

Feb. 28, 1950

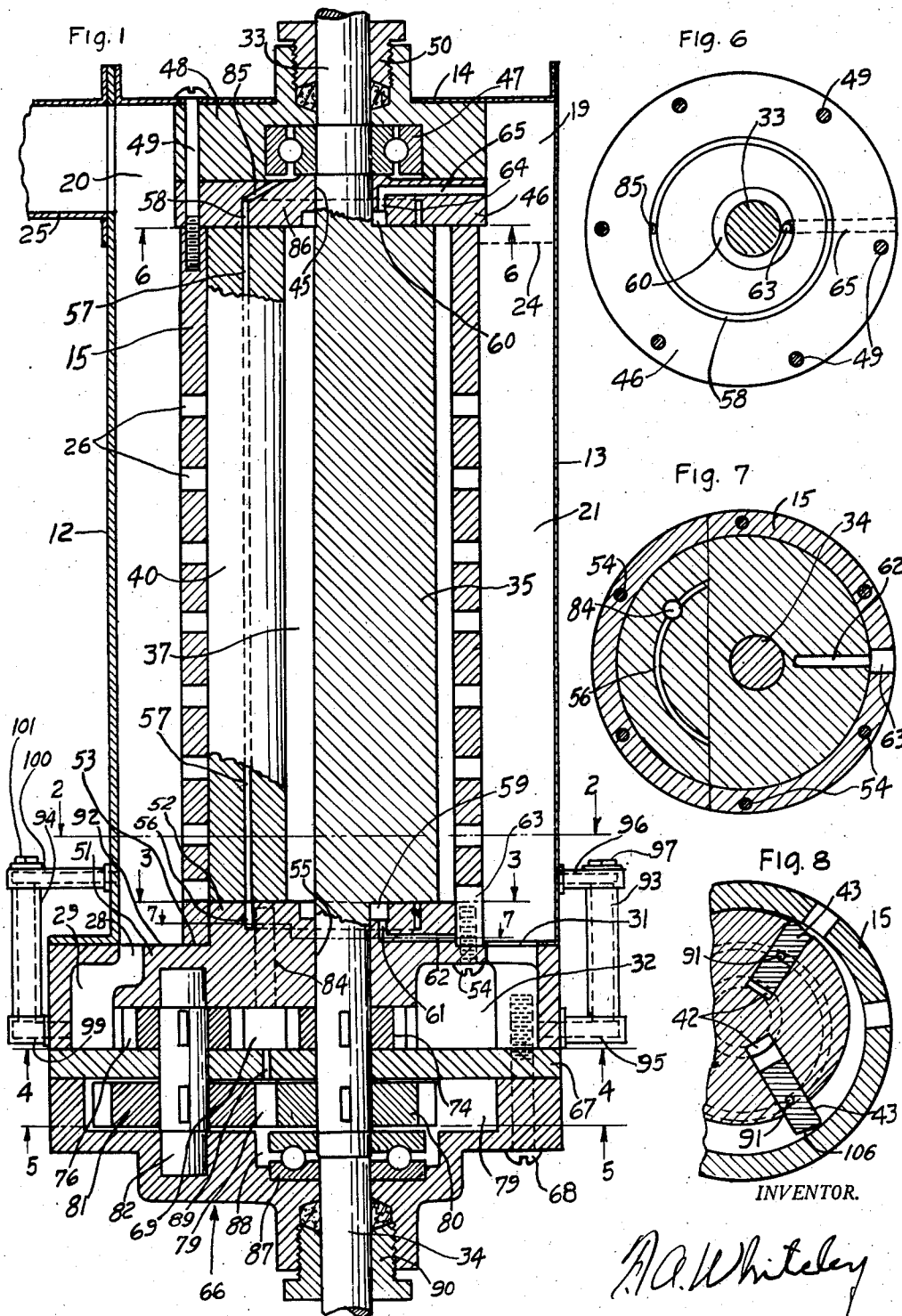
F. A. WHITELEY

2,498,972

ROTARY PUMP

Filed Dec. 4, 1944

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

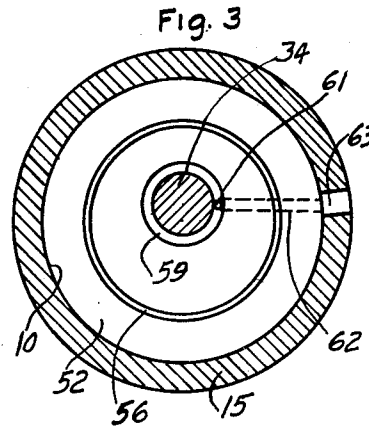
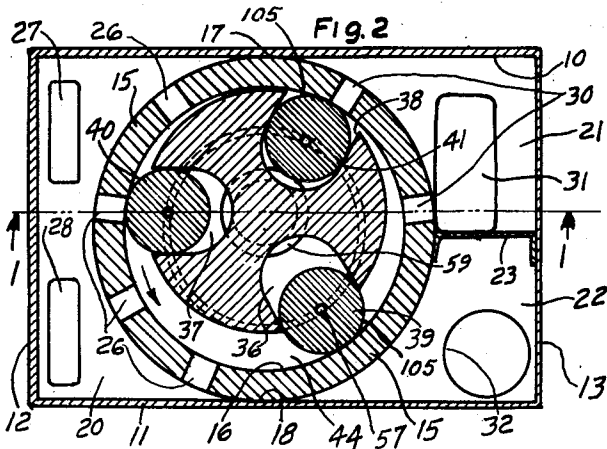


