

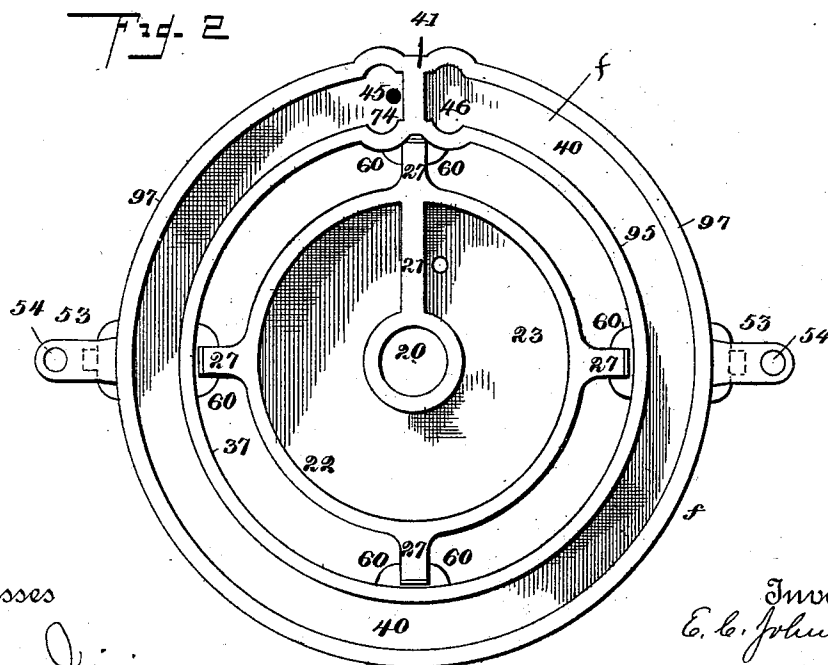
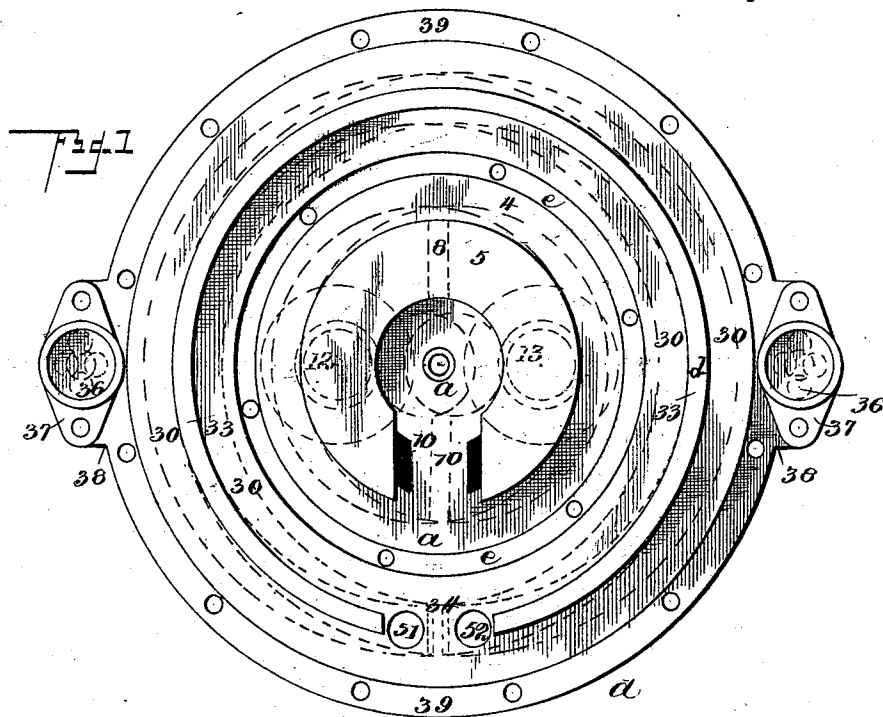
(No Model.)

5 Sheets—Sheet 1.

E. C. JOHNSON.
STEAM PUMP.

No. 519,065.

Patented May 1, 1894.



Witnesses

John Davis
C. K. Davies.

