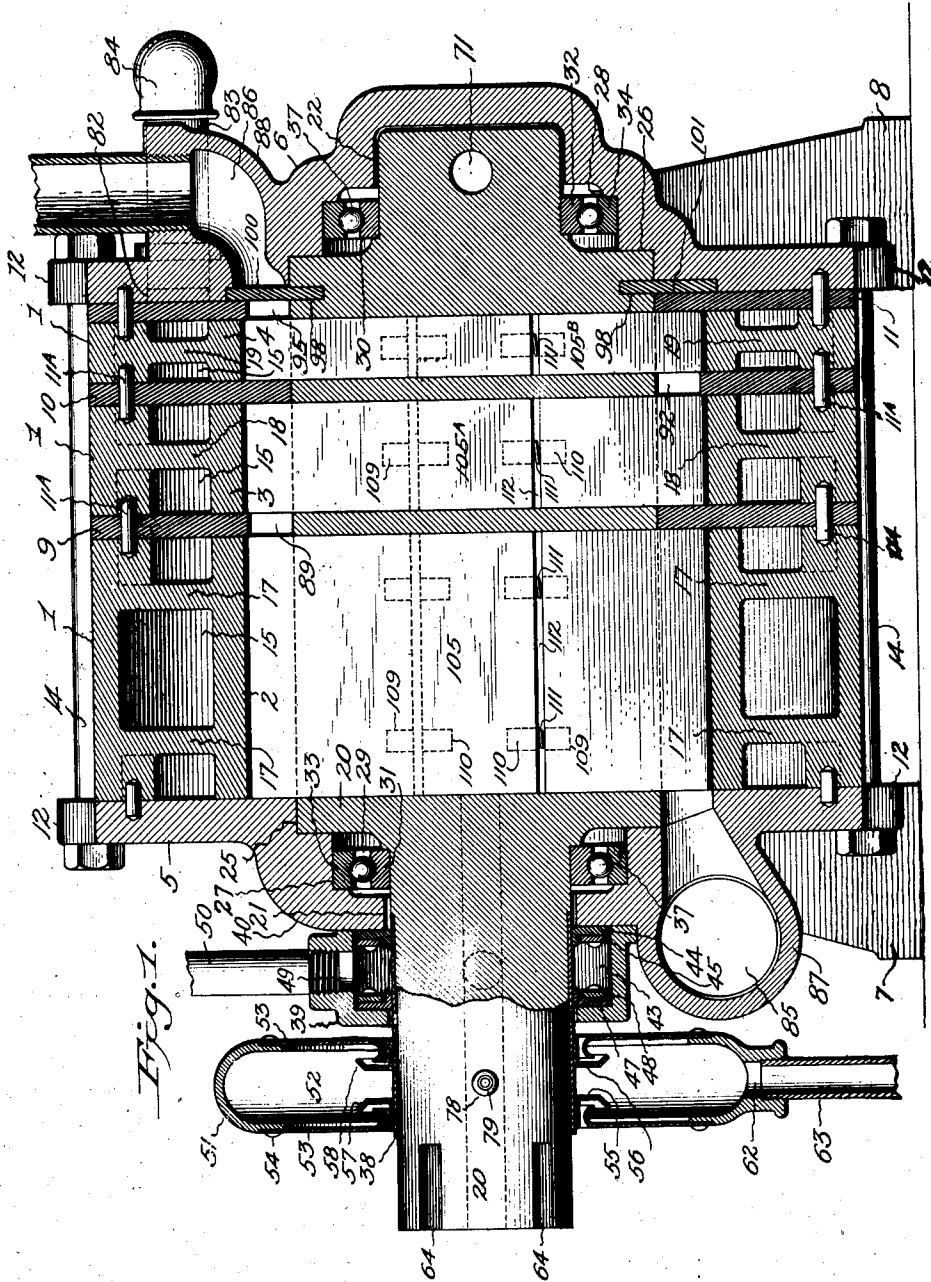


J. G. LEYNER.
 MULTIPLE STAGE AIR COMPRESSOR.
 APPLICATION FILED JUNE 14, 1905.

901,539.