Fig. 4

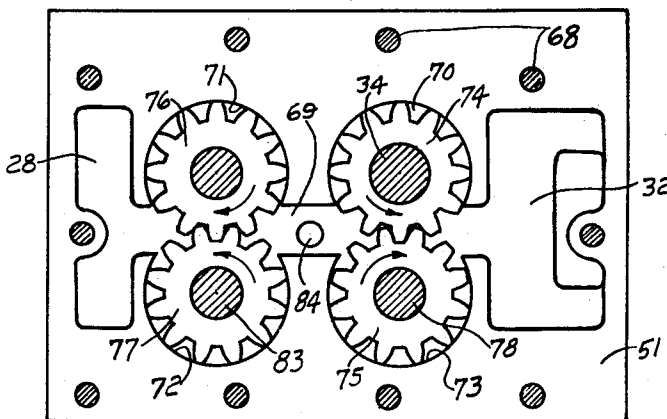
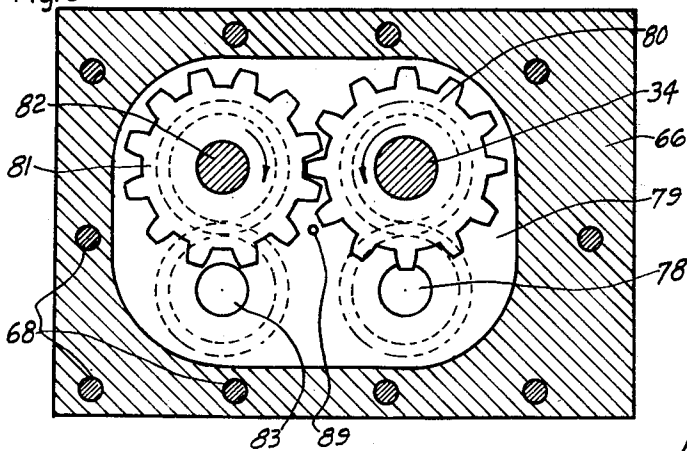


Fig. 5



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UNITED STATES PATENT OFFICE

2,498,972

ROTARY PUMP

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13 Claims. (Cl. 230—152)

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My invention relates to low vacuum high pressure rotary pumps, and has for its object to provide a rotary pump having radially movable cylindrical or other shaped pistons, operated by a rotor eccentrically positioned within a cylinder, wherein the surfaces of the movable pistons, contacting surfaces of the rotor and of the inside walls of the cylinder, are continuously subjected to an oiling action of oil delivered at high pressure.

The well known rotary pump, when used either for producing vacuum or compression, has many advantages over other forms of pumps, such, for example, as reciprocating piston pumps. This is due to its continuous rotary motion, eliminating many friction and inertia losses inherent in such other types of pumps, in consequent large saving of power over them, and in resulting very great decrease of bulk and size in proportion to the power consumed and the volume of fluid evacuated or compressed.

But a serious difficulty has been encountered in the use of rotary pumps on gas where a high vacuum or a high degree of compression is required. This is that leakage of the gas may take place from the high pressure side to the low pressure side of the pump. Many efforts to overcome this difficulty have been made, but the appliances for doing it, oiling appliances for example, have not been really effective for the purpose, and in most of these efforts have added so much in bulk and power consumption as to largely nullify the advantages of using a rotary pump.

It is a primary purpose of my invention to adapt a rotary pump of the type shown in my Patent No. 2,352,748 to the production of a very high vacuum, as $\frac{1}{10}$ to $\frac{1}{100}$ lb. per square inch, with a resulting differential between the low pressure and high pressure sides of the pump of up to 150 lbs. per square inch. I have discovered that this can be done by circulating a very small amount of oil past certain adjacent fixed and movable surfaces of the pump proper at much higher pressures, such as up to 300 lbs. per square foot, aided by connecting the spaces at the rear of the radially movable pistons with the high pressure side of the pump, and with independent return of the circulated oil from the two sides of the pump to the oil pump so as to effectively block communication between the high pressure and lower pressure sides of the vacuum pump.

It is a principal object of my invention, therefore, to provide a rotary pump having a cylindrical pumping chamber, with parallel end walls, in which is eccentrically mounted for rotation

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a rotor formed with one or more longitudinal radial slots opening at the ends of each slot to the end walls, and with a piston member movable radially in each slot, together with means for forcing oil at high pressure into the spaces between the end walls and the ends of the pistons.

