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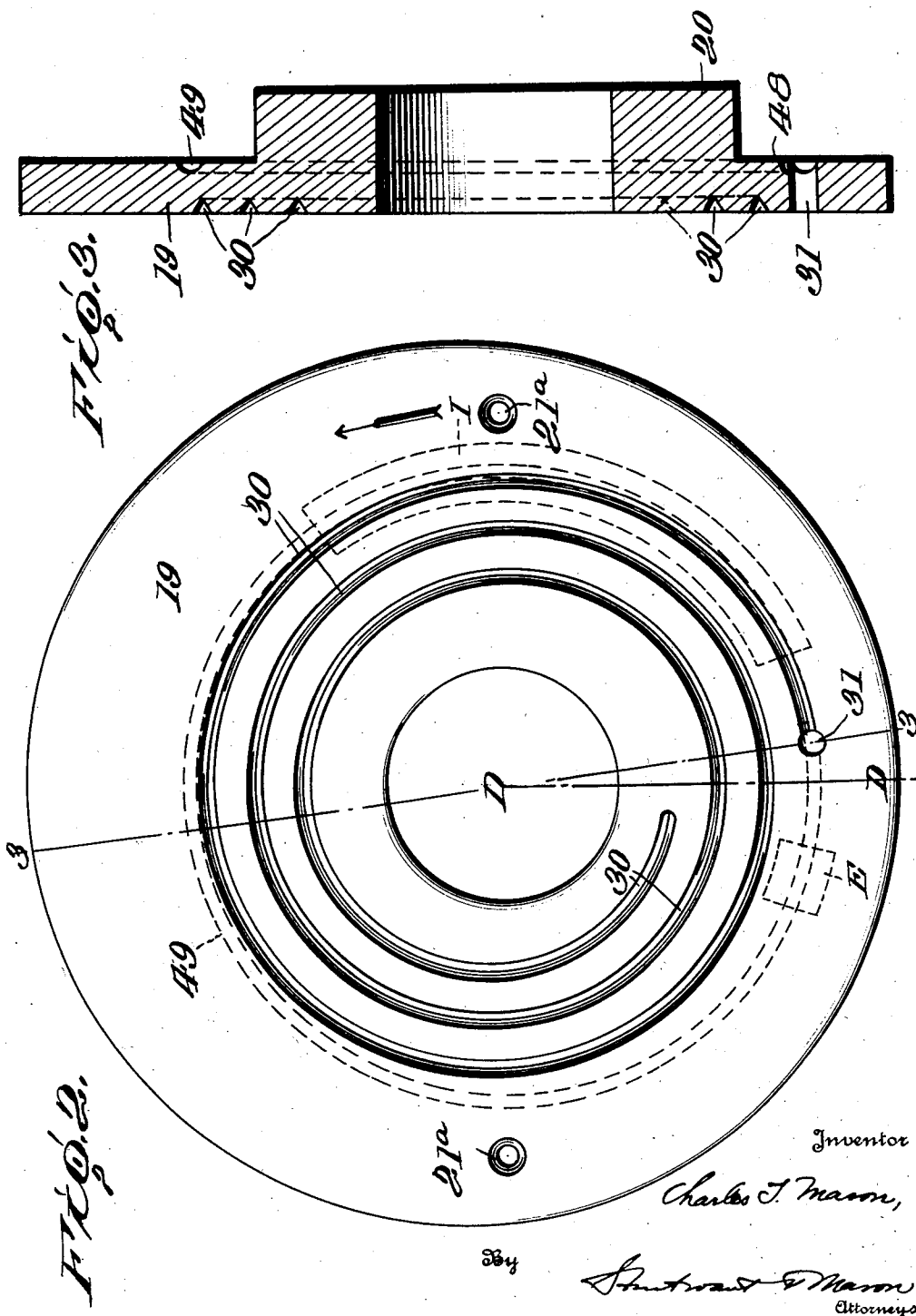
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LUBRICATING AND SEALING SYSTEM FOR ROTARY COMPRESSORS

