March 25, 1930. J. ROSETT 1,751,843

AIR COMPRESSOR

Filed June 5, 1929

Fig. 1.

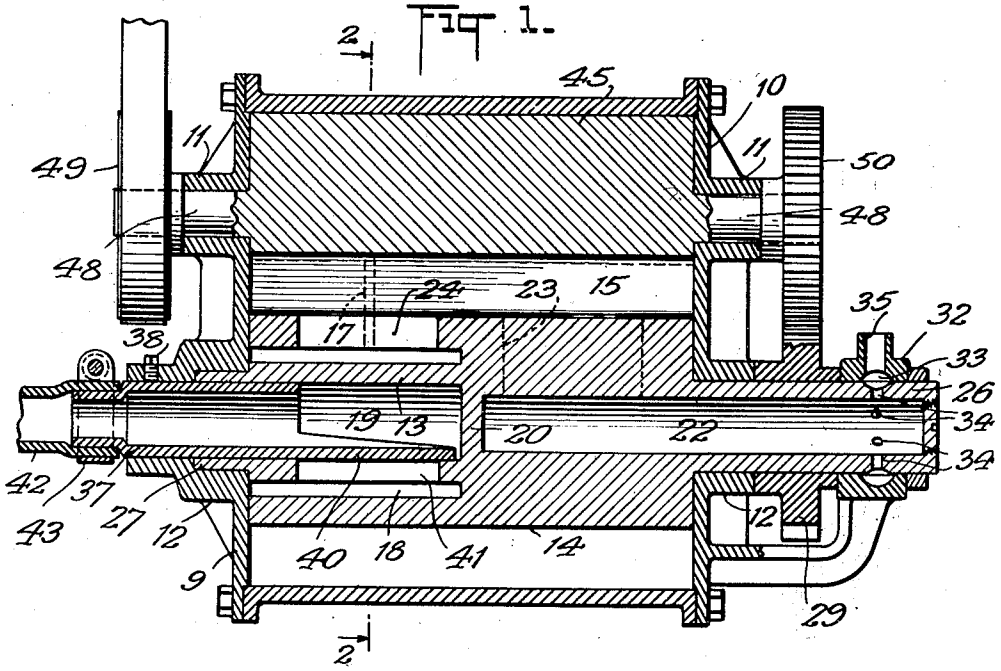


Fig. 4.

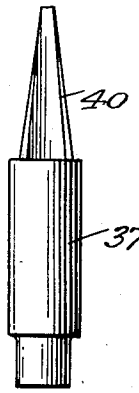


Fig. 2.

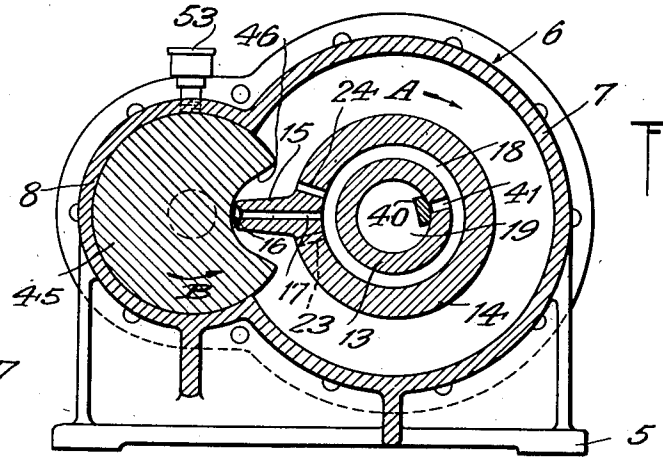
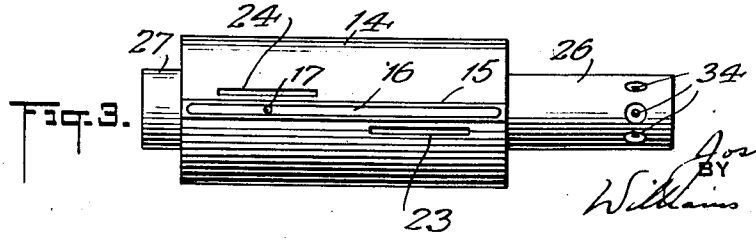


Fig. 3.



