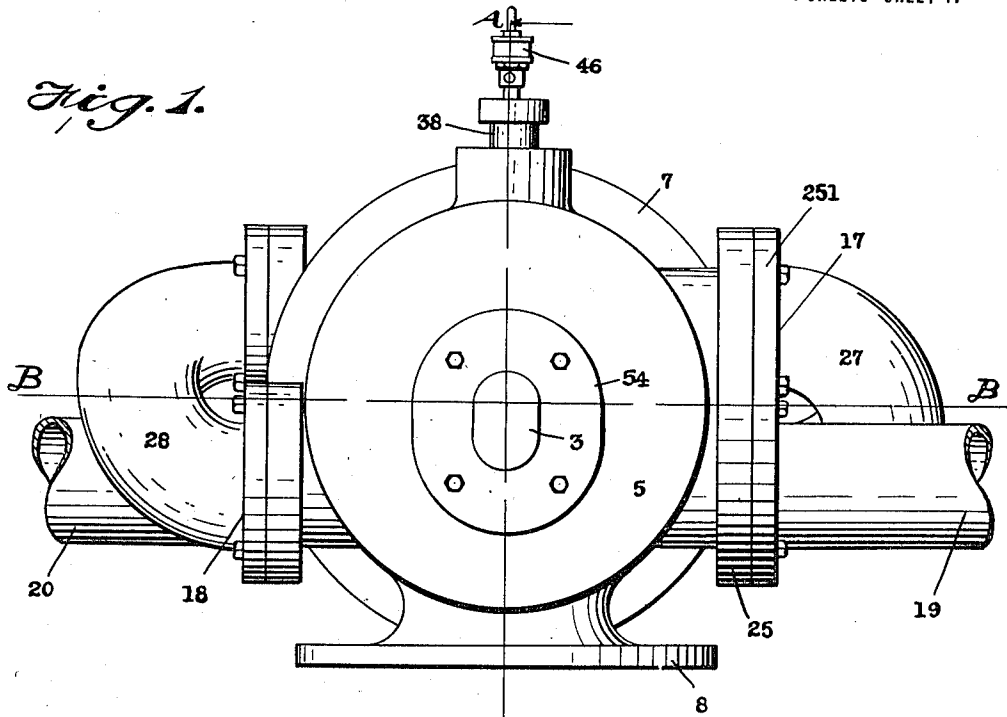
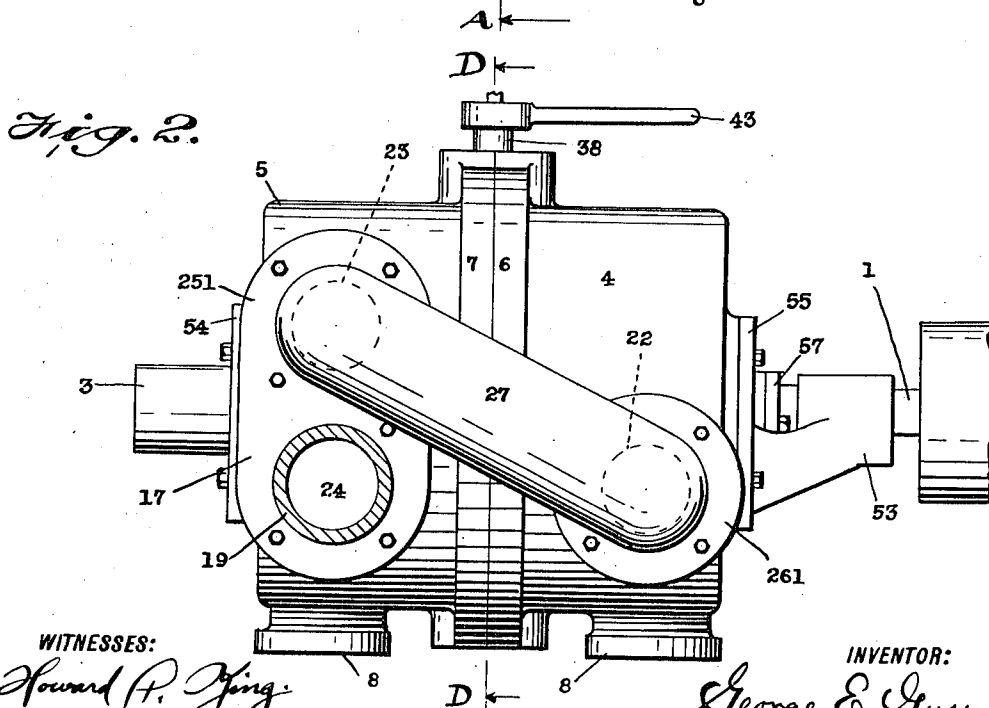


G. E. GUY.
 ROTARY PISTON PUMP.
 APPLICATION FILED APR. 23, 1913.

1,241,624.

Patented Oct. 2, 1917.
 4 SHEETS—SHEET 1.



WITNESSES:

Howard P. King.
Janet A. Ayers.

INVENTOR:

George E. Guy,
 BY *Russell M. Everett,*
 ATTORNEY.

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4 SHEETS—SHEET 2.