Inventor

E. C. Johnson

By his Attorney

W. A. Barrett

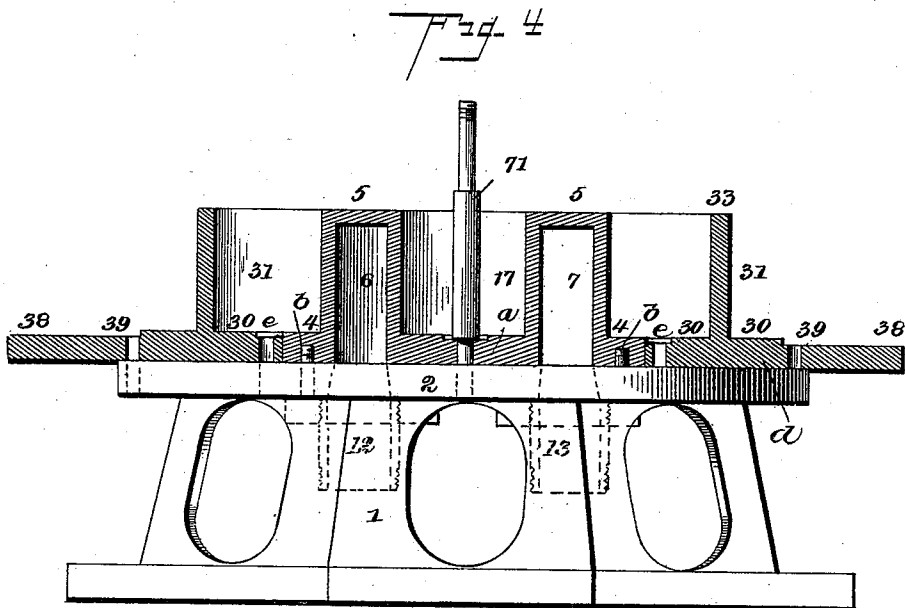
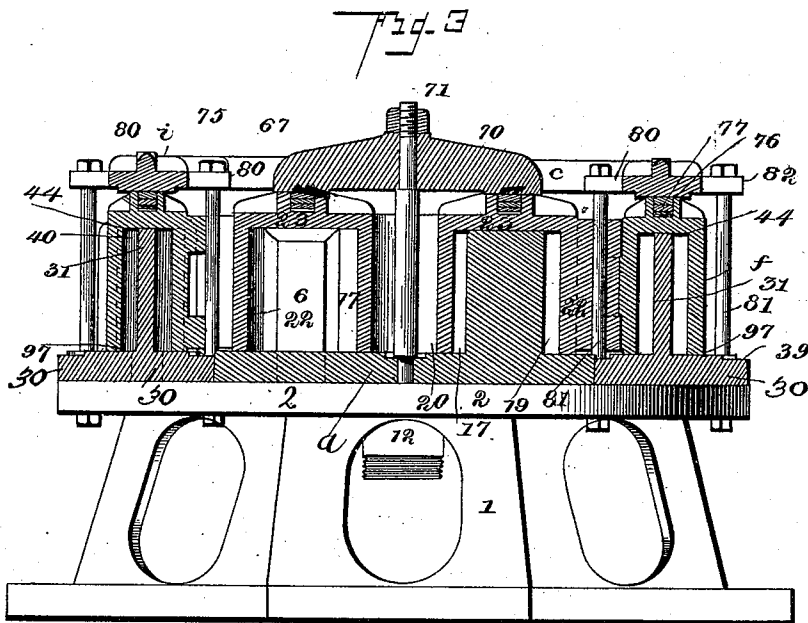
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Witnesses