It is a further object of my invention to provide a rotary pump having a cylindrical chamber with parallel end walls and to mount eccentrically therein a cylindrical rotor with an element thereof in close engagement with the inner surface of the chamber, and to form a slot or a number of slots, equally spaced and longitudinally extending in the rotor opening to the end walls, with piston members in said slots having their end faces engaging the said end walls, and further to mount an oil pump operated by the same means that operates the rotor with connections therefrom to effect delivery of oil at very high pressure to the spaces between the end faces of the rotor and pistons and the end walls of the chamber.

It is a further object of my invention to provide a gear oil pump with two gear couples receiving return oil from the high pressure and lower pressure sides of the rotary pump and delivering the oil at high pressure to a common chamber, with all communication between the high pressure and low pressure sides of the rotary pump blocked by the respective gear couples.

It is a further object of my invention to provide passages for conveying the high pressure oil directly to the space between an end wall of the rotary pump chamber and the adjacent end faces of the rotor and piston or pistons, and to provide longitudinal passages through each piston to convey the high pressure oil to the space between the other end walls of the piston and rotor and the other end wall of the pumping chamber.

It is a further object of my invention to form in the two end walls of the gas pumping chamber circular slots concentric to the cylindrical walls of the gas pumping chamber, to mount a high pressure oil pump on one of said end walls, with oil inlet ports connected independently with the high pressure and the low pressure sides of the gas pump, and with direct connection of the outlet high pressure side of the oil pump with one of said circular slots, and to connect the two slots for oil delivery from one to another by longitudinal passages through the pistons, which passageways are at all times held to center on the respective slots, whereby at all times high pressure oil is delivered to the spaces between the end walls of the pumping chamber and the sets

of end walls of the rotor and the piston or pistons.

It is a further object of my invention to have continuous connection of the inner parts of the rotor slots with the high pressure side of the gas pump, both to permit discharge of oil and gas from the back of the slots and also to maintain a constant pressure on the backs of the pistons to hold them firmly in contact with the cylinder walls and to push the oil fed down at the junction of piston walls with the slot walls into the space between them with a considerable degree of pressure.

The full objects and advantages of my invention will appear in connection with the detailed description thereof, as given in the appended specification, and the novel features by which the aforesaid advantageous results are obtained will be particularly pointed out in the claims, it being understood that the particular form of rotor and pistons here shown and claimed may be varied without departing from the scope of my invention.

In the drawings illustrating an application of my invention in one of its forms:

Fig. 1 is a longitudinal sectional view of my invention taken on line 1—1 of Fig. 2.

Fig. 2 is a transverse sectional view taken on line 2—2 of Fig. 1.

Fig. 3 is a transverse sectional view across the pumping cylinder only taken on line 3—3 of Fig. 1 and viewed in the direction of the arrows.

Fig. 4 is a transverse sectional view of the invention taken on line 4—4 of Fig. 1.

Fig. 5 is a transverse sectional view of the invention taken on line 5—5 of Fig. 1.

Fig. 6 is a transverse sectional view taken on line 6—6 of Fig. 1, viewed in the direction of the arrows.

Fig. 7 is a transverse sectional view taken on line 7—7 through the end casting viewed in the direction of the arrows.

Fig. 8 is a partial sectional transverse view taken through the pumping cylinder and parts therein only, corresponding to the similar parts of Fig. 2 showing application of my invention of a different form of piston.

As illustrated, referring to Figs. 1 and 2, a rectangular outer casing is provided formed of heavy sheet metal which comprises side walls 10 and 11, end walls 12 and 13, and a top wall 14. In the form of the invention shown, this casing is as indicated and is supported in a vertical position by any suitable means (not shown), although the invention may be effectively embodied where the casing has its longest extent horizontal.

Within the above noted casing is fixedly mounted a cylinder 15 having its walls of substantial thickness and its inner surface 16 polished to a true and smooth cylindrical surface. This cylinder is secured at 17 and 18 to the side walls 10 and 11 by welding or other suitable means so as to make a gas-tight joint therewith and divide the space within the casing into two chambers 19 and 20, of which chamber 19 is divided into two smaller chambers 21 and 22 by an upright partition 23, Fig. 2, which terminates as indicated in dotted lines at 24, Fig. 1, short of the top of chamber 19. The respective chambers 21 and 22 are, therefore, connected at their top, but are separated by gas-tight sealing of partition 23 to casing end wall 13 and cylinder 15. A gas inlet passageway 25, Fig. 1, admits gas to chamber 20, the passageway 25 connecting with any source of supply of gas (not shown) either for creating

vacuum in a chamber, not shown, or for feeding for compression in the chamber 19 and the chambers 21 and 22 connected therewith. Whether the device is used for creating high vacuum or for compressing, gas chamber 19 and connected chambers 21 and 22 are at the high pressure side of the gas pump and chamber 20 is at the low pressure side of the pump. A series of openings 26 extend through the walls of cylinder 15 into chamber 20. Through these openings the air or other gas being evacuated or compressed enters the pumping cylinder for action of the pump. Also through these openings is discharged the oil, the pumping of which under high pressure makes up a major part of my invention. This oil is thrown out through the openings 26 against the inner surfaces of walls 10, 11 and 12 and gravitates to the bottom of chamber 20 where it passes through openings 27 and 28 to the oil sump 29, later to be described.

