July 9, 1929. E. WILSON 1,719,954

ROTARY COMPRESSOR

Filed Dec. 26, 1925 3 Sheets-Sheet 1

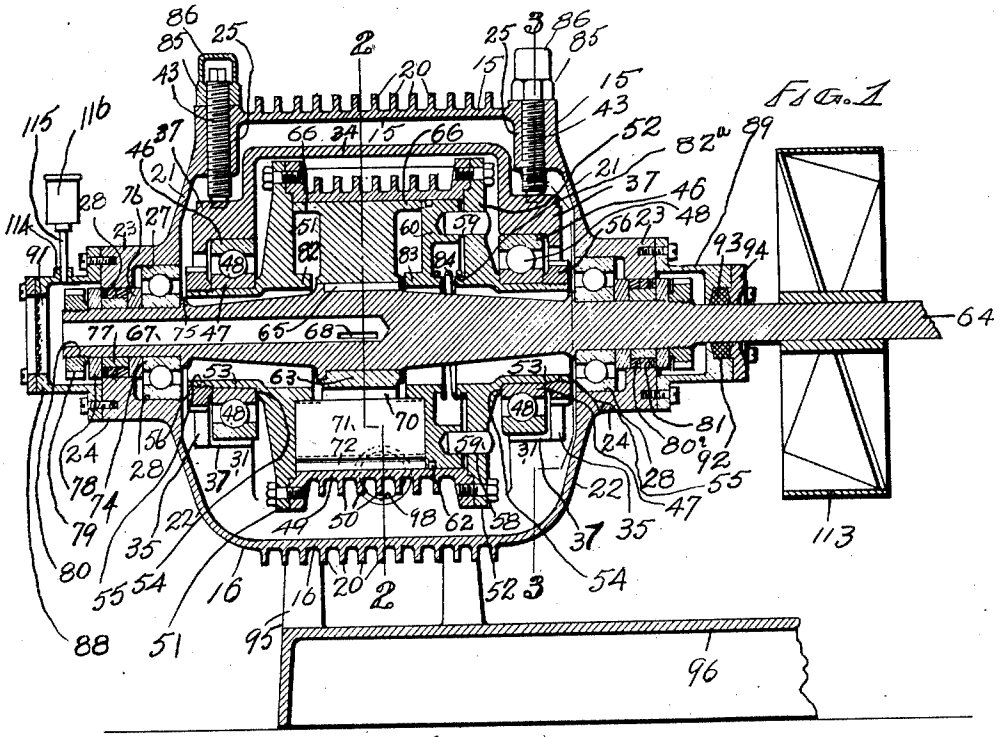


FIG. 1

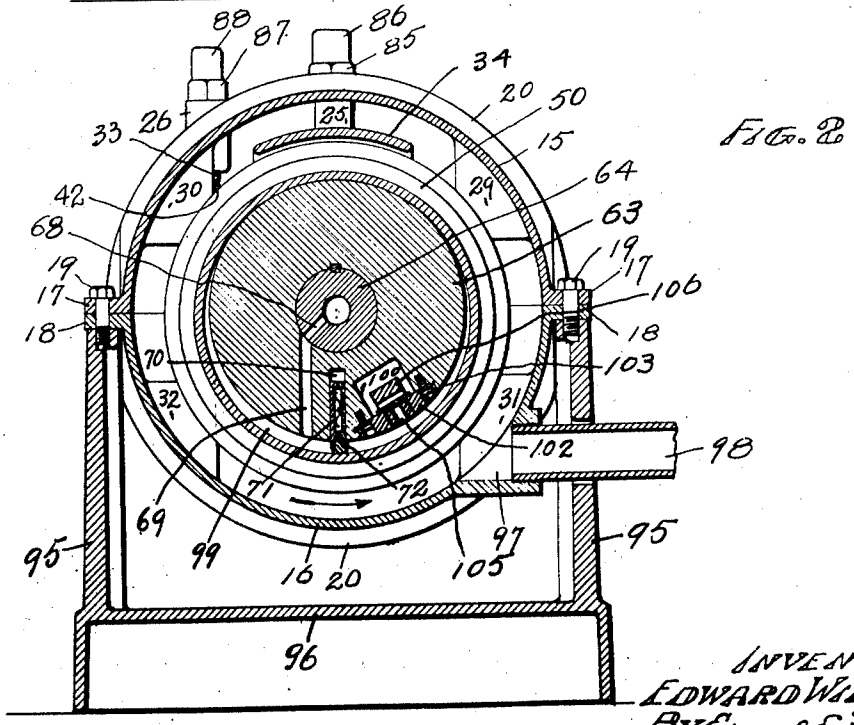


FIG. 2

INVENTOR
EDWARD WILSON
BY Edwards & Lyon
ATTY

