J. JOYNT AND P. L. BOWSER.

ROTARY COMPRESSOR OR ROTARY ENGINE.

APPLICATION FILED FEB. 12, 1920.

1,419,930.

Patented June 20, 1922.

2 SHEETS—SHEET 1.

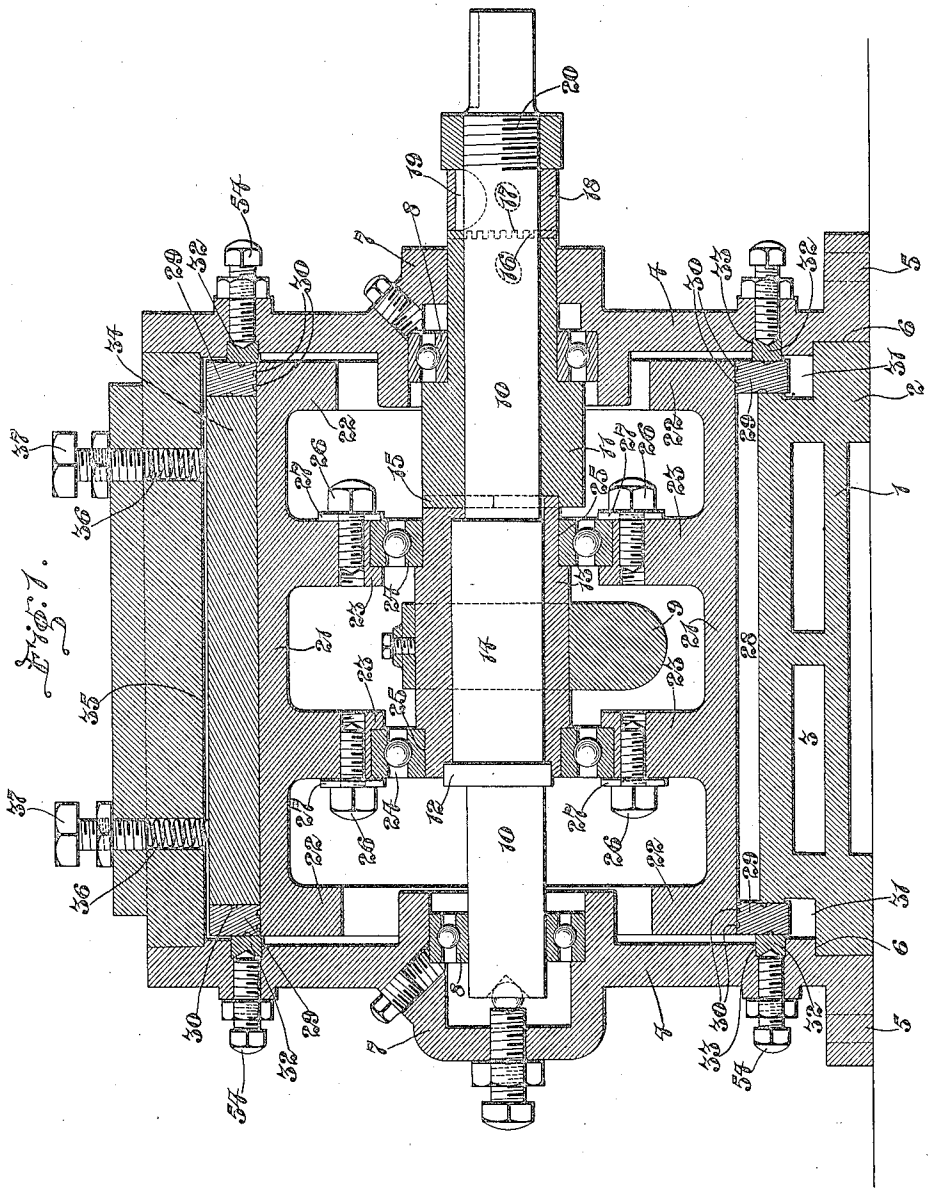

Fig. 1.

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2 SHEETS—SHEET 2.

Fig. 2.