Filed Feb. 16, 1927

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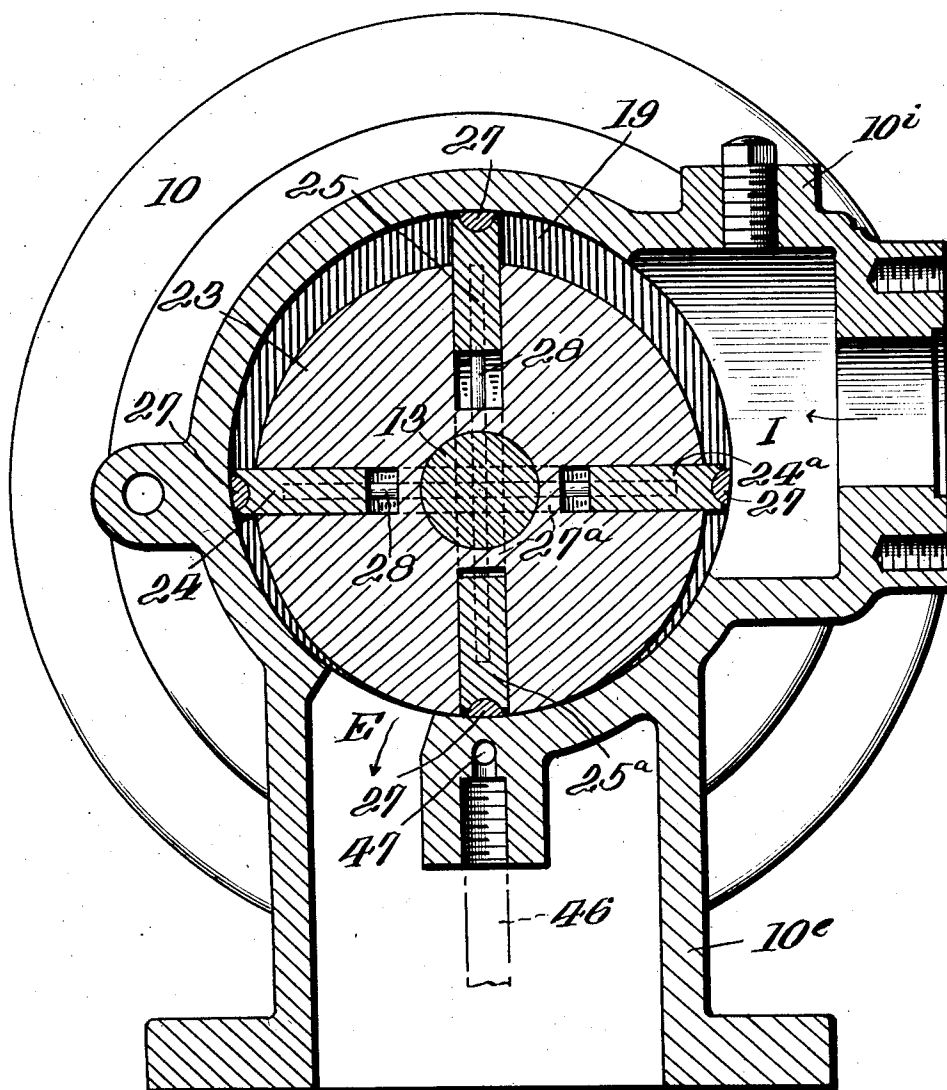


FIG. 4.

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LUBRICATING AND SEALING SYSTEM FOR ROTARY COMPRESSORS.

Application filed February 16, 1927. Serial No. 168,790.

This invention relates to improvements in rotary compressors or pumps, and more particularly bears upon methods of obtaining the lubrication and sealing of the rotor element in its casing.

According to this invention, a difference in pressure of the gaseous fluid is employed to deliver the oil to the end surface of the rotor; and in the form where the rotary pump is used as a compressor, the pressure of the delivered gas is employed to force the lubricating and sealing oil upward in a duct to a point at the rotor face at which a lesser pressure prevails than that at the outlet of the compressor. The invention further presents a means whereby this oil is delivered in copious quantities to the rotor end surface, without incurring the probability that thereby a discharge shall occur which under the action of the centrifugal force developed by the rotor shall immediately project this oil to the outer periphery of the compressor casing.

