W. E. SHORE.

ROTARY PUMP.

APPLICATION FILED DEC. 9, 1912.

1,153,873.

Patented Sept. 14, 1915.

3 SHEETS—SHEET 1.

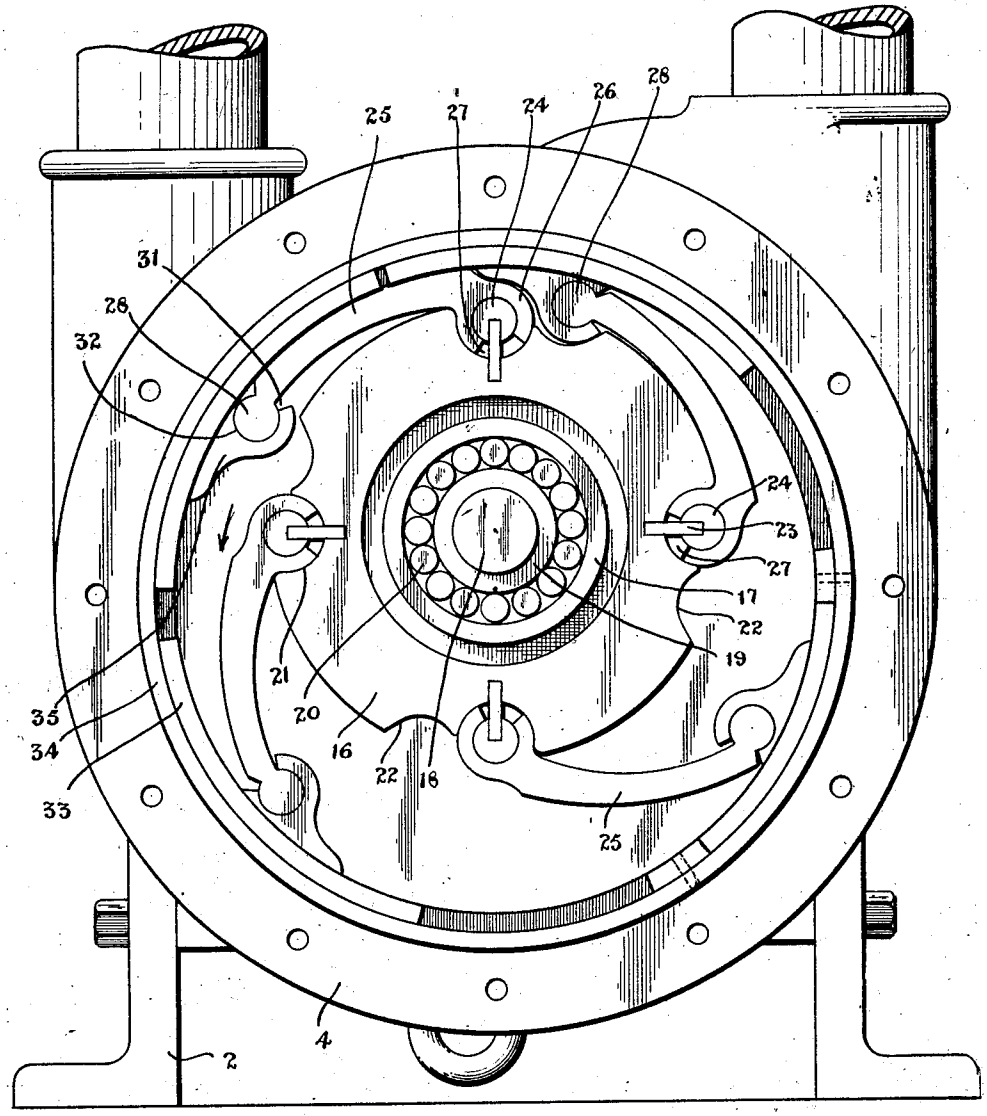


