No. 698,539. Patented Apr. 29, 1902.

T. C. McBRIDE.

ROTARY ENGINE, WATER METER, OR PUMP.

(Application filed May 28, 1901.)

(No Model.) 2 Sheets—Sheet 1.

fig. 1.

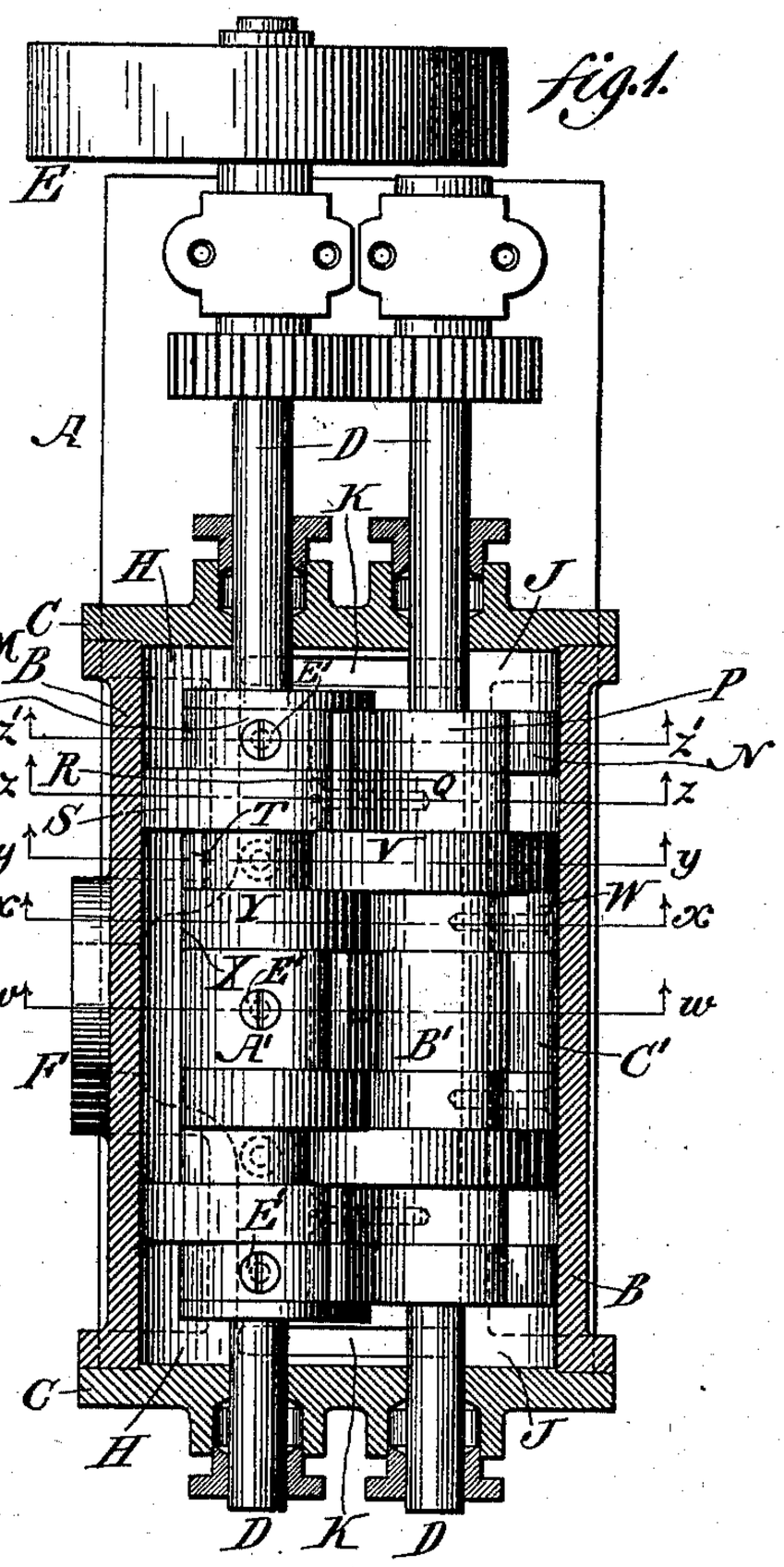


fig. 3. SECTION ON x. x.

