May 11 , 1926. 1,584,207

F. C. BELL

ROTARY COMPRESSOR

Original Filed Feb. 5, 1924

Fig. 1.

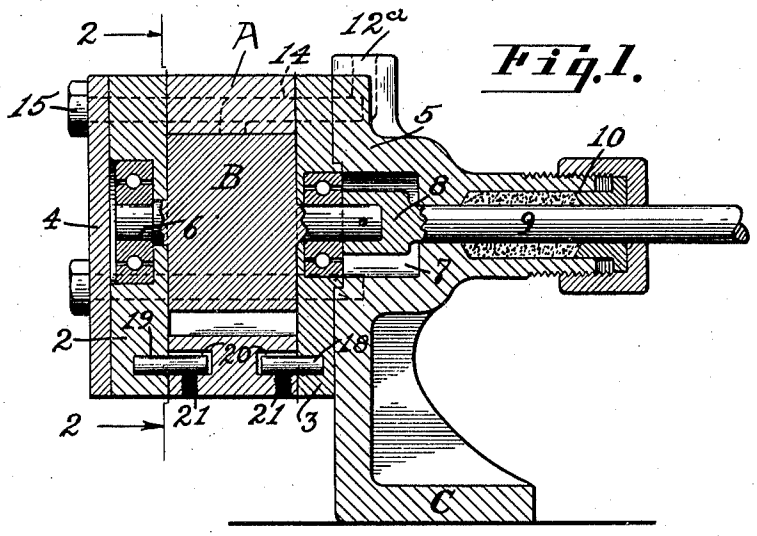


Fig. 2.

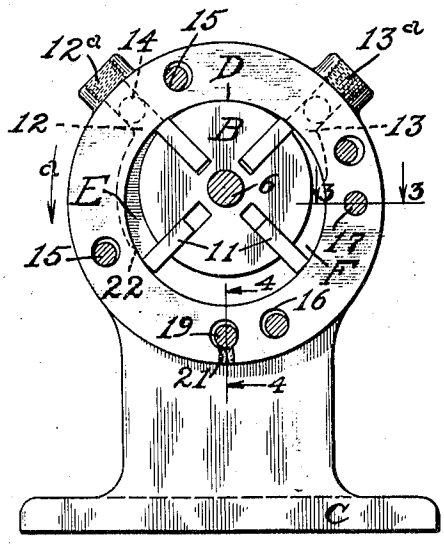


Fig. 3.

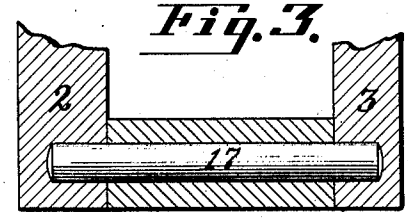
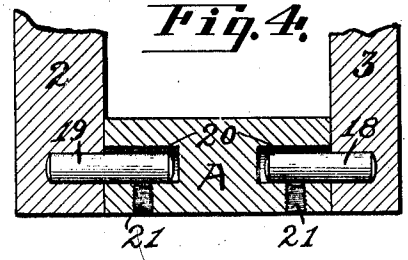


Fig. 4.



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ROTARY COMPRESSOR.

Application filed February 5, 1924, Serial No. 690,790. Renewed October 12, 1925.

This invention relates to a rotary compressor or pump of the vane or blade type in which the rotor is eccentrically positioned in the cylinder, and especially to a structure which permits taking up of wear between the rotor and the cylinder.

