June 25, 1929. J. W. CUTHBERT 1,718,535

ROTARY PUMP OR COMPRESSOR

Filed March 31, 1926

Fig. 2.

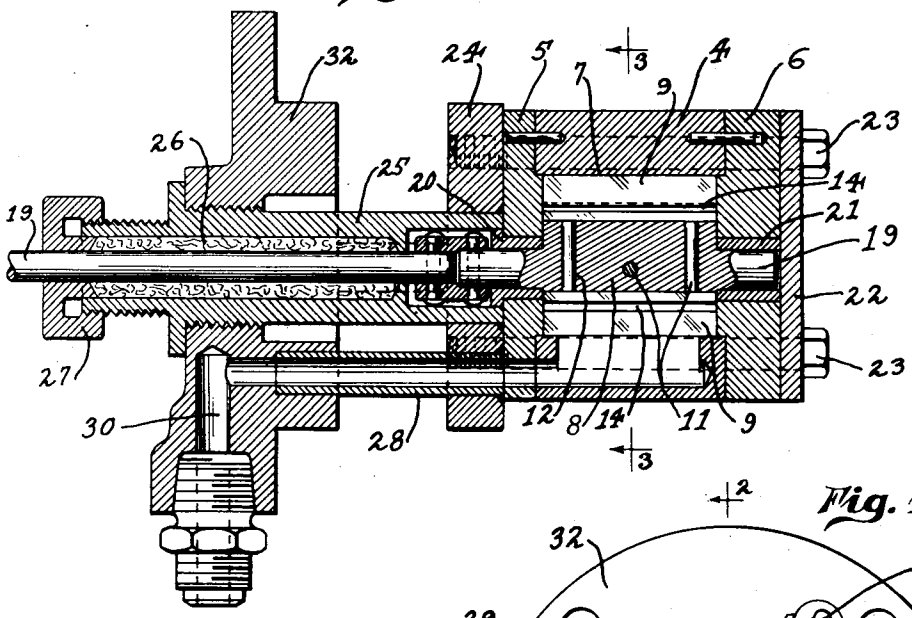


Fig. 1.

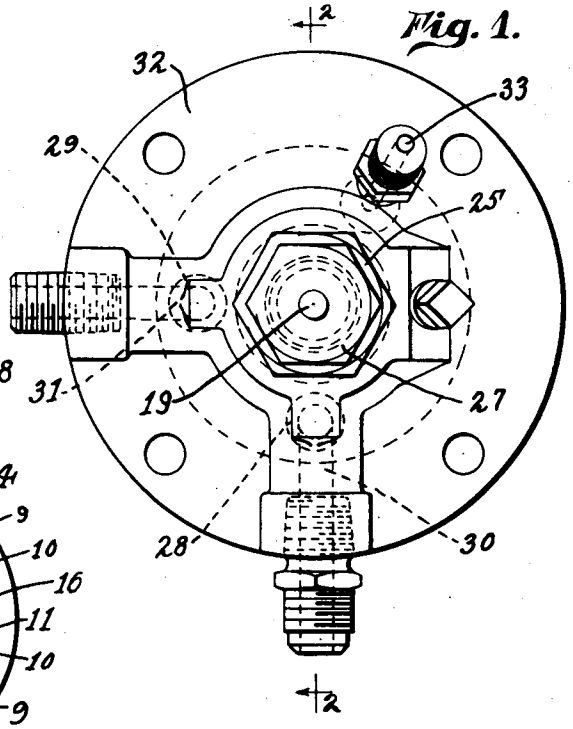


Fig. 4.

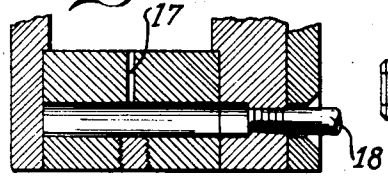
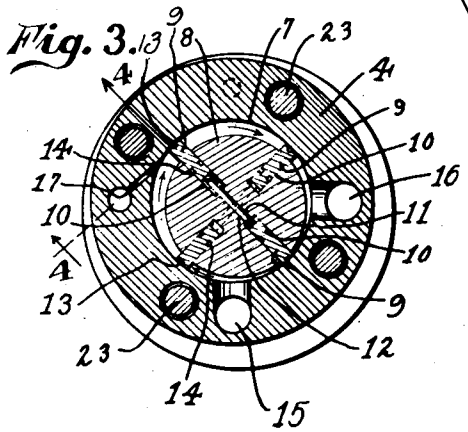


Fig. 3.



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UNITED STATES PATENT OFFICE.

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ROTARY PUMP OR COMPRESSOR.

Application filed March 31, 1926. Serial No. 98,713.