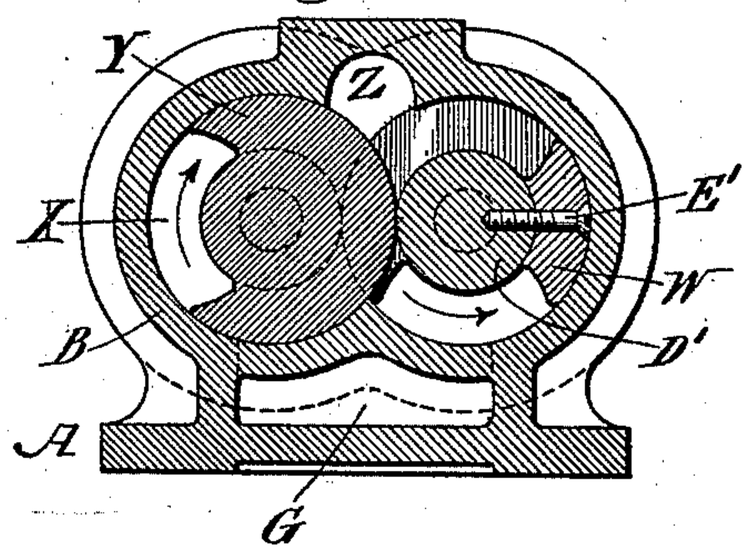


fig. 4. SECTION ON y. y.

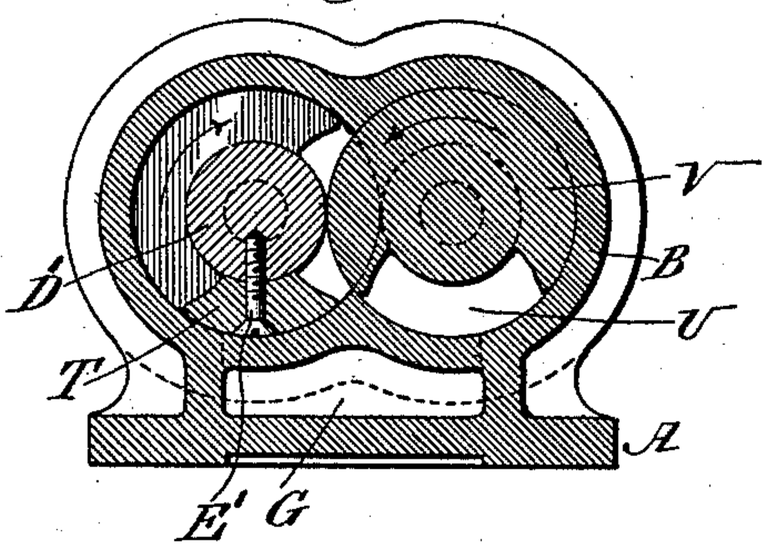


fig. 5. SECTION ON z. z.

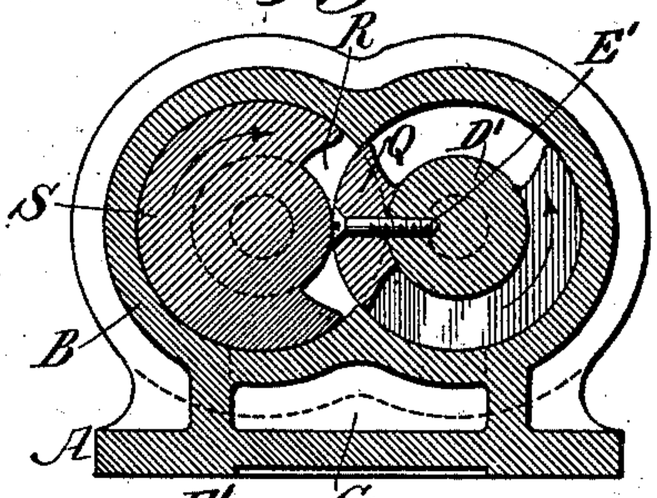


fig. 2. SECTION ON w. w.