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ROTARY COMPRESSOR

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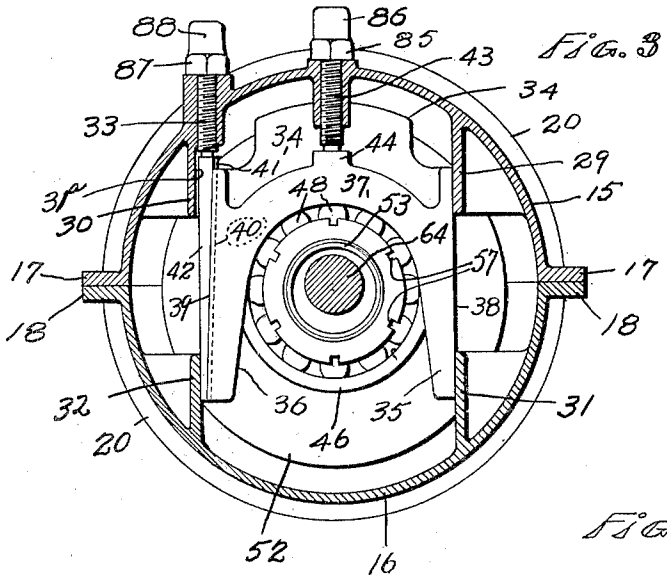


Fig. 3

Fig. 4

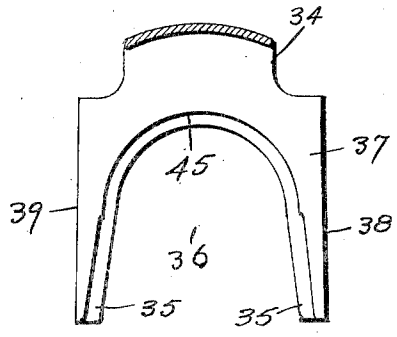
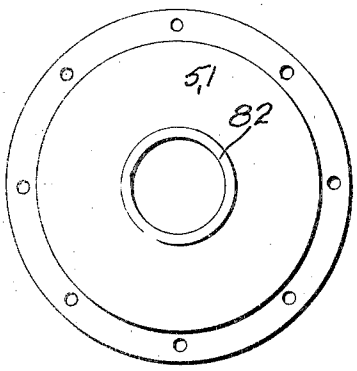
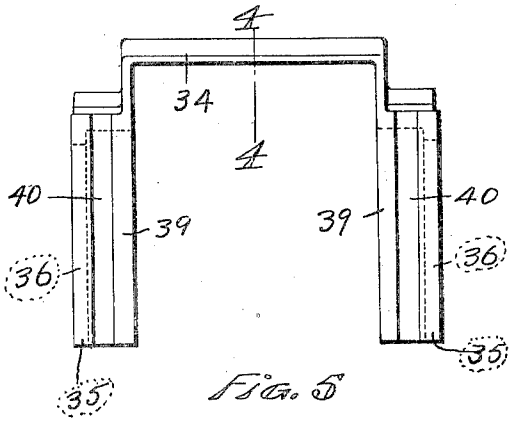