Fig. 1

Witnesses

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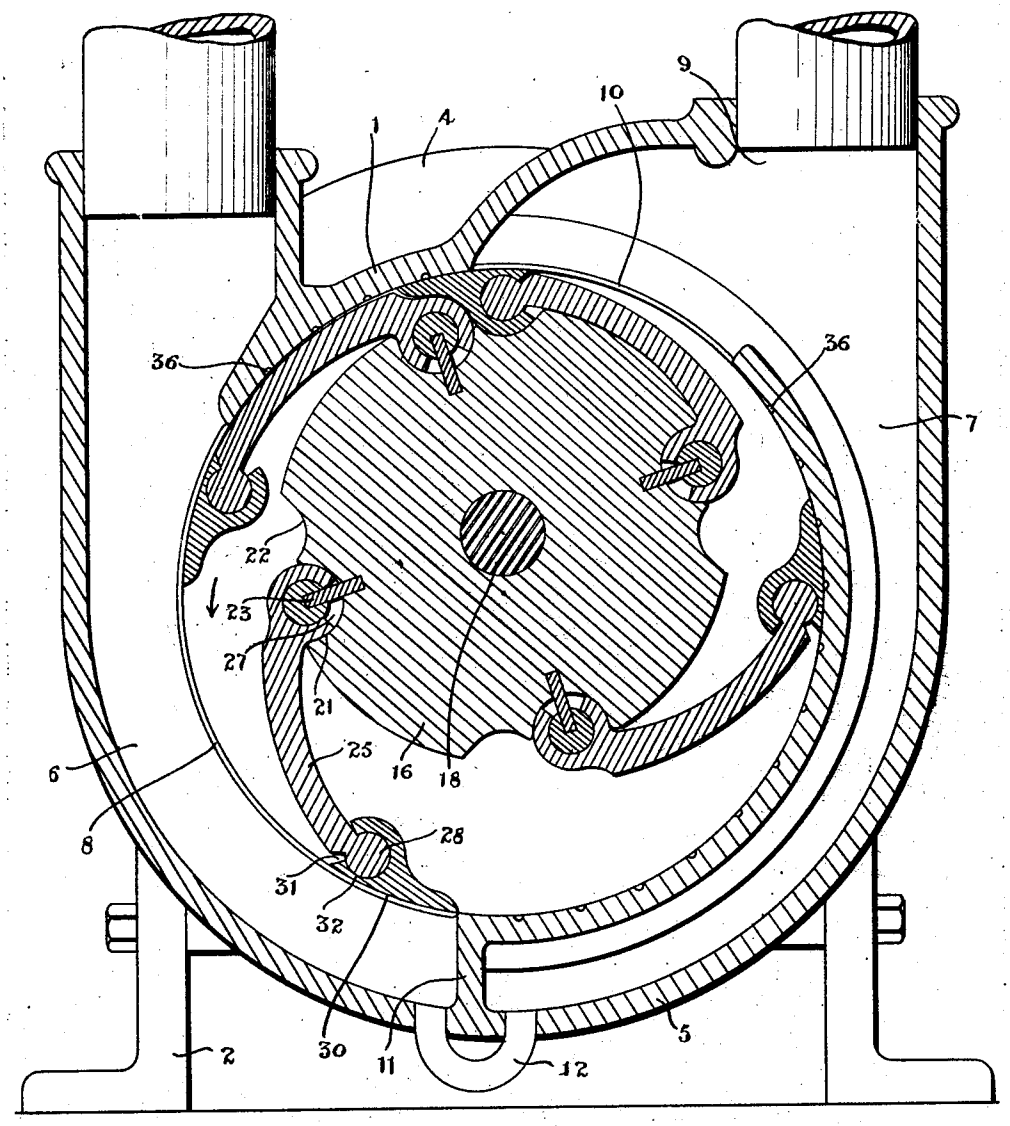


Fig. 2.

