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ROTARY AIR COMPRESSOR OR PUMP

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ROTARY AIR COMPRESSOR OR PUMP.

1,162,962.


To all whom it may concern:

Be it known that I, EDWARD WILSON, a citizen of the United States, and resident of St. Louis, Missouri, have invented certain new and useful Improvements in Rotary Air Compressors or Pumps, of which the following is a specification containing a full, clear, and exact description, reference being had to the accompanying drawings, forming a part hereof.

My invention relates generally to air compressors, blowers, pumps and the like, and the principal objects of my invention are: first, to produce a device of the rotary type, which is simple in construction and substantially noiseless and free from vibration and pounding while in operation; second, to reduce to a minimum the friction which naturally occurs in a compressor or pump of the rotary type; third, to provide a movable bearing ring, the inner face of which is eccentric relative to its periphery for and embracing the rotary head which carries the centrifugal compressing plate to take up wear and play of the rotary head; fourth, to provide means whereby the rotary ring and head are cooled by the atmospheric air drawn into the machine; fifth, to provide means whereby the sides or ends of the rotary head, are kept tight against the inclosing shell by the pressure of the air compressed by the device; sixth, to provide a simple and adjustable means for the bearing of the rotating ring; and seventh, to provide simple means for a thorough lubrication of the movable parts of the device.

To the above purposes, my invention consists in certain novel features of construction and arrangement of parts hereinafter more fully described, pointed out in the claims, and illustrated in the accompanying drawings, in which:

Figure 1 is a vertical section taken longitudinally through the center of my improved compressor; Fig. 2 is a vertical section taken on the line 2—2 of Fig. 1; Fig. 3 is a vertical section taken on the line 3—3 of Fig. 1; Fig. 4 is a detailed section taken on the line 4—4 of Fig. 3; Fig. 5 is a vertical section taken on the line 5—5 of Fig. 1; and Fig. 6 is a side elevation of the rotary head made use of in my improved compressor.

The main body of my improved compressor comprises a cylindrical housing 10, the right end of which is closed by a wall 11, with which is formed integral a centrally disposed bearing 12, and bolted to the opposite end of this housing 10 is a plate 13 with which is formed integral a centrally disposed bearing 14, which is in alignment with the bearing 12.

Bolted to the wall 11 is a housing 15, on the interior of which is formed a perforated wall 16, and formed in the center thereof is a bearing 17, in alignment with the bearings 12 and 14.

Tapped in the housing 15 is a pipe 18, which leads to a suitable compressed air tank or the like. Bolted onto the plate 13 is a housing 19, in which is formed an opening 20, and tapped in the lower portions of said housing 19 and in the lower portion of the housing 15, are suitable oil supply pipes 21.

22 designates the main shaft of the device, which shaft is journaled for rotation in the bearings 12, 14 and 17, and the right-hand portion of this shaft is provided with a longitudinally disposed port or passage-way 23, the inner end of which communicates with the port 24 formed through said shaft 22. The left-hand end of this shaft projects through the opening 20, and is provided with a member 25, which forms a part of a coupling whereby the shaft may be directly connected to the shaft of an armature, motor or turbine.

An opening 26 is formed in the upper portion of the shaft 26 within the housing 19, which opening allows an oil ring 27 to ride directly upon the surface of the shaft 22 to oil the bearing 14, and the bearings 12 and 17 are oiled by means of a ring 28 which rides directly upon the surface of the shaft between said bearings 12 and 17. The shaft 22 is slightly reduced in diameter at the point where the same is engaged by the ring 28, thus forming an oil packing groove which prevents the leakage of air from the chamber within the housing 15 through the bearing 12 into the housing 10.