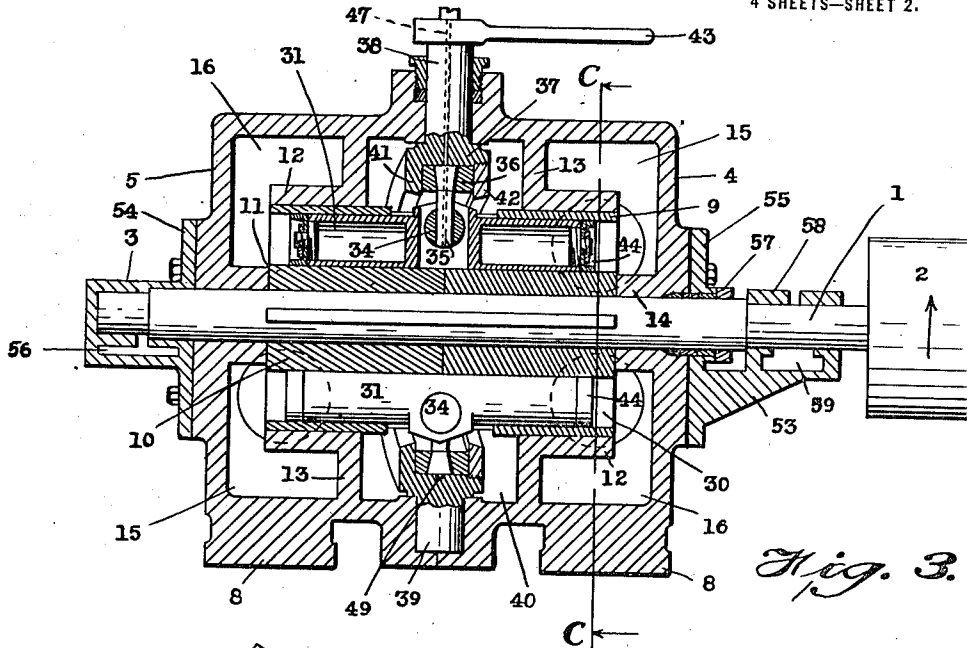


Fig. 3.

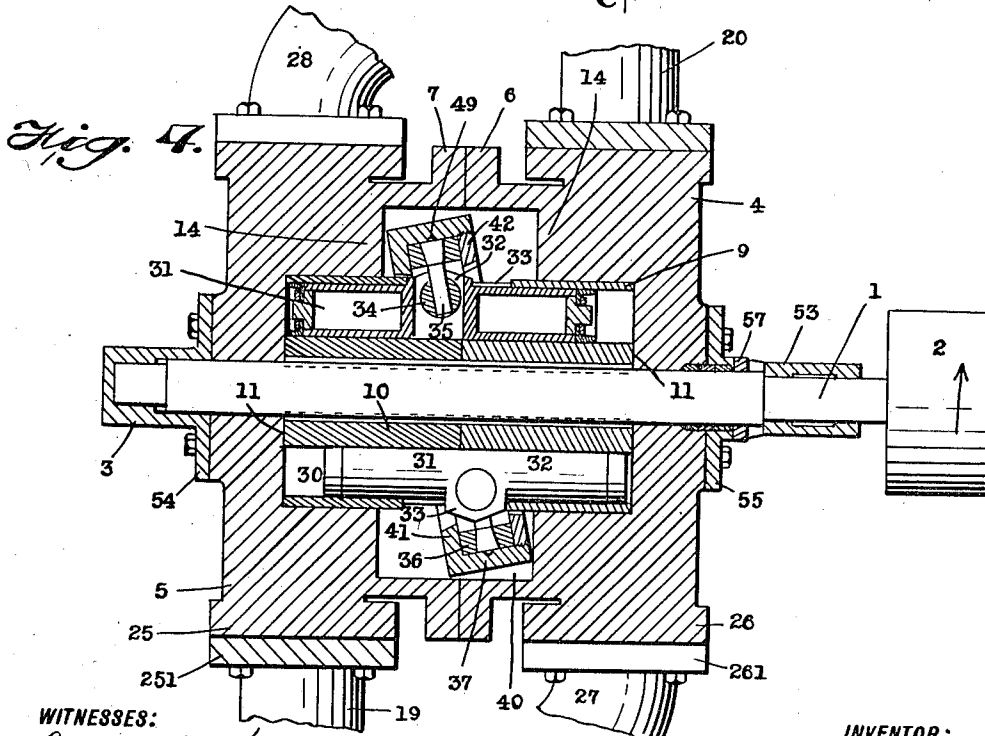


Fig. 4.

WITNESSES:

Howard P. King
 Janet A. Ayers.

INVENTOR:

George E. Guy,
 Russell W. Everett,
 ATTORNEY.

G. E. GUY.
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4 SHEETS—SHEET 3.

Fig. 5.