Patented Oct. 20, 1908.

5 SHEETS—SHEET 1.



Witnesses:
 John Tarnwell
 Clarence H. Tarnwell

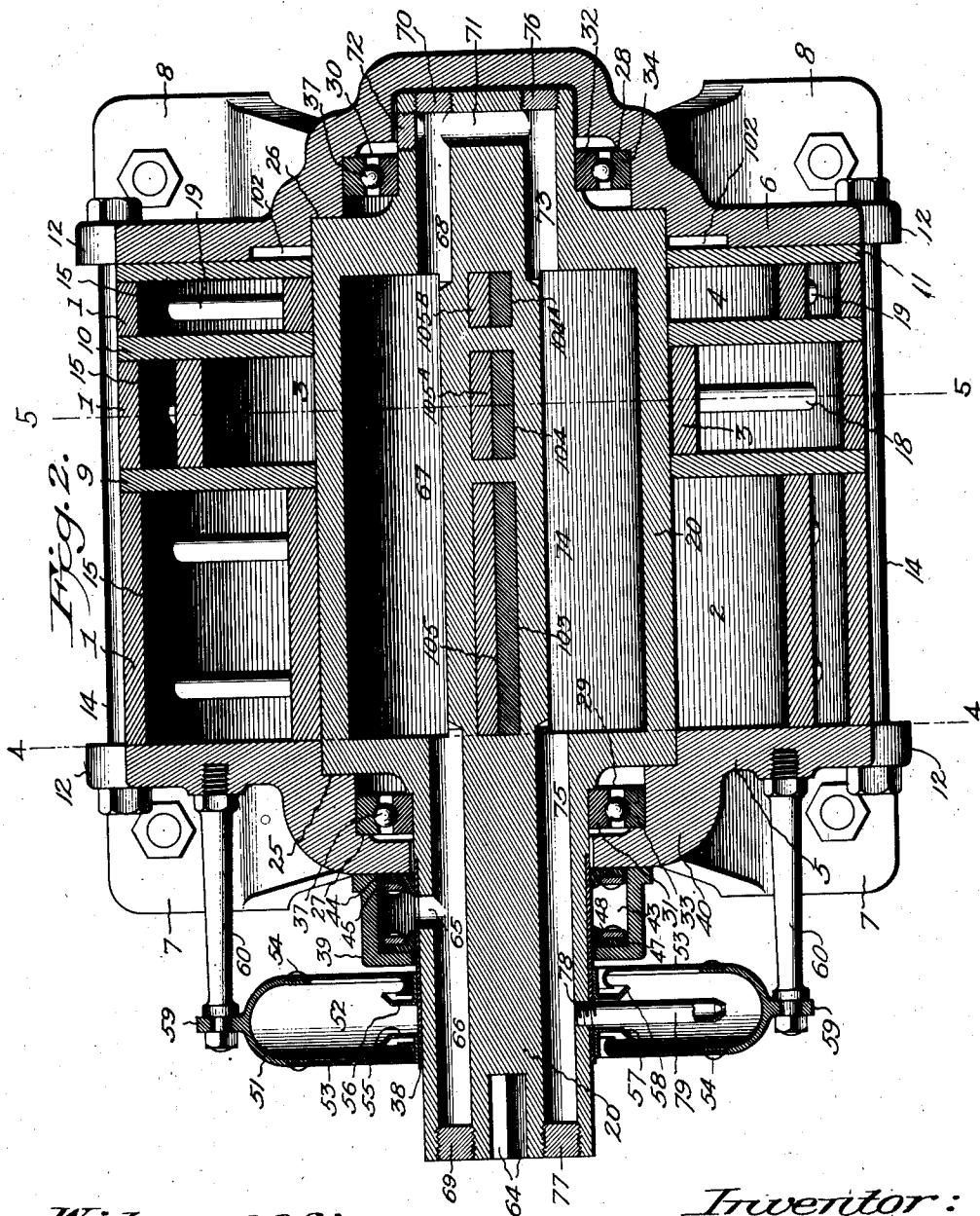
Inventor:
 By John George Leyner
 A. B. Bailey, Attorney.