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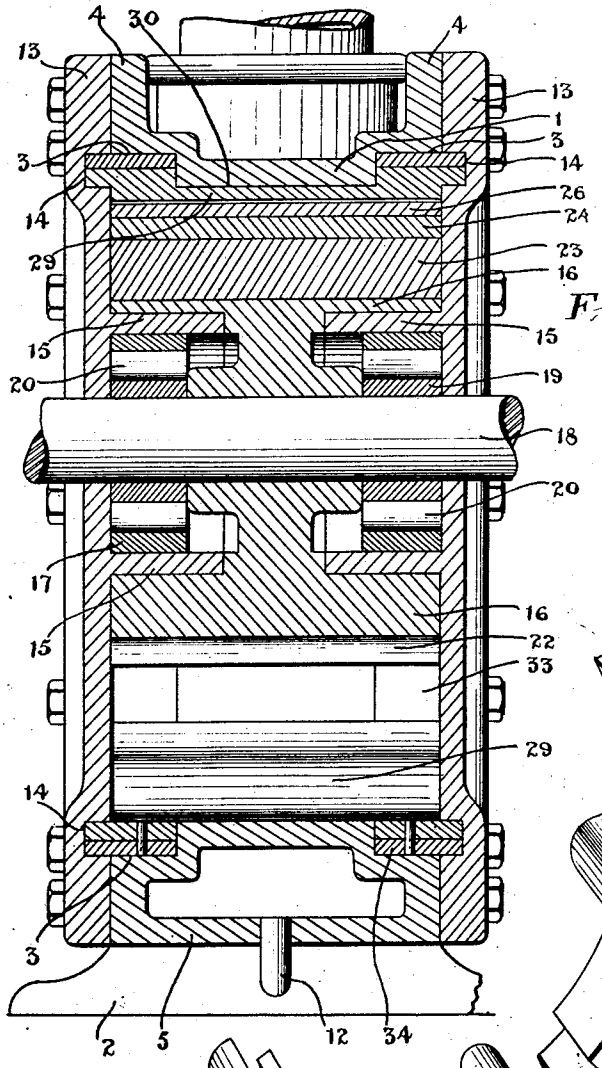


Fig. 3.

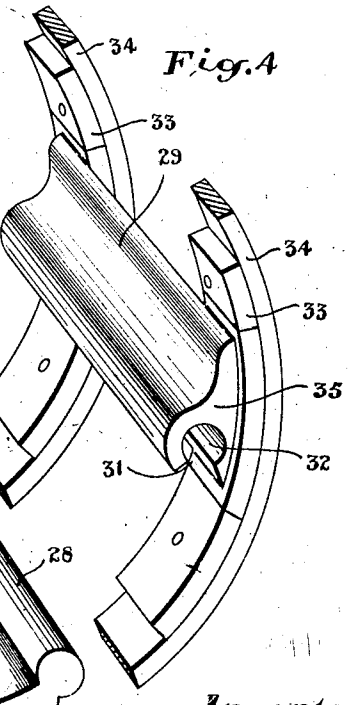


Fig. 4.

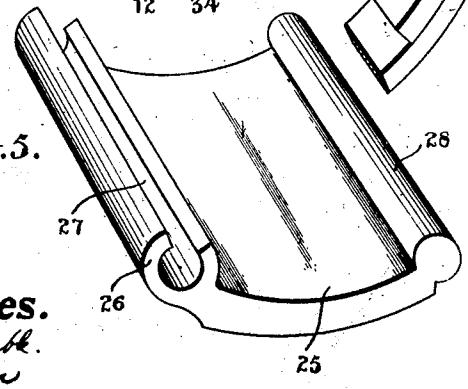


Fig. 5.

Witnesses.

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UNITED STATES PATENT OFFICE.

WILLIAM E. SHORE, OF TORONTO, ONTARIO, CANADA, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO THE FRANEY-SHORE COMPANY, OF WILMINGTON, DELAWARE, A CORPORATION OF DELAWARE.

ROTARY PUMP.

1,153,873. Specification of Letters Patent. Patented Sept. 14, 1915.