Fig. 7





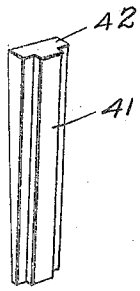


Fig. 6

Fig. 5

INVENTOR
EDWARD WILSON
By Edward & Logan
ATTY

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ROTARY COMPRESSOR

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Fig. 8

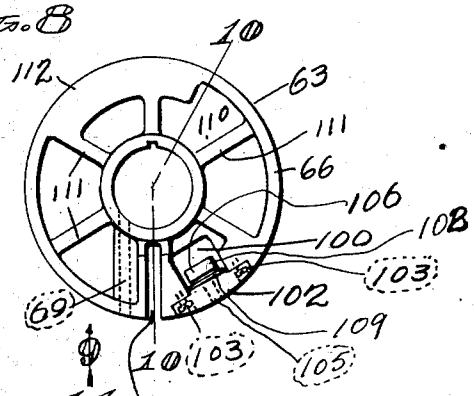


Fig. 9

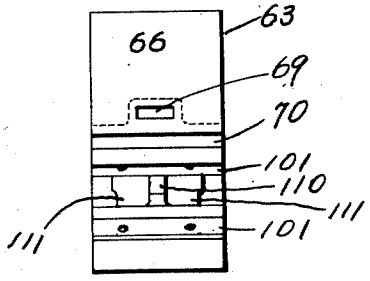


Fig. 11

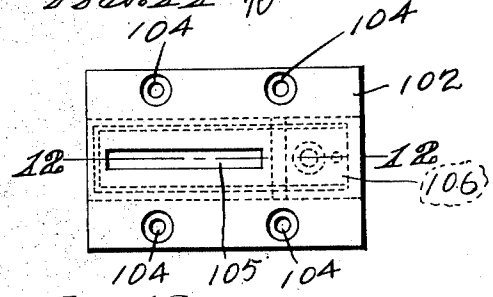


Fig. 10

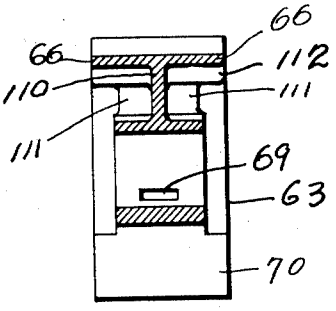


Fig. 12

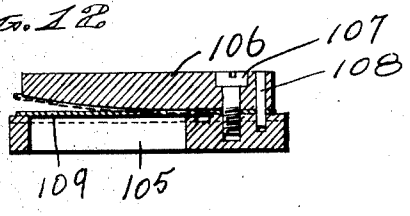


Fig. 13

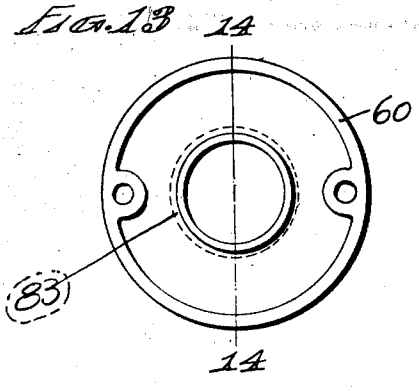
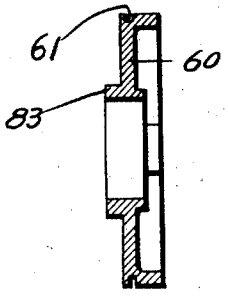


Fig. 14



INVENTOR
EDWARD WILSON
BY Edmund E. Lyon
ATTY.

Patented July 9, 1929. 1,719,954

UNITED STATES PATENT OFFICE.

EDWARD WILSON, OF ST. LOUIS, MISSOURI, ASSIGNOR TO NATIONAL PUMP AND COMPRESSOR COMPANY, OF ST. LOUIS, MISSOURI, A CORPORATION OF DELAWARE.

ROTARY COMPRESSOR.

Application filed December 26, 1925. Serial No. 77,688.

My invention relates to improvements in rotary compressors, and has for its primary object a high speed compressor of the rotary type which is air-cooled, practically noiseless in operation, and which has a relatively small friction loss.

A further object is to construct a rotary compressor in which the casing is split longitudinally whereby the cost of manufacture is reduced and the assembly of the various parts and the final assembly greatly simplified.

A further object is to construct a rotary compressor in which the adjustment of the cylinder is so constructed as to prevent abnormal stresses being set up on the cylinder and the shaft.

A still further object is to construct a rotary compressor in which the cylinder adjustment can be locked or tightned so as to eliminate any lost motion after the adjustment has been made thereby preventing any vibrations of the cylinder bearings.

A still further object is to construct a rotary compressor which is provided with means to positively hold the piston blade in continuous contact with the interior of the cylinder.

Another object is to construct a rotary compressor having a rotating cylinder within the casing in which the cylinder is provided with a floating head which is driven at the same speed as the cylinder thereby preventing all wear between the periphery of the floating head and the interior of the cylinder.

Another object is to provide a rotary compressor with a seal which will prevent the leakage of compression from the casing along the shaft, the seal being so constructed that the pressure set up within the casing will have a tightening tendency on the same.

In the drawings:

Fig. 1 is a central longitudinally vertical section of my device;

Fig. 2 is a cross section of the same on the line 2—2 of Fig. 1 showing the various ports in their proper relation;

Fig. 3 is a cross section taken on the line 3—3 of Fig. 1;

Fig. 4 is a cross section of the yoke taken on the line 4—4 of Fig. 5;

Fig. 5 is a side elevation of the yoke;

Fig. 6 is a perspective view of one of the wedges employed for securing the yoke in position;

Fig. 7 is an inside face view of one of the cylinder heads;

Fig. 8 is an end view of the rotor employed;

Fig. 9 is a face view of the rotor viewed in the direction of the arrow 9 in Fig. 8;

Fig. 10 is a sectional view taken on the line 10—10 of Fig. 8;

Fig. 11 is a face view of the valve;

Fig. 12 is a cross section taken on the line 12—12 of Fig. 11;

Fig. 13 is an end view of the floating head employed; and

Fig. 14 is a cross section of the same taken on the line 14—14 of Fig. 13.