In the accompanying drawings, the invention has been illustrated as applied to a rotary compressor of the type employing an eccentric rotor within a casing, with vanes disposed for radial movement on the body of the rotor and projecting therefrom until they are in contact with the inner wall of the casing. This is a well known type of pump, and is not claimed in this application except as representing a compressor of this type as suitable for specific use with the present invention.

On the drawings:

Figure 1 is an axial section through the rotor and its casing, and through the oil pump.

Fig. 2 is a view on an enlarged scale of an end plate in the casing.

Fig. 3 is a sectional view through this end plate substantially on line 3—3 of Fig. 2.

Fig. 4 is a section on line 4—4 of Fig. 1.

In the illustrative form of the invention, a cylinder 10 is provided with a blind end boss plate 11 which receives the ball bearing assembly 12 which supports the outer end of the compressor shaft 13. The other end of the cylinder 10 is closed by an open end boss plate 14 which has a similar ball bearing assembly 15 therein to support the

shaft 13; this boss plate 14 is likewise provided with a packing 16 to shut off the interior of the cylinder from the atmosphere except through the proper openings. These end plates are bolted to the cylinder 10 by the cap screws 17 and preferably packings 18 are provided to prevent the discharge of the fluid except as desired.

Mounted within the chamber formed by the cylinder 10 and the boss plates 11 and 14 are the end plates 19 and 20 which are preferably locked with regard to the respective boss plate by some means such as the screws 21, whereby their movement about the axis of the shaft 13 is prevented. It will be noted that the axis of the shaft 13 is eccentric to the axis of the chamber of the cylinder 10, as is usual in the construction of pumps of the presently described type.

The rotor comprises a rotor body 23 having radial longitudinal grooves or slots therein to receive the vanes 24, 24^a and 25, 25^a of the impeller system. In the illustrated form of the invention four vanes have been presupposed. It is preferred to provide spacing or stop pins 28 to hold separate and apart the respective pairs of vanes 24, 24^a and 25, 25^a. These pins 28 pass through apertures in the body 23 and the shaft 13. Each of these vanes 24, 24^a, 25, 25^a has a rockable sealing member 27 located at its outer or scraping end to establish a tight seal with the inner wall of the cylinder. The spaces between the bottoms of the respective slots and the inner ends of the respective vanes are placed in communication in opposite pairs by the apertures 27^a, which are independent for the respective pairs.

Each of the end plates 19, 20 is provided with a spiral groove 30, leading from an aperture 31 through this end plate and located adjacent the inner wall of the cylinder, and slightly removed in the direction of the suction from the discharge line of the compressor. This is represented in Figs. 1 and 2, in which latter the plate 19 is shown, and it has been assumed that the rotor is to move counterclockwise. The apertures 21^a are provided for the screws 21 which hold the respective plate against movement about its axis. The radial line D—D on Fig. 2 rep-

resents the position of any vane during its rotation at which all of the air or other gas under pressure has been discharged from this vane through the outlet opening E of the compressor, Fig. 4. It is therefore apparent that, as the particular vane continues to move in a counter-clockwise direction away from the line D—D, a suction is developed until the vane uncovers the inlet opening I, (Figs. 2 and 4), after which the air or other gas is admitted into the respective chamber defined by two adjacent vanes and the rotor, and during the continued movement of the vane, more and more air or other gas will be drawn into the chamber, in which therefore a pressure always exists at this part of the rotation, i. e., opposite the part of the disks 19 and 20 represented by the segment between the line D—D of Fig. 2 and the adjacent end of the inlet port I, which is less than that prevailing in the discharge from the compressor. It will be understood that the openings E and I have merely been designated arbitrarily to illustrate the method of operation of the present system, and that this illustration is to represent that the opening 31 is always at a relatively lesser pressure than that existing at the oil sump. From this opening 31, the spiral groove 30 is curved successively and progressively inward toward the axis of the shaft 13, i. e., in a direction contrary to that which would naturally be taken by the oil when acted on by the centrifugal force of the rotor. The rotor closes the opening 31 of each end plate at all times, and the rotor end face or the end face of the respective vanes substantially closes the grooves at all times; so that there is no tendency for this oil to move out of the groove except as it lubricates and seals the end surface of the rotor and its vanes, and passes in behind the vanes to lubricate them with respect to the rotor and to force them outwardly for sealing. The oil finally collects upon the inner wall of the cylindrical chamber and lubricates it with respect to the vanes; it is scraped from this cylindrical wall by the vanes and delivered into the discharge E, along with the compressed gas, and passes through the outlet.