Application filed December 9, 1912. Serial No. 735,616.

To all whom it may concern:

Be it known that I, WILLIAM EDWARD SHORE, a subject of the King of Great Britain, and resident of the city of Toronto, county of York, Province of Ontario, in the Dominion of Canada, have invented certain new and useful Improvements in Rotary Pumps, described in the following specification and illustrated in the accompanying drawings.

The principal feature of this invention consists in the novel construction and arrangement of parts, whereby the outer ends of the piston vanes, pivotally supported from a rotatable core eccentrically arranged within the cylinder, are held in constant positive, rotative relation to the inner wall of the cylinder, and whereby said piston vanes are arranged to overlap and expel the maximum volume of fluid through the discharge.

The objects of the invention are, to minimize losses due to leakage and friction in a rotary pump having pivotal piston vanes, maintaining a perfect and uniform contact between the cylinder wall and the outer ends of the vanes and to provide the maximum contacting area of surfaces between the intake and outlet, and further to devise a pump which may be operated at very high speed and which may be utilized either as a compressor, a vacuum machine or a power unit.

In the drawings, Figure 1 is a side elevational view of my machine with one of the cylinder caps removed. Fig. 2 is a vertical transverse mid-sectional view of the machine. Fig. 3 is a vertical sectional view taken longitudinally of the shaft. Fig. 4 is a perspective detail of one of the piston contact shoes showing a portion of the rotating ring members. Fig. 5 is a perspective view of one of the pivotal piston vanes.

Like numerals of reference indicate corresponding parts in each figure.

Referring to the drawings, 1 is a cylindrical casing supported on a base 2 and provided with the annular recesses 3 at the ends and the lateral end flanges 4.

5 are enlargements of the central portion of the casing 1 extending therearound for the major portion of its circumference forming the arc-shaped channels 6 and 7 communicating with the intake and exhaust openings 8 and 9 respectively. The channel 6 opens into the cylinder at one side thereof and the opening extends to a point close to the vertical bottom center. The outlet opening 10 through the cylinder wall extends a short distance from the vertical top center.

11 is a longitudinal partition wall separating the channel 6 from the channel 7 at the bottom of the casing.

12 is an oil duct in the form of a pipe forming a communicating passage between the channels 6 and 7 extending below the division wall 11, said pipe having a very small opening therethrough.

13 are heads closing the ends of the cylinder and secured to the annular flanges 4. The heads 13 are each formed with annular channels 14 arranged to register with the annular recesses 3 in the casing 1.

15 are inwardly projecting annular flanges formed on the inner walls of the heads 13 and arranged eccentrically thereto.

16 is a cylindrical core having its ends recessed to receive the inwardly projecting flanges 15 of the heads.

17 are hardened steel rings fitted within the flanges 15.

18 is a shaft fixedly secured centrally within the core 16 and extending outwardly through the heads 13.

19 are hardened steel rings encircling the shaft 18 and 20 are roller bearings arranged between the rings 17 and 19 and forming the supporting bearings for the core 16.

21 are part cylindrical shaped recesses formed in the periphery of the core 16 and extending longitudinally thereof and spaced at equal distances apart.

22 are recesses arranged adjacent to the recesses 21 and also extending longitudinally of the core, the latter recesses being slightly shallower than the former.

23 are metal strips bedded in the core in radial relation to the recesses 21 and extending thereinto and having secured at the outer ends the cylindrical shaped bars 24, the peripheries of which are concentric with the recesses 21 forming circular shaped channels in the core.

25 are the piston vanes formed with the part cylindrical shaped ends 26 adapted to fit snugly into the recesses 21 and to pivot

on the cylindrical bars 24. The ends 26 are slotted longitudinally at the inner side and the bars 24 extend through said slots.

The slots 27 are sufficiently large to allow the vane to swing its maximum movement without engaging the supporting bars 24. The vanes 25 are formed arc-shaped of a radius corresponding to the radius of the inner wall of the cylinder so that they will at a certain period in the operation of the machine fit snugly against the cylinder wall. The outer ends 28 are formed of cylindrical shape.

