

April 1, 1924.

1,489,077

W. A. HATCHER

ROTARY PUMP

Filed Feb. 19, 1921

3 Sheets-Sheet 1

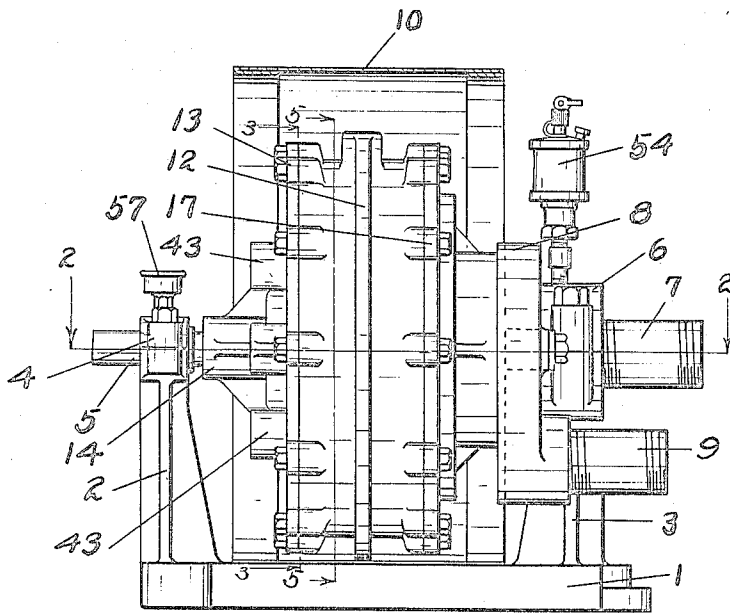


FIG. I.

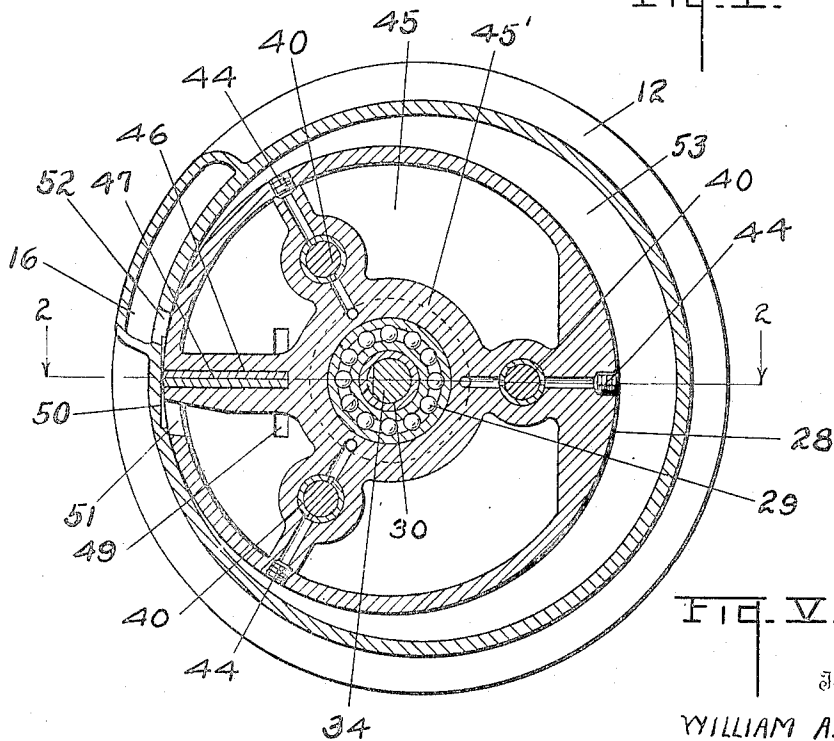


FIG. V.

Inventor

WILLIAM A. HATCHER

Charles Earl

Attorney

Witnesses

M. Louise Thurston

Fred Ulrich

By

April 1, 1924.