In rotary compressors of the type referred to where the rotor is eccentrically positioned in the cylinder, division of the cylinder is obtained by the rotor and the vanes carried thereby as both the rotor and the vanes are maintained in contact with the cylinder. This division permits the formation of a suction and a discharge or pressure chamber on opposite sides of the rotor, each of which is provided with inlet and discharge ports respectively. Leakage between the two chambers is easily prevented around the vanes or blades as the small amount of wear that takes place is automatically taken up, but to prevent leakage between the rotor and the cylinder where they contact is rather difficult as the distance between the chambers is the least at this point, the pressure and vacuum the highest, and wear the greatest. Leakage between the rotor and the cylinder is of no consequence when the pump or compressor is new and a running fit or clearance of about 1/1000 of an inch is maintained, this small clearance being packed or filled with oil during the operation of the pump. The rotor, however, turns at a high speed in many instances and the continuous friction exerted produces considerable wear. The clearance between the rotor and the cylinder therefore rapidly increases and as such forms a by-pass between the compession and the suction chamber which materially reduces the efficiency of the compressor

The object of the present invention is to generally improve and simplify the construction and operation of pumps or compressors of the character described, and especially to provide a structure which permits adjustment of the cylinder with relation to the rotor so that wear between them may be taken up and a constant clearance maintained.

One form which my invention may assume is exemplified in the following description and illustrated in the accompanying drawings, in which—

Fig. 1 is a central, vertical, longitudinal section of the compressor.

Fig. 2 is an enlarged cross-section taken on line 2—2, Fig. 1.

Fig. 3 is a longitudinal section taken on ine 3—3, Fig. 2, said section also showing the position of the outer and inner cylinder heads.

Fig. 4 is a similar longitudinal section taken on line 4—4, Fig. 2.

Referring to the drawings in detail, A indicates the cylinder of the compressor, B the rotor, 2 and 3 outer and inner cylinder heads, 4 a cover plate and 5 a supporting disk which is provided with a foot extension or base section C whereby the compressing unit as a whole is supported. The rotor B is secured to a shaft 6 which is journalled in antifriction bearings mounted in the cylinder heads 2 and 3. The shaft 6 extends into a chamber 7 formed in the plate 5 and it is here coupled as indicated at 8 to a driving shaft 9 which extends through a standard form of stuffing box 10 forming a part or an extension of the plate 5. The rotor B, together with the shaft 6 and the bearings supporting the same, is eccentrically positioned with relation to the cylinder as shown in Fig. 2 and a running contact, with a clearance of 1/1000 of an inch or thereabouts, is maintained between the cylinder and the rotor at the point indicated at D. The rotor is otherwise slotted longitudinally to receive vanes or blades 11. Any suitable number may be employed although four are here illustrated. These blades are loosely mounted in the slots and as such are projected outwardly by centrifugal action when the compressor is in operation and contact between the ends of the blades and the inner surface of the cylinder is thus maintained, and any wear that takes place at this point is automatically taken up.

The cylinder is provided with an inlet port 12 and a discharge port 13. These are placed on opposite sides of the rotor, and as the cylinder proper is adjustable with relation to the rotor and the heads 2 and 3 to take up wear between the cylinder and

the rotor at the point D, lateral ports are provided as indicated at 14 which communicate with the ports 12 and 13. The lateral ports extend through the inner head 3 and they communicate with main ports 12^a and 13^a formed in the disk 5. By this arrangement it is possible to provide permanent pipe connections, as far as the ports 12^a and 13^a are concerned, thereby avoiding the necessity of disconnecting the pipes or disturbing the same when adjusting the cylinder as will hereinafter be described.

Securing bolts 15 are provided for the purpose of securing the cover plate 4, the heads 2 and 3 and the cylinder A to the supporting plate 5. The holes drilled through the respective members to receive the bolts are larger in diameter than the bolts, as indicated at 16 in Fig. 2, and movement of the cylinder with relation to the bolts and the heads 2 and 3 may therefore take place when adjustment is required.

Axial alignment of the cylinder and the roter is essential to maintain and such align ment is obtained by employing a dowel pin 17. This pin is secured in the inner head 3, as shown in Fig. 3, and it snugly fits the drilled holes formed in the cylinder and in the outer head and it thus forms a pivot about which the cylinder and the outer head may be swung. The respective head members are also provided with a second set of dowel pins, as shown in Fig. 4. One dowel pin 18 is secured in the inner head 3, but its outer end extends into the cylinder A; that is, into a hole which is drilled to form a larger diameter so that movement of the cylinder may take place with relation to the dowel pin 18. The outer head 2 is similarly provided with a dowel pin 19 which extends into a drilled hole of larger diameter, such as indicated at 20. The cylinder is also provided with two set screws 21 mounted in alignment with the respective pins 18 and 19, and by adjusting these screws it is possible to raise or lower the cylinder with relation to the heads 2 and 3 and the pins 18 and 19.