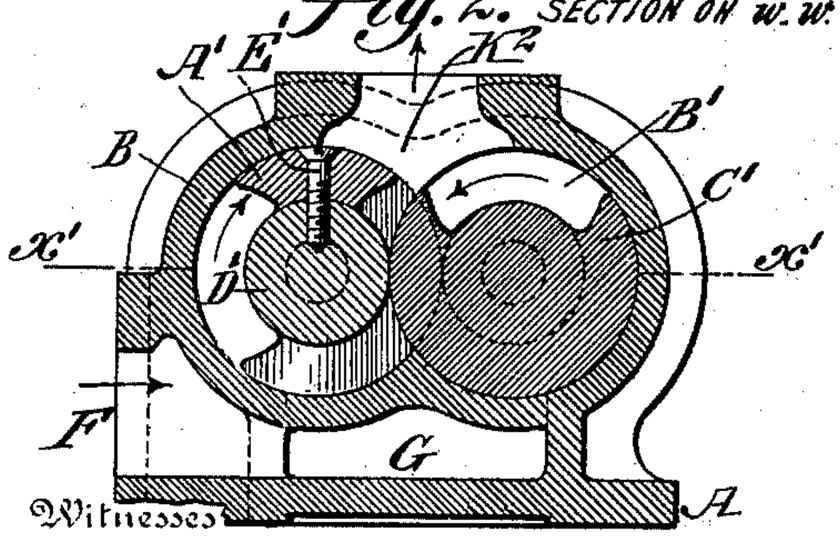
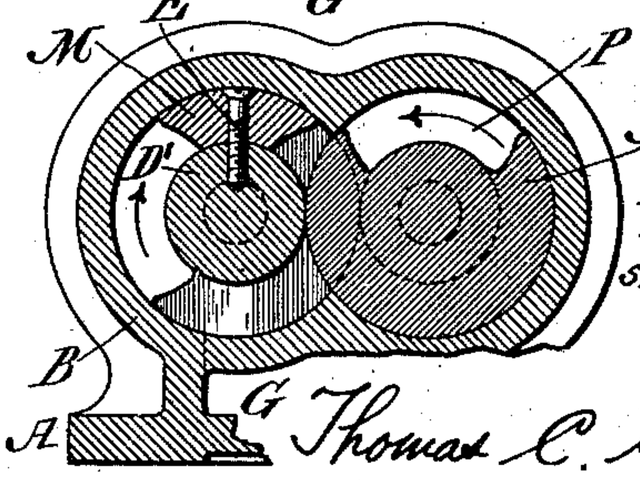


fig. 6. SECTION ON z'. z'.



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(No Model.) 2 Sheets—Sheet 2.

fig. 7.