In the construction of my device, I employ a casing composed of sections 15 and 16, which are provided with outwardly extending flanges 17 and 18 respectively so that the casing is preferably divided in half horizontally. The adjacent faces of the flanges 17 and 18 are preferably ground to a fit so that, when the sections are secured together by means of the bolts 19, an air tight joint will be formed. I may, however, if found necessary, insert packing between these flanges without departing from the spirit of my invention. The casing is preferably cylindrical in form and each section is formed with outstanding ribs 20. These ribs are for the purpose of radiating heat and making the device air-cooled. The sections are closed at each end by means of walls 21 and 22 respectively, which terminate in semi-cylindrical bosses 23 and 24 respectively. These bosses are for the purpose of securing the shaft bearings as will be explained in detail later.

The section 15 is provided adjacent each end wall 21 with screw threaded bosses 25, which are located directly above the central axis of the section and with screw threaded bosses 26, which are offset to one side of the center as is clearly shown in Figs. 2 and 3. The bosses 23 and 24 are provided with semi-cylindrical recesses 27 and 28 so that when the two sections are secured together they will form supports for the bearings and also for the packing, as will be described later. The section 15 is provided with guideways 29 and 30 and the section 16 with guideways 31 and 32. These guideways are preferably L shaped in cross section, the guideways 30 being slightly recessed as at 31 so as to permit the locking screws 33 to pass downward. Positioned between the guideways of the upper and lower sections is a U shaped yoke 34, which is pro-

vided at each end with a web 35 having an opening 36 therein. The web 35 is formed integral with the legs 37 of the yoke, each of which is provided with a straight face 38 and with a tapered face 39. The tapered face 39 is provided with a groove 40 in which the tongue 41 of the wedge 42 extends. The wedge is designed to be forced downward by means of the screw 33 so that the yoke is held firmly in position and against any side movement, the adjusting screw 43 bears down on the lug 44 formed integral with each of the legs and is for the purpose of adjusting the cylinder toward the rotor. The purpose of this will be explained in detail later.

Each of the legs 37 is also provided with a semi-circular recess 45 in which the collar 46 of the cylinder bearing is adapted to pass. Spaced apart from the collar 46 and concentric therewith is a second collar 47 and between these two collars are bearing balls 48, the two collars and the bearing balls forming an anti-friction bearing for the cylinder. The cylinder is composed of a cylindrical member 49 which is provided with ribs 50 projecting from its outer face and which are for the purpose of radiating heat therefrom. Secured to the ends of the cylinder are cylinder heads 51 and 52, which are provided with an outwardly extending sleeve 53. These sleeves terminate in a shoulder 54 adjacent the heads and have their outer ends screw threaded as at 55. This screw threaded portion is adapted to receive the nut 56 by means of which the collar 47 may be tightly clamped against the shoulder so as to render it immovable as far as the sleeves 55 are concerned. In other words, so that the collar rotates with the cylinder heads. The nut 56 is preferably provided with recesses 57 so that a spanner wrench can be used in tightening the same although this feature is not essential.