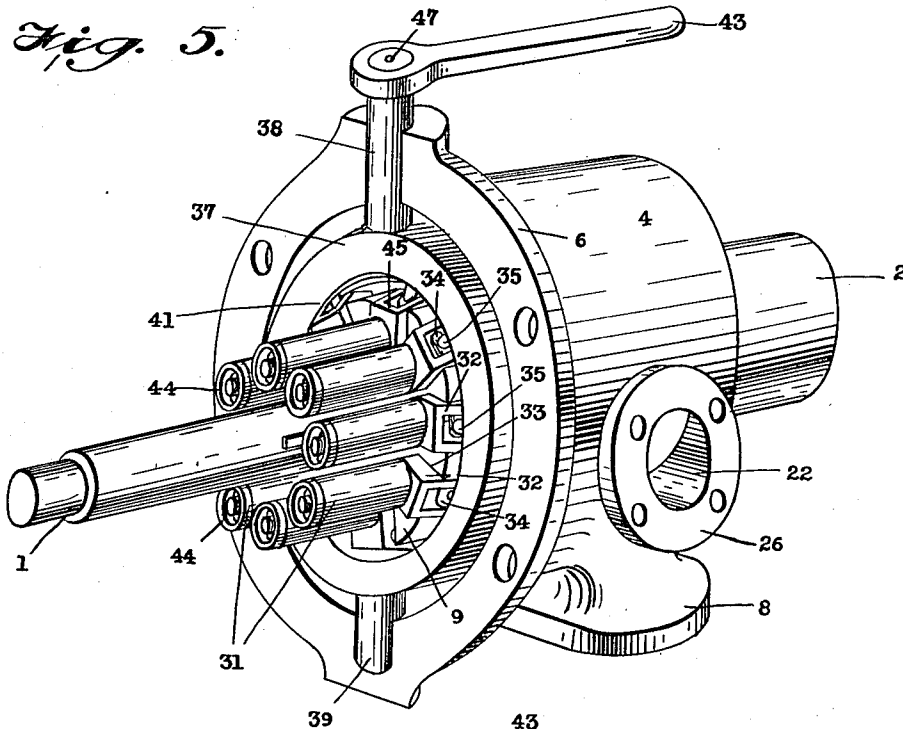
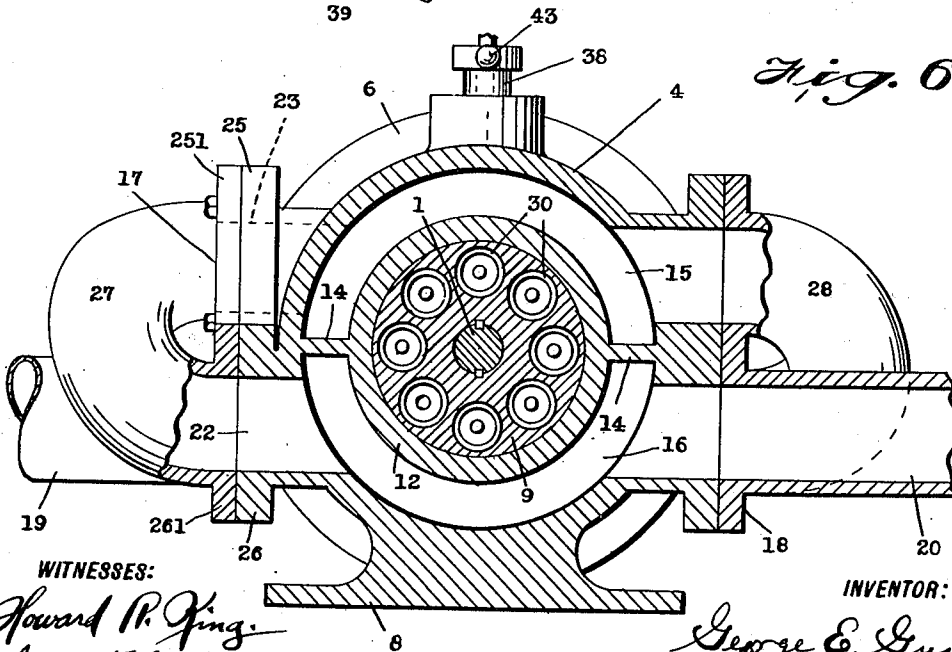


Fig. 6.



WITNESSES:

Howard R. King.
Janet A. Ayers.

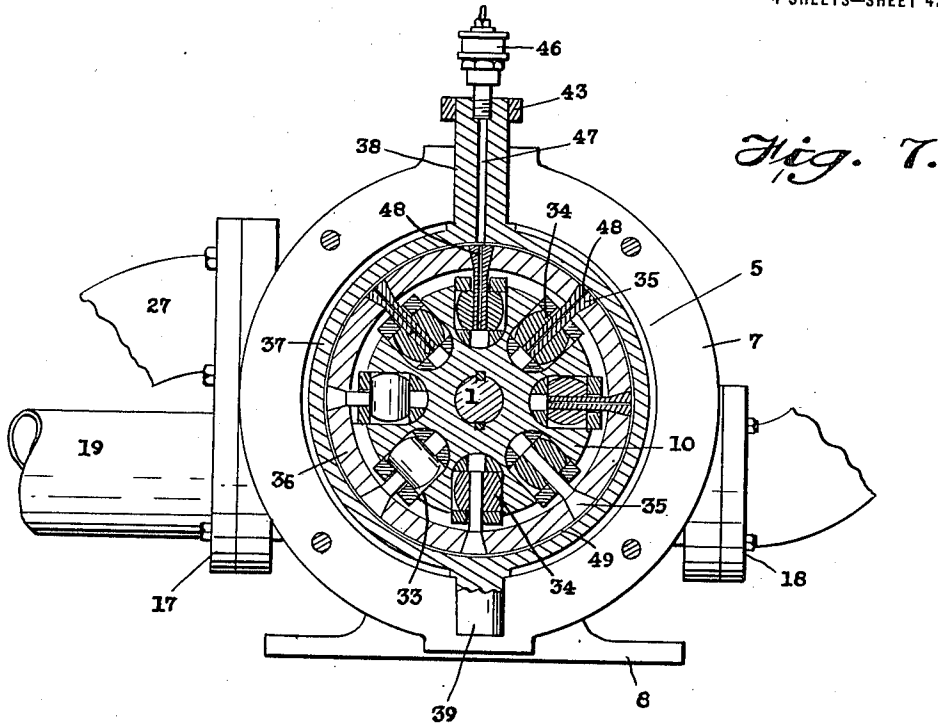
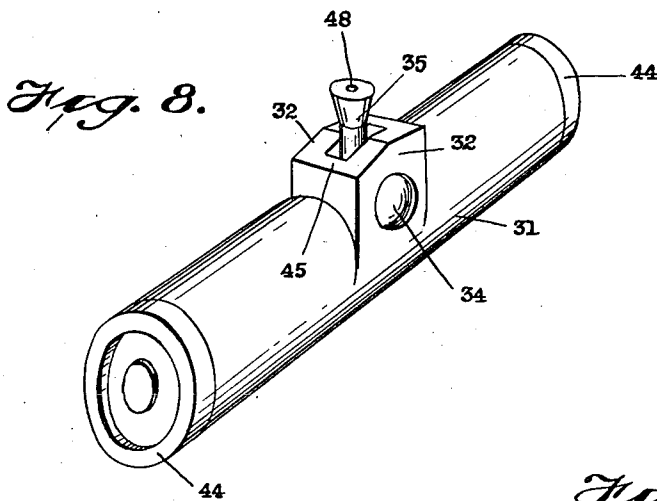
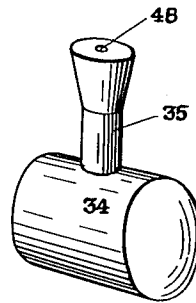
INVENTOR:

George E. Guy,
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 ATTORNEY.

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 4 SHEETS—SHEET 4.



WITNESSES:
 Howard R. King
 Janet A. Ayers.

INVENTOR:
 George E. Guy,
 BY
 Russell M. Everett,
 ATTORNEY.

UNITED STATES PATENT OFFICE.

GEORGE E. GUY, OF TOTTENVILLE, NEW YORK, ASSIGNOR OF ONE-THIRD TO WALTER H. SAMUEL AND ONE-THIRD TO HOWARD H. SAMUEL, BOTH OF BLOOMFIELD, NEW JERSEY.

ROTARY PISTON-PUMP.

1,241,624.

Specification of Letters Patent.

Patented Oct. 2, 1917.

Application filed April 23, 1913. Serial No. 762,991.

To all whom it may concern:

Be it known that I, GEORGE E. GUY, a citizen of the United States, residing at Tottenville, Staten Island, and State of New York, have invented certain Improvements in Rotary Piston-Pumps, of which the following is a specification.

This invention relates to that class of rotary piston pumps in which a series of cylinders arranged to revolve around a common axis are connected to a revoluble ring within a disk or head, and in which the length of stroke of the pistons may be varied by tilting said disk head, thereby varying the output.

The objects of the invention are to obtain a non-pulsating continuous flow by a plurality of pistons two or more of which are pumping simultaneously at all times but at different stages of positive stroke; to avoid the use of valves; to provide by the use of double-ended pistons a compact structure with a large volume of output; to obtain a strong but simple form of drive for said pistons adapted to shift radially with respect thereto as the disk or head carrying said driving means is tilted; to thus keep the points of driving engagement of the disk with the pistons always in a true circle at right angles to the axis of rotation and avoid irregularities in action; to readily vary the output or stop the pump entirely; to secure a construction in which the various parts are easy of access and readily assembled; to provide a pump of this type adapted to economical manufacture; to secure simplicity of construction and operation, and to obtain other advantages and results as may be brought out in the following description.

Referring to the accompanying drawings, in which like numerals of reference indicate the same parts throughout the several views,

Figure 1 is an end elevation of a rotary pump of my new design;

Fig. 2 is a side view of the same as viewed from the right-hand side of Fig. 1;

Fig. 3 is a vertical longitudinal section through the pump, taken on line A—A of Fig. 1 looking in the direction of the arrows;

Fig. 4 is a horizontal sectional view taken on line B—B of Fig. 1 looking down;

Fig. 5 is a perspective view of one end

portion of the casing, the other end portion and the manifolds being removed;

Fig. 6 is a vertical transverse section on line C—C of Fig. 3, looking toward the left-hand as indicated by the arrows;

Fig. 7 is a vertical transverse section on line D—D of Fig. 2, looking in the direction indicated by the arrows;

Fig. 8 shows in perspective one of the double-ended pistons removed from the cylinders, and

Fig. 9 is a detail perspective view of the pin and stud by which one of the pistons is driven.

In the specific embodiment of the invention illustrated in said drawings, the reference numeral 1 indicates a longitudinal shaft shown as extending through the pump and having affixed at one end a driving pulley 2 for connection with any suitable source of power. This shaft 1 may be supported in any suitable bearings adapted to the conditions to be met, but I prefer to employ the particular bearings 3, 53 which I have shown in the drawings and which are bolted to opposite ends of the pump casing by means of flanges 54, 55 respectively. The bearing 3 is in effect a closed cap over the end of the shaft, making an impervious joint with the casing so as to prevent any possible leakage, and providing a lower oil chamber 56 which will automatically lubricate the shaft. The other bearing 53 has adjacent to the casing a stuffing box or packing 57 to prevent any possible leakage outward around the shaft, and has an outer portion 58 in which the shaft is journaled, said outer portion providing a lower oil chamber 59. For ease of assembly it is preferable to construct said casing in sections or halves 4, 5 separable on a transverse plane, said sections or halves 4, 5 having annular flanges 6, 7 at their facing or adjacent ends for bolting them together. In the particular construction shown in the drawings, said halves 4, 5 of the casing are substantially cylindrical, coaxial with the shaft 1, and each provided with a foot or base 8 at a corresponding position on the curved surface thereof to support the pump with the shaft and casing axially horizontal.