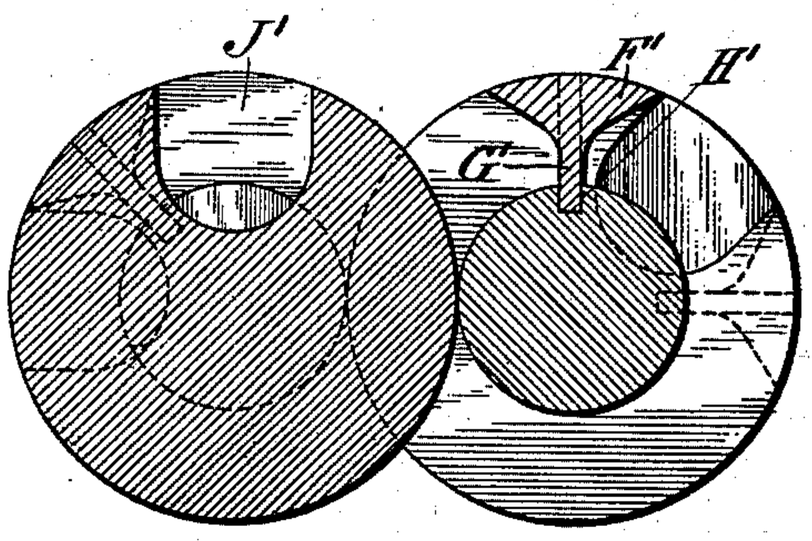


fig. 8.

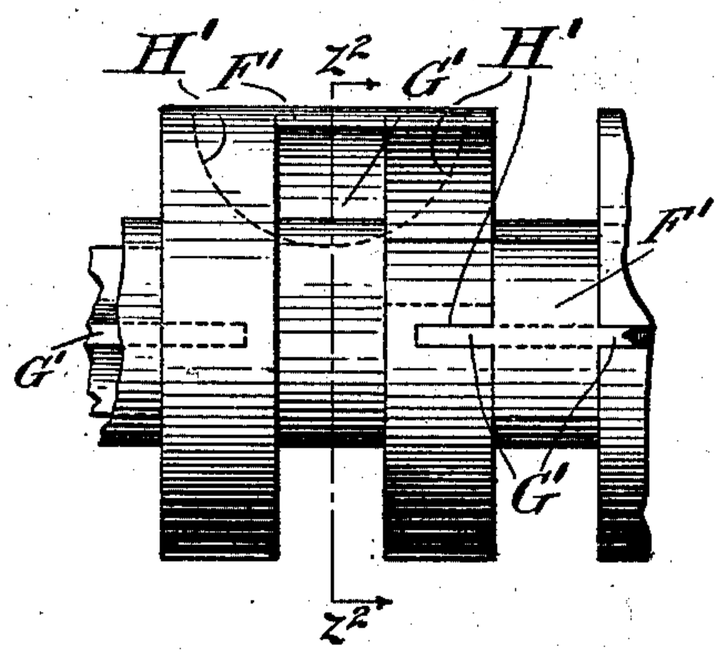


fig. 9.