29 are the piston contact shoes having their outer faces 30 formed arc-shaped and of the same radius as the cylinder and having a longitudinal channel 31 opening from one side thereof.

The shoes 29 are bored longitudinally forming a cylindrical socket 32 adapted to receive the cylindrical shaped ends 28 of the piston vanes. The cylindrical ends of the piston vanes are slipped into the shoes longitudinally and as the walls of the cylindrical socket 32 extend for a distance greater than one-half the diameter, the shoe is pivotally connected and securely held to the piston vane.

33 are segmental shaped members preferably formed integral with the shoes 29 and arranged at the ends thereof extending into the annular recesses 3 in the cylinder casing and the annular channels 14 in the heads.

34 are ring members fitting snugly against the outer periphery of the segmental members 33 and rotatively arranged engaging the outer walls of the annular recesses 3 and channels 14. The rings 34 rotate freely in the annular channels and are fixedly secured to the shoe of one of the piston vanes so that they will rotate in unison with the piston. The segmental shaped portions 33 of the shoe members 29 are of such a length as to allow the shoes to slide freely for the limit of their movement to and from each other as the machine rotates according to the varying differences in distances of centers the long bearing portions presenting the maximum bearing surface to the rings.

The rings 34 which encircle the several shoes at each end limit the outward movement of said shoes and as the outer edges of the segmental portions 33 of the shoes and rings extend beyond the ends 35 of the shoes into the annular channels 14, the shoes being positively held from outward and inward movement in relation to the center of the cylinder, so that the surfaces contacting with the cylinder surface, remain in a constant rotative relation thereto.

The rings 34 hold the shoes against the centrifugal action consequently there will be a uniform contact with the cylinder surface at all times without any friction due to centrifugal force.

The piston vanes and shoes are so constructed and arranged that as the shoes are drawn inward toward the core the forwardly extending O. G. shaped portion of the shoe overlaps and fits snugly against or close to the O. G. shaped portion of the head of the adjacent piston vane, thus minimizing the space between the shoes and insuring the maximum pressure or expulsion of fluid through the outlet.

The inner surface of the cylinder between the inlet and outlet openings is provided with a plurality of longitudinally arranged grooves 36 which extend from end to end thereof forming recesses. The lubricating oil is carried around the cylinder by the centrifugal action of the rotor and filling the grooves 36 forms an excellent oil packing for the shoes in their travel in contact with the wall of the cylinder.

In the operation of this machine, the shaft and core 16 are rotated by suitable means and as the core rotates the piston vanes 25 and the attached shoes and retaining rings also rotate in unison therewith. The shaft and core are journaled eccentric to the cylinder but as the shoes are held within the annular grooves concentric with the cylinder they are maintained in constant and positive relationship to the inner cylinder wall. The shoes present a very broad contacting surface consequently leakage past the shoes is to all practical purposes entirely eliminated. As the rotor rotates in the direction indicated by arrow, the piston vanes are swung outwardly on their pivotal supports in the rotor and both the pivotal connections of the vanes to the rotor and the shoes to the vanes are of such a nature that the lubricating oil forms a perfect packing preventing leakage therethrough. The several chambers thus formed between the rotating piston vanes form positive compression chambers and as the intake port extends to a point almost at the vertical bottom center, the piston vanes will have swung outwardly to practically their maximum distance before the intake port is cut off.

The rotary movement of the piston vanes and shoes draws the fluid inwardly and when the intake port is cut off the fluid contained between the pair of shoes then located between the intake and outlet will be compressed as the vane is gradually drawn inwardly after the shoe passes over the vertical center of the machine. The compression continues within the crescent shaped chamber between the cylinder wall and rotor until the shoe of the advance piston vane uncovers the outlet port 10 in the cylinder wall. The compressed fluid then escapes into the outlet chamber. The piston vane continues to close in against the piston core reaching its innermost position fitting snugly against the core with the rounded back of

the shoe resting in the longitudinal recess 22 before the outer and forward edge of the shoe cuts off the outlet port.