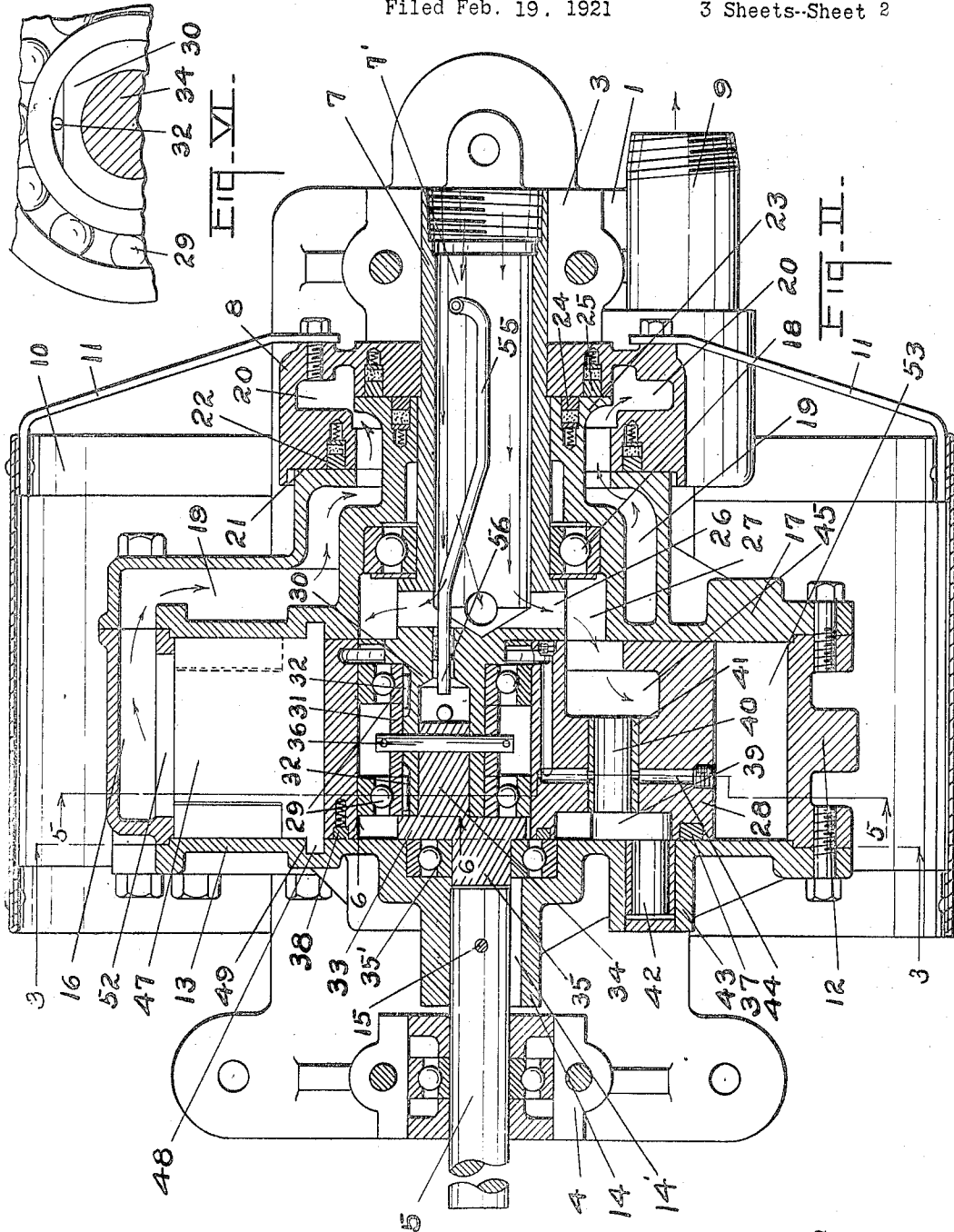
W. A. HATCHER

1,489,077

ROTARY PUMP

Filed Feb. 19, 1921

3 Sheets--Sheet 2



Inventor
WILLIAM A. HATCHER

Witnesses

M. Louise Thurston

Fred Ulbrich

334

Charles Earl

Attorneys

April 1, 1924.