The head 52 is provided with bores 58 in which pins 59 are secured. The pins 59 are movable in a floating head 60. This floating head is provided with a circumferential groove 61 in which a packing ring 62 is mounted. It will be observed from the drawings, especially Fig. 1, that the floating head is mounted inside of the cylinder. Located within the cylinder is a rotor 63 which is secured to the shaft 64 by means of a key 65. The rotor is provided with a rim 66, which has bearing against the cylinder head 51 and the floating head 60. The shaft 64 is provided with a longitudinal bore 67 and with a radial port 68. This radial port communicates with the inlet port 69 formed in the rotor. The rotor is also provided with a slot 70 in which is slidably mounted a piston blade 71. This piston blade is preferably of two sections, each of the same width as the rotor, and is provided on its outer or working end with a rocking shoe 72. The shaft 64 is supported in ball bearings which have a collar 74 pressed tightly against the flange 75 formed integral with the shaft. This collar is held in position by means of a collar 76, which is pressed against the collar 74 by means of a sleeve 77. This sleeve in turn again is pressed by means of a collar 78 against which the nut 79 mounted on the screw threaded portion 80 of the shaft 64 exerts pressure. The sleeve 74 is of less diameter than the bore 28 and in order to prevent leakage. I employ rings 80a and 81, one of which is designed to take lateral pressure, and the other to be split so as to exert radial pressure and thus prevent leakage along the bore 28. The cylinder head 51 is provided with an inwardly extending ring-shaped flange 82, while the floating head 60 is provided with a flange of identical construction 83. These flanges are concentric with the bore of the cylinder and are designed to contact with the inner end of the piston blade as illustrated in Fig. 1 and at all times hold it in contact with the interior of the cylinder. In this way I do not rely upon centrifugal force to project the blade nor is it possible at any time for pressure to force the blade into the pocket and permit the compression to escape from the casing through the inlet port. The floating head is initially held in contact with the rotor by means of the coil spring 84 until pressure is set up, after which the pressure within the casing will have a tendency to hold the floating head against the rotor. This action will be fully described in detail later. The adjusting screws 43 after being properly set are held in position by means of lock nuts 85. These lock nuts are provided with a cap 86, which effectually prevents any leakage of compression from the casing. The locking screws 33 are similarly secured against the accidental loosening by means of lock nuts 87, which are provided with caps 88 for the same purpose.

Secured to the semi-cylindrical bosses, after the device has been assembled, are caps 89 and 90, the cap 90 being provided with a screened opening 91 so that air can enter and forms the suction port of the machine, while the cap 89 is provided with a recess 92 in which packing 93 is located. This packing is held in position by means of a cap 94. The purpose of this packing is to prevent any seepage of oil along the shaft 64 because if such seepage would take place, it would be thrown off by centrifugal force and be discharged on the floor and walls. I have shown the shaft 64 as broken off and without any specific means for placing it in rotation. There may be various ways in which this can be accomplished. This can be done either by a direct connection to a motor by means of a coupling, or belt or gear drive may also be used. These various drives, however, are well understood in the art and are, therefore, not shown and described in detail. The cas-

ing is supported on legs 95, which are preferably formed integral with the base 96 and in the case of a direct motor drive, this base also forms a support for the motor. The casing is provided with an outlet port 97 in which a discharge pipe 98 is secured. This discharge pipe may be lead to any suitable air receiver or to any delivery point desired. It will be noted from Figs. 1 and 2 that the shaft 64 and the cylinder 50 are mounted eccentric to each other so that a crescent-shaped compression chamber 99 is formed. It will also be noted from Fig. 2 that the inlet port 69 is located on one side of the piston blade while on the other side the rotor is provided with a discharge passage 100. Extending across the face of the rotor is milled a slot. This slot is of greater width than the air passage 100 thus forming shoulders 101. Resting on these shoulders is the valve plate 102. This valve plate has one face flat, the other face being curved so as to form a continuation of the periphery of the rotor. The valve plate is held in position by means of screws 103 which pass through openings 104 formed in the valve plate and into screw threaded recesses formed in the shoulders 101. The valve plate is provided with an elongated slot or opening 105. Secured to the flat side of the valve plate and preferably centrally located is a stop or abutment 106. This abutment is held on the valve plate by means of a screw or bolt 107 and, in order to prevent any twisting of the stop, a dowel pin 108 is employed. It will be noted from Figs. 8 and 11 that the stop 106 is of greater width than the slot 105. Interposed between the stop 106 and plate 102 is a reed, more generally known as a feather valve, 109. This reed is formed of flexible or spring material, preferably steel although other material may be used. The reed is held in position by means of the plate 106 and has the screw 107 and dowel 108 passing therethough so that all side movement is eliminated. The under face of the stop 106 is curved as illustrated in Fig. 12. This permits the reed 109 or rather its free end to raise up and uncover the slot 105 and thus permit the compressed gases to escape into the passage 100. The rotor is provided with a central web 110 from which extend radial webs 111, these webs supporting the periphery or rim of the rotor making the same rigid but at the same time not adding a great amount of weight. Diametrically opposite the valve and piston blade is a counterweight 112, which is formed integral with the rim and webs and is for the purpose of counter-balancing the rotor so that it will move smoothly.

