May 19, 1931. J. W. LEES 1,806,206

ROTARY PISTON MACHINE

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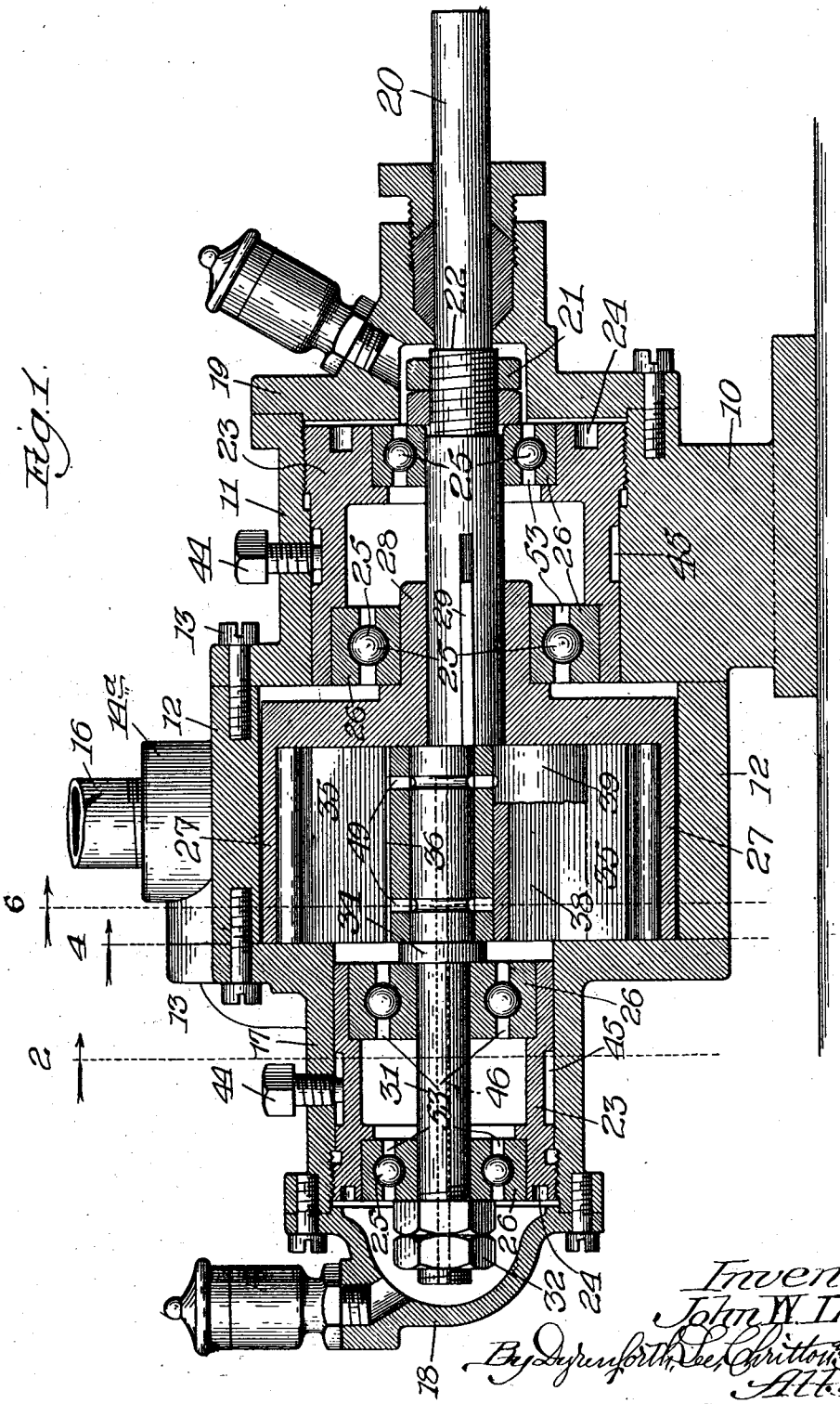


Fig. 1.