Other sets of apertures 30 lead through the cylinder 15 into chamber 21 substantially below the top of partition 23. The evacuated air or other gas as it is being compressed or driven against the pressure of atmospheric air goes through these openings into chamber 21 where it is thrown against the walls 10, 13 and 23 and gravitates to the bottom of chamber 21 going therefrom through an opening 31, Figs. 1 and 2, into oil sump 32, later to be described. The compressed gas or the gas evacuated at the low pressure side of the gas pump thus goes first into the oil-receiving chamber 21 and then rises to spill over the edge of partition 23 into chamber 22, from whence it leaves through aperture 32, Fig. 2, to be discharged out of the system. Aperture 32 may be connected to suitable piping (not shown) to convey the gas thus moved to any desired point for discharge to atmosphere; or, for example, to a suitable gasometer for holding the compressed gas.

In the example shown, formed in conjunction with an upper shaft extension 33 and a lower shaft extension 34 is a pump rotor 35 which is in the form of a cylinder having milled therein a series (in the example shown 3) of long slots 36, 37 and 38. This constitutes the element referred to in the specification and claims as the pumping rotor or simply as the rotor.

In the form illustrated, the slots 36, 37 and 38 are made of a size to receive respectively a series of rollers 39, 40 and 41, Fig. 2, which rollers operate in a well known way within the cylinder 15 as in effect pumping pistons, for which reason they are referred to herein as pistons. There are certain advantages in a pump of the above described type in having these pistons in the form of cylinders, since it gives a rolling contact with the smooth inner wall of the cylinder, thus preventing friction, and the relatively broad curve of the contact portions of these pistons with the inner wall of the cylinder, particularly with the means of forcing the pistons into firm engagement with these walls by reason of the slots being connected with the high pressure side of the gas pump, insures a very firm oil seal at the points of contact of the piston and cylinder surfaces. But my invention is not to be limited to the use of cylindrical pistons, since it will work effectively with pistons of a rectangular type, as shown in Fig. 8, wherein the slots 42 are made considerably narrower than the slots 36, 37 and 38 for receiving the cylindrical pistons, and the pistons 43 used in such slots 42 are rectangular in cross-section with flat side walls en-

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gaging the side walls of the slots and with outer faces preferably somewhat curved to give better contact with the inner wall of the cylinder.

The rotor 35 has its outer walls ground and polished to a smooth cylindrical surface. It is of less diameter than the inner diameter of cylinder 15 and is eccentrically mounted within said cylinder so its outer walls will engage the inner walls of the cylinder tangentially along an element of each. This leaves a crescent-shaped space, indicated at 44 of Fig. 2, in which the piston members 39, 40 and 41 operate, being caused by rotation of the rotor to follow with their outer limits and contact the inner surface of the cylinder 15 so that the crescent-shaped space is successively divided between each pair of pistons into low pressure and then high pressure chambers, receiving gas from the low pressure chamber 20 and driving the relatively compressed gas into the high pressure chamber 21. This operation has long been known as also has the use of cylindrical pistons and I make no claim to invention in respect to these features here described, except as they are modified in structure and arrangement for effecting the purposes and accomplishing the results of my invention.

In the vertical mounting of the rotor, herein disclosed, the shaft section 33 extends through an opening 45 in a top plate 46 through a ball bearing assemblage 47 resting on top plate 46 and held in a recess in a second plate 48. The surface of plate 46 which contacts the upper surface of cylinder 15 and said upper cylinder surface, are milled smooth and true as are the contact surfaces of members 46 and 48. The entire assemblage is held together in gas-tight relation by a suitable number of screw bolts 49, Figs. 1 and 6. A stuffing piece 50 of standard construction is formed on the top of plate 48 for effecting a gas-tight seal about shaft extension 33. At the bottom of the cylinder 15 is secured a heavy piece 51 which has a cylindrical portion 52 that extends within the cylinder 15 and is provided with a ledge part 53 milled true and smooth which engages the lower end of cylinder 15 and is held to it gas-tight by means of a suitable number of screw bolts 54, Figs. 1 and 7. The piece 51 has extending through it an opening 55 for receiving the lower shaft extension 34. A plan view of the upper part 52 of the piece 51 is shown in Fig. 3.

