder-body 5^a are secured the heads 7 and 8, respectively, having extension-jour-

nals 7^a and 8^a, through which the shaft 9 passes. This shaft is continuous through the machine, and upon it is mounted and made fast a cylindrical rotary piston 10, keys 12 being employed for locking the said piston to the shaft. The piston is provided with cavities formed in two opposite sides, adapted to receive impellers 13, each of which has a lip 13^a, adapted to engage the inner wall of the cylinder when the impeller is thrown outwardly or to the operative or open position, as shown at the left in Fig. 2. This is the wearing part of the impeller and is preferably composed of steel or hardened metal and is detachable, whereby it may be removed when worn and a new wearing part substituted at small cost. This lip projects slightly from the body of the impeller and when in the closed position engages a recess 10^b, formed in the piston. The impellers when in the closed position just fill the cavities in the opposite sides of the piston and make the latter a perfect cylinder between its end flanges 10^c. These flanges 10^c of the piston engage the inner wall of the cylinder and form end walls, closing the ends of the annular pocket or water-space 14 between the piston and cylinder. The projecting part of each impeller travels in this water space or pocket. The water enters the pocket by way of a suction or inlet port 15 and escapes therefrom by way of an outlet or discharge port 16. At one side of the discharge-port and between it and the suction-port is inserted a key or abutment 17, which is passed through a slot formed in the wall of the cylinder and forms a partition, separating the water drawn into the pocket through the one port from the water-discharge from the pocket through other port. This abutment, as shown in the drawings, is formed integral with a plate 18, which projects on opposite sides of the slot and is secured to the cylinder by screws 19. The port 15 communicates with a conduit 20, connected with the water-supply source and which is secured to the cylinder by screws 22, passed through a plate 21, connected with the conduit. The body of each impeller is of sufficient length to just fit into the pocket between the flanges 10^c of the piston and close

the said pocket when the impeller is open. Each impeller has two journals 13^c, which engage bearings formed in the ends of the piston, as best shown in Fig. 6. Each journal 5 13^c protrudes beyond the end of the rotary piston. One protruding extremity of each impeller-journal, being that toward the left in Fig. 6, is provided with a crank 23, whose extremity remote from the journal is provided 10 with an antifrictional roller 24, adapted to engage a cam 25, mounted on the cylinder-head, every time the piston makes a revolution. This cam is so located as to close the impeller when it reaches the discharge or outlet port 15 16 and just before it reaches the abutment 17, whereby the impeller is allowed to pass the abutment. Each impeller is closed by this cam once during each revolution of the piston and just long enough to allow it to pass the 20 discharge-port and the abutment. The opposite protruding journal of each impeller is provided with a segmental gear 26, which meshes with a similar gear 27, provided with a crank 28, whose extremity remote from the 25 gear is provided with an antifrictional roller 29. The segmental gear 27 and its crank 28, which, as shown in the drawings, are formed integral with each other, are journaled on a stud 30, mounted on the extremity of the piston. As shown in the drawings, each stud is 30 fast on a plate 31, secured to the end of the piston by screws 22. These plates close the impeller-cavities at the ends of the piston and are flanged to overlap the piston at the end 35 to make room for the fastening-screws. The opposite end of the piston is also provided with corresponding plates 33, which the impeller-journals 13^c directly engage. These plates are employed as a matter of convenience 40 in manufacturing the piston, whereby the impeller-cavities are continued entirely through the piston ends and then closed by these segmental plates. Each crank-roller 29 engages a cam 35, mounted on the adjacent 45 head of the cylinder, whereby the impeller is kept open while traveling from the inlet to the discharge-port of the cylinder.

From the foregoing description it is believed that the use and operation of my improved rotary pump will be readily understood. Assuming that the parts are in the position shown in Figs. 2, 3, and 4, the operation will now be described. In Figs. 2 and 4 the parts are viewed in the same direction, 55 while in Fig. 3 they are viewed from the opposite direction. Hence the arrows which indicate the rotation of the piston point in the same direction in Figs. 2 and 4 and in the opposite direction in Fig. 3. It will therefore be understood that the impellers and their connections 60 which are located at the right and left, respectively, in Figs. 2 and 4 are at the left and right, respectively, in Fig. 3. The impeller at the right in Fig. 2 has just reached the key or abutment 17 and has been closed by the engagement 65 of its crank 23 with the cam 25 on the adjacent head of the cylinder. At the same