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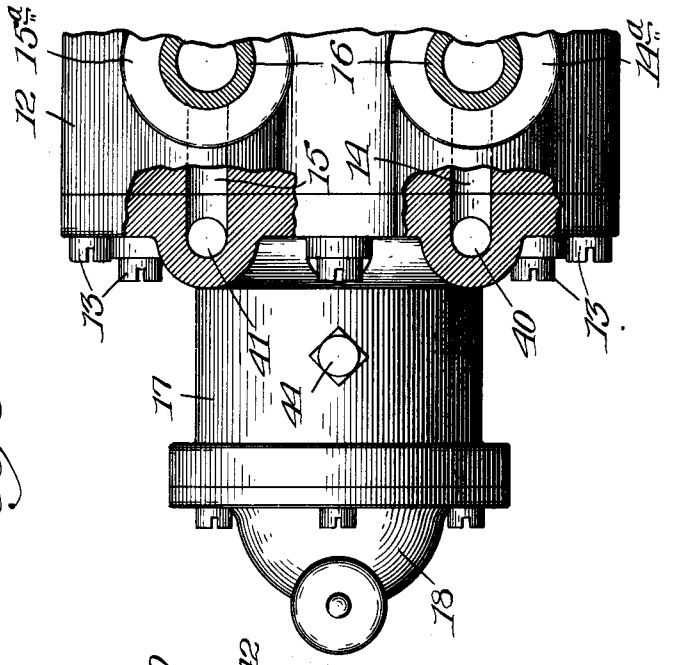


Fig. 3.

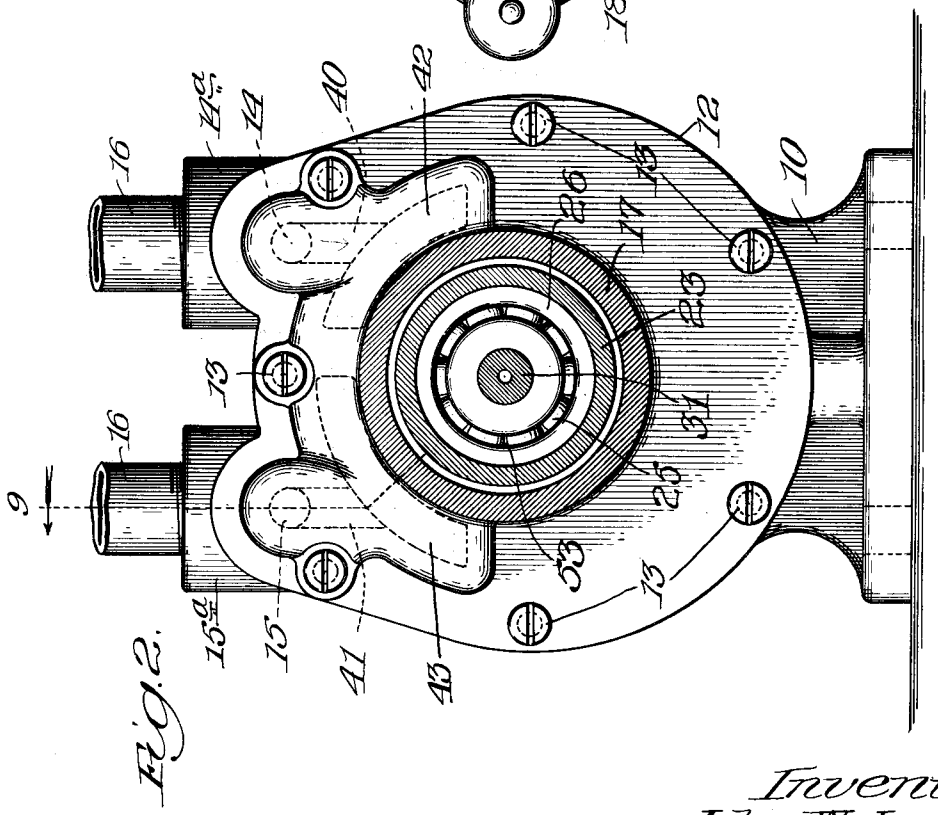


Fig. 2.