In order to cool or assist in cooling the device, I preferably place a fan 113 on the shaft 64. This fan is so arranged that when the device is placed in operation a blast of air will be directed against the casing. This moving air will assist greatly in cooling the same. The cap 90 is provided with a boss 114 in which is screw threaded a pipe 115 to the other end of which is connected a sight feed lubricator. This lubricator is adjusted to permit the oil to pass slowly through the pipe 115 where it is caught up by the suction, drawn through the bore 67, thence through the inlet port into the crescent-shaped chamber. From there the oil is distributed around the inside of the cylinder by means of the piston thus furnishing lubrication. As the oil continues to be fed in the above described manner, it passes out through the discharge valve into the space between the rotor rim, cylinder head 51 and floating head 60 thus furnishing lubrication for the cross movement of the rotor relative to these heads. It will then travel along these heads and lubricate the shoulders against which the inner edge of the piston rides as well as lubricate the sides of the piston. It will then pass along the shaft, out through the hollow bosses of the cylinder heads and be thrown outward by centrifugal force thus lubricating the bearings for the cylinder and also the bearings for the shaft. From there any excess oil in the casing is picked up by the compressed gas and passed through the discharge pipe 98. From this discharge pipe, the compressed gas together with the oil is preferably lead to an oil separator not shown where the oil and compressed gas are separated.

The assembling of my device is as follows:

In assembling my device for operation, the first step is to secure on the shaft 64 the rotor, shaft bearings, the packing, etc. together with the cylinder, its various parts. These assembled parts are placed in the lower half of the casing, the wedges 42 placed in position and the yoke slipped in. The upper half is then placed on the lower half and the flanges secured together, the casing is then secured to its base after which the screws 43 and 33 are inserted in their respective places and the screws 43 tightened until the proper adjustment of the cylinder against the rotor has been obtained after which the lock nuts 55 are tightened. The screws 33 are then screwed down upon the wedges 42, binding the legs of the yoke sufficiently to prevent lateral movement and consequent chattering of the device when in use. After the wedges have been thus adjusted, the lock nuts 87 are secured in place. The caps 89 and 90 are then secured by means of the screws after which the packing 93 is placed in position and then the cap 94 secured to the cap 89. After this the fan 113 is secured to the shaft. The oil connection made to the cap 90 and the device is connected to the proper source of energy, which, as before stated, may be either a motor or other drive.

During the operation of the device the

cylinder being in contact at one point only with the rotor is rotated by the rotation of the rotor and at approximately the same peripheral speed as the rotor but, being of greater diameter than the rotor, its rate of rotation will be less so that the rotor blade during the rotation of the rotor will sweep through the crescent-shaped chamber and compress the gases ahead of it while additional gases enter through the hollow shaft to the rear of the rotor blade and are compressed on the continued rotation of the rotor. As these gases are compressed they raise the valve 109 and escape into the passage 100 and from there to each side of the rotor between the shaft and the flange or web 66, from there these gases escape through the hollow portions or hubs of the heads and into the casing and out through the discharge pipe 98. As the compressed gas is discharged from the cylinder directly into the casing and thence to the receiver or storage reservoir, it will be understood that the compressor cylinder is enveloped in gas at discharge pressure. It will also be readily understood that air is drawn into the cylinder behind the blade at atmospheric pressure and follows the piston during its entire sweep through the compression space at this pressure while during this operation the gas in front of the piston is being compressed from atmospheric pressure to discharge pressure and that the mean pressure during this operation is considerably less than the final or discharge pressure. It therefore follows that during the entire cycle of compression the average pressure exerted within the cylinder is very much less than the maintained pressure surrounding the cylinder within the casing.

The pressure within the cylinder is exerted upon the heads tending to force them from the ends of the rotor while a greater pressure from without the cylinder is holding the heads against the rotor. The pressure area of the heads against which these pressures are acting is the area of a cross section of the crescent-shaped compression space before referred to, outlined upon the heads. Both cylinder heads are influenced by this differential pressure but one head being loose with respect to the cylinder is free to move axially therein while the other head may also move axially but would move the cylinder with it and both heads tend to move toward each other and would come together under the action to this differential pressure but for the restraining action of the rotor which is squeezed between the two heads, whereby an air-tight seal is maintained at the ends of the compression space regardless of the wear which continually takes place between the ends of the rotor and the cylinder heads. The floating head, however, is so constructed that in the event of any sudden rise of compression in the compression chamber occurring, this excess pressure will force the floating head outward and in so doing separate it from the rotor thereby opening the compression chamber and permitting this excess pressure to be relieved. As previously described during this operation oil is being constantly fed both by suction and compression and also by centrifugal force to the various working parts of the device. This oil will also assist in making the floating head air-tight as it will form an oil seal between the floating head and the cylinder.

It is also my intention to have the shaft bearings fit snugly, yet not tightly in the recesses formed in the casing halves so that when the device is in operation the outer ring of the bearings can turn slowly thereby providing equal wear all around for the ball race. However the fit will be snug enough so that there can be no vibration of these ball bearings which would tend to make the device noisy.