time the opposite impeller is open and has been held open by the engagement of one of the cranks 28 with the opening cam 35 and 70 by virtue of the engagement of the gear 27 of the last-named crank with the gear 26 of the impeller. The open impeller is driving the water before it in the pocket 14 and forcing the water out through the discharge- 75 opening 16, and at the same time the water is drawn into the pocket by way of the opening 15 in the rear of the open impeller by suction or by reason of the formation of a partial vacuum in the pocket after the impeller leaves 80 the inlet-opening. The open impeller will continue to drive the water before it out of the opening 16 and to draw it into the pocket in the rear until the said impeller reaches or approaches the discharge-opening. Near this 85 discharge-opening and above the same, as shown in Fig. 2, the inner surface of the cylinder is cut away, starting at a point A and gradually increasing in depth to the opening 16. The cut-away portion of the cylinder 90 forms a space B outside of the impeller as it approaches the opening 16 and allows the water to pass to the rear of the impeller for the purpose of balancing the latter in order to reduce the power required to close the im- 95 peller. In order to further facilitate the balancing of the impeller, an orifice C is formed through its center to a small chamber D, formed between the impeller and the piston, but closed at both ends to prevent leakage 100 between the impeller and the piston. This construction greatly reduces the friction between the piston and the impeller, since only a portion of the adjacent surface of the impeller is in direct engagement with the pis- 105 ton, and when the piston reaches the space B (at which point the impeller begins to close) it will be entirely surrounded by water except where it engages the piston at the ends of the chamber D, and is therefore very nearly 110 perfectly balanced, whereby but little power will be required to close the impeller as it approaches the key or abutment 17. Stops 41 (see Fig. 4) may be applied to the end 115 plates 33 adjacent the cranks 23 in order to form a positive lock to prevent the lips of the impellers from moving out into the space B as they approach the discharge-opening. The cam 25 will hold the impeller closed until it passes the abutment 17, after which the im- 120 peller will be released from the influence of the closing cam and will be acted on by the opening cam 35 through the instrumentality of a crank and the meshing segmental gears 27 and 26. The impeller is fully open by the 125 time its lip 13^a reaches the opposite or farther side of the opening 15, when this impeller carries the water before it and sucks in water behind it, whereby there is a continual outward flow of water through the opening 16 130 and a continuous inflow of water through the opening 15. By the time either impeller has reached the space B and allows the water to pass to its rear the other impeller has passed

beyond the inlet-opening 15. Consequently there can be no backward flow of water through the inlet-opening.

The apparatus is provided with two drain-pipes 37, leading from the end chambers 36 and communicating with the suction-conduit 20, for the purpose of drawing off any water that may have leaked into the said end chambers from the annular water space or pocket 10 in which the impellers travel.

Attention is called to the fact that my improved apparatus may be used to pump gases as well as liquids. It is also evident that substantially the same construction may be used 15 as a motor operated either by liquid or gases.

Having thus described my invention, what I claim is—

1. In a rotary force-pump, the combination with a casing having inlet and discharge openings, of a piston revoluble in the casing, impellers carried by the piston and journaled therein, the impellers being located in cavities formed in the piston, the latter having flanges at the ends closing the water-space 20 between the piston and casing, said space communicating with the inlet and discharge opening of the casing, a key or abutment closing the water-space between the inlet and the discharge opening, and suitable means for automatically opening and closing the impellers at predetermined intervals, whereby the water is driven through the water-space in front of the impellers and out of the discharge-opening, and drawn into said space behind 25 the impellers from the inlet-opening, said means being located in the chamber formed between the end of the piston and the end of the casing, and arranged to act on the impeller-journals which protrude into the said chamber. 30

2. The combination with a casing having a cylindrical chamber and provided with inlet and discharge openings, a piston revoluble in said chamber and having a water-pocket 35 closed at the ends, impellers carried by the piston and journaled therein, chambers being formed between the ends of the piston and the ends of the casing, a stop located in the water-pocket between the inlet and discharge opening, and means interposed between the ends of the piston and the ends of the casing and located in the said end chambers for operating the impellers whose journals protrude 40 into the said end chambers, whereby the impellers are alternately opened and closed with reference to the water-pocket, through which pocket the water is driven by the impellers when open, from the inlet to the discharge opening, the water being drawn into the pocket by the impellers by suction. 45

3. A rotary force-pump, comprising a casing having inlet and discharge openings, a piston revolubly mounted in said casing, a water-pocket being formed between the piston and casing, with which the outlet and discharge openings communicate, a stop located in said pocket between the inlet and discharge

openings, impellers carried by the piston and journaled therein, their journals protruding through the ends of the piston into a space 50 formed between the ends of the piston and the ends of the casing and shut off from the water-pocket, and means interposed in the said space and acting on the impeller-journals, for alternately opening and closing the 55 impellers at predetermined intervals.