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Fig. 4.

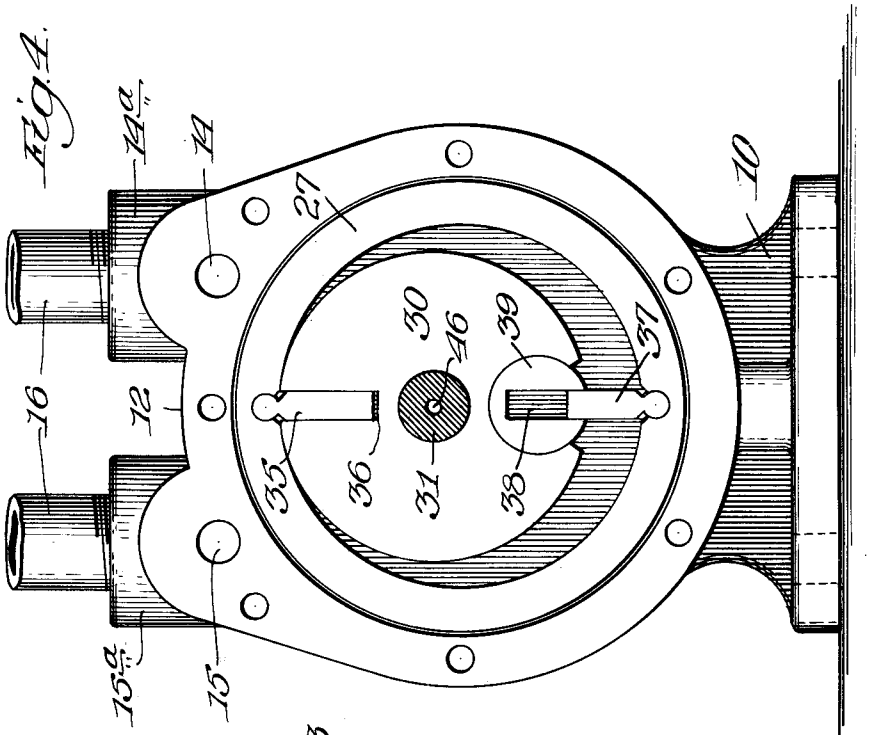
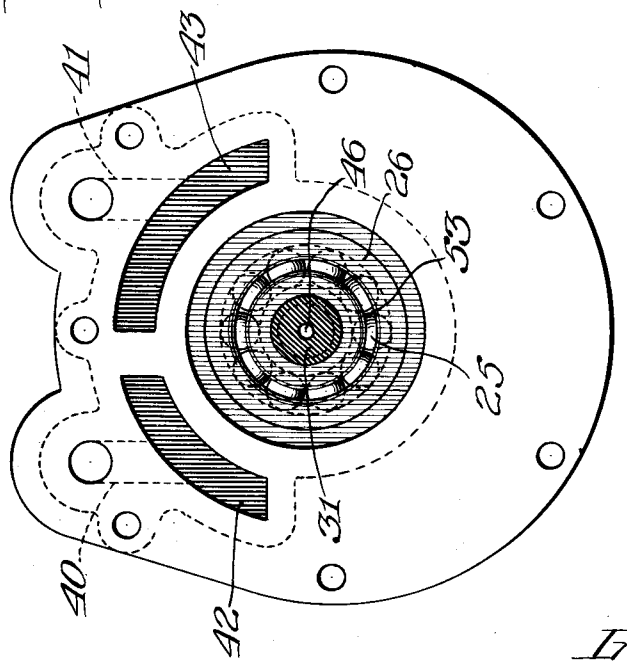


Fig. 5.