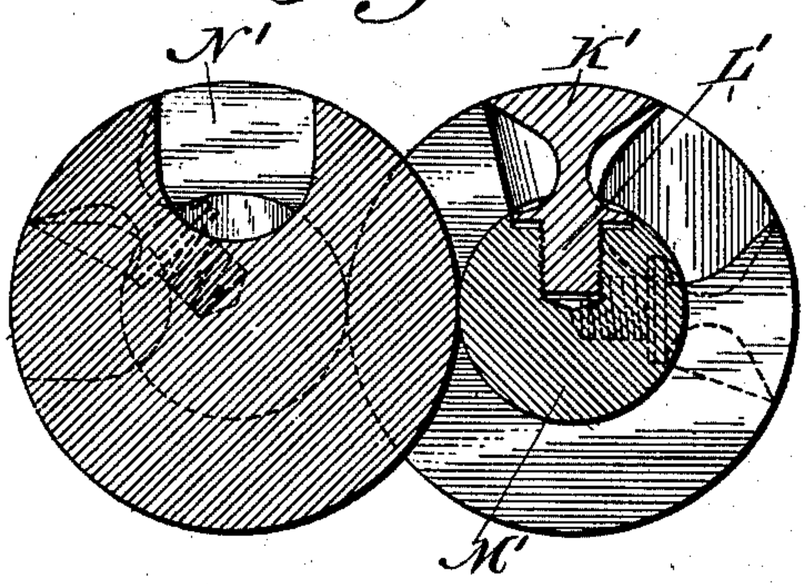
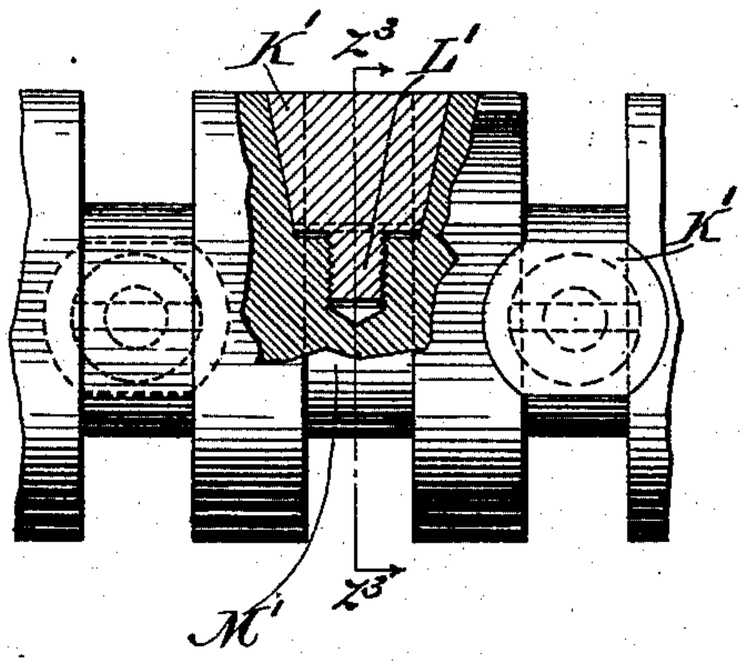


fig. 10.



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UNITED STATES PATENT OFFICE.

THOMAS C. McBRIDE, OF PHILADELPHIA, PENNSYLVANIA.

ROTARY ENGINE, WATER-METER, OR PUMP.

SPECIFICATION forming part of Letters Patent No. 698,539, dated April 29, 1902.

Application filed May 28, 1901. Serial No. 62,239. (No model.)

To all whom it may concern:

Be it known that I, THOMAS C. McBRIDE, a citizen of the United States, residing in the city and county of Philadelphia, State of Pennsylvania, have invented a new and useful Improvement in Rotary Engines, Water-Meters, or Pumps, of which the following is a specification.

My invention consists of a novel construction of a rotary engine, water-meter, or pump, consisting of two preferably parallel shafts mounted in a suitable casing, one of said shafts having on it a rotating piston with a vane or vanes, while the other of said shafts has a rotating abutment-piston provided with a gap or gaps, into which the vane or vanes of the rotating piston are adapted to mesh at the proper intervals. Beside this unit are placed other similar units delivering in series into and through each other, my invention being especially designed as an improvement upon rotary engines of that general type wherein a pair of shafts are provided with screw-threads which intermesh, and my invention being designed to obviate the disadvantageous features of pumps of this character which require a very careful design of screw-threads and a very accurate adjustment of the pairs of screws and threads not only as to angularity, but also as to the distance between the oppositely-located screw-threads.

It further consists of novel details of construction, all as will be hereinafter set forth, and particularly pointed out in the claims.

Figure 1 represents a horizontal section taken on line x' x', Fig. 2, of a rotary engine or pump embodying my invention. Figs. 2, 3, 4, 5, and 6 represent vertical transverse sections taken, respectively, on lines w w, x x, y y, z z, z' z' of Fig. 1. Fig. 7 represents a transverse section taken on line z^2 z^2, Fig. 8, illustrating another embodiment of my invention. Fig. 8 represents a side elevation of one of the members seen in Fig. 7. Fig. 9 represents a transverse section taken on line z^3 z^3 of Fig. 10 of another modification embodying my invention. Fig. 10 represents an elevation thereof, partially in section.

