Feb. 5, 1935. J. F. JAWOROWSKI 1,989,864

ROTARY PUMP

Filed Feb. 24, 1933 2 Sheets-Sheet 1

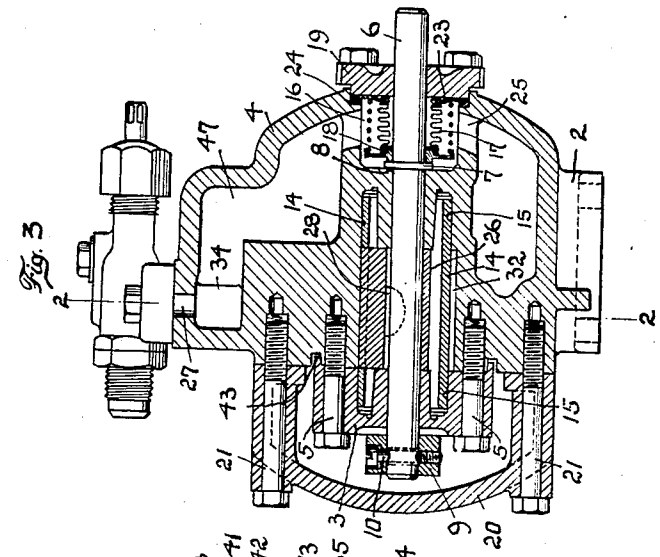


Fig. 3

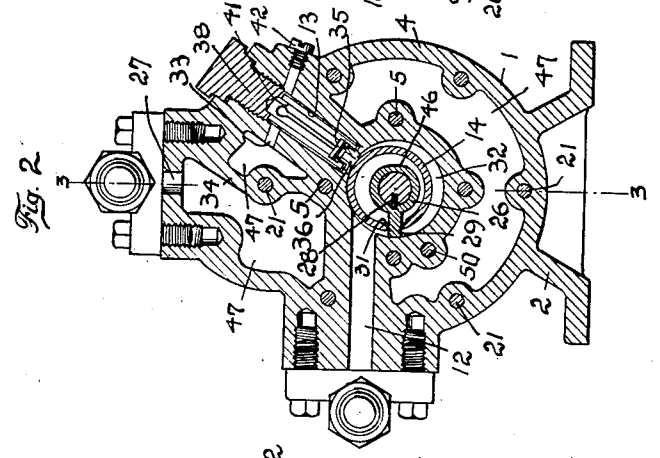


Fig. 2

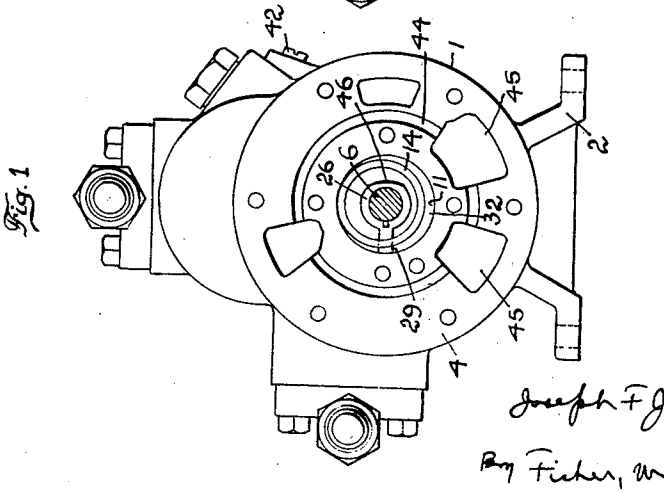


Fig. 1

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ROTARY PUMP

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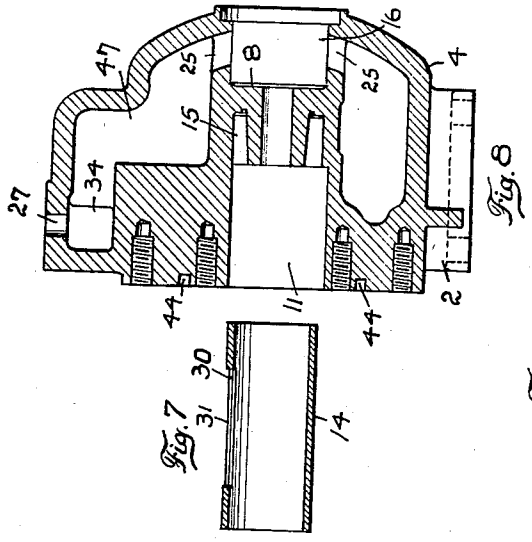