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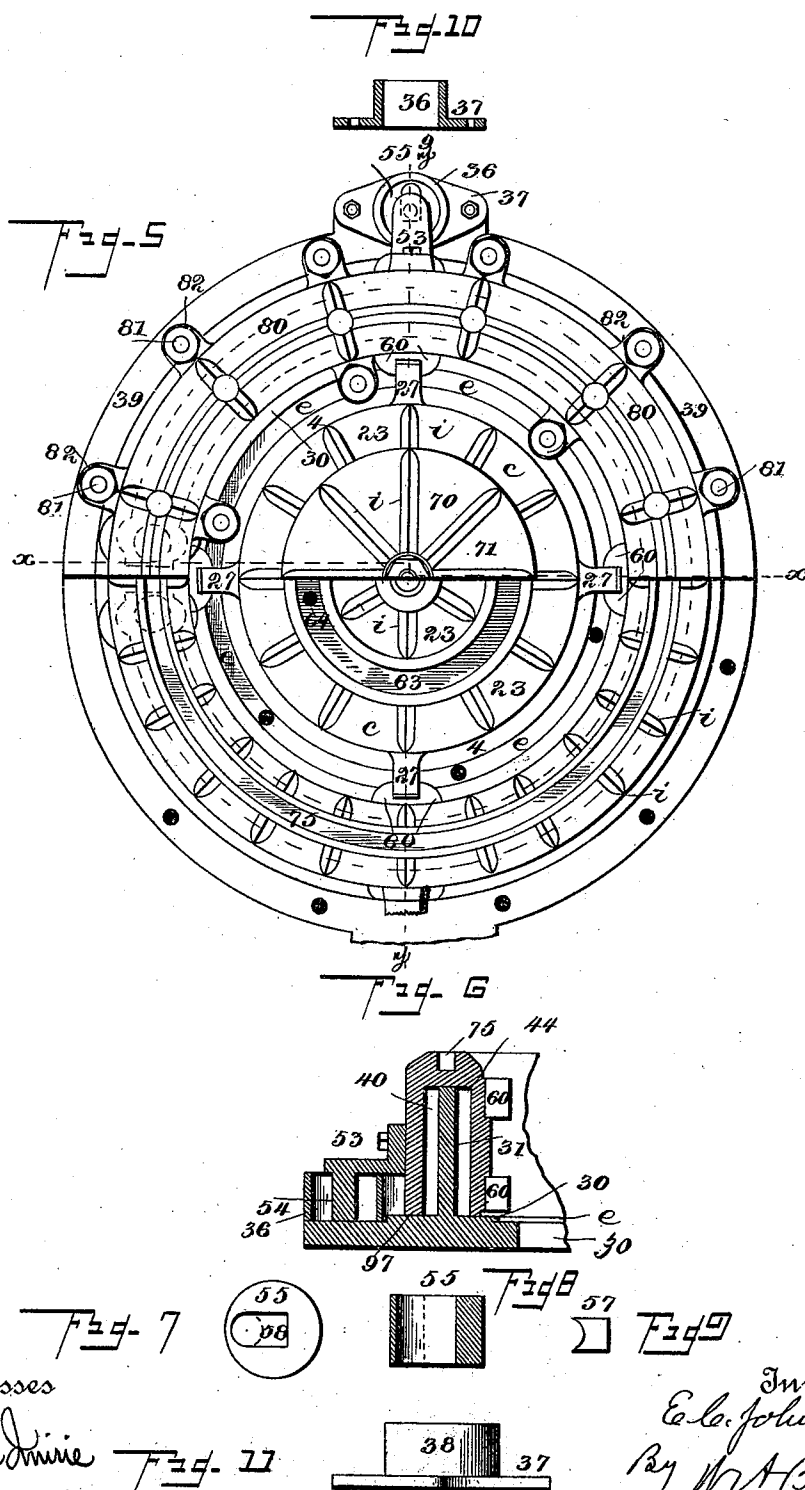
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Fig. 11



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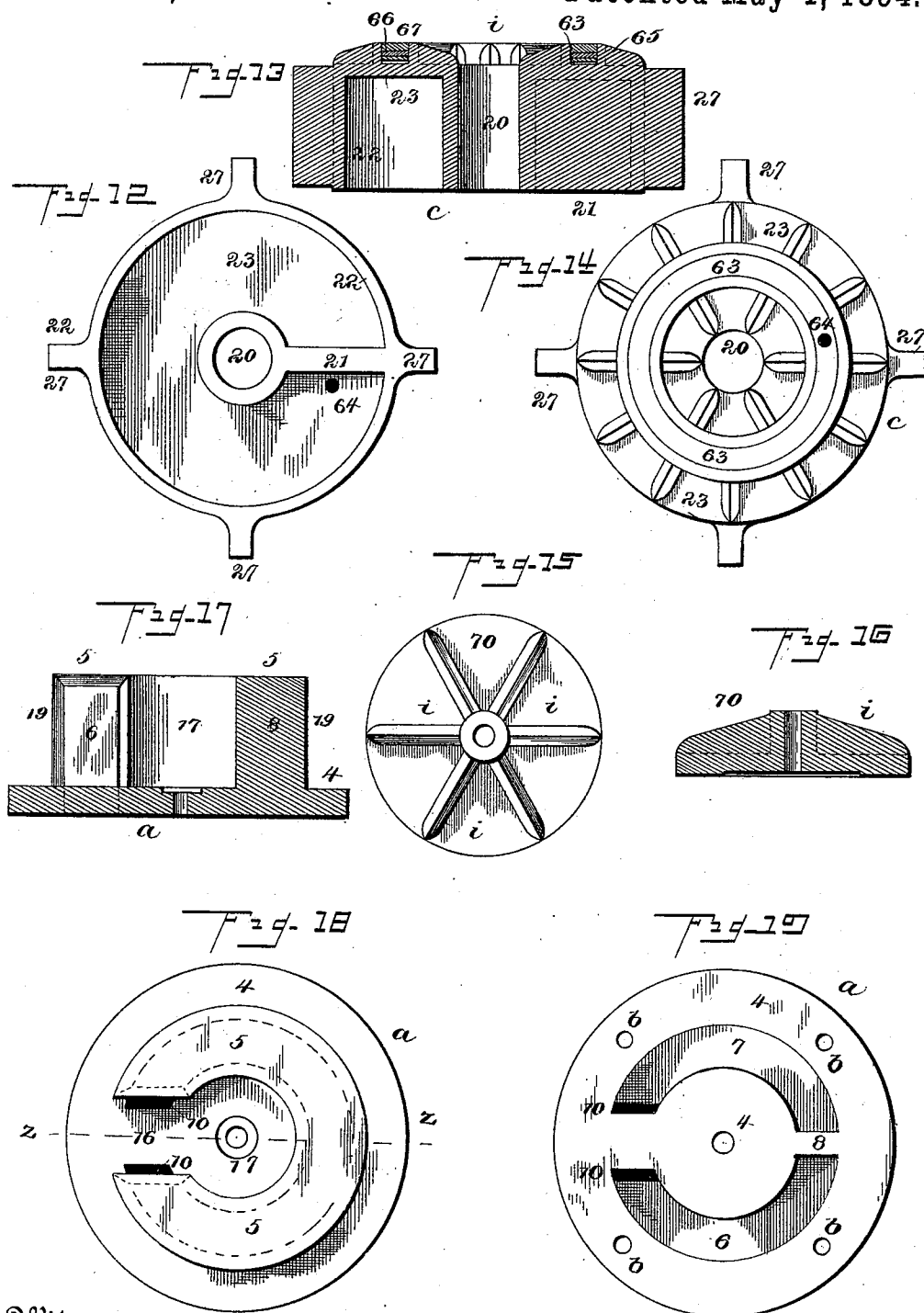
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Witnesses