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Fig. 6.

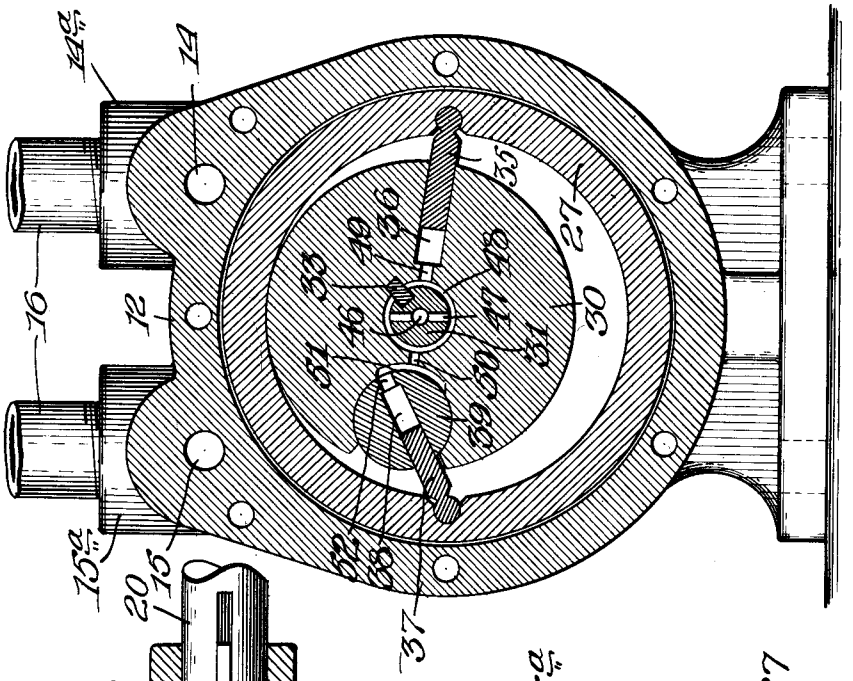


Fig. 7.

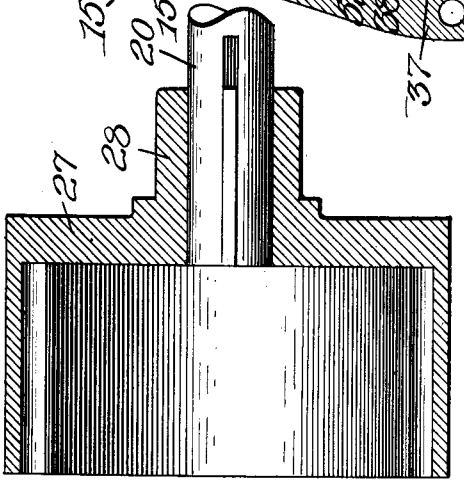


Fig. 8.

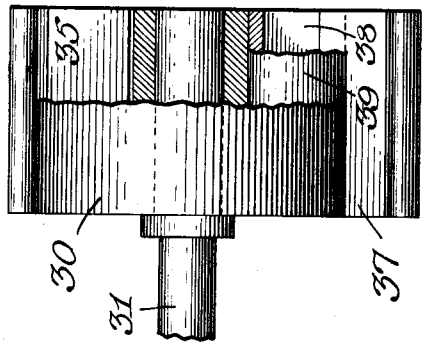
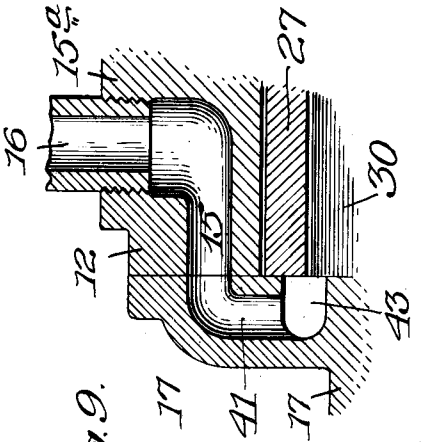


Fig. 9.



