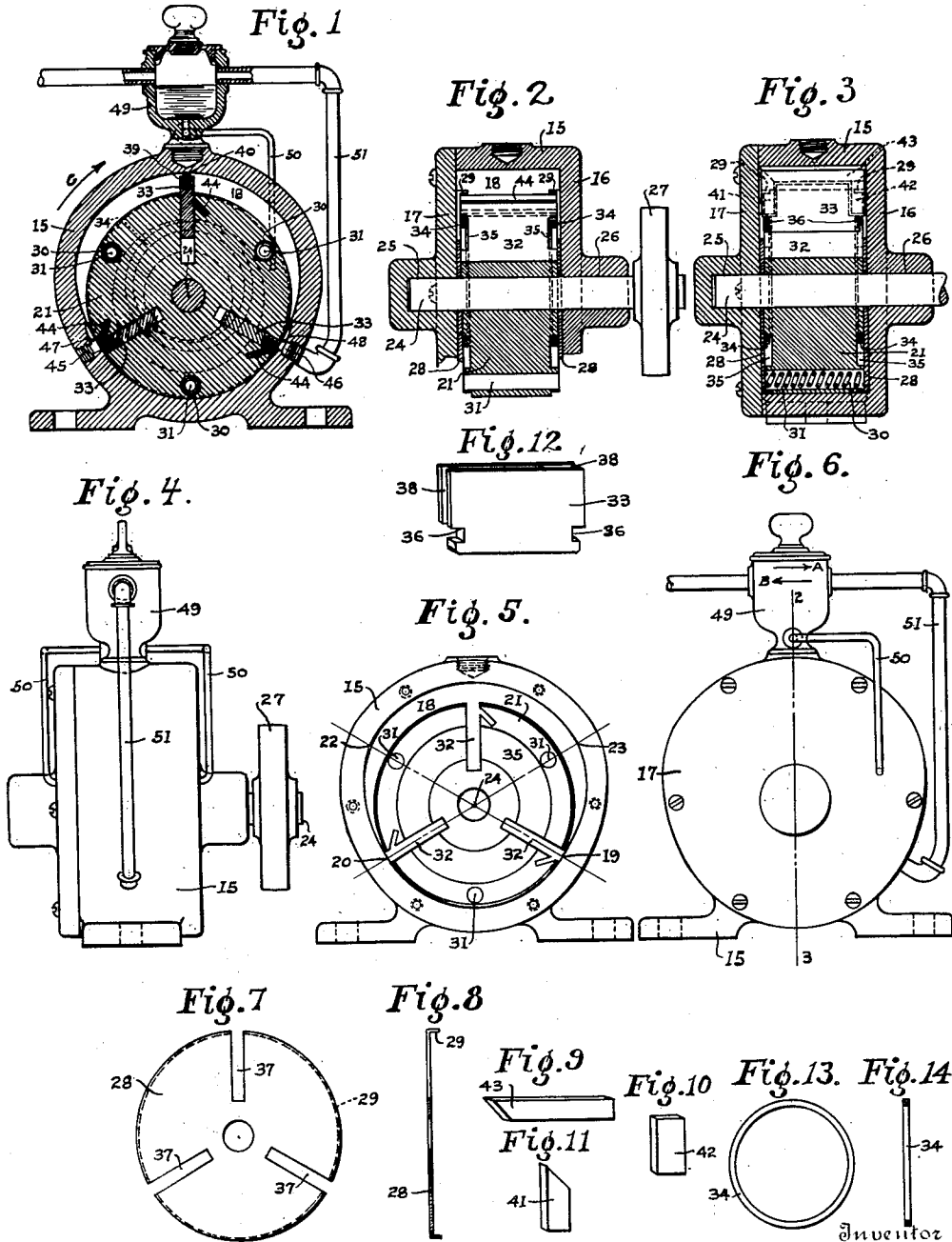


H. F. STOKE.
AIR COMPRESSOR.
APPLICATION FILED MAY 17, 1918.

1,321,340.

Patented Nov. 11, 1919.



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HARVEY F. STOKE, OF ROANOKE, VIRGINIA.

AIR-COMPRESSOR.

1,321,340.

Specification of Letters Patent.

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Application filed May 17, 1918. Serial No. 235,059.

To all whom it may concern:

Be it known that I, HARVEY F. STOKE, a citizen of the United States, residing at Roanoke, in the county of Roanoke and State of Virginia, have invented certain new and useful Improvements in Air-Compressors, of which the following is a specification.

This invention relates to air compressors or the like and has for its object to produce improvements generally in compressing machines of the rotary type. These improvements are designed principally to give increased efficiency to such machines and to enable them to be used for producing higher pressures. The improvements will be found applicable also to rotary exhausters. The invention consists of the formation, combination and arrangement of parts as will be herein set forth and particularly claimed.