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230. GAS PUMPS AND
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UNITED STATES PATENT OFFICE

JOSHUA ROSETT, OF NEW YORK, N. Y.

AIR COMPRESSOR

Application filed June 5, 1929. Serial No. 368,465.

This invention relates to air compressors of the type employing a pair of rotors, which are journaled within a housing and cooperate with each other to draw air in through an intake opening and expel it from a discharge opening under increased pressure, one of such rotors being provided with a vane which is adapted to enter and pass through a vane-receiving pocket at a period intermediate the intake and compression stages.

Heretofore attempts have been made to maintain a tight seal between the compression and intake sides of the rotating vane at the time it passes through the vane-receiving pocket, and to also provide absolute synchronism in the operation of the rotors, the fulfillment of both of these conditions being recognized as essential to proper operation of the machine. However, it has been impossible to meet these requirements from a practical standpoint due to the extreme accuracy called for in machining and fitting the various parts and in the timing of the rotors in their operation, with the result that the machines could not be successfully operated at high speeds or for any considerable period of time.

One important object of this invention is to provide a generally improved device of the character mentioned, in which accuracy in the fitting of the outer end of the vane with respect to the wall of the vane-receiving pocket is not required, the necessity for accuracy in synchronizing the rotors is obviated and in which the various parts are so related to each other that smoothness and efficiency in operation is assured and the degree of wear is reduced to a minimum.

Another important object of this invention is to provide a generally improved device of the character mentioned which is so constructed that adequate lubrication of the various parts is insured under all conditions of operation and which in itself serves as an effective separator as between the lubricant employed and the air undergoing compression so that such air is delivered free from particles of lubricant, the presence of which in numerous instances is highly objectionable.

Other objects and advantages of the invention will become apparent from the following description, taken in connection with the accompanying drawings, in which—

Figure 1 is a horizontal sectional view through the compressor embodying this invention; Figure 2 is a transverse sectional view taken on line 2—2 of Figure 1; Figure 3 is a view in elevation of the main rotor as viewed from the outer end of the radially projecting vane thereof; and Figure 4 is a plan view of one end of a shaft-like conduit, showing a valve tongue carried by the inner end thereof.

Referring to the drawings, the numeral 5 indicates a suitable base, upon which is supported a housing 6 including a pair of generally cylindrical casings 7 and 8, the former being adapted for the reception of a main rotor, hereinafter more particularly described, and the latter being adapted for the reception of an auxiliary rotor, also hereinafter more particularly described. The housing 6 may be cast and cored, according to well-known practice, whereupon the interior walls of the casing 7 and 8 may be machined or finished so as to present smooth interior cylindrical surfaces. To opposite ends of the housing 6 are secured head plates 9 and 10, which are provided with suitable bearings 11 and 12, disposed co-axially with the casings 8 and 7, respectively.

Located within the casing 7 is a main rotor 14, which has an outer diameter substantially less than the inner diameter of the casing within which it is located, and is provided with an outwardly projecting or radially disposed vane 15, which is co-extensive with the inner wall of the casing 7 and is of a length equal to the rotor by which it is carried. This vane 15 is provided at its outer end with a longitudinal groove 16, extending substantially to the ends of the vane, through which leads a duct 17, communicating with an annular chamber 18 provided at one end of the rotor 14. This annular chamber 18 is formed by milling a groove in the rotor 14, with the result that a central boss is left, the boss being later drilled centrally and longitudinally thereof to provide a cylindrical wall 13 and a central valve chamber or outlet passage 19,

which is coextensive with the annular chamber 18, the bottom of the chambers 18 and 19 being formed by a divisional wall 20, which is located substantially midway of the rotor 14 and is formed by boring out the opposite end of the rotor 14 and its stub shaft 26 to provide therein an intake passage 22. Formed in the wall of the rotor 14, is an inlet port 23 which maintains communication between the intake passage 22 and the space intermediate the rotor and the inner wall of the casing 7, the port being located rearwardly of or at the intake side of the vane 15. Formed in the wall of the rotor 14 at the opposite side of the vane 15, is an outlet port 24 which maintains communication between the annular chamber 18 and the space afforded between the rotor 14 and the inner wall of the casing 7 at the compression side of the vane 15.