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Patented May 19, 1931 1,806,206

UNITED STATES PATENT OFFICE

JOHN W. LEES, OF CHICAGO, ILLINOIS

ROTARY PISTON MACHINE

Application filed May 5, 1928. Serial No. 275,483.

This invention relates to improvements in a type of machine in which rotary pistons are employed and which may function as a pump, engine or compressor.

One of the primary objects of the invention is to provide a machine of durable and comparatively simple construction which will function with high efficiency. More particularly, the invention provides a construction by which friction between the parts is diminished; also, it provides means for adjustment of the rotating parts, and means for conveying fluid to and from the working chamber with a minimum of leakage. Other objects and advantages will appear as the description of my invention proceeds.

Referring to the drawings:

Figure 1 is a longitudinal sectional view, some of the minor parts being shown in elevation, illustrating a machine embodying my invention. Figure 2 is a vertical sectional view, the section being taken as indicated at the line 2 of Figure 1. Figure 3 is a top plan view of the front portion of the machine, which view is partly broken away to show the inlet and outlet passages in the casing members. Figure 4 is an end view, in elevation, of the piston chamber, the end casing member having been removed at the point indicated at line 4 of Figure 1. Figure 5 is an end view, in elevation, of the end casing member which is removed from the machine at the point indicated at line 4 of Figure 1, the view being in the direction opposite the point of the arrow. Figure 6 is a vertical sectional view, the section being taken as indicated at line 6 of Figure 1. Figure 7 is a broken sectional view showing the rotating sleeve member, the rotor having been removed therefrom. Figure 8 is a broken sectional view of the rotor showing the arrangemment of the vanes therein. Figure 9 is a vertical sectional view, the section being taken as indicated at line 9 of Figure 2.

Referring more particularly to the arrangement of parts shown in Figure 1, 10 represents a standard which is supported by a flanged base. Upon the standard 10, and preferably formed integral therewith, is a tubular casing member 11. Secured thereto is a main casing member 12 which is somewhat cylindrical in shape and which provides on its interior a chamber in which the working parts are located. The casing members 11 and 12 may be secured together by means of bolts 13. At its upper portion, the casing member 12 is preferably equipped with conduits 14 and 15, either of which may serve as an outlet or inlet. For purposes of illustration, conduit 14 will be regarded as the inlet and conduit 15 as the outlet. The bosses 14^a and 15^a around the conduits 14 and 15 are preferably threaded interiorly to engage threaded pipes 16. A third tubular casing member 17, somewhat similar in construction to casing member 11, may be secured to casing member 12 by means of bolts 13. Its outer end is closed by an end-plate 18 which provides a recess for lock-nut 32. Similarly, the tubular casing 11 is closed by end-plate 19, which is apertured to receive a drive-shaft 20 and is also preferably recessed on its inner side to provide room for lock-nut 21, which is adapted to engage a threaded portion 22 of the drive-shaft. The end-plate is provided with the usual packing means.

While I have illustrated casing members 11, 12 and 17 as connected by bolts, it is obvious that some of these members may be formed integrally with each other.

Within the tubular casing members 11 and 17 are arranged adjusting members 23, which are threaded to engage threaded portions of the casing members. The adjusting members 23 are shown provided at their outer ends with recesses 24 which are adapted to receive the ends of a spanner wrench by which the adjusting members may be moved in a forward or rearward direction. Suitable anti-friction means such as ball bearings 25, equipped with races 26, may be supported within recesses provided within the adjusting members and these furnish suitable bearings for the rotating parts hereinafter described.

