Jan. 20, 1931. W. G. E. ROLAFF 1,789,842

PUMP OR COMPRESSOR

Filed June 1, 1925

Fig. 1.

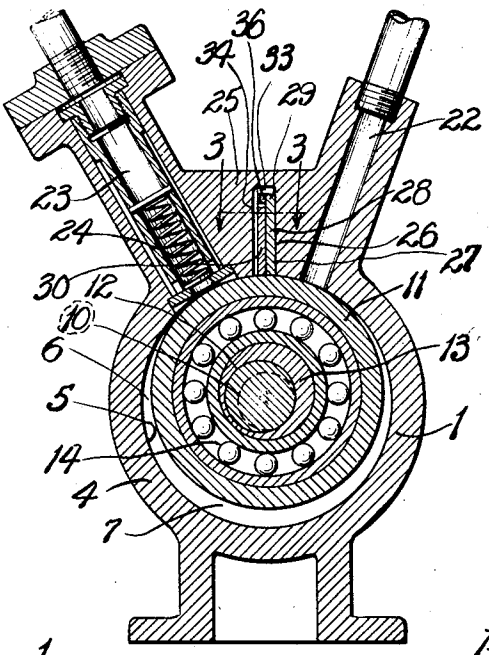


Fig. 2.

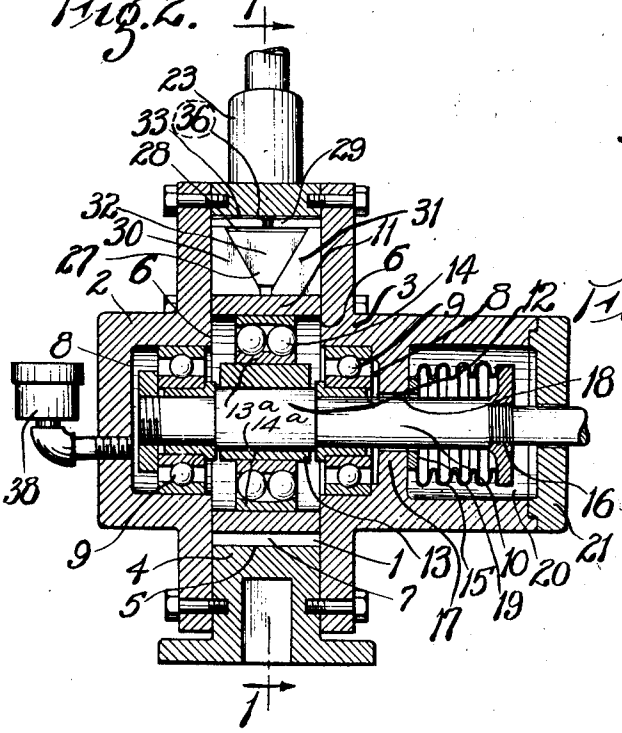


Fig. 3.

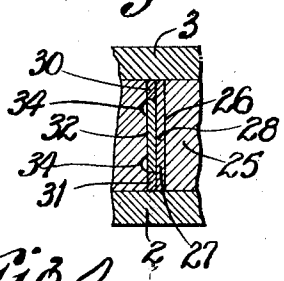
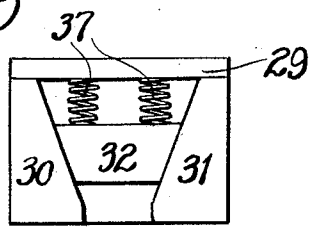


Fig. 4.



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UNITED STATES PATENT OFFICE

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PUMP OR COMPRESSOR

Application filed June 1, 1925. Serial No. 33,951.

This invention relates to improvements in compressors designed more particularly for use in the art of mechanical refrigeration, but, in principle, equally applicable for use in the general art of displacing liquids and gases, including pumping.

The invention is chiefly concerned with improvements in that type of compressor using double or complementary eccentrics, actuated from a main drive shaft and operating automatically to effect and maintain sealing contact of the rotor with the wall of the cylinder in its movement over the same.

A characteristic feature of the invention resides in the employment of a single self-aligning bearing located within the rotor and co-operating with double eccentrics to secure and maintain correct alignment as between the surfaces of the rotor and the cylinder, both as respects parallelism and plane.

