Nov. 10, 1925. 1,561,068

B. M. FINE

ROTARY FLUID PRESSURE APPARATUS

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Fig. 1.

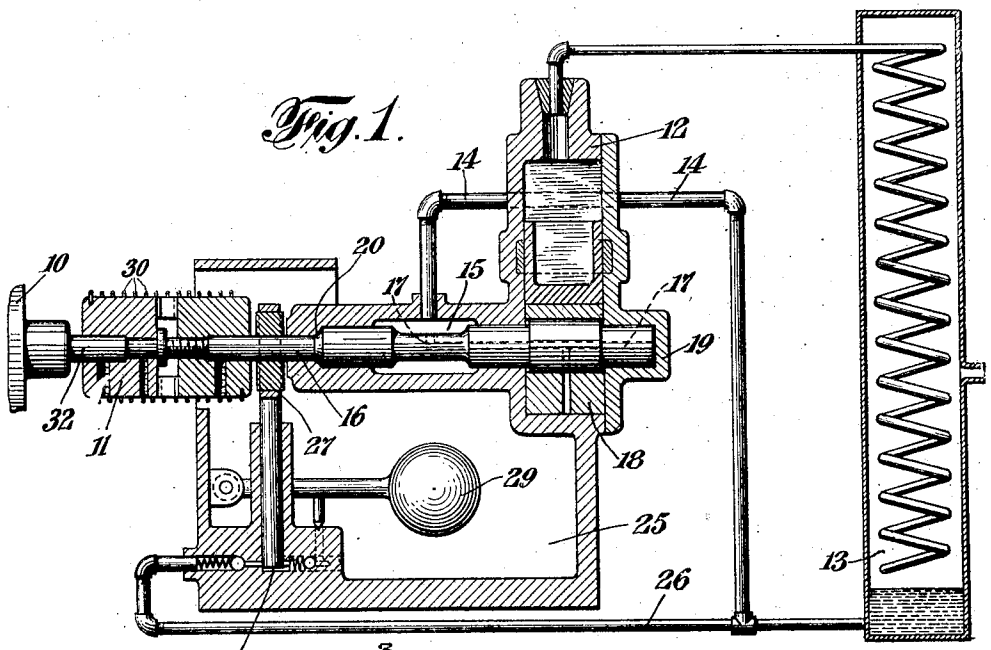


Fig. 2.

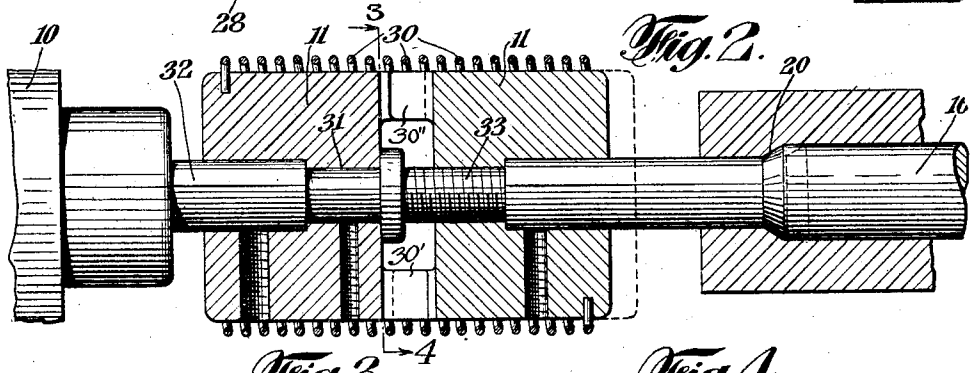


Fig. 3.

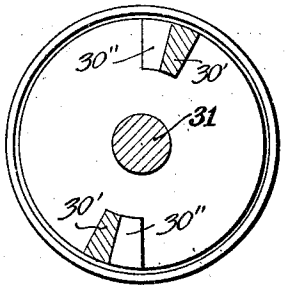
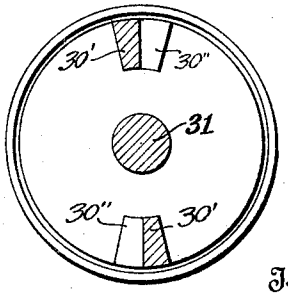


Fig. 4.