Referring to Figs. 1 and 3, a circular channel 56 is cut in the upper surface of the extension 52 which, as the rotor 35 is mounted within the cylinder 15, is eccentric to the center of the rotor, but concentric with the circular cross-section of the inside of the cylinder. The cylinder pistons 39, 40 and 41 are of a diameter in reference to the depths of the slots 36, 37 and 38 so they will not reach the bottoms of the slots in their most retracted position and will not have their diameters extended beyond the outer limits of the slots in their most projected positions. Centrally through each of the roller pistons 39, 40 and 41 is formed a bore or passageway 57 of a diameter equal to the width of the channel 56, and this passageway through each and all of the cylindrical pistons at all times travels along and directly above the channel 56. Likewise these passageways travel along a circular channel 58 formed to open out of the top piece 46. The channels 56 and 58 are identical in width and depth and are both of quite considerable depth. It follows that if oil under high pres-

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sure is delivered to the channel 56 it will also continuously be delivered through the passageways 57 to the upper channel 58 and this oil under high pressure will be continuously forced from the channels 56 and 58 between the upper and lower end faces of the rotor and the cylindrical pistons and the respective upper and lower plates or plate portions 46 and 52 so that the moving faces of the rotor and piston ends will always be traveling along and upon a film of high pressure oil and thus will effectively block any tendency for leakage of gas from the high pressure to the low pressure sides of the pump.

As shown in Figs. 1 and 3, and 1 and 6, another circular groove is cut in each of the top and bottom plates designated respectively as groove 59 in the portion 52 of plate 51 and groove 60 in the top plate 46. These grooves are circular surrounding respectively the lower shaft 34 and the upper shaft section 33. From groove 59 is cut a tubular downwardly extending hole 61 which communicates with a lateral passageway 62. The passageway 62, as clearly shown in Figs. 1, 3 and 7, opens directly into an elongated aperture 63 extending through the wall of cylinder 15 into chamber 21. This is on the high pressure side of the gas pump. In practice several such connections as the vertical and horizontal passageways 61 and 62 may be made to give ample area for the discharge of oil from the back portions of slots 36, 37 and 38, all of which at all times overlie the circular groove 59, as clearly shown in Fig. 2. The angularly disposed double tubular passageways 61 and 62 are made necessary so as not to connect the circular channel 56 with the circular channel or groove 59, which would result in rapid flooding of the pressure oil from the oil pump, hereinafter to be described.

As shown in Figs. 1 and 6, from the channel 60 is a similar vertical tube 64 which connects with a horizontal tube 65, indicated in dotted lines in Fig. 6. Here again several of such passageways 64, 65 may be employed to fully open the groove 60 directly to the high pressure chamber 19.

This will permit the free flow of gas from the pressure side through the passageway or passageways 65, 64 and the circular channel or groove 60 into the rear ends of rotor slots 36, 37 and 38, thus subjecting the backs of the pistons 39, 40 and 41 continuously to the pressure of the gas at the high pressure side.

That would mean that if the apparatus were used, for example, to evacuate air to produce a very high vacuum of say $\frac{1}{16}$ to $\frac{1}{15}$ of a pound per square inch, that the differential of air pressure in the high pressure side transmitted to the grooves 36, 37 and 38, and from the grooves to the back of the pistons 39, 40 and 41, as against the low pressure side, would be up to 150 lbs., which at all times will insure firm contact of the outer margins of the piston against the inner surface of the cylinder chamber. This is particularly important with the rolling contact which will take place in connection with the use of cylindrical pistons such as shown. The pressure in the slots back of the pistons opposed to the low pressure side, which is the only place where gas leakage is likely to occur, will force the oil into the channels 105 wedge-shaped in cross-section at the sides of the roller pistons or channels 106 similarly wedge-shaped in cross-section along the sides of the straight wall pistons and with the high oil pressure employed will effectively prevent any cross leakage of gas.

The oil pump is shown in Figs. 1, 4 and 5. Here

a lower housing member 66 and a separator plate 67 above it having true flat contacting surfaces, are held together in gas-tight relation by screw bolts 68 threaded at suitable points of separation into the bottom piece 51. The bottom piece 51 has formed therein the oil sump chambers 28 and 32, Fig. 4, and a connecting channel 69. From the channel 69 are formed pump gear housing chambers 70, 71, 72 and 73. Within housing 70 is a pump gear 74 which extends into the connecting channel 69 and meshes across said channel with a pump gear 75 which is in the gear chamber 73 and which extends into channel 69 to mesh with pump gear 74. Within gear housing chamber 71 is a pump gear 76 which extends into connecting channel 69 and meshes with a pump gear 77 in gear housing chamber 72, the gears 76 and 77 meshing across said connecting channel 69.

The pump gear 74 is fast on the drive shaft extension 34 and is driven directly by the main drive shaft. The pump gear 75 is fast on a bearing shaft 78. The housing member 66 has formed therein a chamber 79 just below separator plate 67 and on the shaft 34 is a drive gear 80 which meshes with a drive gear 81 fast on a shaft 82 upon which is mounted the spur gear 76, as clearly shown in Figs. 1 and 5. The gears 80 and 81 have the same diameter. The pump gear 76 and drive gear 81 are on the common shaft 82. Hence the pump gear 76 has the same rate of rotation as the pump gear 74 and since pump gear 76 meshes with pump gear 77 which is mounted on bearing shaft 83, the pump gears 76 and 77 will rotate at the same rate as the pump gears 74 and 75.