The rotating sleeve member 27, in the chamber provided by casing 12, is closed at one end and is preferably equipped with a

hub 28 which may be secured to the drive-shaft 20 by means of a key 29. The hub 28 of the sleeve member is shown supported by the ball bearings 25 while the shaft, at a point near the end-plate 19, is shown supported directly by similar ball bearings 25. As illustrated, the annular sleeve member 27 and rotor 30 do not contact with the casing member at any point, thus reducing the amount of friction to a minimum.

A rotor 30 is supported eccentrically within the sleeve member 27 upon rotor-shaft 31 which is carried by anti-friction means, such as ball bearings 25. The outer end of the rotor-shaft 31 is provided with a lock-nut 32, which is housed within recessed end-plate 18. The rotor 30 is illustrated in Fig. 6 as secured to the rotor-shaft 31 by means of a key 33. If desired, however, the shaft may be stationary and the rotor equipped with anti-friction means. A collar 34 is preferably formed integrally with the rotor-shaft 31 and between the races 26 and rotor 30.

The vane 35 is pivotally secured to the sleeve member 27 and is adapted to slide in a slideway 36 with which the rotor is provided. A second vane 37, which is also pivotally secured to the sleeve member 27, slides in a similar slideway 38 with which swivelled member 39 is equipped. The swivelled member 39 is illustrated as a comparatively small cylinder, pivotally mounted in rotor 30. The periphery of the rotor adjacent the small cylinder 39 is preferably cut away at an angle to provide for angular movement of the vane 37.

As shown in Figs. 3, 4 and 6, the conduits or flow passages 14 and 15 in the casing 12 pass downwardly a short distance and then forwardly in a substantially horizontal line to register with flow passages 40 and 41 in tubular casing member 17.

As illustrated in Figs. 2, 5 and 9, the latter flow passages 40 and 41 pass back in a substantially horizontal line from the point where they register with conduits 14 and 15 and then pass downwardly a short distance to communicate with the somewhat crescent-shaped slots or openings 42 and 43. The latter openings communicate with the working chamber formed between the eccentrically disposed rotor 30 and sleeve member 27. In order to prevent leakage, it is preferred that the openings 42 and 43 shall not extend as far as the outer periphery of the sleeve member 27.

The discharge opening 43, as shown best in Fig. 5, is preferably extended to a point at which a maximum discharge will be secured or, as illustrated, where it would touch an imaginary diametrical line drawn through the sleeve member 27, perpendicular to the base of the machine. By this enlargement or extension of the opening, it has been found that hydraulic traps are avoided and that the operation proceeds more smoothly and efficiently. It will be understood, however, that in order to secure the desired results, it may not be necessary to extend the opening 43 exactly to the point where it cuts the diametrical line; the opening may extend slightly beyond or fall short of the line.

In order to rigidly secure the adjusting members 23 in position, set screws 44, or other suitable locking devices, may be provided in the casing members 11 and 17. The inner ends of the screws 44 are illustrated as finding a bearing surface within annular slots 45.

As shown in Figs. 1 and 6, lubricating ducts are provided for the rotating parts. The rotor-shaft 31 is preferably provided centrally with a lubricating oil passage 46. Diametrical ducts 47, as best shown in Fig. 6, communicate with the passage 46 and also with the annular passage 48. A short duct 49 leads from the annular passage 48 to the slideway 36. A second duct 50 is shown leading from the annular passage 48 to a conduit 51 through which the bearing surface of the small cylinder 39 may be lubricated. A duct 52 provides communication between receptacle 51 and slideway 38 in the small cylinder 39. The anti-friction bearings may be lubricated by oil which passes through the spaces 53 between the races 26.

In the operation of the machine which, for purposes of illustration, will be described as a pump, the drive-shaft 20 is set in operation, thereby causing the annular sleeve member 27 to rotate. The vanes 35 and 37, as they traverse the chamber, cause also the rotor 30 and rotor-shaft 31 to rotate. The rotor 30 and sleeve member 27 form an abutment with a minimum practical clearance to diminish the amount of slippage. Both sleeve member 27 and rotor 30 travel in the same direction but their faces, owing to the eccentric arrangement of the sleeve and rotor, have different peripheral speeds. Compensation for this difference is provided by slideway 36 in the rotor 30 and by the slotted cylinder 39, as is illustrated clearly in Figs. 4 and 6.