A further characteristic feature of the invention resides in the employment of a blade located in a slot in the wall of the cylinder, and co-operating with the surface of the rotor to effect sealing contact therewith, so as to provide, successively, a compression and exhaust area within the cylinder as the rotor gyrates within the same, together with the use of an elastic medium for forcing the blade into sealing contact with the surface of the rotor.

Preferably, the blade I employ is in the form of a multiple self-packing blade, such as shown and described in my Patent No. 1,280,306, dated October 1st, 1918.

The simplest form of my invention is that in which the same is embodied in a construction designed to act as a pump. Such embodiment is shown in the accompanying drawing, in which—

Figure 1 is a longitudinal sectional view through a pump constructed according to my invention, and taken on the line 1—1 of Figure 2;

Figure 2 is a cross-sectional view of the pump;

Figure 3 is a broken sectional view taken on the line 3—3 of Figure 1 showing the ports affording communication between the cylinder chamber and a chamber at the rear of the blade; and Figure 4 is a view in front elevation of a modified blade construction showing the use of springs for actuating the central wedge-plate of the blade.

Referring now to the drawings, the numeral 1 indicates a cylinder, which comprises end sections 2, 3, bolted to a central annular section 4, the inner surface 5 of which constitutes the working surface of the cylinder. The end walls of the cylinder are provided by flat faces 6 on the inner sides of the members 2 and 3, which faces project inwardly beyond the surface 5 of the cylinder to provide a working chamber 7. Each of the members 2, 3, is recessed, as indicated at 8, to provide a space for an anti-friction bearing 9, in which bearings is mounted the drive shaft 10. Located within the chamber 7 is an annular roller or rotor 11, which is mounted on the shaft 10 in such manner as to provide for automatically producing and maintaining a sealing contact with the wall 5 of the cylinder, and also to be self-aligning therewith.

To this end, I provide on the shaft 10, an eccentric 12, which is circular in cross-section, and mount on this eccentric an eccentric sleeve 13. That is to say, the sleeve 13 has an eccentric bore which fits on the eccentric 12 so as to be capable of rotating thereon, the construction providing a double eccentric, which functions automatically as a take-up for the space between the rotor and the cylinder.

Mounted on the eccentric sleeve 13 to extend between the same and the inner wall of rotor 11 is a single self-aligning bearing, which supports the rotor. This bearing, in combination with the eccentric sleeve 13, allows universal alignment of the rotor to the cylinder wall, both as to parallelism and plane. In principle, this bearing is the same as that described and claimed in my prior Patent No. 1,441,375, dated January 9th, 1923, or in my prior Patent No. 1,632,562, dated June 14th, 1927. It comprises an annular race-way 13*a* surrounding the eccentric sleeve 13 and grooved on its periphery to provide race-ways for the balls 14. Surrounding these balls is an annular bearing

member 14*a*, the periphery of which is flat and in engagement with the inner surface of the rotor 11, and the inner surface of which is transversely machined to the shape of a correct segment of a sphere, this surface being in engagement with the outer surfaces of balls 14. This arrangement allows the rotor to adjust itself parallel to the cylinder walls in any direction, because it is essentially, in principle, a universal joint or bearing. The stuffing box for the end of the shaft which projects through the wall of the cylinder is in the form of a metal bellows 15, one end of which is screwed on the shaft 10, as indicated at 16, and the other end of which bears against an inner wall 17, constituting the outer wall of the bearing recess 8, which wall is provided with a shaft opening 18 of larger diameter than the shaft, through which the medium being pumped can pass into the bellows 15, which will, accordingly, expand and force its other end, which is in the form of a packing ring, 19 firmly against the outer side of the wall 17 to make sealing contact therewith and prevent the escape of the medium being pumped. The bellows is located in a chamber 20 cast in the cylinder member 3, which chamber is closed by a plate 21, apertured to permit the driving end of the shaft to pass through it.