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Fig. 5.

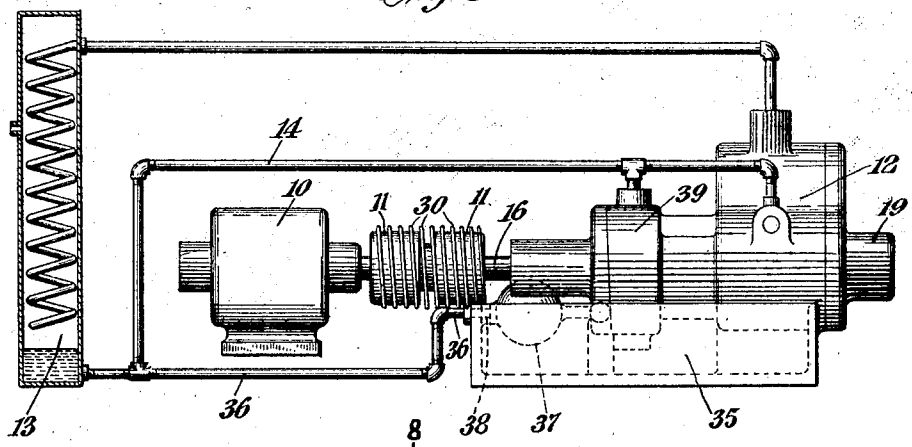


Fig. 6.

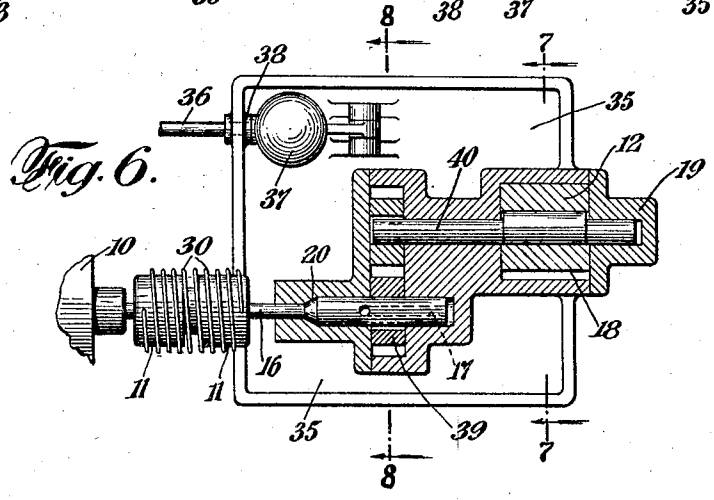


Fig. 7.

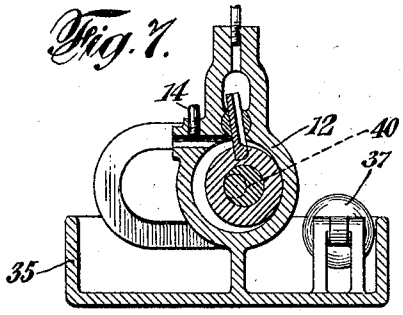
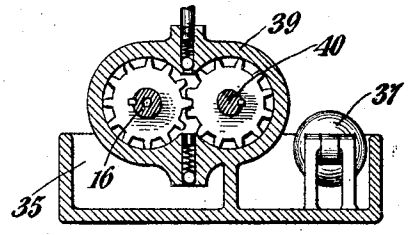


Fig. 8.



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UNITED STATES PATENT OFFICE.

BERNARD M. FINE, OF EAST ORANGE, NEW JERSEY.

ROTARY FLUID-PRESSURE APPARATUS.

Application filed March 18, 1920. Serial No. 367,026.

To all whom it may concern:

Be it known that I, BERNARD M. FINE, a citizen of the United States, and a resident of East Orange, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Rotary Fluid-Pressure Apparatus, of which the following is a specification.