Arranged within the housing 10 is a bearing ring 29, the opening in which is slightly eccentric relative to the periphery thereof, and thus said ring has greater thickness on one side than upon the other, and when said ring is positioned within the housing, the thicker portion of said ring is arranged at the top. Formed in the periphery of half of this ring is a series of recesses 30, any one of which is formed integral a centrally disposed bearing 12, and bolted to the opposite end of this housing 10 is a plate 13 with which is formed integral a centrally disposed bearing 14, which is in alignment with the bearing 12.
of which is adapted to receive the point of a set screw 31, which is seated in the top of the housing 10, and when it is desired to rotate this ring for the purpose of adjustment, a pin or key 22 is inserted through a slot 33 formed in the upper portion of the housing 10, the inner end of said pin or key being successively engaged in the recesses 30. The corners on the inner edges of the ring 29 are cut away, as designated by 34, to form ball raceways, which are occupied by hardened metal balls 35, and applied to the sides of said ring are plates 36, which retain the balls in the raceways.

Arranged for rotary movement in the ring 29, and bearing upon the balls 35, is a cylindrical shell 37, the right hand end of which is provided with a wall 38, in the center of which is formed an opening 39 to accommodate the left hand portion of the bearing 19, and fitted onto the outside of this wall 38 is a ring or plate 40, and located in the space between the edge thereof and the right hand end of the shell 37 is a series of balls 41, against which bears a plate 42 loosely positioned against the inner face of the wall 11. The plate 42 serves to take up the side thrust of the shell 37, and also serves the important purpose of packing the ends of the shell or compression cylinder and also the ends of the rotary head and compression plate, which operate in said shell and which are hereinafter described.

Formed through the wall 11, at a point which may be termed “the center of pressure”, is an opening 43, in which is arranged for sliding movement a plug 44, and bearing against the outer end of this plug is a resilient metal diaphragm 45 held in place by a perforated cap 46. In some instances, and particularly where large compressors are constructed, it may be found desirable to provide a number of these plugs or diaphragms.

Keyed upon the shaft 22 is a cylindrical head 47 on the right hand end of which bears against the inner surface of the wall 38, and, formed integral with the left hand end of this head is a flange 48 against which the left hand end of the shell 37 bears when the rings are properly assembled. This construction of head 47 and shell 37 in conjunction with the diaphragm 45 and plug 44, and by virtue of the receiver pressure acting upon the diaphragm 45, provides effective means of maintaining fluid-tight joints at the point of contact between the left hand end of the shell 37 and flange 48 of the head 47 and the wall 38 of the shell 37 and the right hand end of the head 47. This construction of head 47 and shell 37 in conjunction with the diaphragm 45 and plug 44 permits the receiver pressure, which prevails in the chamber within the housing 15, to force the diaphragm inward thus imparting a corresponding movement to the plug 44 and therefore maintaining the bearing-plate 42 against the ball bearings 41 which action continues while the compressor is in operation thus maintaining fluid-tight joints at points of contact between the shell 37 and the head 47 and incidentally takes up any side thrust of the shell 37 and parts carried thereby. It will be understood that the area of the diaphragm is such as to produce as little pressure as possible upon the sliding surfaces.

Fitted onto the outer face of the flange 48 is a ring 49, in which is formed a ball raceway 50, occupied by hardened metal balls 51, which latter bear directly against a bearing plate or ring 52 fixed in the inner face of the plate 13.

Formed in the periphery of the rotary head 47 is a transversely disposed bearing 53, which is loosely mounted a head or journal 54, and formed integral with this head or journal is a wing or blade 55, which forms the centrifugal compression blade or plate, and the outer face of which plate or blade is formed to conform with the inner surface of the shell 37.

Formed in the head 47 is a port or passage-way 56, the inner end of which communicates with the port 24 formed in the shaft 22, and the opposite end of said port or passage-way 56 terminates beneath the plate or blade 55, and arranged in this end of said port or passage-way 56 is a spring held outlet valve 57.

Formed in the head 47 is a suction chamber 58, and leading therefrom to the exterior of said head, immediately adjacent and to the rear of the bearing 53, is a port 59. Ports 60 are formed through the side wall of the head 47 and establish communication between the chamber 58 and the spaces within the housing 10.

Formed through the upper portion of the housing 10 is a series of air inlet ports 61, the outer ends of which are covered with sections 62 of thin wire gauze or like material, capable of filtering dust from the air drawn into the compressor.

A small passage-way 63 is formed through the head 47 and leads from one side thereof to the center of the bearing 53, thus providing means whereby oil is delivered to said bearing for the purpose of lubricating the head or journal 54.