1,489,077

W. A. HATCHER

ROTARY PUMP

Filed Feb. 19, 1921

3 Sheets-Sheet 3

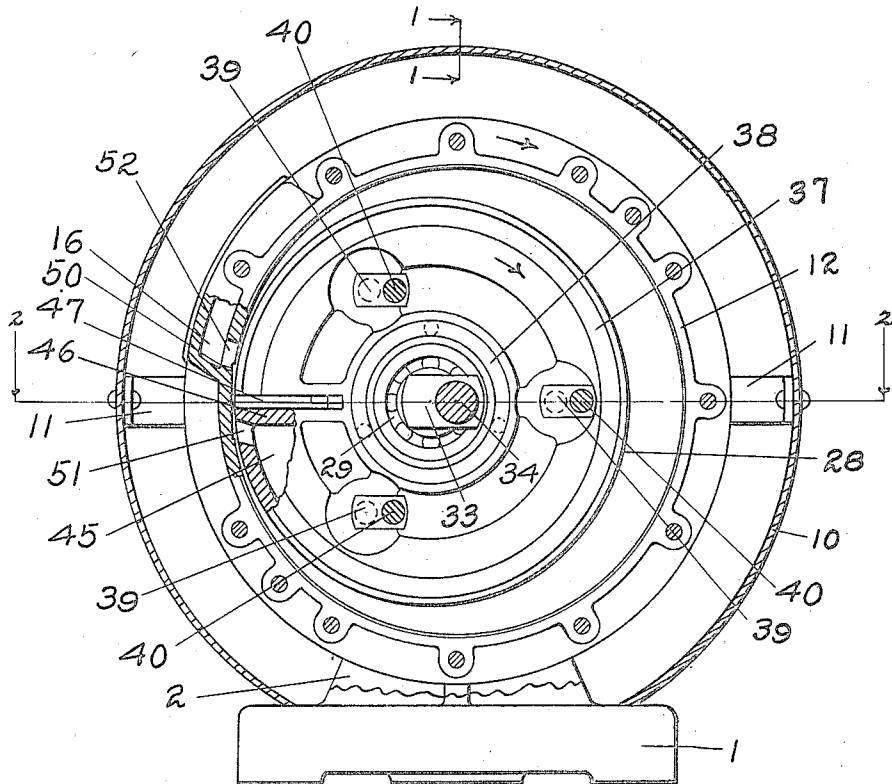


FIG. III.

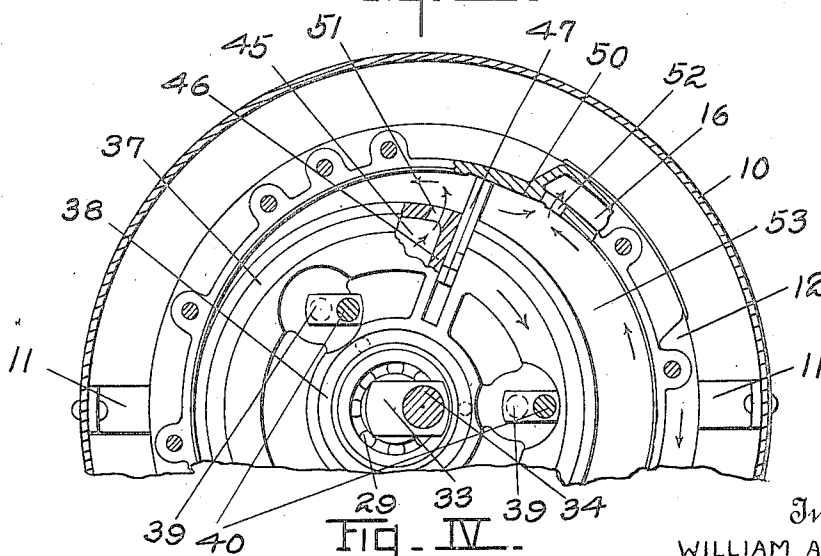


FIG. IV.

Inventor
WILLIAM A. HATCHER

Witnesses
M. Louise Thurston
Fred Ulbrich

34

Chapman & Earl

Attorneys

UNITED STATES PATENT OFFICE.

WILLIAM A. HATCHER, OF DETROIT, MICHIGAN, ASSIGNOR TO WERNICKE-HATCHER PUMP COMPANY, OF GRAND RAPIDS, MICHIGAN, A CORPORATION OF MICHIGAN.