Liquid or gas enters the working chamber through inlet pipe 16, flow passages 14 and 40, and opening 42. It is forced by the vanes into discharge opening 43 and out through flow passages 41 and 15 into outlet pipe 16.

In order to keep the rotor 30 and the annular sleeve member 27 at a desired distance from the end casing members 11 and 17, adjusting members 23 on either side of the impeller chamber are provided and may be operated by removing end-plates 18 and 19, inserting the end of a spanner wrench in the recesses 24 and rotating the adjusting members 23 to cause them to proceed or recede

to the point desired. The nice adjustment between the parts thus provided enables the operation to be carried on with a minimum of leakage. Also, the adjustment means eliminate the requirement for a great deal of precision in manufacture due to their capacity to compensate for the necessary plus and minus tolerances. They permit the operator to keep the sleeve member at a proper distance from the end casing member, irrespective of wear of the parts, and also to vary readily the clearance between these parts when it is desired to operate upon various kinds of liquids or gases which require different adjustments for efficient operation upon them.

The lubricants for the working parts may be supplied in the following manner. The lubricating oil received in the chamber provided by the end-plate 18 passes through the duct 46 and communicates, by means of short ducts 47, with the annular flow passage 48 from which the duct 49 leads to slideway 36 and duct 50 leads to conduct 51 and through passage 52 into slideway 38. Lubrication of the ball bearings is secured by the passage of lubricants through the spaces 53 between ball races 25.

While I have shown the small slotted cylinder 39 pivotally secured to the rotor, it is obvious that other arrangements involving such as, for example, a reversal of the parts with the slotted cylinder mounted in the sleeve and the vane 37 pivotally secured to the rotor, may be employed to secure the same results and are, therefore, within the scope of my invention. It is also clear that more than two vanes, such as are illustrated herein, may be employed; that the machine may be equipped with only one of the two adjusting members which have been described; and, also, that the machine may be driven by means of the rotor-shaft 31 as well as by the drive-shaft 20.

From Figs. 4 and 5 it will be observed that on the inner surface of the end casing member 17 the flow passages 40 and 41 are separated from the elongated openings 42 and 43 by a strip of metal which may be varied in area as desired, preferably this is sufficiently extensive to cover the clearance between the sleeve member 27 and the casing 12. By this construction liquid is prevented from by-passing the flow passages 14 and 15 through the passage provided by the clearance between sleeve member 27 and casing 12.

While I have illustrated and described a particular construction embodying my invention, I do not wish to be understood as intending to limit it thereto as the same may be variously modified and altered without departing from the spirit of my invention.

What I claim is new, and desire to secure by letters patent, is:

1. In a machine of the character set forth, a stationary cylindrical casing equipped with inlet and outlet ports and provided with a drive-shaft bearing and also with a rotor-shaft bearing, a drive-shaft mounted in said bearing, a sleeve member closed at one end and supported by said drive-shaft, a rotor-shaft mounted in said rotor bearing, a rotor supported by said rotor-shaft eccentrically in said sleeve member and in abutment with the internal surface of said sleeve member, and a vane pivotally connected with said sleeve member and slidable in a slot in said rotor.

2. In a machine of the character set forth, a casing comprising an open ended annulus, an end casing member closing one end of said annulus and provided with a drive-shaft bearing, a second end casing member closing the other end of said annulus and provided with a rotor-shaft bearing, a drive-shaft journalled in said drive shaft bearing, an annular sleeve member supported on the inner end of said drive-shaft, a rotor-shaft journalled in said rotor-shaft bearing, a rotor supported upon said rotor-shaft eccentrically within said sleeve member and provided with a slot, said rotor and sleeve member providing, between them, a working chamber, a vane pivotally connected with said sleeve member and slidable in said slot in the rotor, and inlet and outlet ports communicating with said working chamber.