The rotor 14 is rotatably supported within the casing 7 by the stub shaft 26 in conjunction with a similar shaft 27, both of which are journaled in the bearings 12 and the latter of which constitutes an extension of the wall13. The shaft 26 serves as a driving shaft for the rotor 14 and is provided at its outer end with a gear 29, by which the rotor 14 is rotated in synchronism with the auxiliary rotor to be hereinafter described.

In order that the compressor embodying this invention may be employed as a vacuum pump, when desired, the shaft 26 is provided with a stationary collar 32, suitably anchored with respect to the shaft 26 and provided with an annular groove 33 in its inner wall which is maintained in communication with the intake passage 22 through a plurality of openings 34 drilled or otherwise formed in the wall of that shaft, the collar 32 being provided with a tubular extension 35 which also communicates with the groove 33 and may be connected to the thing or object to be evacuated, as will be readily understood.

Projecting through the end plate 9 and the stub shaft 27 at the opposite end of the rotor 14 is a shaft-like outlet conduit 37 which is held in a fixed position by a set screw 38 and communicates with the valve chamber 19. Carried by the inner end of the conduit 37 is a tapered valve tongue 40 which is so shaped on its periphery as to conform to the cylindrical contour of the valve chamber 19. This valve tongue 40 is adapted to gradually open and close communication, as the rotor 14 rotates, between the annular chamber 18 and the valve chamber 19 through an outlet port 41 formed in the wall 13 of the valve chamber at a point substantially diametrically opposite the outlet port 24, as will hereinafter more clearly appear. For the purpose of conducting the compressed air to a desired location outside of the compressor, such as a storage tank not shown, there may be provided a hose 42, or the like, which is secured to the outer end of the conduit 37, the connection being herein shown as made by a suitable clamp or compression ring 43.

The auxiliary rotor, above mentioned, is indicated by the numeral 45 and is of such a size and is so located that its periphery is adapted to engage the periphery of the rotor 14 during the major portion of each revolution. This auxiliary rotor is provided with a vane-receiving pocket 46, into and through which the vane 15 passes upon the completion of each compression cycle, the relation of the vane and the wall of the vane-receiving pocket being such, however, that they do not come into contact with each other inasmuch as it is not necessary with the machine embodying this invention to maintain a seal at this instant between the intake and compression sides of the vane. By reason of the fact that the construction is such that the necessity for an accurate fit of the vane 15 with respect to the wall of the vane-receiving pocket 46 is obviated, it follows that extreme care and precision in synchronizing the rotors 14 and 45 is unnecessary, as previously mentioned. The rotor 45 is mounted for rotation within the casing 8 by a pair of stub shafts 48 journaled in the bearings 11. To one of the stub shafts 48 is connected a pulley 49 by which power of rotation may be transmitted to the rotors, the other of the shafts 48 being provided with a gear 50 which meshes with and is of such a size with respect to the gear 29 carried by the shaft 26 that the rotors are rotated in synchronism. As the rotors 14 and 45 are rotated in the direction of the arrows A and B in Figure 2, the vane 15 upon emerging from the vane-receiving pocket 46 engages the inner wall of the casing 7 and establishes a substantial air-tight joint therewith, and at the same time a similar joint is established between the peripheries of the rotors 14 and 45 by reason of their engagement with each other. As rotation of these rotors continues, air is drawn in through the intake passage 22, and intake port 23, such air entering the progressively enlarging space at the rear of the vane 15 and in front of the contacting surfaces of the two rotors.