Referring to Figure 1, the numeral 22 indicates an inlet or suction port, through which the material to be pumped may pass or be sucked in, in the operation of the pump, and the numeral 23, an outlet from the cylinder, which is provided with any suitable form of check valve 24. The ports 22 and 23 are provided in castings formed integral with the cylinder, and intermediate these ports, a casting 25 is provided in which is located a slot 26, which is of the length of the cylinder chamber 7, and in this slot is located a blade 27 which, as stated, is preferably of the self-packing type of my prior patent. This blade may be briefly described as comprising a back-plate 28 having at its outer end a shoulder 29, extending throughout the length, and of the width of the slot, on which back-plate are mounted two tapered packing plates 30 and 31, and in the wedge-shaped space between these packing plates, a freely-movable wedge-plate 32. This blade may be held in sealing contact with the surface of the rotor 11 by any suitable elastic means, such as a spring or fluid, but I prefer the latter. To this end, the outer end of the slot 26 terminates in a small chamber 33, with which communicates ports 34 drilled in the wall of the blade-slot 26 and leading from the cylinder chamber 7. These ports are located just beyond the outlet 23, or at substantially the point of greatest compression within the chamber 7. According to this construction, when the pump is placed in operation, the medium being pumped passes through the ports 34 into the chamber 33 and forces the inner edge of the blade 27 into sealing contact with the surface of the rotor and, of course, maintains such contact.

In order to facilitate the direct pressure of the fluid upon the central wedge-plate 32, an opening 36 may be provided in the shoulder 29 to permit access of the fluid to the wedge-plate, which, accordingly, operates to force the packing plates 30 and 31 into engagement with the end walls of the cylinder to form sealing contact therewith, which contact is automatically maintained during the operation of the pump.

Referring now to the action of the double eccentric, comprising the shaft eccentric 12 and the eccentric sleeve 13 mounted on the same, when the shaft 10 is rotated, the eccentric 12 immediately acts upon the eccentric sleeve 13, which, in turn, acts upon the bearing 14, and the latter, the outer member of which is in the form of an annulus, acts upon the inner surface of the rotor, forcing it outward into engagement with the wall 5 of the cylinder. It may require a few revolutions of the shaft before the rotor is thus adjusted, and, of course, the faster the shaft rotates, the quicker the eccentrics will be moved to the position in which the rotor is forced into sealing contact with the wall of the cylinder.

It will be at once recognized that the action of the double eccentrics not only enables me to secure a gyroscopic movement of the rotor within the cylinder and in contact with the wall thereof, which, in itself, is not new; but that I am enabled also to maintain a constant automatic adjustment of the rotor to compensate for wear; and at the same time, by reason of the self-aligning bearing located within the rotor, I likewise secure and maintain an automatic alignment of the surface of the rotor with the inner surface of the cylinder, so that the contact is uniform and constant throughout the length of said surfaces. Furthermore, the contact pressure of the rotor with the wall of the cylinder is in direct proportion to the resistance offered to the movement of the rotor by the degree of pressure within the chamber 7, due to the resistance offered by the substance being pumped. In operating under great resistance, as in pumping a liquid to a considerable height, without the self-compensating feature of my invention, such resistance could be offered that the medium being pumped would be forced between the rotor and the wall of the cylinder, and thus lower the efficiency of the pump. In the arrangement described, however, this becomes impossible, as, with increased resistance to the movement of the rotor, the latter automatically is forced into firmer contact with the wall of the cylinder by the action

of the eccentrics. In operation, therefore, there can never be less than sufficient pressure to provide a sealing contact of the surface of the rotor with the wall of the cylinder.

By by-passing a portion of the fluid being pumped to the chamber 33 at the upper side of the blade 27, the lower or working edge of the latter is yieldingly held in sealing contact with the surface of the rotor. That is to say, the pressure on the blade is directly responsive to the pressure within the working chamber, changing from maximum to minimum in synchronism with the varying pressure within the working chamber of the cylinder.

In Figure 4, I have shown the use of springs 37 interposed between the shoulder 29 and the top of the wedge-plate 32, which operate to force the latter inward and the wedge-plates 30 and 31 laterally into engagement with the end walls of the cylinder. In this construction, the wedge-plate 32 is slightly shortened to provide space for the springs.

Any desired manner of lubricating the interior of the pump may be employed, and I have shown at 38 oil cups located on the cylinder at a plurality of points and communicating with the interior thereof to supply oil to the working parts. If oil were being pumped, of course, the lubrication would be effected automatically. In certain applications, oil could be simply supplied to the interior of the pump from time to time and the surplus be expelled in the pumping operation.