The bearings 12, 14 and 17 are so formed on the corresponding plates 11, 13 and 16 as that when the parts of the compressor are properly assembled, the rotary head 47 is eccentrically arranged within the shell 37, and the periphery of said head 47 fits snugly against the inner surface of said shell in such manner that an eccentric or crescent shaped compression space is formed between the rotary head 47 and shell 37.
When the device constructed as herein described is to be used as an air compressor, the shaft 22 is rotated, and as the rotor head is likewise rotated, the blade or wing 55 will be thrown out by centrifugal force and by air pressure, with its outer surface in constant engagement with the inner surface of the shell 37. The head 47 and the plate 53 being in frictional engagement with the shell 37 causes said shell to rotate with said head 47, and during this rotation the shell 37 bears on the balls 35 located in the race-ways 24. During this rotary motion, the blade or wing will vibrate or move outward and then inward, owing to the eccentric arrangement of the head 47 relative to the shell 37, and as this action takes place, the air in advance of the wing or blade will be compressed and such compression will force the valve 75 open, thus permitting the compressed air to pass into the port or passage-way 23 and from thence into the chamber within the housing 15 and from thence to the pipe 18, and finally, to the tank or receiver. As this compressing action takes place, atmospheric air is drawn into the device through the ports 61 to the interior of the housing 10 and from thence through the ports 60 to the chamber 55, and from thence through the port 59 into the compression chamber between the head 47 and shell 37.

The port 59 is arranged immediately to the rear of the bearing 53 in order that there will be little or no leakage or escape of air at the time said port is passing the point of contact between the head 47 and the shell 37.

The atmospheric air entering the chamber within the housing 10 exerts a cooling action upon the rapidly rotating parts of the compressor, owing to the absorption of a portion of the heat of compression by the incoming air. This cooling action is greatly intensified from the fact that the lubricating oil held in the casing is thrown over the internal surface of the casing and the outer surfaces of the shell and head. If the motor were used as a gas engine this would furnish a very effective means of cooling as the oil could be circulated continuously through a cooler, however, in the present case, the incoming air is a coolant.

The vacuum created by the rotor head and shell 37, due to pressure within the compression space, is taken up by the ball bearings 41 and 51, and the friction resulting from the rotation of the head 47 and shell 37 is materially reduced by reason of the ball bearings 35, and by reason of the low relative velocity of the two rotating parts.

While the device is in operation the receiver pressure is utilized for forcing the plug 44 inward to cause the bearing plate 42 to engage against the ball bearings 41, thereby doing away with any lateral vibration of the shell 37 and head 47 during the operation.

In addition to preventing lateral vibration, the plug 44, forced inward by the receiver pressure maintained within the chamber in the housing 15, serves the important purpose of preventing the pressure of air within the compression space from forcing the head 47 and shell 37 apart and permitting the escape of air between the ends of 75 said head and shell. The diaphragm is made of sufficient size so that the receiver pressure exerted upon the outside will overcome the pressure exerted outwardly by the air within the compression space at any point during the compression period. It will be understood that the pressure within the crescent-shaped compression space is not always acting upon the same area, but as the pressure rises the area of surface upon which said pressure is acting is constantly decreasing, the total pressure being practically constant and therefore the area of the diaphragm is such that the pressure on the exterior thereof will just overcome the pressure within the compression space at all times. It being understood that this pressure should be as little in excess of the total pressure within the compression space as possible in order that the friction be as little as possible.

During the rotary movement of the parts, the left-hand end of the shell 37 bears directly upon the right-hand face of the flange 48, and this bearing face is lubricated by maintaining a quantity of oil in the lower portion of the shell 37.

The right-hand end of the head 47 and the inner face of the plate 38 are lubricated by the oil which is forced through the bearing 15, and which oil is thrown outward by centrifugal force and finally passes onto the inner face of the wall 38. The bearing 53 is lubricated by oil which is delivered to said bearing through the passage-way 63.