ROTARY PUMP.

Application filed February 19, 1921. Serial No. 446,467.

To all whom it may concern:

Be it known that I, WILLIAM A. HATCHER, a citizen of the United States, residing at Detroit, county of Wayne, State of Michigan, have invented certain new and useful Improvements in Rotary Pumps, of which the following is a specification.

This invention relates to improvements in rotary pumps.

The objects of the invention are:

First, to provide a rotary piston pump in which the parts are effectively balanced.

Second, to provide a rotary pump in which effective sealing against leaks to or from the working chamber can be easily maintained.

Third, to provide a rotary pump in which the movement of the parts on each other is minimized to facilitate the sealing of working members and insure close contact of the piston with the cylinder wall surface without excessive friction.

Fourth, to provide a connection means between the cylinder and piston of such a rotary pump that shall lessen the strain on the vane.

Further objects and objects which pertain to details and economies of construction and operation will definitely appear from the detailed description to follow.

I accomplish the objects of my invention by the devices and means described in the following specification. The invention is clearly defined and pointed out in the claims.

A structure which is a preferred embodiment of my invention is fully illustrated in the accompanying drawings, forming a part of this specification, in which:

Fig. I is a detail side elevation view of my improved pump, the guard being shown in section on line 1—1 of Fig. III.

Fig. II is an enlarged detail horizontal sectional view taken on line 2—2 of Figs. I, III and V.

Fig. III is an enlarged detail transverse sectional view taken on line 3—3 of Figs. I and II, a part being broken away to show the intake port in the piston and the discharge passage and port in the cylinder.

Fig. IV is a partial detail sectional view, similar to that of Fig. III, showing the piston in a different stage of the movement of rotation.

Fig. V is an enlarged detail sectional view taken on line 5—5 of Figs. I and III, show-

ing further details of the vane and the method of supporting and coupling the piston to the cylinder, the section lines being somewhat irregular, as seen in Fig. II.

Fig. VI is an enlarged detail sectional view taken on line 6—6 of Fig. II, showing details of the means of retaining the main bearing and bushing for the piston in place.

In the drawings all of the sectional views are taken looking in the direction of the little arrows at the ends of the section lines and similar numerals of reference refer to similar parts throughout the several views.

Considering the numbered parts of the drawing, 1 is the base, having standards 2, 3, at each end. The standard 2 has a journal bearing box 4 at its upper end in which revolves the driving shaft 5, a suitable ball bearing being interposed. The standard 3 has a cap 6 at its upper end which holds the journaled support 7 for the cylinder and piston securely in place, on which is also carried the end bracket or fixed head 8 of the pump. The intake 7' is through this support. 9 is the discharge pipe leading from the fixed head, which fixed head contains the annular discharge conduit 20.

10 is the sheet metal guard which surrounds the rotary pump (see Figs. I, II and III). The guard is supported in place by suitable arms 11 attached to the fixed head 8 and is also attached to the base 1.

12 is the pump cylinder having heads 13 and 17. The head 13 has the central hub 14 secured to the driving shaft 5 by a key 14' and the cross pin 15 therethrough. 16 is an enlarged portion of the cylinder for the discharge passage at the periphery of the pump. The head 17 contains the discharge passage 19. A ball bearing 18 is within the hub and between it and the journaled support 7 and in axial alinement with the driving shaft 5. The discharge passage 19 connects to the annular passage 20 in the fixed head 8 and leads off to the discharge pipe 9 (see Fig. II).

The face 21 of the head casing 17 abuts a flat surface on the fixed end bracket between which is a ring packing 22 to maintain a sealed joint. The casing is extended into a hub 23, the end of which is faced and extends within the fixed head or bracket 8. There is a double ring packing, 24, 25 at this point. As these packings are made the subject matter of an independent patent appli-

cation concurrent herewith, I do not define the same in detail.