Keyed or otherwise non-rotatively secured end to end on said shaft 1 and symmetrically positioned within the casing, are two cylinders or barrels 9, 10, which thus

revolve with the shaft. The extreme outer ends 11, 11 of these barrels are located in planes perpendicular to the axis of rotation and bear or seat slidably against diametric walls 14, 14, separating the intake and discharge as hereinafter described. It is within the scope of my invention to bolt these two barrels 9, 10 together longitudinally, if desired. The barrels 9, 10 are surrounded adjacent their respective outer ends 11 each by a cylindrical collar 12 fitted sufficiently snug about the curved surface of the barrel to prevent the passage of fluid between the two said parts as the barrel rotates within the collar. A web 13 extending radially outward from the inner end of each of these collars 12 joins the same integrally to the inner circumferential wall of the casing whereby an annular compartment is formed at each end of the pump casing divided imperviously off from the rest of the interior space. These annular compartments are furthermore each imperviously partitioned within itself by one of the diametric walls 14, dividing each annular compartment therefore into two semi-annular chambers 15, 16, and for rotation of the cylinders in the direction indicated by the arrow in Figs. 3 and 4 together with the particular direction of tilt given the disk or head shown and hereinafter described, the upper chamber 15 at the right-hand side of Fig. 3 will be an intake or suction chamber, while the recess 16 below the same will be the discharge or exhaust chamber, whereas upon the opposite or left-hand side of Fig. 3 the upper compartment 16 will be the discharge chamber while the intake chamber 15 is below it.

In order to conduct the fluid to and from the pump and require only one pipe connection to be made, upon installation, from a source of fluid supply to the pump, and also only one such connection to a discharge main, I provide manifolds 17, 18 adapted to be affixed to the opposite sides of the pump or its casing, see Figs. 1 and 2, one manifold 17 providing a single supply pipe or nipple 19, and the other manifold 18 providing a single discharge pipe or nipple 20. For economy of construction the halves 4, 5 of the casing are preferably duplicates or counterparts, whereby the same pattern may be used in casting each, and hence a port opening which appears, say on the front side of one of the halves 4, (see Fig. 2), will appear upon the reverse or rear side of the other half 5, and vice versa. By an inspection of Figs. 1, 2 and 6 more especially, it will be appreciated that the two manifolds may be also constructed in duplicate and are the same except that where a part in one is for exhaust the same part in the other is for intake and so on. With this distinctly in mind, therefore, a description of the particular form and operation of the intake

manifold 17 will next be given in detail as sufficient for both manifolds.

Observing the intake side of the pump casing, as would be shown in Fig. 2 were the manifold 17 removed, three port openings 22, 23 and 24, (see Figs. 5 and 6), are provided through the casing walls. One of these port openings, 22, opens into the lower part of the exhaust chamber 16 of the right-hand half 4 of the casing as viewed in Figs. 2 or 5, whereas the other two port openings 23 and 24 are arranged one above the other and lead into the upper and lower chambers 16 and 15, respectively, of the other half 5 of the casing, see Fig. 6. A suitable flange 25 surrounds this pair of openings 23, 24 in the casing portion 5 and a flange 26 surrounds the single opening 22 in the other casing portion 4, whereby the manifold 17 may be suitably bolted or otherwise secured in place. The inlet nipple 19 of the manifold 17 is adapted to aline or register with the lower port 24 of said pair, and the manifold provides as a part of itself a U-shaped tube or elbow 27 adapted to extend between and thus connect the upper port 23 of the pair and the lower single port 22 at the other end of the casing. A suitable flange 251 is provided on one end of this U-shaped elbow 27 to bolt to the double flange 25 of the casing, and at the other end of the manifold a flange 261 joins the elbow 27 and nipple 19 and is adapted to fit upon and be bolted to the flange 26 of the pump casing. The nipple 19 thus leads to the intake chamber 15 of the left-hand end of the pump, see Figs. 2 and 6, and since a U-shaped elbow 28 (similar to the one already described) of the other manifold 18, extends at the opposite side of the pump casing diagonally upward from said suction chamber 15 to the suction chamber 16 of the right-hand end of the pump casing, fluid will be supplied to both ends of the pump, or the two intake chambers 15, 15, simultaneously and through the same nipple 19. Similarly, the exhaust nipple 20 of the manifold 18 will communicate with, and receive the discharge from, both ends of the pump, or the two outlet chambers 16, 16 thereof.