Fig. 8

Fig. 7

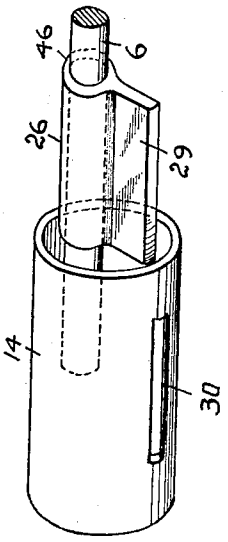


Fig. 10

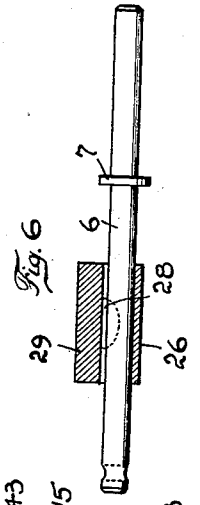


Fig. 6

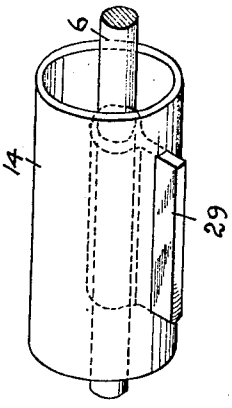


Fig. 9

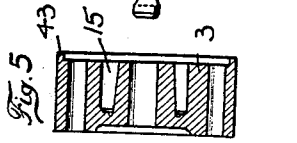


Fig. 5

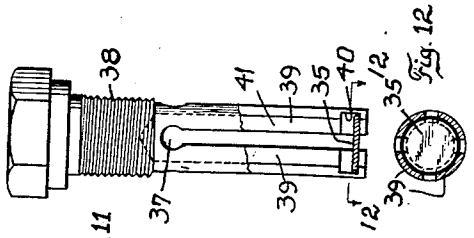


Fig. 12

Fig. 11

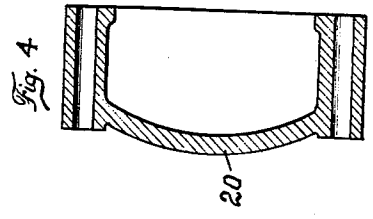


Fig. 4

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Patented Feb. 5, 1935 1,989,864

UNITED STATES PATENT OFFICE

1,989,864

ROTARY PUMP

Joseph F. Jaworowski, Cleveland, Ohio

Application February 24, 1933, Serial No. 658,419

2 Claims. (Cl. 103—136)

This invention relates to rotary pumps or compressors in which a rotor piston of the blade type is concentrically mounted within a working chamber. The pump is especially adapted for pumping refrigerant to and through the coils and condenser of a refrigerator or a refrigerating plant, which refrigerant according to common practice consists of sulphur dioxide or ammonia carrying a small quantity of lubricating oil.

The general object of the invention is to provide means for separating the working chamber into suction and compression areas or portions whereby wear on working parts of the pump will be reduced to a minimum.

Another object of the invention is to provide eccentrically mounted means within the working chamber slidably connected with and freely rotated by the rotor and cooperating with the rotor and its blade to separate the suction side of the pump from the compression side.

A further object of the invention is to provide a novel form of pressure relief valve for the discharge outlet which permits of convenient assembly and disassembly of the valve.

A still further object of the invention is to provide efficient means for separating the lubricant from the refrigerant and preventing the escape of the latter from the pump.

Other objects and advantages of the invention will be apparent as the specification is considered with the accompanying drawings in which:

Figure 1 is a side view of a rotary pump according to the invention, the cover member and the front part of the casing being removed to disclose the working parts of the pump:

Figure 2 is a sectional view through the pump, the section being taken on line 2—2 of Figure 3;

Figure 3 is a longitudinal sectional view through the pump, the section being taken on line 3—3 of Figure 2;

Figures 4 through 8 show the parts of the disassembled pump, thus Figure 4 is a sectional view through the cover member; Figure 5 a sectional view through the front part of the casing; Figure 6 a side view of the shaft with the rotor piston member attached thereto, Figure 7 a sectional view through the rotatable cylinder and Figure 8 a sectional view through the rear portion of the casing;

Figure 9 is a perspective of the cylinder rotor member and its shaft assembled;

Figure 10 is a perspective view showing the manner in which the cylinder and rotor are assembled;

Figure 11 is a side view partly in section of the plug seating check valve; and

Figure 12 is a sectional view on line 12—12 of Figure 11.