Radial passages 26 are at the inner end of the intake 7' and open into annular chamber 27 in the cylinder head 17. The cylindrical piston 28 is supported on the ball bearings 29, carried on the offset crank-shaped portion 30 on the inner end of the journaled support 7, eccentric to the cylinder bearing. A bushing 31 is disposed around this crank portion for separating the bearings 29. The bearings 29 are retained in place by the supporting and locking pins 32 interposed between the same and a flattened side of the crank-shaped part 30 to prevent turning so that bearings 29 can slide endwise to allow the piston to locate itself to the cylinder. A crank-shaped piece 33 is secured to the end of the part 30, having a crank-like pin 34 in an end socket. Cross pin 36 extends transversely through the bushing 31, the crank-shaped piece 30 and the pin 34 to retain them in operative position. This crank-shaped part 33 has an outwardly projecting pin 35 which is in axial alinement with the driving shaft 5. A ball bearing 35' surrounds the crank pin 35, as seen in Fig. II, and is axially alined with the main bearing of the casing.

It will thus be seen that the journals on which the piston revolves are very effectively supported and effectively alined with the cylinder. Packing rings, 37 the air ring and 38 the oil ring, are interposed between the face of the piston and the said head 13.

A series of small parallel cranks 39, disposed parallel to a plane through the cylinder and piston bearing, are journaled at 40 in suitable bushings 41 in the piston, and with the projecting pins 42 journaled in the casing at 43, maintain the piston in correct relative operative position to the cylinder when the pump is being rotated by the driving shaft 5. Oil holes 44 are provided for lubricating the little crank pins 30 (see particularly Figs. II and V).

The piston 28 is made hollow at 45 and has a central hub 45' and a radial block portion 46 having a radial recess in which is disposed the specially constructed vane 47. This vane has laterally projecting lugs or fingers 48 on the inner side at each end, which engage transverse grooves 49 in the cylinder heads 13 and 17, said grooves being disposed at right angles to the radius of the vane. The vane is specially constructed of divided sliding members to fill the space and avoid the necessity of special packing. As I have made these vane features the subject matter of a separate concurrent patent application, Serial No. 446,469, filed Feb. 19, 1921, I do not describe them here in detail.

The outer end of this vane oscillates back and forth on a plane surface 50 (see Fig. V) tangent to the inner cylinder wall

at the point of contact of the vane. This oscillatory rubbing contact insures a perfect seating. An intake port 51 is formed in the piston at the side of the radial recess walls 46 in rear of the vane 47, and a discharge port 52 is put through the cylinder on the opposite side ahead of the vane (see Fig. V). By reversing the direction of the drive, the cylinder port becomes the intake and the piston port becomes discharge port. 53 is the crescent-shaped working chamber within the cylinder 12 formed by the piston 28 within the same, the piston being supported eccentric to the said cylinder, as seen in Fig. V.

The internal bearings are oiled from the oil cup 54, which has a conduit 55 leading through the intake through the fixed portions at 56, as seen in Fig. II. A grease cup 57 is provided for the driving shaft 5 (Fig. I).

The operation is simple and very readily followed. When the driving shaft 5 is driven, air enters through the intake 7', passes out the radial passages 26 into the chamber 27, and connects into the hollow 45 of the piston 28, and passes out into the cylinder chamber 53 through the port 51. As both the cylinder and the piston are revolving, these parts will pass from the position indicated in Fig. III to the position indicated in Fig. IV, and this movement causes the cylinder to take in air at the intake port 51 and to discharge at the outlet port 52, owing to the displacement by the piston within the cylinder. The contact of the piston with the inside of the cylinder walls is subject to a limited compensating movement. The relative parallelism of the parts is maintained by the little cranks 39. The slight movement between the piston and cylinder due to difference of centers causes oscillation at the outer end or side of the vane 47 against the tangential flat surface 50, which is specially formed flat to insure a good sealing surface. Each revolution of the shaft 5 opens and closes the crescent-shaped chamber 53, giving a complete impulse to the pump.