As shown in Figs. 1 and 4, the casing 10 is formed internally as the cylindrical chamber for the rotor and vanes, and has the integral hollow offsets or bosses 10¹ and 10² which respectively form the inlet and outlet channels and communicate with the chamber itself by the ports I and E. The outlet boss 10² in the present illustration has an external lower flange which is bolted to the delivery conduit 40 to form a packed joint therewith. The bottom boss 43 of this conduit forms an oil sump to contain a supply of lubricating and sealing oil for the compressor. A baffle jacket 44 is fixed within the aperture 40^a at the top of the casing 40 and has a number of

holes 45, 45^a therethrough by which the air or gas may escape from the interior of the jacket 44 to the conduit 41. It will be understood that in this way a pressure is maintained upon the body of the oil in the sump 43 which forces this oil upward within the duct 46 to a passage 47 in the cylinder 10 which is parallel to the axis of the shaft 13. The lubricating oil moves in the passage 47 to the substantially radial channels 49 formed in the respective end boss plates 11 and 14, and thereby gains access to a circular groove 49^a which is formed on the rear of each of the end plates 19 and 20, thence through the opening 31 of the respective plate 19 and 20 and thence to the spiral groove 30. It is apparent that by this construction the position of the hole 31 may be varied to obtain the greatest efficiency with the particular compressor, without thereby cutting off the delivery of lubricant and sealing material through the same.

In operation, the illustrated compressor receives air through the inlet port I, and the vanes successively engage this air and compress it and deliver it through the outlet port E into the sump jacket 44. Any oil which may have been scraped by the vanes from the inner wall of the cylinder goes along with this air but drips down and collects in the sump 43, while the air passes substantially free from oil through the openings 45, 45^a to the passage 41. The air pressure, however, in the sump jacket 44 is greater than the partial vacuum prevailing in the opening 31 or at the opening I; and this difference of pressure as existing between the lower end of the duct 48 and the aperture 31 of the respective plate, causes the oil to rise and accomplish the lubricating and sealing functions outlined.

The progressive inward curvature of the spiral groove is provided in this preferred form, so that the rotational movement of the rotor will by frictional action upon the oil in this groove cause this oil to move successively inward, as distinguished from a centrifugal throwing of the oil to the exterior of the cylinder.

The oil which is forced into the interior of the cylinder through the pipe 46 by the opening 47, and thence through the opening 31 and thence to the spiral groove, will fill all of the following spaces which may be open and unoccupied by oil: the ball bearings, the spaces around the spacing pins, the spaces behind the slides 25, 24, and the opening through the shaft which communicates with each of the slots in which the vanes are positioned. As each of these pairs of opposed slots comes to the vertical position as in Fig. 4, one vane will be nearer the center of the rotor and the other farther from the center of the rotor, and this relation will reverse at each half revolution: the

oil which is accumulated in the space between the bottom of its slot and the vane which is farther from the center of the rotor will pass through the respective openings 5 27^a, 27^a in the rotor body 23 and the shaft 13 to the opposite space each time that the rotor makes a half revolution, and so likewise with the other two blades. In this way the quantity of oil behind each pair of blades 10 remains constant and simply passes from side to side through the openings 27^a, 27^a shown in the rotor 23 and shaft 13 which produce a communication between the two opposed slots. These two oil openings 27^a, 15 27^a through the rotor and shaft are independent and disconnected one from the other, and are positioned in the shaft at separate places so that no oil can be admitted from the one of these openings in the 20 shaft to the other. This oil which occupies the spaces in the slots in the rotor behind the blades performs the office of keeping the vanes in contact with the cylinder walls and constitutes a liquid piston operating to keep 25 these vanes separated as far as the cylinder will permit. The spacing pins 28 act as stops to keep the blades from moving too far towards the center. Any leakage from this chamber by reason of accomplishment 30 of the sealing and lubricating function is constantly replenished by oil under pressure from the grooves 30.