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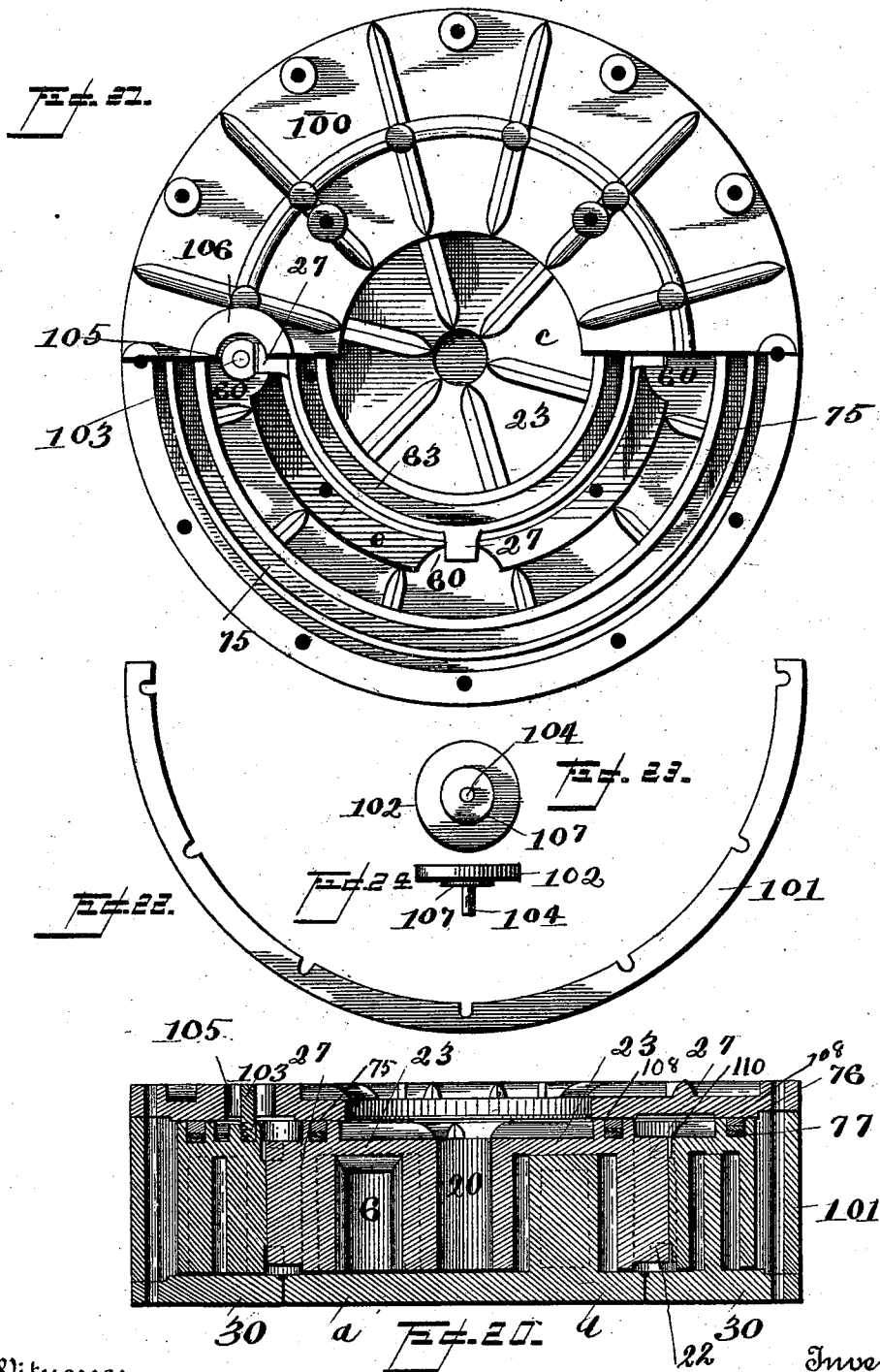
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5 Sheets—Sheet 5.