Similar letters of reference indicate corresponding parts in the figures.

Referring to the drawings that the operation may be more easily understood, we will consider the invention working as a pump. It will be evident, however, that by admitting steam to what will be described as the delivery-opening the machine will run in the opposite direction as a rotary engine.

A designates the frame or bed of my improved construction of rotary engine or pump, upon which the casing or cylinder B is mounted, the latter having the heads C, which are provided with suitable bearings and stuffing-boxes for the shafts D, the latter being prolonged at one end of the casing and geared together, so as to rotate in unison, and one of said shafts being provided with a suitable coupling or pulley E for the application of power thereto.

F designates a suction-opening which is located, preferably, at the lower portion of one or both sides of the cylinder B and communicates with the channel or passage G at that lower portion of said cylinder, said channel extending lengthwise thereof and communicating with the piston-chambers H and J by means of the ports K, located at the ends of the cylinder. It will thus be understood that water being drawn into the passage G will flow upwardly through the ports K and thence from each end of the casing B through the different pumping units, as described, toward the central portion of the casing to the discharge-outlet K^2, and as it will be apparent that the flow of the water from each end of the cylinder or casing toward the discharge-opening K^2 thereof will be substantially the same it will only be necessary to describe one-half of the apparatus—as, for example, the upper half. (Seen in Fig. 1.)

To understand the operation of my invention, consider first the central unit. (Shown in cross-section in Fig. 2.) It is evident that if the pistons are rotating in the direction shown by the arrows the vane A′ will be and will have been delivering water to the delivery-opening K^2. The vane T in the third unit (shown in Fig. 4) will at the same time have been delivering water through the gap X, Fig. 3, in the abutment-piston Y into the space behind the vane A′ in the central unit, Fig. 2. Thus any tendency to leak past vane A′, Fig. 2, will be prevented by vane T, Fig. 4, and it will be noted that in this position of the pistons the vanes A′, Fig. 2, and T, Fig.

4, are assisting each other in pumping in series on the same column of water. Similarly the vane W, Fig. 3, moving in the direction of the arrows is delivering water through the open space in front of it into the opening Z, which is part of the delivery-opening space K^2, Fig. 2, and is also being assisted by vane Q_2 Fig. 5, which is pushing the same column of water through the gap U of abutment V, Fig. 4, into the space behind vane W, Fig. 3. Thus any number of units, limited only by the practical length of the machine, may be used to reinforce each other.

It will be apparent to those skilled in this art that there is a time in the rotation of each piston, when its vane has meshed with the gap of its abutment, when, unless the vane and the gap have both been carefully designed and made of a particular form, so that they will mesh accurately, there will be more or less clear passage past the vane, at which time this unit of the pump will cease pumping and if not assisted by other units allow the water to pass backward through it. It is to overcome this difficulty that I have placed, as above explained, beside the single central unit hereinabove described, other units either placed only on one side or divided and placed on both sides of said first-mentioned unit so as to balance any end thrust on the shafts, and have so located the vanes angularly around the shaft that the period described above where the pumping would cease will not happen at the same instant that pumping would have ceased in the other units. This combination is equivalent to a number of rotary pumps placed side by side and acting in series and results in the production of an apparatus delivering water at a uniform rate, it being also apparent that where it is desired to pump against higher pressure it is advisable to increase the number of units, so that slippage due to leakage between the parts will be decreased. It will thus be seen that while I have started with an assumption of the use of a single-vane piston and single-gap abutment and have placed beside these parts practically identical units, but at a receding angle on the shaft, and have for convenience of construction placed on each shaft a piston with its vane adjacent to an abutment with its gap it will be apparent that the use of a number of these units thus combined approaches the idea of a screw-pump, being analogous to this principle in that the water passes along the cylinder parallel to the shafts without any circular motion in the direction of the circumference of the cylinder. It will, however, be seen that my invention is an improvement over this class of screw pumps or engines having intermeshing threads, since pumps of this type require a very careful design of screw-threads and a very accurate adjustment of the pairs of screws and gears, not only as to angularity, but also as to the distance of oppositely-fastened screw-threads on each shaft; whereas in my invention a very considerable angular error in adjustment may be allowed in the gears without any trouble resulting from the two halves of the pump grinding on each other and wearing, since the vane on each unit need not fit accurately the gap into which it meshes, for the reason that the other units will pump the water through these units when they, through not being accurately fitted, cease for a time to pump.