In actual operation we will assume that the machine here shown is employed as an air compressor, and that air is admitted through the ports 12 and 12^a. The air follows around with the vanes 11 as one side of the compressor forms a suction chamber such as indicated at E, while the other side forms a compression chamber such as indicated at F. Suction takes place until the vanes reach the point indicated at 22, compression then commences and increases until the air is swept out through the ports 13 and 13^a. The compression pressure is therefore greatest adjacent the port 13, and the vacuum is similarly the greatest at the point adjacent the port 12. The distance between the ports 12 and 13 is fairly small and by-passing of air under pressure from the port 13 to the port 12 can only be prevented by maintaining a snug running fit between the cylinder and the rotor at the point indicated at D. A running fit of approximately 1/1000 of an inch or thereabouts is usually maintained and a compressor of this character is fairly efficient when this is the case, but as the speed of the rotor is fairly high in many instances, it is obvious that the wear is considerable and that the running clearance is gradually increased to a point where the air under pressure will gradually by-pass and enter the upper part of the suction chamber. The efficiency of the compressor naturally decreases in proportion to the amount of air by-passed and it is this feature that is avoided by the structure shown in this application. The moment that a noticeable decrease in pressure or capacity is noted, it will only be necessary for the operator to re-adjust the clearance between the cylinder and the rotor. This is accomplished by loosening the four securing bolts indicated at 15, and then swinging the cylinder in the direction of arrow *a* about the fixed dowel pin 17 until physical contact is obtained between the cylinder and the upper surface of the rotor. The set screws 21 may then be tightened to insure physical contact between the cylinder and the rotor, and they are then slacked off, for instance one-eighth of a turn, so as to produce a clearance between the end of the set screws and the pins 18 and 19 which equals 1/1000 of an inch or thereabouts. The bolts 15 are then slightly tightened and the lower side of the cylinder is tapped with a hammer or other tool until the set screws are brought back into engagement with the pins 18 and 19. This causes a reverse swinging movement of the cylinder about the fixed dowel pin 17 and as the movement is limited by the clearance between the set screws and the pins 18 and 19, a fixed and predetermined clearance will be obtained between the top of the rotor and the cylinder, this clearance as previously stated being approximately 1/1000 of an inch. The bolts 15 may now be securely tightened as the running fit desired has been obtained and the compressor may again be placed in operation.

From the foregoing it can be seen that wear between the rotor and the cylinder may be taken up from time to time and that a fixed or predetermined clearance may be obtained by the adjusting screws 21. It will further be noted that any adjustment of the cylinder will not affect the pipe connections with the compressor as these are connected to the ports 12^a and 13^a and as such are not disturbed. The area of the lateral ports 14 which connects the ports 12, 12^a, 13 and 13^a is liberal so that any slight move-

ment of the cylinder will not reduce the effective area required. The movement of the cylinder is, of course, under usual conditons, measured by 1, 2 or 3/1000 of an inch and even though the area of the ports 14 is exactly equal to the ports 12, 12ª, 13 and 13ª no noticeable difference would be found, nor would the capacity or efficiency of the compressor be in any way affected.

While certain features of the present invention are more or less specifically illustrated, I wish it understood that various changes in form and proportion may be resorted to within the scope of the appended claims. I similarly wish it understood that the materials and finish of the several parts employed may be such as the experience and judgment of the manufacturer may dictate or various uses may demand.

Having thus described my invention, what I claim and desire to secure by Letters Patent is—

1. In a pump or compressor of the character described, a cylinder, a rotor eccentrically positioned therein, and means permitting adjustment of the cylinder with relation to the rotor to maintain a constant or running clearance between the rotor and the cylinder at the point of least eccentricity.