This invention relates to rotary pumps or compressors of that type in which a fluid is inducted into an impeller chamber and is acted on by a rotary impeller to either compress the fluid or, if the fluid is incompressible, to forcibly eject the fluid from the impeller chamber. The invention is especially useful in connection with refrigerating machines of the type disclosed, for example, in my copending application for patent filed March 5, 1925, Serial No. 13,086, but it is to be understood that the invention can be used to advantage wherever a rotary pump or compressor is required. The construction disclosed herein that corresponds to the construction disclosed in the above mentioned copending application is not claimed in said copending application, as this particular compressor may be used in other relations than there disclosed.

Rotary pumps and compressors are rather difficult to efficiently lubricate and this is notably true of compressors, especially when said compressors constitute portions of refrigerating machines and apparatus, and an object of this invention is to effect lubrication of the impeller independently of the induction and exhaust of the fluid that is being pumped or compressed. This enables the invention to be used to advantage in refrigerating apparatus where it is advisable to utilize the heat generated by compression to aid in the separation of the refrigerating medium from the lubricant and at the same time supply the lubricant at a sufficiently low temperature to the impeller so as to properly lubricate and seal the impeller, thus avoiding excessive wear and obtaining relatively high efficiency in the compressing operation.

Another object is to construct a pump or compressor of the rotary type that will be relatively inexpensive.

Another object is to make provision for positive actuation outwardly of an impeller vane by inward movement of another of the impeller vanes so as to insure that the impeller vane behind the liquid being pumped or compressed will, when extended, closely fit against the peripheral wall of the impeller chamber, thus avoiding leakage between the impeller vane and said wall.

Other objects and advantages will appear in the subjoined detailed description.

The accompanying drawings illustrate the invention:

Figure 1 is an end elevation of a rotary pump or compressor constructed in accordance with the provisions of this invention.

Figure 2 is a longitudinal section on the line indicated by 2—2, Fig. 1.

Figure 3 is a sectional elevation on the line indicated by 3—3, Fig. 2.

Figure 4 is an enlarged sectional detail on the line indicated by 4—4, Fig. 3.

There is provided a suitable impeller chamber formed, in this instance, by a cylinder 4 and heads 5, 6, said heads closing the ends of the bore 7 of the cylinder. Eccentrically mounted in the bore 7 is an impeller 8 provided with impeller vanes or abutments 9 which slide in radial slots 10 in the impeller body. The impeller body is of less diameter then the bore 7 and is eccentrically positioned in said bore so that it almost touches the cylinder at one side and is spaced a material distance away from the opposite side of the cylinder.

The vanes 9 will be in pairs and, in this particular instance, two pairs are provided. The vanes of each pair are diametrically opposed and are positively connected to each other by rods 11 which pass through openings 12 in the impeller body, the rods that connect the vanes of different pairs being staggered or offset, so as to pass one another. The distance from the outer end of one vane to the outer end of the other vane of the same pair is substantially equal to the diameter of the bore 7 so that the impellers will closely fit the bore.

Preferably, the outer edges of the impeller vanes 9 are provided with longitudinally extending grooves 13 in which lubricant collects and is held so as to seal the vanes against leakage of fluid from the pressure side of the vane to the opposite side. Also, the vanes 9 are preferably provided between their outer and inner edges with grooves 14 for lubricant, so as to seal the slots 10 against passage of fluid between the impellers and the walls of said slots.

The cylinder is provided with an intake port 15 and, in a position substantially 90° from the port 15, with an exhaust port 16. Both of the ports 15, 16 extend through the head 5.

Opening into the cylinder bore is a lubricant feed duct 17 having a portion preferably extending tangentially of the bore and another portion extending longitudinally of said bore. The duct 17 is adapted to communicate with any desired source of lubricant supply. The duct 17 is positioned approximately opposite to the intake port 15. The provision of this duct 17 is an important feature of the invention, as it enables cool lubricant to be discharged at approximately the point where such lubricant is required to properly lubricate and seal the vanes or blades 9. The duct 17 communicates with one end of a tube 18. The exhaust port 16 is between the intake port 15 and lubricant duct 17.

The impeller shaft is indicated at 19 and rotates in bearings 20, 21 in the respective heads 5, 6. The outer end of the bore of the bearing 21 is closed by a plate 22 and bolts 23 extend through the plate 22, head 6, cylinder 7, head 5 and are threaded into a flange 24 on a stuffing box 25, through which the shaft 19 projects, there being packing 26 in the stuffing box compressed by the gland 27.

In this particular instance, the ports 15, 16 communicate through tubes 28, 29, respectively, with ducts 30, 31 in a member or plate 32 into which the stuffing box 25 is threaded. The member 32 serves as a closure for the opening through which the pump or compressor is inserted in and withdrawn from the chamber, not shown, in which the pump or compressor is to operate. The other end of the tube 18 communicates with a duct 33 in the member 32.