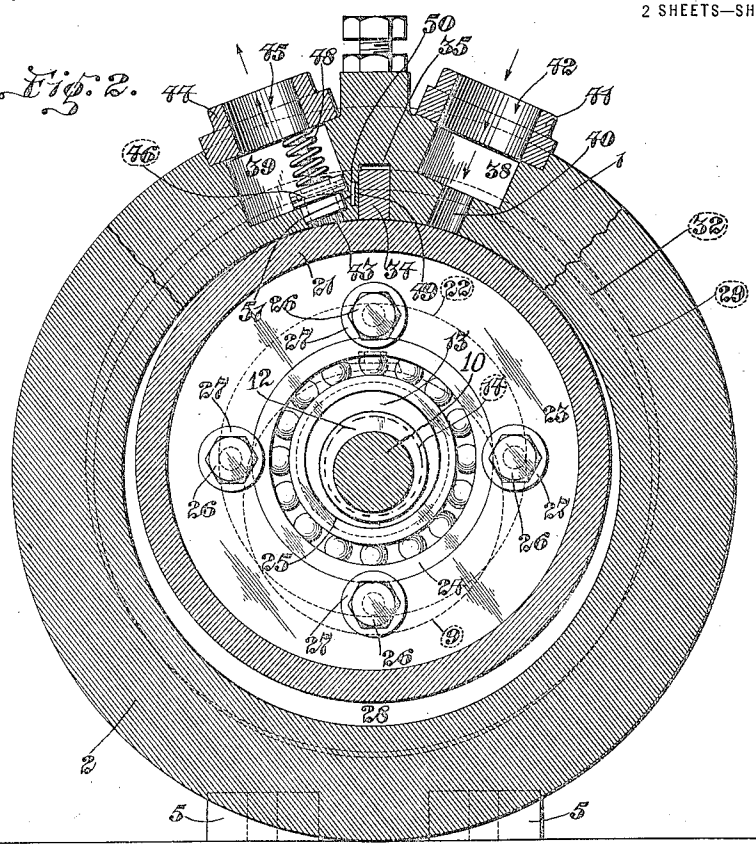
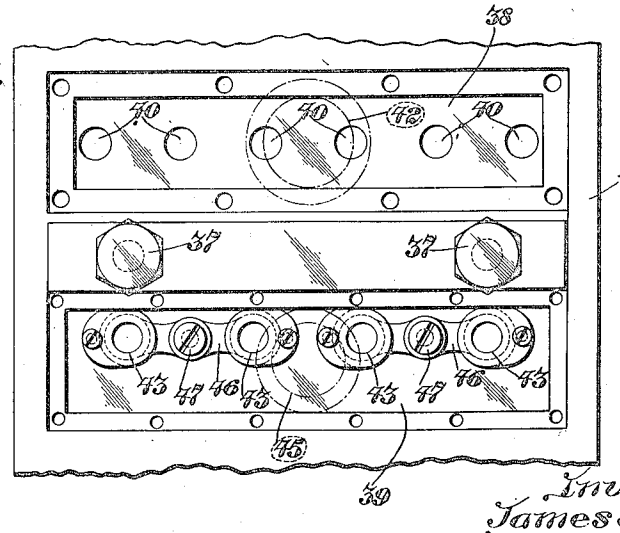


Fig. 3.



Attest.

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UNITED STATES PATENT OFFICE.

JAMES JOYNT AND PERCY L. BOWSER, OF ST. LOUIS, MISSOURI, ASSIGNORS TO ARCTIC ROTARY PUMP COMPANY, OF ST. LOUIS, MISSOURI, A CORPORATION OF MISSOURI.

ROTARY COMPRESSOR OR ROTARY ENGINE.

1,419,930. Specification of Letters Patent. Patented June 20, 1922.

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To all whom it may concern:

Be it known that we, JAMES JOYNT and PERCY L. BOWSER, citizens of the United States, residing at the city of St. Louis and State of Missouri, have invented new and useful Improvements in Rotary Compressors or Rotary Engines, of which the following is a specification.

This invention relates to improvements in apparatus designed to operate as a rotary compressor, vacuum pump, or rotary engine, and consists in the novel construction hereinafter disclosed.

An object of the invention is to provide a compact and durable apparatus which may be efficiently operated either as a compressor by mechanically or manually driving the rotor, or as an engine by means of steam, compressed air, or other fluid.

Another object of the invention is to provide an apparatus of the class described including a stator and an eccentrically mounted rotor with a yielding piston between the rotor and stator, the apparatus being so designed that it efficiently operates with a minimum degree of friction between the moving parts.

The invention comprises improved means for packing the compression chamber of the apparatus.

The invention further comprises improved means for effecting the eccentric adjustment of the rotor in respect of the stator.

The invention also comprises improved means for mounting the rotor.

The invention additionally comprises improved means of lubricating the apparatus.

The apparatus embodying the invention has, for convenience, been illustrated and will be described in detail as a compressor, it being understood, however, that there is no limitation on the invention by reason of the selection of the illustrated embodiment to an apparatus useful alone as a compressor, but that the apparatus, without involving invention, may be changed to operate as a vacuum pump or a rotary engine.