The piston vanes and shoes are so arranged and constructed that when the vane swings inwardly to its innermost position against the core the O. G. shaped forward side of the shoe fits snugly against the O. G. shaped back of the advance vane, consequently there will be no waste space in which the compressed fluid will be contained but the maximum quantity will be expelled through the outlet port.

The outer peripheral surface of the arc-shaped piston vanes corresponds in radius with the inner wall of the cylinder and as the core rotates the outer surface of the vane moves into contact with the inner wall of the cylinder, making perfect surface contact therewith and maintaining a fluid tight division between the intake and outlet side of the machine until the following shoe closes off the outlet port at the back of the piston vane. This combined operation occurs with each shoe and all are arranged to overlap each other so that it will be readily seen that a perfect packing and separation will always be maintained without any loss due to friction caused by centrifugal action. The shoes are rotatably held in a positive circular path within the encircling rings 34 and as the rotor rotates it will be seen that each of the shoes will move successively closer to the succeeding shoe and then move farther away owing to the differences between the center of rotation of the core and the center of rotation of the shoes. Consequently the shoes will differentiate in speed and they can have a very slight movement within the rotating rings as said rings are connected to one of the shoes of each set.

The device when used as an air pump or vacuum machine or blower will have a considerable quantity of oil as a bath in the bottom chambers, consequently the rings and shoes and all parts will be perfectly lubricated as well as packed by the oil to prevent loss either through friction or leakage.

If the device is used as a power unit, being rotated by steam directed into the cylinder, the oil will be circulated in a similar manner. The pressure within the exhaust chamber forces the oil through the communicating oil duct which has a very small opening therethrough only sufficiently large to allow enough oil to pass without creating a loss in pressure.

A machine such as described is very compact and inclosed in small compass and may be adapted for various uses.

What I claim as my invention is:—

1. In a rotary pump, the combination with a cylinder, a rotary piston core eccentrically journaled in said cylinder and piston vanes pivotally connected to said core, of shoe members pivotally secured to the outer ends of said piston vanes, and rotatable means connected to one of said shoe members and engaging the remaining shoes and holding them in fixed relation to the axis of the cylinder.

2. In a rotary pump, the combination with a cylinder, a rotary piston core eccentrically journaled in said cylinder and piston vanes pivotally connected to said core, of shoe members pivotally secured to the outer ends of said piston vanes, and ring members rotatably supported concentric with the cylinder and operatively engaging said shoes and holding them in fixed relation to the axis of the cylinder.

3. In a rotary pump, the combination with a cylinder, a rotary piston core eccentrically journaled in said cylinder and piston vanes pivotally connected to said core, of shoe members pivotally secured to the outer ends of said piston vanes, and heads closing the ends of said cylinder having annular grooves therein concentric with said cylinder and adapted to receive the laterally extending ends of said shoes to hold said shoes in operating contact with the surface of the cylinder.

4. In a rotary pump, the combination with a cylinder, a rotary piston core eccentrically journaled in said cylinder and piston vanes pivotally connected to said core, of shoe members pivotally secured to the outer ends of said piston vanes and having segmental members arranged at the ends thereof, and heads closing the ends of said cylinder and having annular grooves into which the said segmental members extend.

5. In a rotary pump, the combination with a cylinder, a rotary piston core eccentrically journaled in said cylinder and piston vanes pivotally connected to said core, of shoe members pivotally secured to the outer ends of said piston vanes and having segmental members arranged at the ends thereof, annular rings encircling said segmental members and forming a running contact therefor and forming a means for restraining the outward movement of the shoes and piston vanes due to centrifugal force, said rings being rotatively supported in the cylinder casing concentric with the inner cylinder wall.