The construction and operation of the invention will be evident from the above description, but a brief description of the operation follows: Assuming that the shaft 19 is being driven to rotate the impeller in the direction of the arrow in Fig. 3, and assuming also that the fluid to be operated on is being supplied to the duct 30 and that a lubricant is being supplied to the duct 33, the fluid, if compressible, will be inducted into the bore of the cylinder by reason of the production of a partial vacuum behind the impeller vanes and will be compressed as the vanes advance from the wider portion of the compression space to the narrower portion of said space, in a manner well understood in this art. As the vanes pass the duct 17, the grooves 13 will be filled with lubricant and, since the lubricant is under greater pressure than that in the cylinder bore portion adjacent to the duct 17, the lubricant will continuously discharge into the cylinder bore and become mixed with the fluid that is being compressed in said bore in a manner that is understood, for example, in the art relating to refrigerating machines, which machines are provided with a device for aiding in the separation of the refrigerating medium from the lubricant. It will be noted that the construction is such that the lubricant may be inducted into the cylinder from a source remote from said cylinder so that, when the invention is used as a part of a refrigerating apparatus, the lubricant, after separation from the refrigerating agent, can be suitably cooled and then returned to the cylinder and thus used over and over. When this compressor is enclosed in a chamber and is immersed in a body of lubricant, as is disclosed in the above mentioned patent application, the heat of the compressor will be absorbed by the lubricant body and said heat will aid in the separation of the refrigerating medium from the lubricant. A portion of the lubricant from the heated lubricant body will be taken a little at a time away from said lubricant body through a suitable tube, cooled in a radiator or other cooling apparatus, and then conveyed to the duct 33, whence it again passes through the tube 18 and duct 17 to the cylinder, as before. This circulation of the lubricant continues as long as the compressor is in operation.

I claim:

1. A rotary pump or compressor comprising a cylinder, an impeller mounted to rotate eccentrically in the cylinder and provided with slidably mounted vanes, means to hold the vanes outward in engagement with the cylinder wall, the cylinder having intake and exhaust ports communicating with the bore thereof, and the cylinder having a lubricant duct opening through the circumferential wall of the cylinder to the bore thereof, said duct being always isolated from both ports by said vanes, and means to turn the impeller.

2. A rotary pump or compressor comprising a cylinder, an impeller mounted to rotate eccentrically in the cylinder and provided with slidably mounted vanes, means to hold the vanes outward in engagement with the cylinder wall, the cylinder having intake and exhaust ports communicating with the bore thereof, and the cylinder having a lubricant duct opening through the circumferential wall of the cylinder and at all times isolated from said ports by said vanes, said lubricant duct having a portion extending tangentially of the bore and communicating therewith, and means to turn the impeller.

3. A rotary pump or compressor comprising a cylinder, an impeller mounted to rotate eccentrically in the cylinder and provided with a slidably mounted vane, means to hold the vane outward in engagement with the cylinder wall, the cylinder having intake and exhause ports communicating with the bore thereof, and the cylinder having a lubricant duct opening through the circumferen-

tial wall of the cylinder to the bore thereof, a plate, a stuffing box connected with the cylinder and screwed into the plate, a shaft connected with the impeller and extending through the stuffing box, packing in the stuffing box around the shaft, a gland for the stuffing box to compress the packing, the plate having ducts therein, and tubes connecting the ports and lubricant duct with the respective ducts in the plate.

4. A rotary pump or compressor comprising a cylinder having intake and exhaust ports and having a lubricant feed duct in the circumferential wall of the cylinder, and isolated from said ports, impeller vanes rotatably mounted in the cylinder and having grooves in their outer edges adapted to receive lubricant from said duct, and means to operate the vanes.

5. A compressor comprising a cylinder, a rotatable element withiin said cylinder, said element being smaller than said cylinder and journaled to contact against one side of the cylinder wall, vanes movable radially within said rotatable element and adapted to slidably engage the inner wall of the cylinder, an inlet port and an outlet port in said cylinder on opposite sides of the contact between the cylinder wall and the rotable element, an oil inlet port comprising a duct through the cylinder wall substantially opposite one of said ports whereby the inlet port is cut off by a vane prior to the injection of oil and the oil duct is cut off by a vane prior to the opening of the outlet port.

6. In a compressor of the sliding vane type in which variable chambers are formed between adjacent vanes, an oil duct extending through the casing at such a point that said duct communicates with said chambers after said chambers have moved out of communication with the inlet port of the compressor and before said chambers have moved into communication with the outlet port of said compressor, said duct extending tangentially with respect to the cylinder, whereby the oil acts to increase the efficiency of the compressor by serving as a circumferential seal, by acting as a lubricant, and by reducing the volume of the charge between the compressor vanes.

Signed at Los Angeles, California, this 25 day of March 1926.

JOSEPH W. CUTHBERT.