The invention relates to rotary fluid pressure generating apparatus such as rotary compressors, engines and the like; and it has reference more particularly to means for sealing the rotatable power shaft thereof in manner to obviate the use of all fabric, metallic or similar packing in a stuffing box usually provided about the shaft.

The apparatus, moreover, is designed more particularly to prevent the escape, about the driving shaft, of the working medium as well as the entrance of any external fluid; and to provide at the same time suitable lubricant to the apparatus to serve, also, as a sealing medium.

The invention is herein described as applied to household refrigerating apparatus of the character set forth in my co-pending application, Serial No. 361,778, filed February 27th, 1920.

In the accompanying drawings—

Fig. 1 illustrates diagrammatically, and in part section, the general arrangement of a household type of refrigerating apparatus equipped with the improved means for sealing.

Fig. 2 is a detail longitudinal section of clutch mechanism employed.

Figs. 3 and 4 are transverse vertical sections taken on the lines 3—4, Fig. 2, and looking in the direction of the arrows—Fig. 3 showing the relative position of the clutch lugs when the apparatus is at rest, while Fig. 4 shows the relative position of said lugs when the apparatus is in motion.

Fig. 5 is a diagrammatic view illustrating a modification.

Fig. 6 is a fragmentary horizontal section thru the sealing and pump mechanism thereof.

Fig. 7 is a vertical section, taken on the line 7—7, Fig. 6, of one form of pump device which may be employed.

Fig. 8 is a vertical section, taken on the line 8—8, Fig. 6, of a combined lubricant pump and drive mechanism, employed in the system shown in Fig. 5.

Similar characters of reference designate corresponding parts thruout the several views.

Referring to the drawings, 10 designates a motor of any suitable type which, thru a clutch mechanism 11 hereinafter more fully described, operates to drive pumping mechanism 12 for circulating a suitable gas or liquid, for example for refrigerating purposes—all of which is more fully set forth in my aforesaid co-pending application.

The present invention has reference more particularly to means for preventing the escape of the working medium, by way of the driving shaft, from the pumping mechanism by which it is compressed and circulated, and to afford the necessary lubrication of said mechanism.

To this end, a suitable viscous fluid or lubricant is employed and so introduced to the pumping mechanism as to act as a packing as well as a means to enhance the degree of compression and operation of the parts. This lubricant or viscous fluid is collected, for example, in the lower part of a condensing or separator vessel 13, being therefore under the pressure existing therein; and by virtue of same, is forced thru the pipe 14 to an enlargement or chamber 15 of the bearing for the driving shaft 16. Reference being had more particularly to Fig. 1, of the drawings, it will be noted that the pipe 14, thru chamber 15, delivers the lubricant into an axial bore 17 extending in one direction thru the driving shaft and thence a portion to working chamber 18 of the pump 12, thus supplying sufficient of the sealing lubricant thereto to afford an ample supply for operation of the pump. Also, the lubricant delivered thru the far end of the bore will react against the end bearing wall 19 and exert a thrust tending to force the longitudinally slidable shaft 16 against a shoulder 20 of the bearing, the shaft being reduced at this end to conform to said shoulder. The fluid thus entering the chamber 15 will be substantially at the pressure existing in the separator, which pressure will obtain also in the working chamber 18

of the pump 12. The lubricant introduced would thus tend to diffuse toward the working chamber 18 in one direction and in the other direction along the driving shaft 16, past shoulder 20 of the bearings. In the first instance, it will be resisted by the elongated bearing for the shaft and by an equal and opposite pressure existing, the greater part of the time, within the working chamber of the apparatus. Any small amount which might thus enter the working chamber would be of no detriment but, on the contrary, would serve to enhance the compression. However, in the other direction, namely along the shaft 16, resistance to leakage also will be offered due to the elongated bearing and by the constricted opening formed between the shoulder and the reduced portion of the shaft. Fluid which escapes at this point is designed to be caught in a suitable reservoir 25 placed beneath the shaft and bearing; and, when a sufficient quantity thereof has collected, the same is returned thru pipe 26 to the separator vessel 13 under the action of a pump 27 operated from the shaft 16, communication between the pump chamber 28 and reservoir 25 being controlled by a float 29, as is well understood. The float controlled pump inlet is for the purpose of preventing the entrance of a foreign medium in the event sealing medium is not present in the tank. Or, the return of the fluid may be effected in any other suitable manner, for example, as hereinafter set forth.