2. In a pump or compressor of the character described, a cylinder, a pair of head members therefor, a rotor in the cylinder and eccentrically positioned with relation thereto, said rotor being maintained in substantial contact with one side of the cylinder, and means for adjusting the cylinder with relation to the rotor to maintain a predetermined clearance between the substantially contacting points of the cylinder and the rotor.

3. A pump or compressor of the character described, comprising a cylinder, a fixed support forming a closure for one end of the cylinder, a head member forming a closure for the other end of the cylinder, a shaft journalled in the fixed support and the head member, a rotor secured on the shaft within the cylinder, said rotor and shaft being eccentrically positioned with relation to the cylinder and one side of the rotor being maintained in running contact with the cylinder, and means for adjusting the position of the cylinder with relation to the fixed support and the rotor to take up wear, and to maintain a constant running fit between the rotor and the cylinder.

4. A pump or compressor of the character described, comprising a cylinder, a fixed support forming a closure for one end of the cylinder, a head member forming a closure for the other end of the cylinder, a shaft journalled in the fixed support and the head member, a rotor secured on the shaft within the cylinder, said rotor and shaft being eccentrically positioned with relation to the cylinder and one side of the rotor being maintained in running contact with the cylinder, a dowel pin secured to the fixed support and forming a pivot for the cylinder, means permitting movement of the cylinder about the dowel pin to take up wear and to maintain a constant running fit between the cylinder and the rotor, and means for securing the cylinder against movement about the dowel pin.

5. In a pump or compressor of the character described, a cylinder, a pair of relatively fixed heads, one at each end thereof, a shaft journalled in the heads and extending through the cylinder, a rotor secured on said shaft, said rotor and shaft being eccentrically positioned with relation to the cylinder, and said rotor being maintained in running contact with one face of the cylinder, a dowel pin extending through the peripheral edge of the cylinder and secured in the respective head members, said dowel pin forming a pivot about which the cylinder may swing to and away from the rotor, a pair of dowel pins fixed in each head member, said dowel pins entering holes formed in the respective ends of the cylinder and said holes being of larger diameter than the dowel pins, and a pair of adjusting screws carried by the cylinder, one engageable with each of said last named dowel pins.

6. In a pump or compressor of the character described a cylinder, a pair of relatively fixed heads one at each end thereof, a shaft journalled in the heads and extending through the cylinder, a rotor secured on said shaft, said rotor and shaft being eccentrically positioned with relation to the cylinder and said rotor being maintained in running contact with one face of the cylinder, means for radially adjusting the cylinder with relation to the heads and the rotor, and means for securing the cylinder between the heads when adjusted.

7. A pump or compressor of the character described comprising a stationary support, a head member thereon, a second head member carried by the stationary support and interspaced with relation to the first named head member, a cylinder disposed between the head members, a shaft journalled in the head members and extending through the cylinder, a rotor within the cylinder and secured on the shaft, said cylinder being eccentrically positioned with relation to the rotor and radially adjustable with relation to the rotor, its shaft and the heads, and means permitting longitudinal adjustment of the head members to clamp the cylinder between the same

8. A pump or compressor of the character described comprising a stationary support, a head member thereon, a plurality of bolts secured in the stationary member, a second head member supported by the bolts

and longitudinally adjustable thereon, a cylinder disposed between the head members, a shaft journalled in the heads and extending through the cylinder, a rotor secured on the shaft within the cylinder, said cylinder having openings formed therein through which the bolts extend and sufficinetly large to permit radial adjustment of the cylinder with relation to the rotor, and means for securing the cylinder when adjusted.

9. In a rotary compressor, a fixed support and bearing, a driving shaft journalled therein, a cylinder, a rotor eccentrically positioned in the cylinder and connected to the driving shaft, and means for radially adjusting the position of the cylinder with relation to the rotor and driving shaft.

10. In a rotary compressor, a fixed support and bearing, a driving shaft journalled therein, a cylinder, a rotor eccentrically positioned in the cylinder and having a rigid driving connection with the shaft, and means for securing the cylinder to the support, said means permitting radial adjustment of the cylinder with relation to the rotor and shaft.

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