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No. 519,065.

Patented May 1, 1894.



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UNITED STATES PATENT OFFICE.

EDWARD C. JOHNSON, OF NEW LONDON, CONNECTICUT.

STEAM-PUMP.

SPECIFICATION forming part of Letters Patent No. 519,065, dated May 1, 1894.

Application filed February 23, 1893. Serial No. 463,500. (No model.)

To all whom it may concern:

Be it known that I, EDWARD C. JOHNSON, residing at New London, in the county of New London and State of Connecticut, have
5 invented certain new and useful Improvements in Steam-Pumps, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to steam pumps of
10 the oscillating variety.

The object of the invention is to produce an oscillating steam pump in which the steam cylinder and water cylinder may be independent and separately removable, without
15 disarranging many other parts of the device; also to make other parts of the machine separable; also to improve the construction of the steam and water cylinders; also to provide for balancing the steam piston by steam
20 pressure and the water piston by water pressure; also to improve the pump in various particulars.

Figure 1 is a plan of the water cylinder and steam cylinder, with piston removed, some
25 positions of the piston ring being indicated in dotted lines. Fig. 2, is a bottom plan of the two pistons and piston guides. Fig. 3 is a section of the pump complete, on line $x-x$, Fig. 5. Fig. 4 is a section of the water cylinder and steam cylinder and base, on the
30 line $y-y$, Fig. 5. Fig. 5 is a top plan—the upper half of figure being a plan of the pump complete, and the lower half showing covers removed, and one guide broken away. Fig.
35 6 is a broken cross sectional detail of steam cylinder, piston, and one guide. Figs. 7 and 8 are plan and section of one of the rotating eccentrics which produce the oscillation of the pistons. Fig. 9 is a plan of key which
40 may be used in said eccentric. Figs. 10 and 11 are section and elevation of the guide boxes. Fig. 12 is a bottom plan, Fig. 13 is a vertical section, and Fig. 14 a top plan of the water piston. Fig. 15 is a plan, and Fig. 16
45 a vertical section of the cap to the water piston. Fig. 17 is a section of the water cylinder, on the line $z-z$, Fig. 18, and Fig. 18 is a top plan of said cylinder. Fig. 19 is a bottom plan of the water cylinder removed from
50 the base. Fig. 20 is a central cross section

of the engine modified to have the outer casing to form a steam jacket. Fig. 21 represents a top plan, the upper half of the figure showing pump complete except guide cover, the lower half showing top of pistons and bot-
55 tom of cylinders. Fig. 22 is a top view of part of steam jacket or casing. Fig. 23 is a bottom plan of the guide cover. Fig. 24 is a side elevation of guide cover.

The numeral 1 indicates the base of the
60 machine. This is shown as an octagonal casting, but may be of any suitable form and material. The upper base plate 2 is preferably a metallic disk, with a plane upper surface,
65 and with seats on its lower face for steam and water supply and escape pipes. The water cylinder a rests on the central portion of the plate 2. As shown in Figs. 17, 18, and 19, this
70 cylinder a has a flat disk 4 at bottom, which disk has a broken ring 5 raised from its face, forming a broken hollow cylinder, with perpendicular walls, and the upper surface a
plane parallel with the upper face of disk 4. The ring 5 is hollow, and has two curved
75 chambers, 6 and 7, divided from each other by partition 8. These chambers are open at the ends 16 where the ring is broken, also open at the bottom through the disk 4, the curved opening in the bottom plate preferably extending a little nearer together than
80 the ends of the ring, as seen at 10, 10. The opening into these chambers at the end of the broken ring is preferably beveled, so as to make a good water passage.

When the cylinder a is applied to base 2,
85 and secured by bolts entering holes b from below the base plate, the chambers 7 and 6 will be respectively over the inlet and outlet passages through said base plate indicated
90 in dotted lines, Figs. 1 and 4. A pipe 12 communicates with the inlet passage, from any suitable source of water supply, and a pipe 13 leads from the pump. (See Fig. 4.)

The water piston c is cylindrical in its general form. It has an annular plate 23 forming
95 the cover, a central hollow cylindrical hub 20 and side walls 22 concentric with said hub and a radial partition 21 connecting the hub and wall. This piston c lies like an inverted cup on top of cylinder a , the partition
100

21 extending through the break 16 in ring 5, (see dotted lines Fig. 1) the hub 20 lying in central chamber 17 of the cylinder.