3. In a machine of the character set forth, a stationary cylindrical casing equipped with inlet and outlet ports and provided with a drive-shaft anti-friction bearing and also with a rotor-shaft anti-friction bearing, a drive-shaft mounted in said bearing, a sleeve member closed at one end and supported by said drive-shaft, a rotor-shaft mounted in said rotor bearing, a rotor supported by said rotor-shaft eccentrically in said sleeve member and in abutment with the internal surface of said sleeve member, and a vane pivotally connected with said sleeve member and slidable in a slot in said rotor.

4. In a device of the character set forth, a casing provided with a tubular extension, a sleeve member adapted to rotate in said casing, a rotary piston adapted to rotate within said sleeve member, a tubular adjustment member threadedly connected to the inner side of said tubular extension of the casing and adapted to move said rotary piston in a forward and rearward direction.

5. In a machine of the character set forth, a casing, an annular sleeve adapted to rotate in said casing, a rotor eccentrically disposed therein and adapted to form therewith a working chamber, blades connecting said sleeve member and rotor and adapted to traverse said working chamber, and means in said casing for adjusting said sleeve mem-

ber and rotor in a forward and backward direction without moving said casing.

6. In a machine of the character set forth, a casing provided with an internally threaded tubular extension, an annular sleeve member open at one end and adapted to rotate in said chamber, a drive-shaft connected to said annular sleeve and journalled in said tubular extension, a rotor eccentrically disposed within said sleeve member to form a working chamber, vanes connected to said sleeve member, and rotor and adapted to traverse the chamber, and an externally threaded tubular member engaging the internally threaded portion of said tubular extension and making contact on its inner end with said annular sleeves.

7. In a machine of the character set forth, a casing provided with an extension, bearings housed within said extension, a sleeve member having an open end and a closed end and adapted to rotate in said cylinder, a shaft journalled in said bearings and secured to the closed end of said sleeve member, a rotor eccentrically disposed within said sleeve member to form a working chamber, said rotor being equipped with vanes adapted to traverse the chamber, and an adjustable member extending within said casing extension and adapted to shift said bearings in a forward or rearward direction.

8. In a device of the character described, a casing provided with an extension, a rotatable sleeve member having an open and a closed end and rotatably mounted in said casing, a shaft engaging the closed end of said sleeve member, said sleeve member and casing providing between the closed end of said sleeve member and the casing a space through which the sleeve member may be shifted, and shifting means associated with said casing extension adapted to move said sleeve member in a forward or rearward direction.

9. In a device of the character set forth, a casing providing a chamber, a sleeve member rotatably mounted in said chamber, said sleeve member being provided with a closed and open end, said casing and sleeve member having a space therebetween through which said sleeve member may be adjusted longitudinally, a shaft secured to a closed end of said sleeve member and journalled in said casing, an end member closing the end of said casing adjacent the open end of said sleeve and provided with inlet and outlet passages, and means associated with said casing adapted to shift said sleeve member longitudinally of the casing, said passages in said end member extending through said end member and registering with inlet and outlet ports with which the casing is provided.

10. In a machine of the character set forth, a stationary cylindrical casing equipped with inlet and outlet ports and provided with a sleeve-shaft bearing and also with a rotor-shaft bearing, a sleeve-shaft mounted in said sleeve-shaft bearing, a sleeve member closed at one end and supported by said shaft, a rotor-shaft mounted in said rotor bearing, a rotor member supported by said rotor-shaft eccentrically in said sleeve member and in abutment with the internal surface of said sleeve member, and a vane pivotally connected to one of said members and slidable in a slot in said other member.

In testimony whereof, I have hereunto set my hand this 1st day of May, 1928.

JOHN W. LEES.