Because all of the parts are balanced and readily counter-balanced, the pump can be run at very high speed and do very effective work. Due to the slight to-and-fro rub between the piston and cylinder wall, a practically ground joint is maintained. A vacuum above 99.9 per cent has been produced by a 50 cu. ft. pump running at 1500 revolutions per minute. Because of the complete balance of the parts, the pump runs without any appreciable vibration and with practically no noise. Because the piston and cylinder are coupled and maintained in parallel relation and the vane is carried by one (the piston) and abuts against the other (the cylinder) and per-

mits a to-and-fro movement, the strain and friction is minimized and the joints are easily kept sealed. The little crank-like devices are preferred and are very superior for this purpose. I am aware other means could be employed and I desire to claim these features specifically and broadly as well.

I have described my improved pump in its preferred form as to all its features. I desire to state that it can be very considerably varied in detail without departing from my invention. I desire to claim the features specifically as well as the invention broadly, as pointed out in the appended claims.

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

1. In a rotary pump the combination of a suitable cylinder, a driving shaft connected to one head thereof to revolve the same, a fixed journaled support, with anti-friction bearings between it and the said cylinder, an offset crank-like portion on said journaled support, a hollow cylindrical piston of less diameter than said cylinder disposed on said crank-like support, on bearings eccentric to the bearing support of the said cylinder, said piston having a radial recess at one side and an intake port in proximity thereto, a discharge passage through the head to the periphery of the said cylinder and a discharge port connecting thereto, intake passages connecting to the cavity within the said piston, a vane disposed in said radial recess having suitable projecting lugs at each side of the inner end, slotted grooves at right angles to the radius of the said piston for receiving the said vane projections, a plane surface at right angles to the radius within the periphery of said cylinder for contact with the opposite end of said vane, the vane being disposed between said intake and discharge ports, packing interposed between the faces of said piston and cylinder, and coupling means connecting the head of said cylinder to the face of said piston, comprising a series of parallel cranks disposed in planes parallel to the plane of the center line of the bearings of said cylinder and piston, all coacting substantially as described for the purpose specified.

2. In a rotary pump the combination of a suitable cylinder, a driving shaft connected to one head thereof to revolve the same, a fixed journaled support, with anti-friction bearings between it and the said cylinder, an offset crank-like portion on said journaled support, a hollow cylindrical piston of less diameter than said cylinder disposed on said crank-like support, on bearings eccentric to the bearing support of the said cylinder, said piston having a radial recess

at one side and an intake port in proximity thereto, a discharge passage through the head to the periphery of the said cylinder and a discharge port connecting thereto, intake passages connecting to the cavity within the said piston, a vane disposed in said radial recess having suitable projecting lugs at each side of the inner end, slotted grooves at right angles to the radius of the said piston for receiving the said vane projections, a plane surface at right angles to the radius within the periphery of said cylinder for contact with the opposite end of said vane, the vane being disposed between said intake and discharge ports, and coupling means connecting the head of said cylinder to the face of said piston, comprising a series of parallel cranks disposed in planes parallel to the plane of the center line of the bearings of said cylinder and piston, all coacting substantially as described for the purpose specified.

3. In a rotary pump the combination of a suitable cylinder, a fixed journaled support therefor, a driving shaft to drive said cylinder, a hollow cylindrical piston of less diameter than said cylinder disposed eccentrically within the same to contact with the wall thereof, bearings on said fixed support for said piston eccentric to the bearings for said cylinder, a vane disposed in a radial recess in the said piston with lateral projections to engage guiding grooves in the heads of the said cylinder, guiding grooves in said cylinder heads at right angles to the radius thereof, a flat surface formed in said cylinder wall to coact with the outer end of said vane, coupling means connecting the face of said piston to the head of said cylinder, comprising a series of parallel crank devices, a suitable peripheral intake port in the said piston in proximity to said vane and a suitable discharge port on the opposite side of said vane in the periphery of said cylinder, coacting as specified.

4. In a rotary pump the combination of a suitable cylinder, a fixed journaled support therefor, a driving shaft to drive said cylinder, a hollow cylindrical piston of less diameter than said cylinder disposed eccentrically within the same to contact with the wall thereof, bearings on said fixed support for said piston, eccentric to the bearings for said cylinder, a vane disposed in a radial recess in the said piston, a flat surface formed in said cylinder wall to coact with the outer end of said vane, coupling means connecting the face of said piston to the head of said cylinder, comprising a series of parallel crank devices, means to maintain the said vane in contact with said surface, a suitable peripheral intake port in the said piston in proximity to said vane, and a suitable discharge port on the opposite

side of said vane in the periphery of said cylinder, coacting as specified.