The height of broken ring 5 of the cylinder is such that the plate 23 rests on top of this ring when the edge of wall 22 rests on plate 4 of the cylinder. (See Fig. 3.) When the cylinder and piston are turned together, as in Fig. 3 the upward extension of the cylinder will lie in the inverted cup of the piston, and the hub of the piston will rest in the central chamber 17 of the cylinder.

It may be stated that the terms cylinder and piston are merely relative terms. I have denominated the part *c* a piston and the part *a* a cylinder because the part *c* moves and the part *a* is fixed. Strictly speaking both may perhaps be called cylinders. The relation of these parts is such that when the hub 20 is placed eccentrically in chamber 17, so as to rest against one side of said chamber, the wall 22 of the piston will rest against the vertical wall 19 of the broken ring of the cylinder. (See dotted lines, Fig. 1.)

The piston *c* is driven by outside power, as by the steam piston to be hereinafter described, so as to oscillate with reference to the cylinder. There will be a broken crescent shaped chamber or water space around the hub 20, and another between the walls 19 and 22, said chambers being connected through the break in ring 5. The partition 21 divides these chambers. As the piston *c* is caused to oscillate, the crescent shaped chambers will be caused to widen and narrow in circles about the center, and water flowing in at one side, through chamber 6 will be carried around and expelled at the other side through chamber 7, the mouths or ends of said chambers being open in the space 16.

The steam cylinder *d* (Figs. 1, 3, and 4) has a base ring 30, which surrounds the disk 4 of the water piston. The edges of this flat ring are of reduced thickness, leaving a groove *e* just outside of the water cylinder and a flat outer ring 39 of less thickness than the ring 30. These thin portions of the base ring 30 permit the fastening bolts to pass through base 30 into the plate 2, without interfering with the even surfaces 4 and 30 on which the edges of the steam and water pistons rest. They allow the overhang of the pistons to wear to the edge of the base plates, so as not to wear a shoulder thereon. These steam and water cylinders in their oscillation will slightly overhang the base plates on which they move, so that the wear will be uniform, but this overhang will of course be less than the thickness of the rims of the pistons. The steam cylinder base ring 30 has an upwardly projecting broken ring 31, with perpendicular walls and a flat top at 33. The ring is broken at 34, and is concentric with the water cylinder ring, but is not necessarily hollow, as will be explained. At opposite sides of the base ring 30 are guide cups 36, preferably short

hollow cylinders with flanges or ears 37 which are bolted to projections 38 from opposite sides of the steam cylinder base. Of course these cups might be integral with the cylinder base, but the parts can be turned up more easily when made separate.

The steam piston *f* is practically a hollow ring, open at one side, and having annular chamber 40 divided by a radial partition 41. The depth of this chamber 40 is equal to the width of ring 31, and when the piston is applied to the cylinder the edges 97 of the piston lie on the cylinder ring 30, while the top of ring 31 rests against the plane face 44 at the top of piston chamber 40. The chamber 40 is enlarged at 45 and 46, next the partition 41, so that in the oscillation of the piston the inlet steam port 51 and exhaust port 52 may not be uncovered by the surfaces 97 of the piston. Lugs or wings 53 53 project from opposite sides of the steam piston. These wings are preferably separate pieces bolted to the piston. The wings 53 have guide pins 54 projecting into the guide cups 36. A short cylindrical bushing 55 surrounds each guide pin 54, and fills the guide cup 36. The pistons are shown concentric with the cylinders in Fig. 3, but are thrown over into eccentric position for working, by dropping the keys 57 into the mortises 58 in the bushings, alongside of the pins 54. (The keys 57 may be of elastic material.) When the guide pins 54 are in the guide cups 36, and forced into eccentric relation to said cups, the oscillation of the piston causes the bushing 55 to rotate in the cups 36, (see dotted lines, small circles, Fig. 1,) or rather the bushings are caused to rotate, and their rotation compels the piston to oscillate uniformly. The partition 41 will be carried from side to side of the break 34 in the cylinder ring, and the walls of the piston will form crescent shaped chambers alongside the ring 31, the crescent form moving round the ring as explained. Two positions of the piston rings are indicated in dotted lines, Fig. 1, but the position is constantly changing with the "wabbling" movement of the pistons. (The movement of the piston on the cylinder may be compared to the movements in rolling pellets or balls between the hands.) Steam being admitted at port 51, forces the piston to one side, and the steam enters the openings between the walls of the piston and the broken ring 31 of the cylinder, thus forming the cup of the piston into eccentric relation with the cylinder. This eccentric relation changes under the pressure of the steam, which pressure carries the piston with a wabbling movement, to the side, then back, then to the opposite side, and then to the front, in the same manner that a solid substance would do if carried around between the vertical flanges of the piston and cylinder. Two of the positions of the piston are indicated by dotted lines, Fig. 1, but there will be an infinite number of positions with

each piston stroke. The steam piston carries the water piston with it, and causes it to partake of its wobbling movement, drawing the water in at the inlet and expelling it at the outlet port.