Referring more particularly to the drawings, the pump comprises a casing 1, which may be cast and provided with a base 2 for mounting upon any suitable support, not shown. Casing 1 comprises a front portion 3 and a rear portion 4 connected together by means of bolts 5 passing through portion 3 and threaded into portion 4, the base 2 being formed on the latter portion. The inner periphery of the front portion 3 of the casing is formed with arcuate flanges 43 which snugly engage in cooperating arcuate recesses 44 formed in the rear portion 4, thus facilitating assembly of the two parts of the casing, and a dowel pin 50 serves to align and center the bearings in the respective parts. The front end of the casing is closed by a cover 20 secured in place by bolts 21. A drive shaft 6 extending through axially alined bores in the front and rear portions of the casing is held against inward longitudinal movement by means of a collar 7 having a working clearance with respect to shoulder 8, while at its inner end the shaft is held against outward movement by means of a collar 9 and bolt 10. Danger of the shaft being carelessly pulled out against the sylphon bellows 17 hereinafter referred to is thus eliminated.

The casing is formed with a circular working chamber 11, with which a fluid inlet passage 12 for the fluid being drawn into the pump communicates, and from which chamber the fluid is discharged through a valved passage 13 and thence to an outlet port 27 in a manner hereinafter described. A cylinder 14 of considerably smaller diameter than and extending eccentrically through the working chamber is rotatably supported at its ends in bearing openings or recesses 15, while the intermediate portion of the cylinder engages the upper wall of the working chamber with a close working fit and thus separates inlet and outlet passages 12 and 13 from each other, and divides this chamber into suction and compression areas. The walls of bearing openings or recessed 15, of course are eccentrically arranged with respect to the axis of the working chamber 11 and also the axis of the drive shaft 6.

The rear portion 4 of casing 1 is cored to form a chamber 16 about the outer end of shaft 6, for the reception of the sylphon bellows 17, previously referred to, and which is resiliently seated at its inner end against a packing ring 18 in turn seated against collar 7 with sealing effect. A cap 19,

through which the outer end of the shaft 6 extends, bears against the outer end plate 23 of bellows 17 and clamps the same into tight engagement with a shoulder 24 on the casing, thus tightly sealing the chamber 16 against the escape of oil and liquid therefrom. Openings 25 through the walls of chamber 16 provide for free circulation of fluid from the top to the bottom of oil chamber 47 while bores 45 permit of free circulation between the front and rear portions of chamber 47.

A rotor piston member 26 sleeved upon and fixed to the drive shaft 6 by a key 28 is formed with an integral radially extending piston blade or paddle 29 which blade extends through a longitudinally disposed slot 30 in the cylinder 14, and into rotatable contact with the circular wall of working chamber 11. The side edges of the blade fit the corresponding edges of the slot but the sides of the blade are slightly spaced from top and bottom edges of the slot. As driving shaft 6 extends concentrically through working chamber 11 and is eccentric to the bearing openings or recesses 15 at each side of chamber 11, in which bearings the cylinder 14 is rotatably supported or guided, it follows that the cylinder will be freely rotated in its bearings by blade 29, when the shaft is driven by any suitable source of power not shown. Slot 30 is preferably beveled, as at 31, to permit of slight relative rocking movement between the cylinder and blade which might occur in starting and stopping the pump, thus reducing frictional wear to a minimum.

In order to facilitate assembly and disassembly of the rotor 26 and cylinder 14, that portion of the rotor diametrically opposed to the blade 29, is cut away or formed concentric with the inner face of the cylinder, as at 46. The rotor is first slipped within the cylinder with the cut away portion 46 snugly engaging that part of the cylinder wall opposite the slot 30, and is then pushed to Figure 1 position forcing the blade 29 through the slot and into engagement with the wall of chamber 11. The drive shaft 6 with its key 28 is then inserted through the rotor thus locking the blade in working position. Replacements can thus be conveniently and quickly made.