So long as the arrangement is such that more fluid will be delivered to the chamber 15 thru the feed or supply pipe 14 than can escape about the shoulder 20, no loss of the working medium will result. It will be understood, however, in case high pressures are employed that the end thrust on the shaft 16 will be undesirably large and would therefore effect too great a frictional power loss at the shoulder 20. Therefore, means should be provided for affording suitable opening at this point during operation. It will be appreciated, also, that this opening should again be closed when the device is inoperative to prevent the escape of the refrigerating or working medium, as it is evident that the same will expand during a period of inactivity and force out all of the sealing fluid or lubricant.

To provide for the aforesaid action, the clutch 11 consisting of the two halves shown in Figs. 2, 3 and 4 are so arranged that one half will have an initial rotation prior to the other. This rotation, in turn, is designed to effect a longitudinal motion of the shaft 16 to slide its reduced end away from the shoulder 20 at the beginning of the pumping action and to reverse this motion and allow of the closing of the space between the reduced end of the shaft 16 and shoulder 20 when the apparatus is shut down and inoperative. To this end, a coil spring 30 is mounted about the two clutch halves and one end thereof secured to the one half and the other end thereof to the other half, said halves each being provided respectively with a pair of lugs 30′ and 30″ adapted for engagement with each other in the operation of the clutch to transmit the rotation of the motor to the shaft 16. Fig. 3 indicates the position of the clutch halves when at rest and Fig. 4 the position of the same during running of the apparatus. A shouldered screw 31, moreover, is fixedly secured in the end of the motor shaft 32 to which shaft the one motor clutch half is secured. The screw 31, furthermore, is provided with an extension 33 which threads into the other or pump shaft clutch half, the latter clutch half being fixedly secured to the shaft 16. In this manner, in commencing operations, Fig. 3, the lugs 30′ of the motor clutch half will be required to make a fractional rotation before picking up the corresponding lugs 30″ of the pump shaft half; and in so doing, the threaded extension 33 causes an advance in the clutch half of the pump shaft, moving thereby the latter and the said shaft itself axially the desired extent, indicated (greatly exaggerated) by the position shown in dotted lines Fig. 2. When the motor is shut down, owing to the fact that the torque required to rotate its shaft is considerably less than that required to rotate the pump shaft 16, the torsion of spring 30 effected by the initial relative rotation of the pump shaft clutch half will rotate the motor clutch half and screw 31 in a direction reverse to the normal operating rotation, thereby moving shaft 16 axially from the position indicated in dotted lines to return the said shaft to substantially seal the constriction between its reduced end portion and the said shoulder 20.

In applications where the working pressures are low, so that the friction power loss due to a metal to metal contact at shoulder 20 is of no consequence, and, at the same time, where the loss of the sealing medium by way of shoulder 20 is of no moment, the reservoir 25 and mechanism pertaining thereto may be omitted.

In Figs. 5, 6 and 8, a modified arrangement is shown, a sealing medium being injected from a free state, that is to say from a reservoir 35 which is in communication with the separator tank 13 thru a pipe 36, the supply to the reservoir being controlled by a float 37 operating to close a valve 38 when the proper level of liquid in the reservoir is obtained. When this occurs, the liquid is picked up by a gear pump 39 comprising two gear wheels meshing with each other, the one being driven by the shaft 16 and the other on a shaft 40 for operating the

pump 12. In this manner, the transmission device for operating the pump 12 serves also as a pump by which the liquid in reservoir 35 is forced against the pressure in the feed line 14; and as this pressure is equivalent to that in the working chamber 18 of the pump no escape of the working medium can take place. Shaft 16 operates, with reference to the shoulder 20 to prevent escape of lubricant and working medium about the said driving shaft, in manner similar to that already described in connection with the apparatus shown in Fig. 1.