The water piston is provided with radial wings 27 which rest between lugs 60 at the inside of the steam piston, so that the movement of the steam piston is communicated to the water piston—but the connection is such that either piston may be lifted away from its cylinder without removing the other.

The water piston *c* has an annular groove 63 in its upper surface. A small opening 64 through the disk or plate 23 permits water to pass from below up into this groove. Packing rings 65, 66, and 67, one at least of which is elastic, lie in the groove, so that the water comes below these rings. A cap 70 rests on top of these packing rings, and is held down by a bolt 71 which passes down through the hollow hub of the piston into the base plate 2. The hole in hub 20 is large enough to permit the oscillation of the hub about this bolt 71, and there is a little space about the bottom of the bolt to prevent wearing to a shoulder. The parts are shown in Fig. 5, in concentric position, but the cap 70 is large enough to cover the packing rings 66 and in any position the piston assumes during its oscillation. The cap 70 and the piston covers may be strengthened by radial ribs *ii*. The steam piston has a small opening 74 in its upper ring plate, leading into an annular recess 75 in the steam piston. Packing rings 76, 77 fill the upper portion of this recess, and an annular ring cap 80 covers all these packing rings, and is wide enough to permit the oscillation of the piston without uncovering said rings. The ring cap 80 is held down by bolts 81, passing through lugs 82 on the ring cap, and down at each side of the steam piston into the base of the pump, leaving space for the oscillation of the piston.

The area of the bottom of the groove or annular recesses 63 is such as to equal or slightly exceed the area of the top of the water pistons, minus the area of the broken annular surface 5. Consequently the water pressure downward in said groove will balance or slightly overbalance the upward pressure on the piston. The balancing pressure on the steam piston is arranged in similar manner. A single small opening in the top of the pistons will generally suffice to convey water or steam through the top of the piston to give a packing pressure. It will be seen that the connection of the steam and water pistons is such as to permit an independent vertical movement. It is not necessary that the chambers of the pistons shall be of the same depth.

As the operation of the pump would be the same if inverted, or would be practically the same if the so called pistons were made to stand still while the so called cylinders were

oscillated, it will be understood that I desire to cover such change of function, so far as I may fairly do so within the limits of my invention.

The so called caps or covers 70 and 80 are really thrust pieces or bearings, and have no function save to hold down the packing in chambers 63 and 75. These caps might be made of slats, and if desired antifriction balls may be interposed between the packing and these thrust pieces.

The oscillation of the water piston serves to draw in the water through supply pipe 12, and pass it through chamber 6 out into the crescent shaped spaces outside and inside the walls of the cylinder ring, and inside the water piston. The oscillation of the piston moves these crescent spaces, as the hub and ring of the piston shift, moving about a center, but not rotating. This drives the water round to the opening into chamber 7, at the other side of partition 21. The water is thus forced into chamber 7 and out at the escape pipe. The course of the steam inside the piston is similar to that of the water. The guide cups and bushing compel the pistons to oscillate uniformly. If the steam piston be exactly on its dead center it will permit a passage of steam around the piston without moving the same, but the piston can be easily thrown off its concentric position. With the guide bushing 55 and keys 58 in position the piston cannot take a concentric position relative to the cylinder.

The partition 41 of the steam piston may be made thick enough to wholly or partly close the supply port 51 during part of the vibratory movement of the piston, thus serving as a valve to regulate the steam supply.

For a low service pump the positions of the steam and water cylinders and pistons may be reversed, the outer cylinder of larger area and capacity being made hollow instead of the inner, and the steam and water connections being changed accordingly, or both cylinder rings may be made hollow, and the inlet and outlet ports can then be arranged with convenient reference to these hollow rings.

In the modification, Figs. 20, 21, 22, &c., the casing covering is indicated by 100, and 30 indicates the base. A casing 101 incloses the space between the top and base plates, and forms a steam chamber surrounding the engine. This chamber receives steam from the exhaust, or from any other suitable place, and serves to prevent radiation. The space 110 between the two pistons is also inclosed, and exhaust steam admitted thereto. As water is formed by the condensation of steam in this space 100, it may be carried off through a suitable outlet to the ejector side of the pump. The cover 110 has on its under side projecting annuli 108, which act as thrust bearings for the packing 75 and 76. The opening 105 through the cover 100, and the cover 102 therein, together form guides to

give a true oscillating movement to the piston. Cover 100 has a circular opening in its center which allows the air to come in contact with the larger part of the surface of the water piston, thus avoiding any undue heating of water while passing through the pump. The cover 100, is provided with suitable holes for studs by which it and the casing 101 and the bottom 30 of the pump can be securely fastened to the base 1, shown in Figs. 3 and 4. Guide cover 102 is fastened to cover 100. It has a projection 107 which centers it in hole 105. It has a pin 104 projecting from its under side which leaves an annular space in which guide pin 103 revolves. When the pistons are in a working position pin 103 will just touch the inner surface of hole 105 and the outside of pin 104 thus forming a guide preventing any movement of the pistons except in the direction they are intended to move. The position on the pistons of recesses 63 and 75 is changed to accommodate the placing of a single cover or thrust-piece instead of the two previously shown but their use not otherwise changed.