The barrels 9, 10 have each a plurality of cylinders 30, extending through it axially parallel to the shaft 1 and each the same distance therefrom. Furthermore, the barrels each have the same number of cylinders, as I prefer to construct the pump, and corresponding cylinders of each barrel are in alinement. Operatively mounted within each pair of these alined cylinders is a double-ended piston 31, adapted to reciprocate therein and obviously making an exhaust stroke within one cylinder simultaneously with an intake stroke in the other cylinder. The piston is held against rotation within the cylinder by a pair of parallel ears 32, 32

tangent to opposite sides of the piston 31 intermediate the ends of the same and projecting laterally into a slot 33 through the outer curved walls of the meeting-ends of the barrels. Mounted transversely of the piston 31 and rotatively supported by said ears 32, 32 substantially perpendicular thereto is a rocker pin 34, and as here shown the ears 32, 32 are each provided with a circular hole in which the ends of the said pin are rotatively held. This rocker pin 34 slidably receives in a transverse hole of itself intermediate of its ends, a radially disposed stud 35 projecting from a ring 36 around the barrel and rotatively supported in a swinging carrier 37. The said studs 35 are shown as each having a tapered head seated in a correspondingly tapered radial socket in the ring 36 by driving from the outside, but they might be otherwise mounted.

The swinging head 37 comprises an annular body portion encircling the central or inner ends of the barrels, and supported on trunnions 38, 39 journaled in the pump casing, between the flanges 6, 7 of the two sections thereof, transverse to the shaft 1 and here shown as perpendicular thereto and vertical. One of these trunnions, as the top one 38, projects from the casing and I have shown a lever 43 thereon for swinging the head 37. Other suitable means might be employed, however.

It may here be noted that the swinging head is mounted by these trunnions within a central annular chamber 40 inclosed by the casing portions 4, 5 adjacent their meeting ends and between the webs 13, 13 thereof. When so desired, this chamber 40 may be filled with a lubricant such as oil so that the pistons and other moving parts within the chamber may be thoroughly lubricated at all times.

In order to rotatively mount the stud ring 36 in the swinging head 37, said head is provided with an inwardly directed radial flange 41 at its one side, and adjacent its other inner edge is screw threaded to receive a ring nut 42 corresponding to the flange 41. This construction provides an annular channel or seat between the flange and ring nut in which the stud ring 36 is free to rotate. It is to be understood that the studs are inserted from the outside of the stud ring before assembly in the head, so that the tapered ends of said rings fitting in correspondingly tapered holes retain the studs from inward displacement while outward displacement is prevented by the engagement of the outer ends thereof with the annular seat of the body portion of the swinging head.

As the shaft 1 rotates, it carries the barrel around with it and necessarily rotates the pistons about the shaft, so that the studs 35 engaging in the rocker pins 34 in

the ears 32, 32 of the pistons cause the stud ring 36 to revolve within the swinging head 37. When said head is swung on its trunnions 38, 39, as by the lever 43, out of a perpendicular plane to the shaft 1, the studs 35 guide the pistons in an elliptical path as the barrel and ring simultaneously rotate, and a reciprocation of the pistons results, dependent upon the tilt or swing given to the swinging head. For greatest stroke of the piston, therefore, the head is swung from its perpendicular position the greatest possible amount, and to stop the reciprocation the swinging head is swung into perpendicular relation with the barrels and shaft.

In order to accommodate the varied radial distance of the stud ring 36 with respect to the shaft 1 when the head is swung from perpendicular relation thereto, the studs 35, instead of being slidably mounted within the transverse rocker pin 34 and fast in the ring, might be slidable in the ring and fast in the pins, if desired, and all such obvious changes are intended to be covered by the appended claims.

Supposing the head to be swung in a counter-clockwise direction, viewed from above, (see Figs. 3 and 4), and the rotating parts actuated as indicated by the arrow, that is, clockwise as viewed from the right-hand end in Figs. 3 and 4, the operation is as follows. As shown in Fig. 4, the piston passing the partition wall 14 in a downward direction, is at its greatest stroke toward the left (at the top of said Fig. 4) while the diametrically opposite one is at its greatest stroke toward the right, so that as any piston is carried from one partition to the other through the lower part of its revolution it reciprocates from left to right and will draw fluid into the cylinder at the left-hand end of it and eject fluid from the cylinder at the right end of it, and as it travels through the remaining portion of its path a reversed action takes place. The retraction of a piston obviously takes place during half a rotation and the horizontal wall 14 separates the annular compartments at the ends of the cylinders into the two chambers 15, 16 so that while in communication with the one, 15, the piston retracts, and while in communication with the other one, 16, the piston reenters the cylinder and ejects the fluid therefrom into that chamber. For utilizing the effect of this suction and ejection on opposite sides of the wall 14, the said wall is adapted to provide an impervious seat against which the end of the barrel tightly fits in sliding engagement separating the two chambers entirely one from the other, so that each cylinder fills with fluid while in communication with the chamber 15 and pumps it out into the chamber 16, the amount of fluid so pumped

varying with the tilt or swing given the head regulating the stroke of the pistons.

The ends of the pistons 31 are preferably closed and provided with leather cups 44 in any suitable manner so as to prevent leakage between the walls of the cylinders and the pistons.

Furthermore, the ears 32, 32 on each piston are preferably connected at their opposite ends by webs 45, 45 for greater strength, and it will be understood that the space between said ears and webs may be cored out right through the double-ended piston 31, as I have shown.

Preferably, the studs 35, are of a diameter only slightly less than the space between the ears 32, 32, and the rocker pin 34 is sufficiently shorter than the distance between the walls of the slot 33 in the barrels so that as the barrels turn, the ears of the pistons press against the stud 35 to turn the stud ring. In other words, I prefer that the stud engage the ears 32, 32 before the ends of the pin 34 engages the walls of the slot 33 in the barrel, as such last-mentioned engagement would cause friction in reciprocation of the pistons.