The several pump gears rotate in the direction of the arrows (see Fig. 4). It will be noted that the inlet side of the gear couple of gears 74 and 75 is open to the oil sump 32 and the inlet side of the gear couple made up of gears 76 and 77 is open to the oil sump 28. The oil sump 32 receives return oil from the high pressure side of the gas pump and the oil sump 28 receives oil from the low pressure side. The respective gear couples, therefore, block all pressure communication between the high pressure side and the low pressure side.

Both gear couples discharge the oil into the center part of the chamber 69 where it is delivered at high pressure. It discharges from the chamber through a discharge bore 84, shown in longitudinal extent in the top member 51 in Fig. 1, and in transverse outline in Figs. 4 and 7. As shown in Fig. 7, the bore 84 extends into the annular channel 56 so that the high pressure oil goes directly from chamber 69 through the short bore 84 into the annular channel 56.

From this annular channel the high pressure oil will spread between the lower surface of the rotor 35 and the upper surface of the plate extension 52, and it will also spread between the upper surface of said plate and all the lower surfaces of the rollers 39, 40 and 41.

The oil from the annular channel 56 will also be forced upward through all of the bores 57 in the centers of the pistons 39, 40 and 41. From the top of each of these bores the oil will be delivered to the annular channel 58 in top plate 46 from which it will be forced between the lower surface of said top plate and the upper surfaces of the piston rollers 39, 40 and 41 and the upper surface of the rotor 35. A bore 85 leads through top plate 46 to communication with the chamber 86 of the ball bearing 47, which thus receives a constant supply of oil from the annular channel

58 to keep the upper ball bearings 47 properly lubricated.

A thrust ball bearing 87 is mounted in a chamber 88 within head member 66 for supporting for free rotation the rotor and the upper shaft extension 33 and lower shaft extension 34 thereof. Oil is delivered to chamber 79 housing the drive gears 80 and 81 through a small port 89, see Figs. 1 and 5, which keeps the chamber 79 filled with oil for oiling gears 80 and 81, and likewise keeps the chamber 88 for the thrust roller bearings properly oiled.

There will, of course, be a very small amount of oil pumped through the system and that at high pressure. This will require an adaptation of the oil pump gear couples and various passages in size such as to make possible the movement of the requisite amount of oil at the high pressure demanded.

A stuffing box 90, Fig. 1, seals the shaft 34 in gas-tight condition.

Where rectangular pistons, such as are shown in Fig. 8 are employed the annular grooves 56 and 59 in lower plate extension 52 and the annular grooves 58 and 60 in the top plate 46 and all connections thereto will be identically the same as where the cylindrical pistons are employed. In the non-cylindrical pistons there will be bores 91 which will register at their respective ends with the annular channels 56 and 58. In this form of piston there will, of course, be no rotation but since the channels 56 and 58 are concentric with the inner wall of the cylinder 15 it is obvious that they will always register with said channels.

The oil level will be maintained at substantially the top surface 92 of the ledge part 53 of the piece 51. Gauges 93 and 94 are provided, gauge 93 connecting as indicated in dotted lines at 95 with the lower part of oil sump 32 and connecting as indicated in dotted lines at 96 with the chamber 21. A screw cap 97 sealing the gauge gas-tight may be opened for supplying more oil. Similarly, the gauge 94 opens, as shown in dotted lines at 99 to the lower part of oil sump 29 and opens, as indicated in dotted lines at 100, into the chamber 20. The gas-tight screw cap closure 101 may be removed to permit addition of oil. The oil level when the pump is at rest would be somewhat higher than the level 92, dropping to that level as the discharge of oil through the different parts of the apparatus takes up a considerable part of the oil in the two separated sumps. Somewhat more oil will go back into the oil sump 32 on the high pressure side than goes into the sump 28 on the low pressure side, but substantially all loss of oil will be on the high pressure side where the compressed gas is pushed out of chamber 22; for which reason the levels on the two sides, that is above oil sump 32 and oil sump 28, will remain substantially constant.

The advantages of my invention follow directly from the structure and combination of elements hereinbefore described. In operation the high pressure oil will be constantly forced between the contacting surfaces of the rotor and pistons on the one hand and of the end cylinder walls on the other. A certain amount of this oil will be forced through the small space between these sets of end walls and at the top thereof will gravitate down the pistons themselves. Where the roller pistons are employed this oil will, by the rotation of these pistons, constantly be drawn into the wedge-shaped contact space between the

walls of the rotor slots, being forced inwardly at one side of the rotor and outwardly at the other side. The oil will thus be caused to pile up in these wedge-shaped contact portions and effectively seal gas-tight against any leakage of gas past the contacting elements of the piston walls with the cylinder and slot walls.

A fundamental advantage of my invention, considering the results effected by it, is its extreme simplicity. Everything is in effect housed in a single casing. The gear pump is driven simultaneously with the drive of the rotor and by the same means. The oil channels, both for pressure oil and for discharge of oil from the rear ends of the slots, can be made by a simple milling operation and all oil-conducting channels are short and direct. All moving parts are constantly traveling in oil. Friction is thus reduced to the smallest minimum. Maintaining of the special connection back of the pistons with the high pressure side of the gas pump keeps the roller pistons in their extended position and prevents any tendency for them to be pushed back while the piston is moving through the compression or high pressure side of the pump.