During the major portion of one revolution such intake of air continues and such air as was taken into this space in a similar manner during the previous rotation is simultaneously expelled, as will be later more readily understood. At the instant the vane 15 reaches the end of its travel, in so far as its engagement with the inner wall of the casing 7 for one revolution is concerned, the vane-receiving pocket 46 presents itself and permits the vane to pass therethrough as the rotor 45 continues to rotate. At or about the time the vane 15 enters the vane-receiving pocket 46, the valve tongue 40 closes communication between the annular chamber 18 and the valve chamber 19 through the port 41, so that, even though the vane does not accurately fit the

vane-receiving pocket, there can be no escape of built-up pressure back through the port 41 of the compressor to the inlet thereof. This closing of the port 41 is effected gradually, by reason of the taper given to the valve tongue 40, so as to eliminate pounding which would occur if such port were completely closed at such a point as would result in the trapping of a substantial amount of air between the vane 15 and the rotor 45. The valve tongue 40 maintains the port 41 closed during such time as is required for the vane 15 to pass through the vane-receiving pocket 46, but at or about the time the vane emerges from that pocket the port begins to gradually open. Due to the fact that the port 41 is gradually opened, the backward flow of built-up pressure through the port 41, annular chamber 18 and port 24 into the compression space containing air at atmospheric pressure cannot take place with extreme violence, and since this is true there cannot be any pounding as the vane 15 emerges from the vane-receiving pocket. This backward flow of air continues until the pressure at the compression side of the vane is built up, by reason of such return and by reason of the compression action of the vane, to a point of equalization, whereupon the air undergoing compression is delivered through the port 41, valve chamber 19 and conduit 37 to storage or a point of utilization. It will be understood, of course, that in the event the device embodying this invention is employed as a vacuum pump, the tongue 40, by closing the port 41 serves to maintain the vacuum during such time as the vane 15 passes through the vane-receiving pocket 46.

Lubrication of the various moving parts entering into the device embodying this invention is afforded by supplying oil to the interior of the housing 6 by suitable means, as through an oil-cup 53 which may be carried by the casing 8. Such oil as is supplied through the oil-cup 53 is directed to the peripheral surface of the rotor 45, from which it is thrown by centrifugal action to the surface of the rotor 14. Centrifugal action here comes into play to throw the oil from the surface of the rotor 14 outwardly to the wall of the casing 7 and also back onto the rotor 45, a sufficient amount of oil being always present on the surfaces of the two rotors to provide an adequate seal between their contacting surfaces. Such oil as may pass from the compression side of the vane 15, through the port 24, into the annular chamber 18, is collected on the outer wall of that chamber from which it is thrown by centrifugal action outwardly through the duct 17 of the vane 15, so that it may collect in the groove 16, formed in the outer end of that vane, where it is needed for lubricating the vane as it passes over the inner surface of the casing 7. It is to be also noted that, since the port 41 is located at a point substantially diametrically opposite the port 24, the wall 13, against which strikes such oil as is commingled with the air entering the chamber 18 through the port 24, serves as an effective barrier for that oil to prevent it from entering the port 41. Inasmuch as the outer end of the duct 17 is at a point more remote from the center of rotation of the rotor 14 than the outer end of the port 24, the centrifugal action through the duct 17 will be greater than through the port 24, and for that reason a substantial part of oil entering the annular chamber 18 will be thrown outwardly through the duct. However, a portion of the oil entering the annular chamber 18 will be thrown outwardly through the port 24, particularly at the time the port 41 is uncovered since the centrifugal action is augmented by the return of pressure from the annular chamber to the compression side of the vane 15, as previously described. Still another part of oil entering the annular chamber 18 will find its way from that chamber onto the inner face of the plate 9 in the vicinity of the bearing 12 and will creep along the surface of that plate, finding its way into the space between the stub shaft 27 and its bearing and into the space afforded between the conduit 37 and the inner wall of the valve chamber 19, so as to provide adequate lubrication between the valve tongue 40 and such wall.

While only one form of the invention is herein shown and described, it will be understood that various changes may be made without departing from the spirit of the invention or the scope of the following claims.