I claim:

1. In rotary fluid pressure apparatus: sealing medium, a power shaft axially movable by said medium, a bearing cooperating with said shaft adapted to receive the sealing medium and sealing thereby the contained portion of the shaft, and means to supply said medium under pressure to said bearing.

2. In rotary fluid pressure apparatus: sealing medium, an axially movable power shaft provided with an axial duct for the sealing medium whereby the said medium may react against the apparatus and produce an end thrust on the shaft for moving same, a bearing cooperating with said shaft adapted to receive the sealing medium and against which bearing said shaft may shoulder to seal substantially the contained portion of the shaft, and means to supply said medium under pressure to said bearing.

3. In rotary fluid pressure apparatus: sealing medium, an axially movable power shaft, a bearing adapted to receive the sealing medium and against which said shaft may shoulder; and means to effect a relative axial movement between the shaft and its bearing during rotation and to return same to its original position during the period of rest.

4. In rotary fluid pressure apparatus: sealing medium, an axially movable power shaft, a bearing adapted to receive the sealing medium and against which said shaft may shoulder; a clutch composed of two halves, one half of which has an initial free rotation to effect a longitudinal movement of the other half.

5. In rotary fluid pressure apparatus: sealing medium, an axially movable power shaft, a bearing adapted to receive the sealing medium and against which said shaft may shoulder; a clutch composed of two halves, one being secured to the power shaft and receiving a threaded extension of the other half, and resilient means secured to the two halves to rotate one half a predetermined amount relatively to the other half.

6. In rotary fluid pressure apparatus: a power shaft, and means to introduce a sealing lubricant thereto; a reservoir to receive spent lubricant; and float controlled means controlling the return of the spent lubricant to said power shaft.

7. In rotary fluid pressure apparatus: sealing lubricant, a power shaft axially movable by said lubricant, a bearing cooperating with said shaft, adapted to receive the sealing lubricant and sealing thereby the contained portion of the shaft, a reservoir to receive spent lubricant, and a pump operated from the power shaft to return the spent lubricant from the reservoir to the said bearing.

8. In refrigerating apparatus employing an elastic fluid as the refrigerant; rotary pumping means to compress said fluid and including an axially movable driving shaft therefor, sealing lubricant, and a bearing cooperating with said shaft adapted to receive the sealing lubricant and against which bearing said shaft may shoulder to seal substantially the contained portion of the shaft, and means to supply said lubricant under pressure to the said bearing.

9. In refrigerating apparatus employing an elastic fluid as the refrigerant; rotary pumping means to compress said fluid and including an axially movable driving shaft therefor, sealing lubricant, a bearing cooperating with said shaft adapted to receive the sealing lubricant and against which bearing said shaft may shoulder to seal substantially the contained portion of the shaft, means to supply said lubricant to the said bearing, a reservoir to receive spent lubricant, and means for controlling the return of the spent lubricant to said bearing.

10. In refrigerating apparatus employing an elastic fluid as the refrigerant; rotary pumping means to compress said fluid and including an axially movable driving shaft, sealing lubricant and means to supply the same to the driving shaft, a reservoir to receive spent lubricant, means for controlling the level of lubricant within the reservoir, and means for controlling the return of the spent lubricant to the said power shaft.

11. In refrigerating apparatus employing an elastic fluid as the refrigerent, rotary pumping means to compress said fluid, including an axially movable driving shaft therefor, a bearing therefor adapted to receive sealing lubricant and against which said shaft may shoulder, means to supply sealing lubricant to the driving shaft, a reservoir to receive spent lubricant, means for controlling the return of the spent lubricant to said power shaft, and means to effect a relative axial movement between the shaft and its bearing during rotation and to return same to its original position during the period of rest.

Signed at New York in the county of New York and State of New York this 16th day of March A. D. 1920.

BERNARD M. FINE.