While three pistons are shown in the example illustrated and described, it will be obvious that any number of pistons may be employed from one up, without departing from the scope of my invention.

Also, although the roller pistons are shown solid with bores drilled through their centers, it will be obvious that these roller pistons may be tubes, as in my aforesaid Letters Patent, with internally-positioned tubes or channels opening at the centers of plates sealing the ends of such tubes.

I claim:

1. A rotary pump, comprising a cylindrical pumping chamber having parallel end walls, passages for high pressure gas and low pressure gas respectively open to opposite sides of the pumping chamber, an eccentrically positioned rotor in the pumping chamber formed with a plurality of longitudinal slots opening to said end walls, an elongated piston member in each of said slots having its ends engaging said end walls, means for rotating said rotor and all of the pistons therewith, means continuously connecting the inner ends of all of the slots with the high pressure side of the pump while the rotor is being rotated, and means including circular channels in said end walls and a passageway through each of the pistons registering with said channels for forcing and conducting oil at high pressure into the space between the two end walls of the rotor and the piston and said end walls while the rotor is being rotated.

2. In combination with a rotary pump embodying a pumping chamber and a rotor and pistons in the pumping chamber for moving gas therethrough and compressing it while being moved, passages for high pressure gas and low pressure gas respectively on opposite sides of and in communication with the pumping chamber, means for pumping oil at high pressure to contacting parts of the rotor, pistons and pumping chamber, comprising a separate sump independently connected with each passage for receiving return oil, a separate gear pump couple for moving oil from each sump while blocking pressure communication between the sumps, a space formed between the couples for receiving the oil pumped by both couples, and means including a passageway directly from the space for conduct-

ing the oil under pressure to parts of the rotor and pistons contacting the walls of the chamber.

3. A rotary pump, comprising a cylindrical pumping chamber having parallel end walls with a circular channel in each end wall concentric with the inner walls of the chamber, a rotor and pistons in the chamber having their ends in substantial contact with the end walls, passages for high pressure gas and low pressure gas respectively on opposite sides of and in communication with the pumping chamber, a separate sump independently connected with each passage for receiving return oil, a separate gear pump couple for moving oil from each sump while blocking pressure communication between the sumps, a space formed between the couples for receiving the oil pumped by both couples, and means including a direct passageway from the space and communicating with one of said circular channels and including a passageway through at least one piston registering with both channels for conducting high pressure oil to the spaces between the ends of rotors and pistons and the end walls.

4. A rotary pump, comprising a cylindrical pumping chamber and having a rotor and pistons in the chamber with parts thereof in contact with walls of the chamber, passages for high pressure gas and low pressure gas respectively in opposite sides of and in communication with the chamber, a separate sump independently connected with each passage for receiving return oil, a drive shaft for the rotor, a separate gear pump couple for moving oil from each sump while blocking pressure communication between the sumps, a gear of one couple being fast on said shaft, a drive gear on the shaft for driving the other couple, a space formed between the couples for receiving the oil pumped by both couples, and a direct passageway from said space for conveying high pressure oil between contacting parts of the gas pumping mechanism with walls of the pump cylinder.

5. In a rotary pump, a cylindrical pumping chamber having parallel end walls, an eccentrically positioned rotor therein formed with a longitudinal slot opening to said end walls, a piston member in said slot having its ends engaging said walls, means for rotating said rotor and piston, an oil feeding channel extending through said piston and opening at its ends in the planes of said end walls, the ends of said channels in the operation of the device moving in circles eccentric to the center of the rotor, circular slots in the end walls correspondingly eccentric to the center of the rotor so as to come over the ends of said piston openings at all times, and a single means for feeding oil under pressure into one of said circular slots whereby said pressure oil will be fed through the piston openings to the other of said circular slots and be distributed to all parts of the adjacent surfaces of the end walls and the ends of the piston.

6. In a rotary pump, a cylindrical pumping chamber having parallel end walls, an eccentrically positioned rotor therein formed with a longitudinal slot opening to said end walls, a piston member in said slot having its ends engaging said walls, means for rotating said rotor and piston, an oil feeding channel extending through said piston member and opening at its ends in the planes of said end walls, the ends of said channels in the operation of the device moving in circles eccentric to the center of the rotor, circular slots in the end walls correspondingly eccentric to the center of the rotor so as to come over the

ends of the said piston openings at all times, a pump chamber having a single opening leading to one of said slots, and means operated by the rotor-operating means for delivering oil under pressure to one of said circular slots, whereby oil under pressure will be delivered through the piston opening to the other of said slots and will be forced in a high pressure film between the ends of the rotor and of the piston into said end walls while the rotor is being driven.