In order to positively oil the stud ring, stud, rocker pin and pistons if desired, I preferably mount upon the outer end of the trunnion 38 an oil cup 46 from which lubricant may pass through a central bore 47 of said trunnion to the groove of the swinging carrier in which the stud ring 36 turns. Furthermore, passages 48 extends longitudinally through each of the studs 35 so as to conduct the lubricant farther inward toward the pistons, and preferably a groove 49 is formed in the swinging carrier into which groove the passages 48 and bore 47 all open.

Obviously various details of construction can be changed to suit different conditions by those skilled in the art, and I do not wish to be understood as limiting myself by what is herein positively shown for purposes of illustration except as required by the following claims when construed in the light of the prior art.

Having thus described the invention, what I claim is,—

1. In a rotary piston pump, the combination of a shaft, a cylinder barrel on said shaft having an annular series of cylinders parallel thereto, a casing providing a bearing for said shaft and the end of the cylinder barrel and having a transverse annular partition encircling the barrel and adapted at its inner edge to engage the cylindrical surface of said barrel, pistons in said cylinders, means for causing said pistons to move in an elliptical path as the cylinder barrel rotates, and means for supplying and discharging fluid.

2. In a rotary piston pump, the combina-

tion of a shaft, a cylinder barrel on said shaft having an annular series of cylinders parallel thereto, a casing providing a bearing for said shaft and the end of the cylinder barrel and having a transverse annular partition encircling the barrel and adapted at its inner edge to engage the cylindrical surface of said barrel, said casing forming between said annular partition and its closed end a compartment divided into inlet and outlet chambers, pistons in said cylinders, means for causing said pistons to move in an elliptical path as the cylinder barrel rotates, and means for supplying and discharging fluid.

3. In a rotary piston pump, the combination of a shaft, a cylinder barrel on said shaft having an annular series of cylinders parallel thereto, a casing inclosing said cylinder barrel and providing bearings for said shaft and the ends of the cylinder barrels, said casing having a transverse annular partition encircling the barrel and provided at its inner edge with a cylindrical flange adapted to engage the cylinder barrel, pistons in said cylinders, means for causing said pistons to move in an elliptical path as the cylinder barrel rotates, and means for supplying and discharging fluid.

4. In a rotary piston pump, the combination of a cylindrical casing divided transversely into two halves or similar end sections, a shaft mounted centrally and longitudinally of said casing, cylinder barrels on said shaft abutting at their adjacent ends and seating at their opposite ends against the casing, means for securing said casing sections together, pistons in said cylinders, means for causing said pistons to move in an elliptical path as the cylinder barrel rotates, and means for supplying and discharging fluid.

5. In a rotary piston pump, the combination of a shaft, cylinder barrels mounted on said shaft, pistons in the cylinders, a casing inclosing said cylinder barrels and providing bearings for said shaft, said casing having transverse annular partitions encircling their respective barrels and adapted to engage at their inner edges the cylindrical surface of said cylinder barrels, a tilting head between said partitions connected to said pistons, longitudinal radial partitions dividing the end compartments into inlet and outlet chambers, and means for supplying and discharging fluid.

6. In a rotary piston pump, the combination of a shaft, cylinder barrels mounted on said shaft, pistons in the cylinders, a casing inclosing said cylinder barrels and providing bearings for said shaft, said casing having transverse annular partitions at a distance from its end provided with cylindrical flanges adapted to engage the cylinder barrels, a tilting head between said

partitions, longitudinal radial partitions dividing the end compartments into the inlet and outlet chambers, and means for supplying and discharging fluid.

5 7. In a rotary piston pump, the combination of a casing providing an interior cylindrical chamber, said casing being divided transversely into two halves or sections, a shaft mounted centrally and longitudinally
10 in said casing, cylinder barrels on said shaft seated at their opposite ends against the casing sections, said barrels providing cylinders, the cylinders of one barrel being in alinement with the corresponding cylinders of the other
15 barrel, means for securing said casing sections together, pistons in said cylinders one piston operating in alined cylinders of both said barrels, means for causing said pistons to move in an elliptical path as the cylinder
20 barrels rotate, and means for supplying and discharging fluid.

8. In a rotary piston pump, a casing divided into similar sections having opposite closed ends and meeting open ends, said
25 closed ends provided with interior radial partitions forming cylindrical cylinder barrel seats, means for securing said sections together, a shaft extending through the sections, cylinder barrels on said shaft and
30 within said seats, pistons in said cylinder barrels, means for causing said pistons to move in an elliptical path as the cylinder barrels rotate, and means for supplying and discharging fluid.

35 9. In a rotary piston pump, the combination of a casing divided transversely at its middle into two like sections, said sections providing at their opposite ends compartments partitioned diametrically into inlet
40 and outlet chambers, ducts one for each section communicating with unlike chambers, and other ducts each leading from the chamber at one end of the casing to the like chamber at the other end of the casing outside
45 said casing.

10. In a rotary piston pump, the combination with a casing having at its opposite ends compartments divided into inlet and outlet chambers and manifolds for the opposite
50 sides of said casing, each having a nipple communicating with one chamber at one end of the casing and an elbow placing the other chamber of said end of the casing in communication with the like chamber at the other end of the casing.
55

11. In a rotary piston pump, the combination with a casing divided transversely into two similar sections, each section providing inlet and outlet chambers one of
60 which has a port at one side of the section and both of which have ports at the opposite side of the section, of manifolds for the sides of said casing each providing a nipple adapted to connect with one of each
65 pair of ports and a passage adapted to connect

the other port of the pair with the single port at the same side of the other casing section, and means for securing said sections together.