With the foregoing objects as well as additional advantageous features of construction inherent in the invention in view, we have designed the apparatus as hereinafter fully disclosed reference being made to the accompanying drawings in which—

Figure 1 is a vertical section through the apparatus illustrating the details of the construction.

Fig. 2 is a cross section through the apparatus.

Fig. 3 is a detailed view of the valve assembly.

In the embodiment illustrated in the drawings, the invention is shown as including a stator comprising a cylindrical case 1 having a base section 2 for mounting the apparatus on a support. The case 1 is preferably made of a casting and can be cored to form a space 3 constituting a water jacket for cooling purposes, if desired.

End plates 4 are arranged to fit with and close the ends of the cylindrical case 1, said end plates 4 being provided with extending flanges 5 which are designed to constitute extensions of the base section 2 of the case 1. Each of the end plates 4 is formed with an annular recess 6 adapted to receive the extremities of the case 1 forming a close fit between the case and end plates. Each of the end plates 4 has a hollow boss 7, which bosses constitute bearing supports for the rotor shaft. The rotor shaft may be journaled in the bearing supports by any suitable bearing construction, the form illustrated in the drawings comprising ball bearings 8 fitted within the supports and held in place in the usual manner. The bearing axis of the bearings 8 is concentric with respect to the axis of the stator.

The rotor shaft 10 extends longitudinally through the case 1, and is supported at one end directly in one of the bearings 8 at one side of the apparatus. The opposite end of the rotor shaft is mounted in a sleeve 11 which sleeve in turn is mounted in the other one of the ball bearings 8. The shaft 10 is provided with an annular flange 12 which constitutes an abutment for a sleeve 13 that fits over an enlarged cylindrical section 14 of the rotor shaft. The axis of the section 14 of the shaft 10 is slightly eccentric with respect to the main rotating axis of the shaft 10, and the axis of the sleeve 13 is also slightly eccentric with respect to the axis of the section 14, so that by relatively adjusting the position of the sleeve 13 circumferentially with respect to the section 14, the exact degree of eccentricity for the rotor support may be accomplished. In order to effect this adjustment an interlocking con-

nection 15 between the adjacent ends of the sleeves 11 and 13 is provided, it being understood that the sleeves 11 and 13 are respectively adjustable circumferentially with respect to the shaft 10.

A balance weight 9 is arranged to fit over the sleeve 13, which weight may be adjusted to balance the rotor and mounting for the rotor.

The outer end of the sleeve 11 is formed with teeth 16 which cooperate with teeth 17 on the end of an adjustable locking collar 18 having a key connection 19 with the shaft 10, the collar 18 having threaded engagement 20 with the end of the shaft 10. Thus it will be understood that by removing the key connection between the collar 18 and the shaft and backing the collar away from the end of the sleeve 11, the relative adjustment of the sleeve 11 and the sleeve 13 with respect to the shaft 10 may be accurately graduated and that the parts may then be locked by readjustment of the lock collar 18. This adjustment is provided so that the eccentric mounting of the rotor may be changed to compensate for wear and to accomplish a close fit between the rotor and stator case.

The rotor 21 is in the form of an open sleeve having marginal flanges 22 and spaced central bearing flanges 23. The ends of the flanges 23 are recessed to receive ball bearings 24 supported between the flanges and the recessed portions 25 in the sleeve 13, the ball bearings being held in place by bolts 26 and washers 27.

The external diameter of the rotor is less than the internal diameter of the stator and, since the rotor is supported eccentrically with respect to the stator, the rotor will contact with the stator wall at a segmental area of the circumference. At either side of the contacting area there is a gradually increasing segmental space that constitutes a compression chamber 28.

In order to seal the ends of the compression chamber loose rings 29 are fitted over each end of the rotor, it being observed that the rotor slightly overhangs the ends of the stator case. It will be observed that there is a slight space between the ends of the rotor and the end plates of the stator case, thus since the rings are loose on the rotor, the rotor may expand longitudinally through the rings and into this space in the event of an unequal expansion of the rotor and the stator.

The rings 29 are provided with oil grooves 30 which serve both to lubricate and seal the joints between the rotor and stator. The rings 29 are held in place by retaining rings 32 which are mounted in channels 33 in the end plates, the rings 32 being adjustable in order to effect a close fit by lock screws 54 operable in threaded openings in the end plates located exteriorly of the channels 33. It will be noted that there is a space 31 between the rings 29 and the stator case. This space is provided to permit movement of the rings 29 and also constitutes oil spaces from which, by the movement of the rings 29, the lubricant will be pumped or forced around the rings effecting equal lubrication thereof.