To compensate for any wear and to prevent leakage of fluid between the shell 37 and the head 47 at point of bearings, the set screw 31 is loosened from the ring 29, and by means of the pin 32 said ring 29 is partially rotated, which action owing to the eccentric construction of ring 29 forces the shell 37 against the head 47. After this ring has been properly adjusted, the set-screw 31 is re-seated in one of the recesses 30.

During operation the wing or blade vibrates outward and inward without jar or sounding, and as the head 47 and shell 37 rotate during the operation, there is a minimum of wear by grinding between the blade 55 and shell 37, which wear would be greater if the shell were rigidly held.

A device of my improved construction is primarily intended for use as an air compressor, a blower or a pump, but said device may be utilized as a prime mover, and where...
so used the direction of rotation is the opposite to that herein shown and described. The device is comparatively simple in construction, and as the mechanical friction in the device is reduced to a minimum, a much higher speed can be maintained than is possible in similar devices of ordinary construction and consequently a greater air compressing efficiency is obtained.

I claim:

1. In an air compressor, members axially movable relatively to each other forming an air compressing chamber, a member acting on one of the movable members and subject to a pressure greater than the pressure within the compressing chamber whereby the movable members of the compressing chamber are moved and normally held in contact with each other to form fluid tight joints.

2. In combination with a housing, cylindrical shell and rotating head, one of which is made up of a number of parts axially movable relative to each other, of means acted upon by pressure generated within the housing and operating to form fluid tight joints between the cylindrical shell and rotating head.

3. In an air compressor, a housing, a shaft journaled for rotation therein, a head fixed on said shaft in which head is formed inlet and outlet ports, a shell arranged for rotation within the housing and partly inclosing the rotating head, which shell is eccentrically arranged relative to said head and rotates therewith during the operation of the compressor, anti-friction bearings for the ends of the head and shell, and means actuated by the pressure of the fluid compressed in the compressor for engaging the anti-friction bearing on the end of the shell.

4. In combination with a housing, cylindrical shell and a rotating head, one of which is constructed of members axially movable relative to each other, of a casing and means carried by the casing acted upon by pressure from within the housing and operating to form fluid-tight joints between said movable members.

5. In a rotary compressor, members composing a rotating cylindrical shell and rotating head, co-acting to form an inclosed compressing space, means for varying the size of the inclosed space, bearings for the axis of the rotating head and an adjustable anti-friction bearing for the periphery of the cylindrical head for holding it normally in fluid tight contact with the rotating head and eccentric thereto.

6. In an air compressor, a shell, an adjustable bearing ring arranged therein, a second shell arranged for rotation in the bearing ring, a housing, a shaft journaled for rotation in the housing, a head carried thereby, which head is eccentrically positioned within the second mentioned shell, there being inlet and outlet ports formed in said head, and a centrifugal plate hinged to the rotary head and bearing against the second mentioned shell.

7. In an air compressor, a shell, an adjustable bearing ring arranged therein, a second shell arranged for rotation in the bearing ring, a housing, a shaft journaled for rotation in the housing, a head carried thereby and which head is eccentrically positioned within the second mentioned shell, there being inlet and outlet ports formed in said head, a centrifugal plate carried by the rotary head and bearing against the second mentioned shell, and a spring-held valve located in the head beneath the centrifugal plate.

8. In a rotary air compressor, a casing, bearings supported by the casing, a cylindrical shell and rotating head arranged in said bearings and forming a compression chamber, the surfaces of which cylinder and said head have a movement relative to each other, said head having a circular depression at each of its ends into which said bearings extend, oil rings adjacent said bearings which supply lubricant to the bearings and ultimately to the moving surfaces of the members forming the cylindrical shell and head.

9. In an air compressor, a housing, an air compressor within the housing, a pressure chamber, a hollow shaft supporting and placing in communication the compressor and pressure chamber, a wall adjacent said casing and pressure chamber, a bearing for said shaft supported by said wall, there being a depression in said shaft adjacent said bearing within the pressure chamber, and an oil ring engaging said depression to produce an oil-packed fluid tight joint around said bearing and between the housing and pressure chamber.