During the rotation of the rotor the inner edge of the rotor blade 71 is in constant contact with the cylindrical projections 82 and 83 which are carried by the cylinder head 51 and by the floating head 60. These ring-shaped flanges are concentric with the interior of the cylinder surface and consequently hold the piston blade out so that the rocking shoe 72 will at all times contact with the periphery of the cylinder. In this way I am not dependent on centrifugal force to hold out the piston although, when the machine is in operation, this force assists greatly in ejecting the piston blade from its pocket but the rings prevent any possibility of the piston blade from falling back into the pocket and releasing the rocking head or shoe. The purpose of this shoe is to obtain a relatively wide surface contact with the interior of the cylinder regardless of the position of the rotor. If this shoe is not present it will be impossible to maintain a full contact with the interior of the cylinder for the reason that the rotor which carries the piston blade is eccentric to the cylinder. In fact merely a line contact having a very small bearing area is obtained, with the result that the wear is an abrasive action, proper lubrication is impossible, destruction of the blade is very rapid, and a proper seal is not maintained.

It will be noted from Fig. 1 that the inner end of the pocket 70 in which the piston 71 is mounted is in direct communication with the interior of the casing so that pressure from the casing can enter this pocket and at the rear of the piston. This pressure will assist in holding out the piston blade and will also permit air pressure to enter the pocket formed between the two sections of the piston blade thus exerting a spreading tendency and causing the piston or rather the sections to fit snugly against the walls of the pocket and prevent leakage of air.

While I have shown one means for guiding or centering the yoke, it is obvious that other equivalent means may be employed for this purpose. As one example of a different guiding or centering means than that shown and described, I may omit the guides 29, 30, 31 and 32, the wedge 42 and screw 33, and employ screws passing horizontally into the casing on opposite sides thereof and engaging the yoke for centering and holding the yoke against vibration.

Having fully described my invention, what I claim is:—

1. In a rotary compressor the combination of a cylinder mounted to rotate, fixed heads secured to the ends of said cylinder, a rotor eccentrically mounted therein engaging the wall of said cylinder, said cylinder and rotor co-operating to form a compression chamber, means for admitting fluid to said compression chamber, a floating head slidably mounted within said cylinder and located between one of the fixed heads of the cylinder and the adjacent end of the rotor, means for rotating said floating head with said cylinder, and means for supplying air under pressure against the outer face of said floating head for holding said head yieldingly against the end of the rotor whereby the floating head may move outwardly to relieve sudden excessive pressure within the cylinder.

2. In a rotary compressor the combination of a rotating cylinder having fixed heads for closing the ends thereof, a rotary piston of less length than the cylinder mounted in said rotating cylinder, a piston blade mounted in said rotary piston, a floating head located within the cylinder and between the rotary piston and the adjacent cylinder head, means carried by said cylinder head and extending slidably into said floating head whereby said floating head is rotated with the cylinder, means carried by the floating head and the opposite fixed cylinder head and concentric with the bore of the cylinder and engaging said piston blade for holding the same in continuous engagement with the cylinder wall.

3. In a rotary compressor a rotating compression cylinder, a head for closing each end of said cylinder, a rotor eccentrically mounted in said cylinder, a piston blade mounted in the rotor, and means carried by and on the inside of the cylinder heads and concentric with the cylinder and slidable longitudinally therein for engaging the base of the piston blade and holding the same in constant contact with the interior of the cylinder wall.

4. In a rotary compressor a rotating compression cylinder, a rotor eccentrically mounted therein and adapted to rotate therewith, heads for closing the ends of the compression cylinder, a piston blade slidably mounted in the rotor, a rocking shoe carried by the outer end of said blade, and means carried by the cylinder heads for positively operating the piston blade outward thereby holding the shoe in contact with the inner surface of the cylinder throughout the revolution of the rotor.

5. A rotary compressor comprising a sectional housing, means for holding said sections together, a compression cylinder mounted to rotate within said housing and eccentric thereto, a rotor mounted within said compression cylinder and eccentric thereto and adapted to rotate therewith, a head for closing each end of said compression cylinder, a floating head mounted in said cylinder between the end of the rotor and the adjacent head of the cylinder, and a connection between the floating head on which said floating head may slide and the fixed head for rotating the same at the same speed as the cylinder whereby peripheral wear of the floating head is eliminated.