5. In a rotary pump the combination of a suitable cylinder, a fixed journaled support therefor, a driving shaft to drive said cylinder, a cylindrical piston of less diameter than said cylinder disposed eccentrically within the same to contact with the wall thereof, bearings for said piston eccentric to the said bearings for the said cylinder, a vane disposed in a radial recess in the said piston, with lateral projections to engage guiding grooves in the heads of the said cylinders, guiding grooves in the said cylinder heads, coupling means connecting the face of the said piston to the inner face of said cylinder, comprising a series of parallel crank devices, a suitable peripheral intake port in the said piston and a suitable discharge port on the opposite side of said vane in the periphery of said cylinder, coacting as specified.

6. In a rotary pump the combination of a suitable cylinder, a fixed journaled support therefor, driving means for said cylinder, a cylindrical piston of less diameter than said cylinder disposed eccentrically within the same to contact with the wall thereof, bearings for said piston eccentric to the said bearings for the said cylinder, a vane disposed in a radial recess in the said piston, with lateral projections to engage guiding grooves in the heads of the said cylinders, guiding grooves in the said cylinder heads transverse to the plane of said vane, coupling means connecting the face of the said piston to the inner face of said cylinder, comprising a series of parallel crank devices, a suitable peripheral intake port in the said piston, and a suitable discharge port on the opposite side of said vane in the periphery of said cylinder, coacting as specified.

7. In a rotary pump the combination of a suitable cylinder, a fixed journaled support therefor, driving means for said cylinder, a cylindrical piston of less diameter than said cylinder disposed eccentrically within the same to contact with the wall thereof, bearings for said piston eccentric to the said bearings for the said cylinder, a vane disposed in a radial recess in the said piston, with lateral projections to engage guiding grooves in the heads of the said cylinders, guiding grooves in the said cylinder heads transverse to the plane of said vane, coupling means connecting the face of the said piston to the inner face of said cylinder, a suitable peripheral intake port in the said piston, and a suitable discharge port on the opposite side of said vane in the periphery of said cylinder, coacting as specified.

8. In a rotary pump the combination of a suitable cylinder, a fixed journaled support therefor, driving means for said cylinder, a

cylindrical piston of less diameter than said cylinder disposed eccentrically within the same to contact with the wall thereof, bearings for said piston eccentric to the said bearings for the said cylinder, a vane disposed in a radial recess in the said piston, with lateral projections to engage guiding grooves in the heads of the said cylinders, guiding grooves in the said cylinder heads transverse to the plane of said vane, means to revolve the said piston at the same rate as said cylinder, a suitable peripheral intake port in the said piston, and a suitable discharge port on the opposite side of said vane in the periphery of said cylinder, coacting as specified.

9. In a rotary pump the combination of a suitable cylinder, a fixed journaled support therefor, driving means for said cylinder, a cylindrical piston of less diameter than said cylinder disposed eccentrically within the same to contact with the wall thereof, bearings for said piston eccentric to the said bearings for the said cylinder, a vane disposed in a radial recess in the said piston, means to maintain said vane in contact with the cylinder wall, coupling means connecting the face of the said piston to the inner face of said cylinder, comprising a series of parallel crank devices, a suitable peripheral intake port in the said piston and a suitable discharge port on the opposite side of said vane in the periphery of said cylinder.

10. In a rotary pump the combination of a suitable cylinder, a fixed journaled support therefor, driving means for said cylinder, a cylindrical piston of less diameter than said cylinder disposed eccentrically within the same to contact with the wall thereof, bearings for said piston eccentric to the said bearings for the said cylinder, a vane disposed in a radial recess in the said piston, means to urge said vane outwardly and maintain it yieldingly in oscillatory rubbing contact with the cylinder wall, coupling means connecting the face of the said piston to the inner face of said cylinder, a suitable peripheral intake port in the said piston, and a suitable discharge port on the opposite side of said vane in the periphery of said cylinder, coacting as specified.