10. In a device of the class described, a housing, a shaft journaled for rotation therein, a head fixed on said shaft, in which head is formed inlet and outlet ports, a shell arranged for rotation within the housing and partially inclosing the head, there being a compression space formed between the head and shell, a compression plate carried by the head and operating within the compression space and which head and shell rotate together, and means actuated by the pressure of the fluid compressed by the device for taking up the side thrust of the rotating head and shell and maintaining tight joints between the engaging faces thereof.

11. In a device of the class described, a housing, a shaft journaled for rotation therein, a head fixed on said shaft, in which head is formed inlet and outlet ports, a shell arranged for rotation within the housing and partially inclosing the head, there being a...
a compression space formed between the head and shell, a compression plate carried by the head and operating within the compression space and which head and shell rotate together, means actuated by the pressure of the fluid compressed by the device for taking up the side thrusts of the rotating head and shell and maintaining tight joints between the engaging faces thereof, and anti-friction bearings for the rotating head and shell.

12. In a device of the class described, a housing, a shaft journaled for rotation therein, a head fixed on the shaft, a cylindrical shell arranged for rotation in the housing and operating with the head, which shell is eccentrically arranged relative to said head to form a crescent-shaped compression space, a flange integral with said head and forming one of the end walls of said compression space, a wall integral with the shell, and forming the opposite end wall for the compression space, and anti-friction bearings engaging the outer faces of said end walls.

13. In a device of the class described, a housing, a shaft journaled for rotation therein, a head fixed on the shaft, a cylindrical shell arranged for rotation in the housing and operating with the head, which shell is eccentrically arranged relative to said head to form a crescent-shaped compression space, a flange integral with said head and forming one of the end walls of said compression space, a wall integral with the shell and forming the opposite end wall for the compression space, anti-friction bearings engaging the outer faces of said end walls, and means actuated by the pressure of the member compressed by the device for preventing the leakage of air from the compression space.

14. In an air compressor, the combination with rotatable members forming together a cylinder and a rotating head, which are subjected to pressure and movable longitudinally of their axes relative to each other, of a movable member acting on the rotatable members, said movable member being subjected to a greater pressure than the first mentioned members, thereby holding the rotatable members in contact with each other to form a non-leaking joint between the rotatable members.

15. In an air compressor, the combination with movable members, movable longitudinally on their axes relative to each other, forming an air compressing chamber, of a movable member acting on one of said compressing chamber members, said movable member being subjected to a proportionally greater pressure than the pressure within the compression chamber, whereby the compressing chamber members are normally held in fluid tight contact with each other.

16. In combination with elements forming a rotary cylindrical shell and head moving axially relative to each other and co-acting to form the walls of a rotating cylinder and a piston operating within the cylinder, of means acted upon by fluid pressure generated within said cylinder acting to change the relative position of the members forming the cylinder, to take up any wear of and maintain tight joints between the points of contact of the elements forming the cylinder and between said elements and the piston.

17. In combination with a cylinder and piston, one of which is made up of a number of parts axially movable relative to each other, of means acted upon in an axial direction by a pressure greater than the pressure within the cylinder for the operation of one of said parts to form fluid tight joints between the cylinder and piston.

18. In a rotary compressor, a cylindrical housing, a two part rotating air compressing means in said housing, a second housing in communication with the first mentioned housing, and means influenced by air from said second mentioned housing for the axial movement of one of the parts of said compressing means.

19. In combination with an air compressing means made up of parts axially movable relative to each other, of a housing in communication with the compressing means, and means acted upon by air from said housing to produce the axial movement of one of the parts of the compressing means.

20. In a rotary air compressor, a cylindrical shell in which is held a quantity of lubricating oil, bearings within the cylindrical shell, members forming a rotating head supported in said bearings, a concentric flange formed integral with the rotating head of larger diameter than and protruding beyond the outer periphery of the cylindrical shell at its lower edge, owing to the relative eccentric arrangement between the head and shell, there being a relative movement of the surfaces of the elements forming the cylindrical shell, and said flange being partially submerged in the lubricating oil within the cylindrical shell for the purpose of disposing oil over said surfaces.

In testimony whereof, I have signed my name to this specification, in presence of two subscribing witnesses.

EDWARD WILSON.

Witnesses:
M. P. SMITH,
E. L. WALLACE.