12. In a rotary piston pump, the combination with a casing divided transversely
70 into two similar sections, each section providing inlet and outlet chambers one of which has a port at one side of the section and both of which have ports at the opposite side of the sections, the single port at
75 the one side of a section and the pair of ports at the other side of the sections having flanges therearound, of manifolds for the sides of said casing each providing two
80 flanges to fit onto the said flanges of the sections, the manifold having a nipple opening through the double flange and a passage leading from said flange to the single
85 flange, and means for securing said sections together.

13. In a rotary piston pump, the combination of a shaft, a cylinder barrel on said shaft having an annular series of cylinders parallel thereto and the wall of each cylinder
90 slotted at the opposite side from the shaft, a casing providing inlet and outlet chambers communicating with said cylinders at one end of the barrel, pistons in said cylinders each having a lateral projection
95 sliding in the slot of the cylinder wall, a tilting head at the end of the cylinder barrel away from the said inlet and outlet chambers, a ring rotatable in said tilting head, and means for connecting said ring
100 to said pistons so as to prevent independent rotary motion while permitting angular movement between said ring and each piston in the radial plane of the latter.

14. In a rotary piston pump, the combination of a shaft, a cylinder barrel on said shaft having an annular series of cylinders parallel thereto with the outer wall of each cylinder slotted in a radial plane of the shaft, pistons in said cylinders each having
105 a lateral projection in the slot of its cylinder wall, a tilting head, a rotatable ring in said tilting head, a pin projecting from said ring and hingedly connected to the piston to swing in a radial plane thereof, said pin
115 being longitudinally slidable with respect to one of said parts, and means for supplying and discharging fluid.

15. In a rotary piston pump, the combination of a shaft, a cylinder barrel on said shaft having an annular series of cylinders parallel thereto with the outer wall of each cylinder slotted in the radial plane of the shaft, pistons in said cylinders each having
120 opposite parallel ears projecting laterally into the slot of its cylinder wall, a pin extending transversely and rotatably between said ears, a tilting head, a rotatable ring in said tilting head, a stud projecting from
125 said ring and hingedly connected to said

pin, said pin being longitudinally slidable with respect to one of said parts, and means for supplying and discharging fluid.

16. In a rotary piston pump, the combination of a shaft, a cylinder barrel on said shaft having an annular series of cylinders parallel thereto with the outer wall of each cylinder slotted in the radial plane of the shaft, pistons in said cylinders each having opposite parallel ears projecting laterally into the slot of its cylinder wall, a rotatable pin mounted transversely in said ears, a tilting head, a rotatable ring in said tilting head, a stud projecting from said ring and extending slidably through said pin, and means for supplying and discharging fluid.

17. In a rotary piston pump, the combination of a shaft, a cylinder barrel on said shaft having an annular series of cylinders parallel thereto with the outer wall of each cylinder slotted, pistons in said cylinders each having opposite parallel ears projecting laterally into the slot of its cylinder wall, a rotatable pin mounted transversely in said ears with its ends free from the walls of the slot, a tilting head, a rotatable ring in said tilting head, a stud projecting from said ring slidably through said pin, and means for supplying and discharging fluid.

18. In a rotary piston pump, the combination of a shaft, a cylinder barrel on said shaft having an annular series of cylinders parallel thereto with the outer wall of each cylinder slotted, pistons in said cylinders each having a lateral projection sliding in the slot of its cylinder wall, a tilting head providing an interior groove, a ring rotatably mounted in said groove, studs projecting from said ring and having at their inner ends heads abutting the bottom of the groove in the ring carrier, means connecting said studs to said projections of the pistons so as to permit radial movement and angular movement in a radial plane of each, and means for supplying and discharging fluid.

19. In a rotary piston pump, the combination of a shaft, cylinder barrels on said shaft

having alined cylinders parallel to said shaft with the outer walls of said cylinders slotted at the adjacent ends of the barrels, a double-ended piston in each pair of alined cylinders having a projection adapted to slide in the slots of said cylinders, a tilting head, a rotatable ring in said tilting head, means for connecting said ring to the projections of said pistons so as to prevent independent rotary motion while permitting angular movement between the ring and each piston in the radial plane of the latter, and means for supplying and discharging fluid.

20. In a rotary piston pump, the combination of a shaft, cylinder barrels on said shaft having alined cylinders with their outer walls slotted at the adjacent ends of the barrel, a double-ended piston in each pair of alined cylinders having midway of its ends opposite ears adapted to slide in the slots of the cylinder walls, a rotatable pin mounted transversely in said ears, a tilting head, a rotatable ring in said tilting head, a stud projecting from said ring and hingedly connected to said pin, said stud being longitudinally slidable with respect to one of said parts, and means for supplying and discharging fluid.

21. In a rotary piston pump, the combination of a shaft, cylinder barrels on said shaft having alined cylinders with their outer walls slotted at the adjacent ends of the barrels, a double-ended piston in each pair of alined cylinders having intermediate of its ends opposite ears adapted to slide in the slots of the cylinder walls, a rotatable pin mounted transversely in said ears with its ends clearing the walls of the slots, a tilting head, a rotatable ring in said tilting head, a stud projecting from said ring slidably through said pin, and means for supplying and discharging fluid.

GEORGE E. GUY.

Witnesses:

RUSSELL M. EVERETT,
HOWARD P. KING.