I wish it understood that while my invention primarily contemplates a rotor having a gyroscopic movement within a stationary cylinder, I do not, as to certain features of the invention, wish to be limited to the use of a stationary cylinder, or to a rotor which gyrates.

It should be further stated that in referring to the self-aligning bearing as producing an alignment between the rotor and cylinder, this contemplates not only an alignment as between the surface of the rotor and the wall of the cylinder, but also an exact alignment of the ends of the rotor with the ends of the cylinder.

While I have described my invention in its embodiment in a gyratory compressor or pump, I wish it understood that my improved device is equally applicable for use as a prime mover, in which application compressed air or any other medium under pressure could be supplied through the suction side of the device, or, by removing the valve, such pressure medium could be supplied through the exhaust port of the machine. Such adaptations and changes are well known to those skilled in the art, and are mentioned here to illustrate that the invention, in its broadest aspect, is capable of the uses or applications stated.

I claim:

1. In a machine of the class described, in combination with a cylinder, a rotor mounted for gyroscopic movement within the cylinder and in rolling engagement with the wall thereof, and means for aligning the rotor with the cylinder independently of the shaft.

2. In a machine of the class described, in combination with a stationary cylinder, a rotor mounted for gyroscopic movement within the cylinder, means for imparting movement to said rotor to cause it to functionally co-operate with the wall of said cylinder, and means for aligning the rotor with the cylinder independently of the shaft.

3. In a machine of the class described, in combination with a cylinder, a rotor mounted for gyroscopic movement within the cylinder and in rolling engagement with the wall thereof, and means located within the rotor for aligning the rotor with the cylinder independently of the shaft.

4. In a machine of the class described, in combination with a cylinder, a rotor mounted for gyroscopic movement within the cylinder and in rolling engagement with the wall thereof, and means for automatically aligning the rotor with the cylinder independently of the shaft.

5. In a machine of the class described, in combination with a cylinder, a rotor mounted for gyroscopic movement within the cylinder and in rolling engagement with the wall thereof, and means located within the rotor for automatically aligning the rotor with the cylinder independently of the shaft.

6. In a machine of the class described, in combination with a cylinder, a drive shaft mounted in the cylinder, a rotor mounted in the cylinder, means on said shaft for imparting a gyroscopic movement to the rotor, and self-aligning means interposed between said shaft and rotor for aligning the latter with the cylinder independently of the shaft.

7. In a machine of the class described, in combination with a cylinder, a drive shaft mounted therein having an eccentric, an eccentric sleeve rotatably mounted on said eccentric, a hollow rotor mounted in said cylinder, and a self-aligning bearing interposed between the inner wall of said rotor and said eccentric sleeve.

8. In a machine of the class described, in combination with a stationary cylinder, a rotor mounted for gyratory movement within the cylinder, a blade slidably mounted in a slot in the wall of the cylinder and co-operating with the surface of said rotor, said blade comprising two packing plates and an interposed wedge-plate, a chamber opening from said slot at the outer end of the blade, and a conduit affording communication between

said chamber and the working chamber of the cylinder, whereby said chamber will receive, under pressure, the medium being acted on within the cylinder, said blade will be maintained in contact with the surface of the rotor and said wedge-plate will operate, under the pressure of said medium, to force the packing plates into engagement with the end walls of the cylinder.

9. In a machine of the class described, in combination with a stationary cylinder, a rotor mounted for gyratory movement within the cylinder, a blade slidably mounted in a slot in the wall of the cylinder and co-operating with the surface of said rotor, said blade comprising two packing plates and an interposed wedge-plate, and means for yieldingly forcing the inner edge of the blade into contact with the surface of the rotor and the wedge-plate inward between the packing plates to force the latter into sealing contact with the end walls of the cylinder.

10. In a machine of the class described, in combination with a stationary cylinder, a rotor mounted for gyratory movement within the cylinder, a blade slidably mounted in a slot in the wall of the cylinder and co-operating with the surface of said rotor, said blade comprising two packing plates and an interposed wedge-plate, and means for forcing the inner edge of the blade into sealing contact with the rotor and for simultaneously moving the wedge-plate inward to force the packing plates into sealing contact with the end walls of the cylinder.

In testimony whereof, I have hereunto set my hand.

WALTER G. E. ROLAFF.