In the drawings which accompany and form a part of this specification, Figure 1 is a vertical sectional view taken substantially on the center line of a rotary air compressor or exhauster constructed in accordance with the present invention: Fig. 2 is a fragmentary vertical sectional view of the same taken substantially on the vertical center line 2—3 of Fig. 6, and with several parts removed for the purpose of clearness. This view is seen in the direction of the arrow A, Fig. 6: Fig. 3 is a similar view taken on the same line but seen in the direction of the arrow B, Fig. 6: Fig. 4 is an end elevational view of the machine: Fig. 5 is a side elevational view of the machine with the detachable head removed and with various detail parts omitted, this figure being given to explain the peculiar shape of the cavity of the casing. Fig. 6 is a side elevational view of the machine: Fig. 7 is a side elevational view and Fig. 8 a vertical sectional view of the rotor compensating plate: Figs. 9, 10 and 11 are perspective views of the several parts of one of the rotor blade inserts: Fig. 12 is a perspective view of one of the rotor blades: and Figs. 13 and 14 are side elevational and vertical sectional views respectively of the blade actuating ring.

Referring now to these drawings which show the preferred embodiment of the invention and in which like parts are similarly numbered, the compressor includes a casing 15 having an integral head 16 and a removable head 17. This casing is made with a cavity 18 of curvilinear form but is prefer-

ably formed, as shown more clearly in Fig. 5, with the lower portion of the peripheral wall, (that portion extending from the point 19 to the point 20) as a true circular arc generated from the axis of the rotor 21 as a center and substantially coincident with the periphery of the rotor which is cylindrical in form. The diametrically opposite portion, (that extending from the point 22 to the point 23) is likewise of arcuate form but while this circular arc is struck from the axis of the rotor as a center, yet it is somewhat removed from the periphery of the rotor, it being generated by a larger radius than the lower portion. The portions of the wall connecting these concentric portions are formed as approximately regular curves and are so formed that all axes of the cavity 18 drawn through the center of the rotor as a center of axes will be of approximately equal length.

The rotor is carried on a shaft 24 which is journaled in bearings 25 and 26 in the heads 17 and 16, this shaft extending through the head 16 and carrying at its outer end a driving pulley 27. Fitted between the ends of the rotor and the adjacent heads are plates or disks 28 which are pressed outward against the heads by the action of the springs 30 which are disposed in suitable openings 31 through the body of the rotor. These disks have inturned circumferential flanges 29 which overlie the periphery of the rotor, the latter being suitably recessed to receive these flanges, as the diameter of the main portion of the rotor and the outer diameter of the disks are substantially the same. These plates or disks compensate for end wear between the rotor and the heads and serve at all times to keep the full space between the heads occupied by the rotor, the disks being rotatable with the rotor and constituting in effect continuations of it. The overlying flange portions of the disks give the opportunity of an oil seal forming beneath the same.

The rotor is radially slotted as at 32 to provide ways or grooves for the radially expansible blades 33 which are adapted to at all times sweep the peripheral wall of the casing. These blades are connected to each other by the end rings 34 which are disposed substantially concentric with the cavity of the casing so that when one or more of the blades 33 are expanding radially as by centrifugal force other of the

blades will be caused by the action of the rings 34 to retract. Or conversely, as at slow speeds, the retraction of one blade as by the diminishing distance between the rotor and the peripheral wall of the casing, will cause an expansion of another blade. These rings 34 are disposed between the rotor body and the disks 28, the rotor having suitable recesses 35 to accommodate the sweep of these rings. The blades 33 are similarly provided with end apertures 36 to receive the rings 34 so that the entire mechanism may be readily assembled through the open end of the casing.

The disks 28 are radially slotted as at 37 to receive the ends of the blades 33 which extend at least partially through these disks, the disks, rotor and blades revolving together as a unit. The blades 33 are made in a peculiar and efficient form as follows:

The ends and outer edge of each blade are grooved as at 38. Fitted within these grooves are a pair of inserts 39 and 40 made of material such as hard fiber and arranged so that the two halves may have a slight relative sliding movement upon each other so as to at all times provide a double seal against the casing at each blade. Each half is further divided into sections so that the centrifugal force acting to expand the inserts radially will at the same time cause the parts thereof to react upon each other to produce a simultaneous longitudinal expansion of the blade and produce a complete seal. Thus in the present embodiment each blade insert is made of the end strips 41 and 42 and the peripheral strip 43. The end strip 41 is mitered against the peripheral strip 43, the end strip 42 underlying the strip 43 and bearing directly against it. The miter between the strips 41 and 42 will, from the centrifugal force cause the expansion desired. In assembling the two pairs of inserts 39 and 40 in a blade the miter is reversed so that a continuous line of possible leakage is avoided. Leakage will thus be prevented between the ends of the blades and the casing heads.