7. A rotary pump, comprising a casing forming a cylindrical pumping chamber having parallel end walls, passages for low pressure gas and high pressure gas respectively on opposite sides of and in communication with the pump chamber, an eccentrically positioned rotor having its ends substantially engaging said end walls, a multiplicity of longitudinal slots in said rotor opening to said end walls, a piston in each of said slots with all the end faces thereof engaging said end walls, correspondingly positioned oil openings extending through each of said pistons, the ends of said openings being caused to travel in a circle eccentric to the center of the rotor, circular slots in the end walls opening to the ends of said oil openings in all positions of all of the pistons, and means for forcing oil under high pressure into one of said circular slots whereby through the openings in the pistons said pressure oil will be forced into the other of said circular slots and oil be distributed in a pressure film between the ends of the rotor and of the pistons and said end walls.

8. A rotary pump, comprising a casing forming a cylindrical pumping chamber having parallel end walls, passages for low pressure gas and high pressure gas respectively on opposite sides of and in communication with the pump chamber, an eccentrically positioned rotor having its ends substantially engaging said end walls, a multiplicity of longitudinal slots in said rotor opening to said end walls, a cylindrical piston member in each of said slots with the end faces of each piston member in close proximity to said end walls, an oil delivering opening through the center of each piston, a circular slot in each of said end walls, said circular slots coming over the oil delivering piston openings in each position thereof, and a source of oil under high pressure having a connection with one of said slots, whereby said pressure oil will be delivered to the other of said slots through said center oil delivering openings and a pressure film of oil will be maintained between the ends of the rotor and of the pistons and the respective end walls.

9. A rotary pump, comprising a casing forming a cylindrical pumping chamber having parallel end walls, passages for low pressure gas and high pressure gas respectively on opposite sides of and in communication with the pump chamber, an eccentrically positioned rotor having its ends substantially engaging said end walls, means for operating the rotor, a multiplicity of longitudinal slots in said rotor opening to said end walls, a cylindrical piston member in each of said slots with the end faces of each piston member in close proximity to said end walls, an oil delivering passageway through the center of each piston, a circular channel in each of said end walls, said circular channels coming over the oil delivering piston openings in each position thereof, a pumping chamber having connection with one of said circular channels, a pair of pumps delivering oil at high pressure to said pumping chamber and simultaneously operated by the

means for operating the rotor, said oil pumps respectively opening to the high pressure side and the low pressure side of the rotary pump, whereby high pressure oil is delivered through the central oil openings from one circular channel to the other circular channel and is distributed as a high pressure film over the ends of the rotor and of the pistons and the respective end walls.

10. A rotary pump, comprising a cylindrical pumping chamber having parallel end walls, passages for high pressure gas and low pressure gas respectively open to opposite sides of the pumping chamber, an eccentrically positioned rotor in the pumping chamber formed with a plurality of longitudinal slots opening to said end walls, a piston member in each of said slots having its ends engaging said walls, means for rotating said rotor and piston, means for supplying a high pressure film of oil between the ends of the rotor and of the pistons and said end walls, and a circular passageway having connection with each of said slots and with the high pressure side of the pump for permitting the drainage of oil accumulating in said piston holding slots and for maintaining a constant pressure against the backs of all said pistons.

11. A rotary pump, comprising a vertically positioned cylindrical pump and chamber having parallel top and bottom walls, passages for low pressure gas and high pressure gas respectively on opposite sides of and in communication with the pumping chamber for conveying the low pressure gas and discharging the high pressure gas after compression thereof, a rotor and pistons in the pump chamber for moving the gas there-through and compressing it while being moved, an oil sump having gravity connection with the low pressure side and a second oil sump having gravity connection with the high pressure side, and a two part gear pump between the sumps, one part having pumping connection with the oil in the low pressure sump and the other part having connection with the high pressure sump.

12. A rotary pump, comprising a vertically positioned cylindrical pump and chamber having parallel top and bottom walls, passages for low pressure gas and high pressure gas respectively on opposite sides of and in communication with the pumping chamber for conveying the low pressure gas and discharging the high pressure gas after compression thereof, a rotor and pistons in the pump chamber for moving the gas there-through and compressing it while being moved, an oil sump having gravity connection with the low pressure side and a second oil sump having gravity connection with the high pressure side, two gear pump couples each independently moving oil from a different sump while blocking pressure communication therebetween, said couples discharging oil at high pressure into a common space between them, and means including a passageway from said space for conducting said high pressure oil to the spaces between the ends of the rotor and pistons and said end walls.

13. A rotary pump, comprising a vertically positioned cylindrical pump and chamber having parallel top and bottom walls, passages for low pressure gas and high pressure gas respectively on opposite sides of and in communication with the pumping chamber for conveying the low pressure gas and discharging the high pressure gas after compression thereof, a rotor and pistons in the pump chamber for moving the gas there-through and compressing it while being moved, an oil sump having gravity connection with the

low pressure side and a second oil sump having gravity connection with the high pressure side, a two part gear pump between the sumps, one part having pumping connection with the oil in the low pressure sump and the other part having connection with the high pressure sump, and common means for simultaneously driving the rotor and the gear pump.

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