What is claimed is:

1. A device of the character described comprising a housing including casings, main and auxiliary rotors located within said casings and provided respectively with a vane and a vane-receiving pocket, into which pocket said vane is adapted to loosely fit, said rotors being adapted to engage each other and form, with said vane and one of said casings, compression and intake chambers of variable capacities, said main rotor having an inlet passage at one end and an outlet passage at the other end, said inlet and outlet passages being adapted to communicate respectively with said intake and compression chambers, a tubular driving shaft carried by one end of said main rotor and communicating with said inlet chamber, and a stationary conduit with which said outlet chamber is adapted to communicate and about which said main rotor is adapted to rotate, said main rotor being provided with an annular chamber surrounding said outlet passage and communicating therewith, and a tapered valve tongue carried by said stationary conduit and adapted to close gradually the outlet passage with respect to the inlet passage at such time as said vane enters said pocket.

2. A device of the character described comprising a housing including casings, main and auxiliary rotors located within said casings and provided respectively with a vane and a vane-receiving pocket, into which pocket said vane is adapted to loosely fit, said rotors being adapted to engage each other and form, with said vane and one of said casings, compression and intake chambers of variable capacities, said main rotor having an inlet passage at one end and an outlet passage at the other end, said inlet and outlet passages being adapted to communicate respectively with said intake and compression chambers, a tubular driving shaft carried by one end of said main rotor and communicating with said inlet chamber, and a stationary conduit with which said outlet chamber is adapted to communicate and about which said main rotor is adapted to rotate, said main rotor being provided with an annular chamber surrounding said outlet passage and communicating therewith, and a tapered valve tongue carried by said stationary conduit and adapted to close gradually the outlet passage with respect to the inlet passage at such time as said vane enters said pocket, said vane being provided at its outer end with a longitudinal groove and having a radial duct formed therein communicating with said groove and with said annular chamber.

3. A device of the character described comprising a housing including casings, main and auxiliary rotors located within said casings and provided respectively with a vane and a vane-receiving pocket, into which pocket said vane is adapted to loosely fit, said rotors being adapted to engage each other and form with said vane and one of said casings compression and intake chambers of variable capacities, said main rotor having an inlet passage formed in one end thereof and having an intake port affording communication between said intake passage and said intake chamber and having at its other end an outlet passage and an annular chamber, said outlet passage and annular chamber being separated by a wall having a communicating port therein, said main rotor having an outlet port communicating with said annular chamber and adapted to communicate with said compression chamber, a tubular shaft carried by one end of said main rotor and communicating with said intake chamber, a stationary conduit projecting into said outlet passage and having a tapering valve tongue carried by its inner end adapted to periodically sever communication between said outlet passage and said annular chamber through said communicating port as said rotors are rotated.

4. A device of the character described, comprising a housing including casings, main and auxiliary rotors located within said casings and provided respectively with a vane and a vane-receiving pocket through the latter of which said vane is adapted to pass, said rotors being adapted to engage each other and form, with said vane and one of said casings, compression and intake chambers of variable capacities, said main rotor having an inlet passage formed in one end thereof and having an intake port affording communication between said intake passage and said intake chamber and having at its other end an outlet passage and an annular chamber, said outlet passage and annular chamber being separated by a wall having a communicating port therein, said main rotor having an outlet port communicating with said annular chamber at a point substantially diametrically opposite said communicating port and adapted to communicate with said compression chamber, and valve means for closing said outlet passage with respect to said inlet passage at such time as said vane enters said vane-receiving pocket.

5. A device of the character described, comprising a housing including casings, main and auxiliary rotors located within said casings and provided respectively with a vane and a vane-receiving pocket through the latter of which said vane is adapted to pass, said rotors being adapted to engage each other and form, with said vane and one of said casings, compression and intake chambers of variable capacities, said main rotor having an inlet passage formed in one end thereof and having an intake port affording communication between said intake passage and said intake chamber and having at its other end an outlet passage and an annular chamber, said outlet passage and annular chamber being separated by a wall having a communicating port therein, said main rotor having an outlet port communicating with said annular chamber and adapted to communicate with said compression chamber, a stationary conduit projecting into said outlet passage and having a valve tongue carried by its inner end and adapted to periodically sever communication between said outlet passage and said annular chamber through said communicating port as said rotors are rotated.

In testimony whereof, I have affixed my signature to this specification.

JOSHUA ROSETT.