In order to prevent leakage down the slots 32 of the rotor the centrifugal seal strips 44 are provided, one for each blade. These are set in suitable slots extending across the rotor in the portion thereof, without the recesses 35. These slots are so cut as to lie at an angle to the blade so that centrifugal force will cause the seal strips 44 to react against and seal one side of the blade. These strips are provided for the leading side of the blades only as the inertia or drag of the blades, together with the pressure, will hold them against the following sides of the rotor slots 32. For reference in the drawings the arrow C in Fig. 1 indicates the direction of rotation. At 45 is indicated the inlet or suction port of the machine and

at 46 is shown the discharge port. These ports are so located peripherally of the casing in such positions as to embrace an arc slightly in excess of that defined by two adjacent blades the periphery of the rotor between these ports coinciding with the bore of the casing so as to avoid undesirable compression and leakage. Channels 47 and 48 extend in opposite directions from the ports 45 and 46 to give some period of time for the ingress and egress of the air.

It will thus be seen that when the rotor is revolved as by the pulley 27 and shaft 24 the air drawn in at the port 45 will be swept around the crescent shaped cavity defined by the rotor body and the casing and as the abutting blade reduces the volume of this space the entrapped air will be gradually compressed and finally discharged out through the port 46.

To complete the sealing of the movable parts there is provided an oiling system that is arranged to deliver drops of oil in such manner as to be effective as a seal while at the same time serving its purpose as a lubricant. To this end there is mounted above the machine an oil cup 49 with a small oil pipe 50 leading to each head of the casing. These pipes deliver a restricted quantity of oil through the casing heads to the faces of the disks 28, the oil being so delivered at a point radially of the rotor within the limits of the same and preferably without the limits of the recesses 35. Circumferentially of the rotor these oil delivery pipes terminate at points where the compression volume is partially but not totally reduced. The oil in the cup 49 is subject to the discharge pressure of the air, the air discharge pipe 51 leading through the oil cup and the space therein above the oil forming a portion of the air discharge passage. There is thus available a differential of pressure which, together with the static head of the oil column will cause oil to be fed down the pipes 50 to the rotor. There will also be evidenced a differential of pressure within the cavity of the casing, which, together with the centrifugal force will cause the oil to travel toward the periphery of the rotor. The excess oil will finally be delivered with the compressed air out through the air discharge pipe and restored to the oil cup. In this manner an oil seal is available for the joints between the rotor disks and the casing heads, between the rotor and the disks, between the rotor blades and the casing heads and between the rotor blades and the peripheral wall of the casing. Experiments have demonstrated that in this manner the efficiency of the machine is greatly increased.

Thus has been described a preferred embodiment of the invention. It will be understood that other embodiments are con-

templated, within the scope of the appended claims, without departing from the spirit of the invention.

What is claimed is,

5 1. In an air compressor, a casing having a cavity therein, heads for the casing, a rotor revolubly mounted within the casing, a radial slot in the rotor and a radially expansible blade in the slot, the ends and the outer
10 edge of the blade being channeled and there being contact strips in each end channel and another abutting strip in the outer edge channel of the blade, the joint between one
15 end strip and the outer strip being cut to a miter abutment and the other end strip having a square abutment against the inner edge of the outer strip.

2. In an air compressor, a casing having a cavity therein, heads for the casing, a
20 rotor revolubly mounted within the casing, a radial slot in the rotor and a radially expansible blade in the slot, the ends and outer edge of the blade being channeled and there being a laminated contact strip in the said
25 channel, each of said laminations being formed of separate abutting side and edge members, the joints therebetween being cut to different angles and the laminations being assembled in the channel in such man-
30 ner that a joint of one angle shall overlie a joint of a different angle.

3. In an air compressor, a casing having a cavity therein, heads for the casing, a
35 rotor revolubly mounted within the casing, a plate disposed between each end of the rotor and the adjacent head, the same having inwardly extending flanges adapted to overlie a portion of the periphery of the rotor and being rotatable with the rotor, and
40 means for expanding the plates against the heads.

4. In an air compressor, a casing having a cavity therein, heads for the casing, a

rotor revolubly mounted within the casing, a plate disposed between each end of the ro- 45 tor and the adjacent head, the same having inwardly extending flanges adapted to overlie a portion of the periphery of the rotor and being rotatable with the rotor, and means for expanding the plates against the 50 heads, said means including a longitudinal orifice through the rotor and an expansible spring disposed in the orifice and abutting the plates.

5. In an air compressor, a casing having 55 a cavity therein, heads for the casing, a radially slotted rotor revolubly mounted within the casing, the rotor being of slightly less length than the distance between the heads, a wear plate disposed between each 60 end of the rotor and the adjacent head, the same having slots in alinement with the rotor slot, and a radially expansible blade disposed within the slots and extending longitudinally of the rotor from one head to the 65 other.

6. In an air compressor, a casing having a cavity therein, heads for the casing, a rotor of slightly less length than the distance between the heads, rotatable wear plates dis- 70 posed between each end of the rotor and the adjacent head, a series of radial slots in the rotor and in the plates and a radially expansible blade in each slot, and means actuated by the rotation of the rotor for caus- 75 ing the radial expansion of one blade to produce a harmonious retraction of another one, the said means including rings disposed concentric with the cavity of the casing but eccentric to the axis of rotation of 80 the rotor and loosely engaging the blades, the said rings being disposed between the rotor and the wear plates.

In testimony whereof I affix my signature.

HARVEY F. STOKE.