11. In a rotary pump the combination of a suitable cylinder, a fixed journaled support therefor, driving means for said cylinder, a cylindrical piston of less diameter than said cylinder disposed eccentrically within the same to contact with the wall thereof, bearings for said piston eccentric to the said bearings for the said cylinder, a vane disposed in a radial recess in the said piston, means to urge said vane outwardly and maintain it yieldingly in oscillatory rubbing contact with the cylinder wall, means to revolve the said piston at the same rate

as said cylinder, a suitable peripheral intake port in the said piston, and a suitable discharge port on the opposite side of said vane in the periphery of said cylinder, coacting as specified.

12. In a rotary pump the combination of a suitable cylinder, having a restricted plane surface at one side, a fixed journaled support therefor, driving means for said cylinder, a cylindrical piston of less diameter than said cylinder disposed eccentrically within the same to contact with the wall thereof, bearings for said piston eccentric to the said bearings for the said cylinder, a vane disposed in a radial recess in the said piston, means to maintain said vane in contact with the plane surface of the cylinder wall, means to revolve the said piston at the same rate as said cylinder, a suitable peripheral intake port in the said piston, and a suitable discharge port on the opposite side of said vane in the periphery of said cylinder, coacting as specified.

13. In a rotary pump the combination of a suitable cylinder having a restricted plane surface at one side of its periphery, a hollow cylindrical piston of less diameter than said cylinder, disposed eccentrically within the same to contact with the wall thereof, a vane disposed in a radial recess in the said piston with lateral projections to engage guiding grooves in the heads of said cylinders, and guiding grooves in the said cylinder heads transverse to the plane of the vane to maintain said vane in contact with the plane surface of said cylinder wall when the pump is being driven.

14. In a rotary pump the combination of a suitable cylinder, a hollow cylindrical piston of less diameter than said cylinder, disposed eccentrically within the same to contact with the wall thereof, a vane disposed in a radial recess in the said piston with lateral projections to engage guiding grooves in the heads of said cylinders, and guiding grooves in the said cylinder heads transverse to the plane of the vane to maintain said vane in contact with said cylinder wall when the pump is being driven.

15. In a rotary pump the combination of a suitable cylinder, a cylindrical piston of less diameter than said cylinder, disposed eccentrically within the same to contact with the wall thereof, a vane disposed in a radial recess in the said piston with lateral projections to engage guiding grooves in the

heads of said cylinders, and guiding grooves in the said cylinder heads transverse to the plane of the vane to maintain said vane in contact with said cylinder wall when the pump is being driven.

16. In a rotary pump the combination of a suitable cylinder, a hollow cylindrical piston of less diameter than said cylinder disposed eccentrically within the same to contact with the wall thereof, a fixed journaled support with bearings for the said cylinder, an offset crank-like portion with bearings for the said piston, and a detachable end portion with bearing concentric with the cylinder bearings, coacting as specified.

17. In a rotary pump the combination of a suitable cylinder, a hollow cylindrical piston of less diameter than said cylinder disposed eccentrically within the same to contact with the wall thereof, a fixed journaled support with bearings for the said cylinder, an offset crank-like portion with bearings for the said piston, and an end portion with bearing concentric with the cylinder bearings, coacting as specified.

18. In a rotary pump the combination of a suitable cylinder, a cylindrical piston of less diameter than said cylinder disposed eccentrically within the same to contact with the walls thereof, bearings for supporting the said cylinder and piston in said relative positions, means connecting the said piston and cylinder to maintain the same in parallel relation the one to the other during rotation, and means for driving the same, as described.

19. In a rotary pump the combination of a suitable cylinder, a cylindrical piston of less diameter than said cylinder disposed eccentrically within the same to contact with the walls thereof, bearings for supporting the said cylinder and piston in said relative positions, a vane disposed in a recess in said piston and abutting the circumferential wall of said cylinder, means independent of said vane connecting the said piston and cylinder to maintain the same in parallel relation the one to the other during rotation, and means for driving the same, as described.

In witness whereof, I have hereunto set my hand and seal in the presence of two witnesses.

WILLIAM A. HATCHER. [L. S.]

Witnesses:

WILLIAM F. HERZOG,
HARRY E. WILLIAMS.