The space between the rotor and the stator is separated by a sliding plate 34 that seals the compression chamber against communication on the suction or inlet side and the exhaust or outlet side. This plate 34 is mounted in a channel 35 formed in the wall of the stator case that runs longitudinally substantially the full length of the rotor. It will be observed that the rings 29 abut against the ends of the plate 34 so as to effectively seal the joint at the ends of the plate. The plate moves on a radial line in respect of the case of the stator and is actuated by springs 36 toward the wall of the rotor. The springs 36 are nested in openings through the stator case and are adjustable by means of lock screws 37 so that the frictional contact between the plate 34 and the rotor may be graduated according to operative requirements.

The plate 34 is provided with a sealing device on the pressure side to prevent loss of pressure around the plate. The device consists of a strip 49 running longitudinally of the plate 34. The strip 49 is seated in a slot 50 formed in one wall of the channel 35, and a spring 51 is mounted back of the strip, thereby forcing the strip into contact with the side of the plate 34 effecting the seal.

At either side of the plate 34 are recessed portions 38 and 39 forming, respectively, a suction or inlet chamber, and an exhaust or discharge chamber. Extending from the bottom of the chamber 37 and communicating with the interior of the stator is a number of spaced passages 40 constituting inlet ports from the suction chamber to the interior of the stator. The suction chamber is provided with a removable cover plate 41 having an inlet opening 42 therethrough. The exhaust chamber has a series of passages 43 extending inwardly therefrom into the interior of the stator and is also provided with a cover plate 44 having an exhaust opening 45 therethrough. The passages 43 constitute exhaust ports which may be controlled by any form of check valves, the form illustrated comprising spring valve closures 46 removably secured by screws 47 to the bottom of the exhaust chamber. Suitably arranged expansion springs 48 are cooperatively adjusted with the valve closures, so as to resiliently hold the valve closures on their seats, permitting the valve closures to open outwardly by the pressure within the compression chamber to exhaust

the pressure from the compresison chamber.

While we have illustrated a plurality of inlet and exhaust ports communicating with the suction and exhaust chambers, it will be understood that a single inlet and a single outlet port will suffice. There is no limitation in respect of the form of check valve as any known type may be employed.

The apparatus may be driven from any suitable source of power applied to the shaft 10.

The operation of the apparatus may be readily understood from the foregoing description. It will be observed from the description of the construction that the rotor shaft is free to rotate in the bearings 8 and that the rotor support includes the eccentrically positioned ball bearings 24, that is the rotor is loosely mounted on the shaft 10. Thus as the rotor shaft is driven the rotor will be moved radially in respect of the stator wall, and will have a short rolling or circumferential movement on each revolution of the shaft 10. Since the diameter of the rotor is slightly less than the internal diameter of the stator there will be on each revolution of the rotor shaft only a slight relative circumferential movement of the rotor in respect of the stator case. The rotor is not revolved with the rotor shaft, as the bearings 24 permit the rotor shaft to revolve without revolving the rotor except for a slight distance, due to the difference in diameter of the rotor and the stator. Therefore, the friction between the movable plate 34 and the rotor does not appreciably increase the utilization of power in the operation of the apparatus, due to the relatively short movement of the rotor in respect of the plate. It will be observed also that on each side of the plate there is a relatively extended segment of surface contact between the rotor and the stator which, added to the sealing effect of the plate 34 in contact with the rotor, permits the machine to develop a high compression. Since there is a relatively low degree of friction between the moving parts, the compressor may be operated without the development of excessive heat, and by a minimum use of power.

It will be understood that the construction may be modified, for instance, by including a plurality of pistons and a plurality of inlet and exhaust ports, if desired, and that other modifications of the construction may be made without departing from the spirit and scope of the invention. We do not limit ourselves, therefore, to the exact construction shown and described, but what we claim and desire to secure by Letters Patent, is:—

1. In an apparatus of the class described, a stator case, a rotor mounted within the stator, a shaft journaled in the stator, a cylindrical enlargement on the shaft having its axis eccentric with respect to the axis of the shaft, a sleeve mounted on said enlargement for adjusting turning movement relative thereto, an abutment on said enlargement for one end of said sleeve, a device for locking said sleeve in different adjustments relative to said enlargement, and anti-friction bearing elements supported by said sleeve for supporting the rotor.

2. In an apparatus of the class described, a stator case, a rotor mounted within the stator, a shaft journaled in the stator, a cylindrical enlargement on the shaft having its axis eccentric with respect to the axis of the shaft, a sleeve mounted on said enlargement for turning movement relative thereto, means for preventing axial movement of said sleeve from said enlargement and means for locking said sleeve in adjusted positions on said enlargement, bearings supported by said sleeve for supporting the rotor, and a plate mounted in the stator movable radially into contact with the rotor.