It will be seen from the foregoing that I have produced a novel form of stepped screw for screw-pumps, said screw being made by finishing-disks on a shaft, said disks having the gaps already cast therein and the space between said disks being closed off at the appropriate places by the vanes, so that each shaft eventually has the appearance of a stepped screw. It will thus be seen that each shaft is provided with a plurality of half-units and that when these shafts and their half-units are assembled each juxtaposed pair or set of half-units makes a complete pumping unit, the construction of which has already been fully described.

It will be apparent from the foregoing that my invention can be very cheaply manufactured, since the gaps in the abutments of the two groups of units on each shaft may be cast roughly in the metal, whereupon grooves can then be turned and the vanes afterward fastened in place by the screws E′. The vanes then require care in finishing only on the extreme end, where in contact with the inside of the casing.

In the construction shown in Figs. 7 to 10, inclusive, I have shown slightly-different means for forming and securing the vanes in position, one form of vane being represented in Figs. 7 and 8 by F′ and having a tongue G′, adapted to be secured in a suitable groove H′, said vane being adapted to coact with the juxtaposed gap J′.

In Figs. 9 and 10 I have shown the vane K′ as provided with different means for securing it in position, said means consisting of the threaded stem L′, which is adapted to be secured into a threaded seat in the body M′, as is evident, said vane K′ being adapted to coact with the juxtaposed gap N′.

Although I have shown the shafts D as made integral with the main body of the group of half pumping units on it, it will be apparent that said body may be made separate and secured on said shaft by the various usual mechanical means.

It will be apparent that slight changes may be made by those skilled in the art which will come within the scope of my invention, and I do not, therefore, desire to be limited in every instance to the exact construction I have herein shown and described.

At the left of Fig. 1 are shown disk-plates on the shaft D at the ends of the left-hand pumping units, between which plates the

units on the said shaft are retained and which, furthermore, serve as guides for the end units on the other shaft.

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

1. In a rotary engine, meter or pump, a casing or cylinder, a plurality of shafts rotatably mounted therein, a plurality of pumping units mounted on said shafts, each of said units consisting of one or more rotary pistons, each provided with a single vane and one or more abutment-pistons, each provided with a single gap, the vanes and gaps of said different units being so located that the vanes on one shaft shall be opposite the gaps on the other shaft so that said units will not cease pumping at the same instant.

2. In a rotary engine, meter or pump, the combination of a casing having a suction-opening in its lower portion, a channel extending longitudinally in the lower portion of said casing, piston-chambers located above said channel, ports extending upwardly from the ends of said channel to said chambers, a plurality of shafts passing through said piston-chambers, and a plurality of units mounted on said shafts between said ports, each of said units consisting of a rotary piston provided with a vane and an abutment-piston having a gap, and each of the half-units being placed in longitudinal juxtaposition, but at a varying angle on their shafts and the pistons on one shaft being arranged opposite the gaps upon the other shaft and in such relative position that the vanes shall mesh with the gaps on the opposing members as the shafts rotate, whereby each pair of opposing members constitutes a pumping unit, whereby said units will not be at the inoperative point at the same instant.