4. The combination with a casing, of a piston revoluble therein and provided with chambers, impellers movably mounted in said chambers and having journals protruding 60 through the ends of the piston into a space formed between the ends of the piston and the ends of the casing, an annular pocket formed between the piston and casing into which the impellers project when open, cams 65 mounted on the ends of the casing, and means mounted on the piston and adapted to engage the cams and act on the impeller-journals for alternately opening and closing the impellers. 70

5. The combination with a casing having inlet and discharge openings, of a piston journaled in the casing, a space being left between the ends of the piston and the ends of the casing, an annular pocket being formed between the piston and the casing, the said 75 pocket being closed from the end chambers, a stop located in said pocket between the inlet and discharge openings, impellers carried by the piston and having journals protruding through the piston ends into the end chambers 80 between the piston and casing, cranks mounted on the piston and connected with the impeller-journals, and cams mounted on the casing ends and engaged by the piston-crank for operating the impellers whereby 85 they are alternately opened and closed. 90

6. The combination with a casing, of a piston journaled therein, impellers journaled in the piston, an annular pocket being formed between the piston and casing, inlet and discharge openings communicating with the said 95 pocket, a stop located in the pocket between said openings, cranks mounted on the piston ends, cams mounted on the casing ends and adapted to be engaged by the cranks as the 100 piston rotates, and a suitable operative connection between the cranks and the impellers. 105

7. The combination with a casing having inlet and discharge openings, a piston revoluble in the casing, an annular water-pocket 110 being formed between the piston and casing, said pocket communicating with the inlet and discharge openings, a stop located in the pocket between said openings, impellers carried by the piston and having journals protruding into chambers formed between the 115 piston ends and the ends of the casing, cranks mounted on one journal of each impeller and located in one end chamber, a cam mounted on the casing and adapted to be engaged by 120 the said cranks for operating the impellers, gears mounted on the opposite journals of the impellers, cranks journaled on the piston and provided with gears meshing with the impel- 125

ler-gears, and a cam mounted on the casing and engaged by the cranks for operating the impellers, the cams, cranks and gears being so arranged at the opposite ends of the piston, that each impeller is alternately actuated in opposite directions.

8. The combination with a casing having inlet and discharge openings, a piston revolvably mounted therein, an annular chamber with which the inlet and discharge openings communicate, impellers movable on the piston, end chambers closed from the annular water-space, means located in the said end chambers for alternately opening and closing the impellers, a stop on the annular chamber between the inlet and discharge openings, the said chamber being gradually enlarged as it approaches the discharge-opening whereby a space is formed between the open impeller and the wall of the cylinder, to allow the water to flow rearwardly and balance the impeller and thereby lessen the power required to turn the impeller to the closed position.

9. The combination with a casing, of a piston revoluble therein and provided with cavities, impellers adapted to engage said cavities and arranged to move therein in the performance of their function, a space being formed between the face of the impeller and the bottom of the piston, and an orifice being formed in each impeller, communicating with

said space to allow the water to enter for the purpose of balancing the impeller and reducing the power required to operate it.

10. The combination with a cylinder, a shaft journaled therein, means for operating the shaft, of a piston fast on the shaft and located in the cylinder, impellers movably mounted in cavities formed in the piston, and adapted to enter an annular water-chamber formed between the piston and cylinder, cams mounted on the cylinder at the ends of the piston, and means connected with the impellers and operated by the cams for alternately opening and closing the impellers, substantially as described.

11. The combination with a cylinder and a rotary piston located therein and provided with means for forcing fluid from an inlet-opening to a discharge-opening, the cylinder having end chambers, of drain-pipes leading from the said chambers in order to carry off any gas or liquid that may escape from the passage through which the gas or liquid is traveling.

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

HOMER P. CURTIS.

Witnesses:

DENA NELSON,
A. J. O'BRIEN.