3. In an apparatus of the class described, a stator case, a shaft extending axially through the stator case, a cylindrical enlargement on the shaft having its axis eccentric with respect to the axis of the shaft, a sleeve on said enlargement capable of turning movements relative thereto, means for holding the sleeve from axial movement on said enlargement, devices for locking said sleeve in any adjusted position on said enlargement, bearings supported by said sleeve, a rotor supported by said bearings within the stator case, means for holding said bearings in proper position to support the rotor, a compression chamber between the rotor and the stator, and elements sealing the ends of the compression chamber.

4. In an apparatus of the class described, a stator case, a shaft extending axially through the stator case, a cylindrical enlargement on the shaft having its axis eccentric with respect to the axis of the shaft, a sleeve on said enlargement capable of turning movements relative thereto, means for holding the sleeve from axial movement on said enlargement, devices for locking said sleeve in any adjusted position on said enlargement, bearings supported by said sleeve, a rotor supported by said bearings within the stator case, means for holding said bearings in proper position to support the rotor, a compression chamber between the rotor and the stator elements sealing the ends of the compression chamber, a plate mounted in the stator movable radially into contact with the rotor, and means for pressing said plate into contact with the rotor.

5. In an apparatus of the class described, a cylindrical stator case, a shaft mounted in the case, a rotor, a support between the shaft and rotor having means for adjusting the rotor eccentrically of the axis of the

stator, and a balance weight for balancing the rotor, a sliding plate mounted in the stator and movable radially with respect of the rotor, and adjustable resilient means for actuating the plate into frictional contact with the rotor.

6. In an apparatus of the class described, the combination with a stator case, of a shaft journaled for rotation therein, a cylindrical enlargement on said shaft having its axis eccentric with respect to the axis of the shaft, a sleeve mounted on said enlargement, bearings mounted on said sleeve, a rotor supported by said bearings within the stator case, a compression chamber between the rotor and the stator, packing rings encircling the rotor and sealing the ends of the compression chamber, and an inwardly movable plate in the stator having its end contacting with said rings and having its inner edge arranged to contact with the periphery of the rotor.

7. In an apparatus of the class described, the combination with a cylindrical stator case, of a rotor mounted in the case, a revoluble shaft having bearings in the stator case and being arranged concentrically therewith, said shaft having an eccentric section, a sleeve carried by the eccentric section, adjustable connections between said sleeve and the shaft, a balance weight adjustable relative to the sleeve and revoluble bearings supported between the sleeve and the rotor.

8. In an apparatus of the class described, the combination with a cylindrical stator case, a rotor mounted in said case, a revoluble shaft for supporting the rotor, a sleeve carried eccentrically with respect to the main rotating axis of the shaft, a balance weight adjustable on and carried by said sleeve, revoluble bearings between the sleeve and the rotor, a plate mounted in the stator and movable radially with respect to the rotor, inlet openings on one side of said plate, exhaust openings on the opposite side of said plate, and packing rings adjustably arranged to seal the joints between the rotor and the stator.

9. In an apparatus of the class described, the combination with a cylindrical stator case having removable end plates, of a revoluble shaft having bearings in said end plates and extending longitudinally through the stator case, a rotor, an eccentric support having relative circumferential movement carried by said shaft and supporting the rotor, said support being adjustable radially to vary the relative eccentrical position of the rotor with respect to the stator, a movable plate mounted in the stator case, a sealing device on one side of said plate, and means for adjusting the tension of said plate for frictional engagement with the rotor.

10. In an apparatus of the class described, a stator case, a shaft extending axially through the stator case, a cylindrical enlargement on the shaft having its axis eccentric with respect to the axis of the shaft, a sleeve on said enlargement having its axis eccentric with respect to the axis of the shaft and also with respect to the axis of said enlargement, means holding said sleeve from axial movement on the shaft and permitting turning movement of said sleeve relative to said enlargement, bearings supported by said sleeve, a rotor supported by said bearings within the stator case, a compression chamber between the rotor and the stator, rings encircling the rotor and sealing the ends of said chamber, devices for holding said rings properly positioned, an inwardly movable plate within the stator case between said rings, and means for moving said plate inwardly into contact with the periphery of the rotor.

11. In an apparatus of the character described, a stator case, a rotor mounted within the stator, a shaft journaled within the stator, a cylindrical enlargement on the shaft having its axis eccentric with respect to the axis of the shaft, a sleeve mounted on said enlargement and being capable of turning movements to different adjusted positions, means for locking the sleeve in different adjusted positions on said enlargement, and a balance weight in connection with said sleeve.

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