3. In a rotary engine, meter or pump, the combination of a casing having a suction-opening in its lower portion, a channel extending longitudinally in the lower portion of said casing, ports extending upwardly from the ends of said channel, piston-chambers located above the lower channel, a plurality of shafts passing through said piston-chambers, a discharge-outlet for said casing, and a plurality of half-units mounted on each of said shafts, each of said units consisting of a rotary piston with a vane, and a rotary abutment-piston with a gap, each of said half-units being placed in longitudinal juxtaposition but at a receding angle on each shaft and the pistons on one shaft arranged opposite the gaps of the members on the other shaft and in such relative position that the vanes shall mesh with the gaps on the opposing members as the shafts rotate, whereby each pair of opposing members constitutes a pumping unit, whereby water is forced from said ports toward said discharge-opening and the vanes and gaps of the different units will not cease pumping at the same instant, whereby the water instead of passing to the next unit at a slight angle is carried substantially one-half way around the shaft before meeting the preceding vane.

4. In a rotary engine, meter or pump, a casing or cylinder, a plurality of shafts rotatably mounted therein, a plurality of independent units mounted on said shafts, each of said units consisting of a rotary piston having a single vane detachably connected thereto and an abutment-piston provided with a single gap, said vanes and gaps being so located with respect to each other with the pistons on one shaft arranged opposite the gaps of the opposing members on the other shaft and in such relative positions that the vanes shall mesh with the gaps on the opposing members as the shafts rotate whereby each pair of opposing members constitutes a pumping unit, so that they will not be at the inoperative point at the same instant.

5. In a rotary engine, meter or pump, a cylinder, a plurality of shafts rotatably mounted therein, each of said shafts being provided with pumping units having abutments with gaps cast roughly therein, the outer peripheries of said abutments and the spaces alternating between said abutments being finished and vanes detachably secured in position on the finished portions between said abutments, the pistons on one shaft being arranged opposite the gaps of the members on the other shaft in such relative positions that the vanes shall mesh with the gaps as the shafts rotate whereby each pair of opposing members form a pumping unit.

6. In a rotary engine, meter or pump, a plurality of shafts having pumping units thereon, said units consisting of abutments having gaps cast therein, the outer peripheries of said abutments being turned or finished and the alternating spaces between said abutments being also finished, the spaces between said abutments being provided with vanes detachably secured thereto, said vanes and gaps being arranged so that each gap when not in mesh with the corresponding vane will serve as a passage through which the next preceding pumping unit in the series shall deliver and adapted to coact, whereby the pumping action of each group of units will not cease at the same instant.

7. In a rotary engine, meter or pump, a cylinder or casing, a plurality of shafts rotatably mounted therein, and a plurality of pumping members on each of said shafts, consisting of rotary pistons, and disks on each shaft alternately between the pistons, said pistons and disks being provided respectively with a vane and a gap permitting each vane to carry the water through the gap substantially one-half way around the shaft before meeting the next adjacent vane.

8. In a rotary engine, meter or pump, a cylinder or casing, a plurality of shafts rotatably mounted therein, and a plurality of pumping members on each shaft, consisting of rotary pistons, and disks on each shaft alternately

between the pistons, said pistons and disks being provided respectively with a vane and a gap permitting each vane to carry the water through the gap substantially one-half way around the shaft before meeting the next adjacent vane, said vanes being disposed in series in screw-like form whereby leakage past one vane is prevented by the next succeeding vane.

9. In a rotary engine, &c., the combination with a casing, of a plurality of shafts rotatably mounted therein, a series of alternating vaned pistons and disks provided each with a gap upon each shaft, the pistons on one shaft being arranged opposite the disks upon the other shaft and in such relative position that the vanes shall mesh with the gaps in the disks as the shafts rotate, whereby each pair of opposing pistons and disks constitutes a pumping unit, supply and discharge passages communicating with the casing, the former arranged to deliver fluid to the first pumping unit and the latter arranged to receive it from the last pumping unit, the gap in each disk serving, when not in mesh with the corresponding vane, as a passage through which the next preceding pumping unit in the series shall deliver.

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