6. A rotary compressor comprising a sectional housing, means for holding said sections together, a compression cylinder mounted to rotate within said housing and eccentric thereto, a rotor mounted within said compression cylinder and eccentric thereto and adapted to rotate therewith, a head for closing each end of said compression cylinder, a floating head slidably mounted in said cylinder between one end of the rotor and the adjacent head of the cylinder, a connection between the floating head and the cylinder head for rotating the same at the same speed as the cylinder whereby peripheral wear of the floating head is eliminated, and means for adjusting said cylinder toward said rotor and at right angles to its axis whereby a rolling contact between the cylinder and rotor is obtained.

7. In a rotary compressor a compression cylinder closed at both ends, a rotor eccentrically mounted therein, means for adjusting said compression cylinder towards said rotor and at right angles to the axis of rotation thereof so that the same will contact, means for simultaneously holding said cylinder in adjusted position and against vibration, and a piston carried by said rotor and contacting with the interior of said compression cylinder throughout the rotation of the rotor, and means for holding said piston in constant contact with the interior of the cylinder throughout the rotation of said rotor, said means acting independently of centrifugal force.

8. In a rotary compressor a casing composed of an upper and a lower complementary section, means for securing said sections together, a cylinder mounted in said casing, bearings carried by said cylinder at its ends, a yoke slidably mounted in said casing and contacting with said bearings on their upper portions only, means for adjusting said yoke in a vertical position in said casing, and means for holding said yoke in adjusted position and securing the same against vibration.

9. In a rotary compressor a rotating compression cylinder, a head for closing each end of said cylinder, a rotor eccentrically mounted in said cylinder, a piston blade mounted in the rotor, and flanges carried on the inside of the cylinder heads and concentric with the cylinder for slidably engaging the inner edge of the piston blade for holding said piston blade in constant contact with the interior of the cylinder wall.

10. In a rotary compressor a casing composed of an upper and a lower complementary section, means for securing said sections together, a cylinder provided with bearings located in said casing, a yoke mounted in the casing, and adapted to contact with a portion of said bearings, means for adjusting said yoke in said casing, and means for holding said yoke in adjusted position and against vibration.

11. In a rotary compressor a casing composed of complementary sections, a shaft mounted in said casing, bearings for said shaft carried by said casing adjacent its ends, packing rings carried by said shaft for sealing the ends of said casing and preventing the escape of compressed air therefrom, a rotor mounted on said shaft within said casing, a compression cylinder surrounding said rotor and eccentric thereto, heads for closing said cylinder, a floating head rotatably located within said cylinder and contacting with one end of the rotor so as to form a compression space, means for adjusting said cylinder toward said rotor so as to form a rolling contact between the same, and means for holding said adjusting means in position and against vibration.

12. In a rotary compressor, a casing having an air opening and a discharge port, a rotating compression cylinder mounted in said casing, a rotor eccentrically mounted in and contacting longitudinally with said compression cylinder, an inlet port formed in said rotor, a passageway between said air opening and said inlet port, a piston located in advance of said inlet port, a valve controlled discharge port in said rotor and in advance of said piston, means for feeding a lubricant into the air as it is drawn into said casing, said air adapted to carry said lubricant with it and into the casing whereby said compressor is lubricated, means for adjusting said compression cylinder towards said rotor, and means for locking said adjusting means against movement.

13. In a rotary compressor a stationary casing, a cylinder mounted to rotate in said casing, a rotor eccentrically mounted in and contacting with said cylinder along a longitudinal line on its inner periphery, a shaft for supporting said rotor carried by said casing and projecting from one end thereof, a floating head located in said cylinder and adapted to contact with one end of said rotor, and means for rotating said floating head simultaneously with said cylinder.

14. In a rotary compressor a casing composed of an upper and a lower complementary section, means for securing said sections together, a yoke mounted in said casing, guide members formed in said casing for centering and guiding said yoke, bearings carried by said yoke, a cylinder carried by said bearings, a rotor eccentrically mounted in said cylinder, means for adjusting said yoke so that said cylinder can be adjusted toward the rotor, wedge members located in said casing for exerting pressure against said yoke for holding said yoke against vibration, and means for exerting longitudinal pressure on said wedge members.

15. In a rotary compressor a compression cylinder closed at both ends, a rotor shaft located within the cylinder and arranged eccentric thereto, a rotor mounted on said shaft, a casing surrounding said cylinder, a yoke for supporting the cylinder at its ends mounted in said casing, a screw mounted in the casing and projecting into the interior thereof and contacting with said yoke for maintaining the same in adjusted position and wedging devices for securing said yoke against vibration.

In testimony whereof I have affixed my signature.

EDWARD WILSON.