It is obvious that the position of the aperture 31 is not limited to that represented and 35 described, but may be varied to any point of the periphery at which a lower pressure prevails than that existing at the outlet. It is likewise obvious that the device is not limited to a compressor, but that so 40 long as a greater pressure is maintained at an inlet or outlet sump than exists at the particular point of the chamber, a similar lubricating and sealing function may be accomplished. In this and other ways the 45 invention may be modified within the scope of the appended claims.

I claim:

1. In a lubricating and sealing system for a rotary compressor or pump or blower having a rotor, a casing and end plates for the 50 casing; an oil sump exposed to the air pressure from the blower, and an oil conduit from said sump to a point on the rotor face of one of said end plates at which a lower 55 pressure prevails during operation than appertains in said sump, said point being adjacent the periphery of the plate; said end plate having a spiral groove on the rotor face thereof, said grooves progressing inward so that the movement of said rotor 60 assists the movement of oil therealong and toward the axis of the rotor.

2. In a lubricating and sealing system for a rotary gas pump having a rotor, a casing 65 having end closing members, an oil sump

exposed to the maximum pressure prevailing in the pump, an oil conduit from said sump to afford passage for oil therefrom to be delivered at a point on the rotor face of one of said end members at which a lower pressure prevails during operation than appertains in said sump, a rotor located in said casing comprising a body and vanes with the end surfaces of said body and vanes in contact with said end members, said vanes 70 being movable radially with respect to the body to maintain the radial outward edges in contact with the interior of said casing, said point being covered by the rotor and vanes at all times during the rotation thereof; said end member having a spiral groove 80 therein on the rotor face thereof, said groove leading from said point and being of less maximum diameter than the outer diameter of the rotor and vanes. 85

3. In a lubricating and sealing system for a rotary gas pump having a rotor, a casing having end closing members; an oil sump, exposed to the maximum pressure prevailing in the pump, and an oil duct from said 90 sump to a passage in said casing, said passage leading to chambers on the face of said end members opposite the rotor, said end members having apertures therethrough opening to the rotor chamber at radial lines 95 thereof which cut the rotor periphery at points always exposed during operation to lesser pressures than prevail in the sump; said end members having spiral grooves therein of lesser maximum diameter than 100 the outer diameter of said rotor and being closed by the adjacent face thereof, said grooves communicating with said apertures and extending around the rotor axis.

4. In a lubricating and sealing system for 105 a rotary compressor having a rotor, a casing having end closing members, an oil sump exposed to the maximum pressure prevailing in the pump, an oil conduit from said sump to afford passage for oil therefrom to be 110 delivered at a point on the rotor face of one of said end members at which a lower pressure prevails during operation than appertains in said sump, said rotor having radial slots in its periphery, rotor blades positioned in said slots in diametrically opposite 115 pairs, said rotor having passages establishing communication between the bottom of each of said slots and the bottom of its diametrically opposite slot, said passages being 120 respectively independent of each other, said end member having a spiral groove therein on the rotor face thereof, said groove leading from the delivery point of said oil conduit on a spiral progressing inward so that 125 the movement of said rotor assists the movement of oil therealong and toward the axis of the rotor, said groove being of less maximum diameter than the outer diameter of the rotor and vanes for communicating with 130

each of said slots between the bottom thereof and the adjacent edge of the respective rotor blade during the course of the movement of the rotor, so that the oil moving in said slot in said groove passes into the slots beneath the respective rotor blades to establish and maintain a liquid column between the blades of the respective pairs, through which liquid column the movement of one blade is transmitted to its paired blade. 10

In testimony whereof, I affix my signature.

CHARLES T. MASON.