6. In a rotary pump, a cylindrical casing having annular recesses at the ends and intake and exhaust passages opening through the cylinder wall, heads closing the ends of said cylinder, a rotary piston core eccentrically journaled in said casing, a plurality of piston vanes pivotally connected to said core and adapted to swing outwardly within the cylinder, shoe members pivotally connected to the outer ends of said piston vanes and having the outer faces are shaped to fit the cylinder wall, segmental members

extending from the ends of said shoes into said annular recesses in the cylinder casing, ring members rotatively arranged in said annular recesses and operatively engaging the outer peripheries of said segmental members and restraining their outward movement, and cylinder heads closing the ends of said cylinder and having concentric annular recesses or channels therein into which said rings and shoe segments project.

7. In a rotary pump, a cylinder having an inlet port arranged in one side thereof and a discharge port in the other side, a piston core rotatively supported eccentrically within said cylinder, arc shaped piston vanes pivotally connected to said core and adapted to engage the cylinder wall between the inlet and discharge port in their rotation, shoe members pivotally connected to the outer ends of said vanes and having arc-shaped faces adapted to engage the inner wall of the cylinder, the forward ends of said shoes being adapted to overlap the inner ends of said vanes connected to the core as the shoe approaches the point of cut-off of the discharge port, and means for holding said shoes in fixed rotative relation to the axis of the cylinder.

8. In a rotary pump, a cylinder having an inlet port arranged in one side thereof and a discharge port in the other side, a piston core rotatively supported eccentrically within said cylinder and having longitudinal recesses of arc-shaped cross section formed in the periphery, arc-shaped piston vanes having their outer surfaces of a radius corresponding with the radius of the cylinder formed with hollow cylindrical shaped inner ends journaled in said recesses, said inner ends being slotted longitudinally, cylindrical shaped bars each supported on a thin flat web arranged in the longitudinal recesses in said core and rigid therewith and extending through the slot in the hollow cylindrical end of said vanes and forming retaining journal members, shoe members pivotally connected to the outer ends of said vanes and engaging the cylinder wall and rotating in constant contact therewith.

9. In a rotary pump, a cylinder having an inlet port arranged in one side thereof and a discharge port in the other side, a piston core rotatively supported eccentrically within said cylinder, piston vanes pivotally connected to said core in a sealed joint, and having cylindrical shaped outer ends, shoe members adapted to engage the cylinder wall in running contact and having a cylindrical socket extending longitudinally and opening at one side adapted to receive in pivotal engagement the cylindrical outer end of said vanes to form a sealed pivotal joint, and means for holding said shoes in constant rotative engagement with the cylinder wall.

10. In a rotary pump, a cylinder casing having an enlarged hollow central portion extending therearound for the major portion of its circumference forming an arc-shaped channel, a division wall at the bottom of said casing dividing said channel into inlet and exhaust, an inlet port in the cylinder wall opening to the inlet channel and extending to a point close to said division wall, a discharge port in the cylinder wall arranged adjacent to the top and communicating with the discharge channel, a piston core rotatively journaled eccentrically in said cylinder and spaced close to the upper side of the cylinder, piston vanes pivotally secured to said core and adapted to close the space between the intake and discharge contact shoes pivotally connected to the outer ends of said vanes and adapted to remain in constant rotative engagement with the cylinder wall, and an oil duct leading around the division wall in said casing and communicating with both intake and discharge channels.

11. In a rotary pump, a cylinder, heads closing the ends of said cylinder and having inwardly projecting annular flanges eccentrically arranged, journal bearings arranged within said flanges, a rotary piston core having journals supported in said bearings, said rotor extending from end to end of the cylinder and engaging said heads, piston vanes pivotally connected to said core, shoes pivotally connected to said piston vanes, and means adapted to hold said shoes in constant rotative engagement with the cylinder wall.

Signed at the city of Toronto, county of York, Ontario, Canada, this 25th day of November 1912.

WILLIAM E. SHORE.

Witnesses:
D. S. TOUELL,
E. HERON.