It will be seen that when the piston is rotated the fluid is drawn through inlet 12 into the suction side of the crescent shaped working area 32 of working chamber 11, and carried around to valved outlet passage 13. Crescent shaped area 32 constitutes the space lying between the cylinder 14 and that portion of the wall of the working chamber which is out of contact with the cylinder. The fluid in advance of blade 29 is carried around by the blade to the compression side of area 32 where it is compressed before being expelled into and through the valved passage 13 and thence through opening 33 into the upper end of oil chamber 47. As the fluid emerges through opening 33 it impinges against a baffle member 34 which causes the oil in the fluid, where a refrigerant is being pumped, to drop down into the lower portion of the oil chamber, while the gas content of the fluid is forced under pressure through outlet port 27, thus reducing the amount of oil which escapes with the gases. The gas is then conducted from outlet 27 to a condenser where it is liquidified, and after being passed through an expansion valve and cooling coil respectively again enters the pump through inlet passage 12. As the refrigerating system just described is old and well known in the art further description or illustration thereof is deemed unnecessary.

It will be noted that a negligible amount of power is required to rotate the cylinder 14 for the reason that its direction of travel coincides with that of the liquid flow. Consequently very little wear is caused by the sliding movement of blade 29 through slot 30. As the rotor piston is coupled directly to the driving shaft the entire resistance of the fluid exerted against blade 29 is communicated directly to the shaft. Furthermore as the oil chamber 47 is filled with oil under constant pressure there will always be a film of oil between the cylinder and its end bearings, as well as between the top wall of the chamber 11 and the cylinder, thus reducing wear to a minimum at these points.

Fluid is prevented from backing up into the pump through outlet port 27 and passage 13 by a metal disk shaped check valve 35, which is held movably in place adjacent the lower reduced end 36 of passage 13 by means of a screw threaded plug 37. This member 37 is formed with a threaded head portion 38 at its outer end cooperating with the outer threaded end of passage 13, and at its lower end is formed with a plurality of spaced resilient fingers 39, which fit loosely in that portion of passage 27 through which they extend. These fingers are formed adjacent their extremities with recesses 40, in which the washer like disk valve 35 is seated with freedom for sliding movement toward and away from the reduced portion 36 of passage 13. This valve will seat upon and close the reduced portion 36 under pressure of liquid backing up in passage 13. One portion of a cross bore 41 through the walls of passage 13 forms the outlet 33 previously referred to and which communicates with the upper end of oil chamber 47 and directs the fluid pumped from the working chamber 11 against baffle member 34, the other end of the bore being closed by a plug 42. Valve 35 can readily be inserted in the recesses 40 by springing the fingers 39 apart, and the plug member and the valve as a whole can be removed by merely unscrewing the plug and withdrawing the same from passage 27.

While I have shown a pump comprising but one working chamber, rotor and associated parts, it will of course be understood that any multiple thereof may be employed within the scope of my invention. Where the invention is incorporated in a double acting pump the rotor blade for one working chamber or cylinder will be directly opposite the rotor blade or paddle for the other working chamber or cylinder.

Having thus described my invention:

What I claim as my invention is:

1. In a rotary pump having a working chamber including inlet and outlet passages, an axially rotatable, hollow cylindrical member extending eccentrically through said chamber and contacting with the wall thereof between said inlet and outlet passages and a rotor member within said cylindrical member arranged concentrically with respect to said chamber, a driving extension on said rotor member extending into said working chamber through a slot in the wall of said cylindrical member for rotating same and for forming a paddle member in said working chamber, said rotor member and its driving extension being dimensioned to permit joint insertion of said rotor and its extension into and withdrawal from the interior of said cylindrical member.

2. In a rotary pump having a working chamber,

a rotor concentrically arranged within said chamber, an axially rotatable slotted cylinder of smaller cross section than said working chamber eccentrically mounted with respect to said working chamber for subdividing same into suction and compression areas, a driving extension on said rotor member extending into said working chamber through the slot in the wall of said cylinder for rotating same and forming a paddle in said working chamber, said rotor and its driving extension being dimensioned to be freely extended into and withdrawn from the interior of said rotatable cylinder, said rotor having its wall diametrically opposite said extension partly cut away to facilitate assembly and disassembly of the rotor and cylinder and thereby increase the available eccentricity of the cylinder with respect to the working chamber.

JOSEPH F. JAWOROWSKI.