What I claim is—

1. In a steam pump of the character described, a base plate having water passages therethrough, and the water cylinder thereon but separate therefrom, said water cylinder having a flat disk base and a broken ring thereon, the ring having curved passages opening through the base and at the ends of the ring.

2. The water cylinder described, consisting of a flat disk base, and a broken ring extending upward from the base thereof, said ring having two chambers each opening at the break in the ring and having a passage through the base, the chambers being divided from each other by a partition.

3. The combination of a water cylinder having a flat base and a broken ring extending therefrom and provided with inlet and outlet chambers, and the water piston of cup form having a central hub and radial partition said piston inverted on the cylinder, and having its partition extending through the break in the cylinder ring, substantially as described.

4. The combination of the cylinder having disk and broken ring extending therefrom, the cup piston having a radial partition extending through the break in said ring, and the piston cap or thrust piece with packing interposed between said piston and cap, substantially as described.

5. The combination of the water cylinder having base and a broken ring extending therefrom and provided with water passages as described, and the inverted cup piston having a radial partition extending through the break in said ring as described, the thrust piece above said piston, and a water balance chamber between said thrust piece and the piston, substantially as described.

6. The combination with the base disk of

the cylinder having an upwardly projecting broken ring and a central depression, of the inverted cup cylinder having a radial partition, the side walls of the cup piston slightly overlapping the base disk as the piston oscillates thereon, substantially as described.

7. The steam cylinder consisting of a flat base ring with a broken ring or cylinder extending upward therefrom, and having the edges of the base ring of reduced thickness, substantially as described.

8. The combination of the flat base, the removable water cylinder having base disk and upwardly extending broken ring, and the removable steam cylinder having base and upwardly extending broken ring concentric with the water ring, the cylinders having supply and exhaust ports through the base, substantially as described.

9. The combination with the steam cylinder having base ring and a broken ring extending upwardly therefrom, and the steam piston having outer and inner walls forming an annular chamber, said chamber divided by a partition passing through the break in the ring of the cylinder, substantially as described.

10. The combination with the base having the upwardly projecting rings as described, and the steam and water pistons covering said rings, said pistons being connected to move together but being separately removable, substantially as described.

11. The combination of the central cup piston having projecting arms, and the surrounding annular piston having lugs with which said arms engage, said piston being separately removable, substantially as described.

12. The combination with the cylinder base having upwardly projecting broken ring and guide cups at opposite sides, of the inverted cup piston having guide pins at its outer sides extending into said cups, substantially as described.

13. The combination with the cylinder base having broken rings extending therefrom, and having guide cups at the sides and movable eccentric bushings therein, of the inverted cup piston having guide pins extending into the eccentrics in the cups, substantially as described.

14. The combination with the cylinder base having broken ring and guide cups as described, and the broken ring piston applied thereto and having pins extending into the guide cups, of the mortised bushings forming eccentrics around said pins, and the keys extending into the mortises of the bushings.

15. The combination of the steam cylinder having broken ring as described, and the ring piston covering said piston as described, with the guide pins on the piston at each side extending into the rotating bushings on the cylinder, whereby the uniform oscillation of the piston is produced, substantially as described.

16. The combination with the central cylin-

der having broken ring as described, the inverted cup piston having perforated central hub, the thrust piece over said piston, and a bolt passing through said thrust piece, through the hole in the hub, and into the base whereby the piston and thrust piece are held down, substantially as described.

17. The combination with the annular cylinder base having broken ring as described, the ring piston thereon, the thrust piece to said piston, and bolts or rods connecting the thrust piece and base but permitting the oscillation of the piston between the same, substantially as described.

18. The combination with the base and the piston having annular balance chamber and a series of packing rings therein, of a thrust piece against which said packing bears and oscillates relatively thereto, substantially as described.

19. The combination with the fixed concentric cylinders having broken rings as described, of the separate pistons, concentric

with each other, and having separate thrust pieces, to permit independent vertical movement between the pistons, substantially as described.

20. The combination with the cylinders and pistons of substantially the character described, of the cover and bottom plate projecting beyond said pistons at its outer periphery and the inclosing casing forming with said plates a steam jacket, substantially as described.

21. The combination of the annular cover and bottom plate, and the chambered cylinders and pistons inclosed therein, of the guide opening in the cover, and the guide piece connected to the piston and extending into said opening, substantially as described.

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

EDWARD C. JOHNSON.

Witnesses:

WILLIAM BELCHER,
NATHAN J. STARK.