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5 SHEETS—SHEET 2.



Witnesses:

John A. Farwell
Clarence H. Simpson

Inventor:

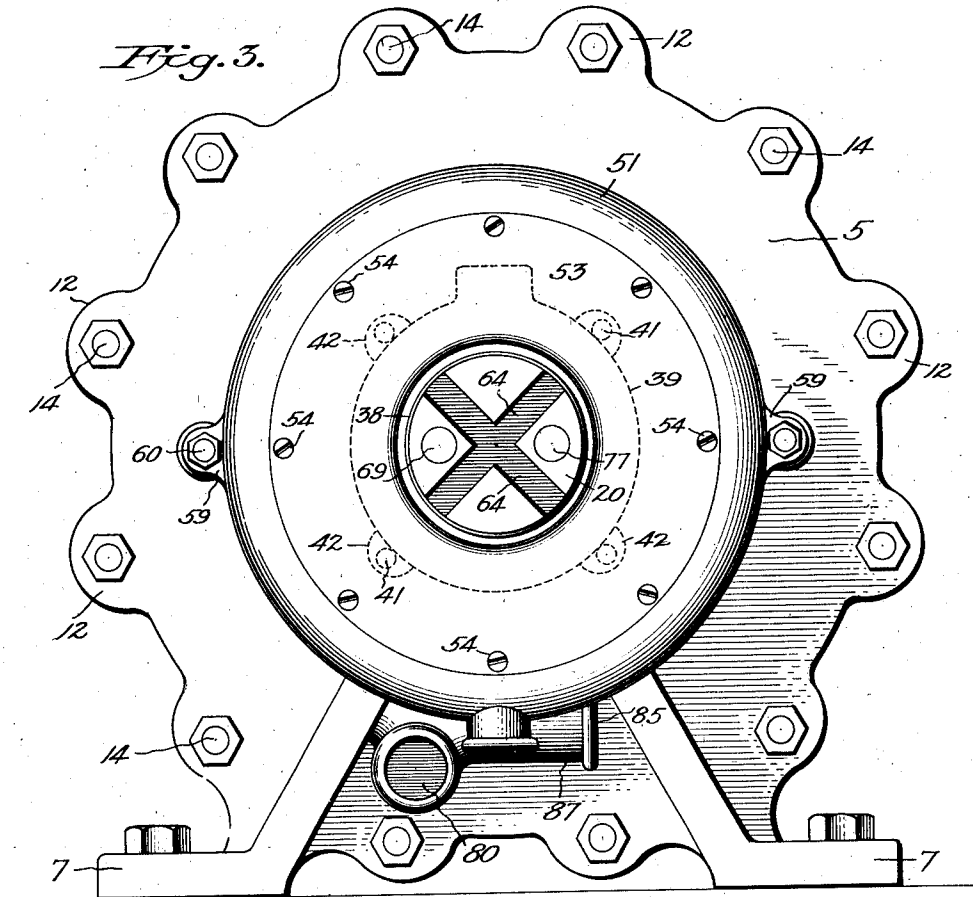
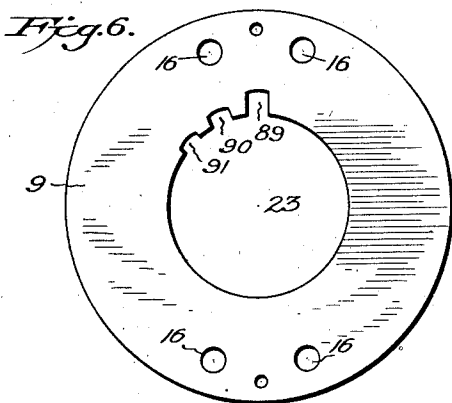
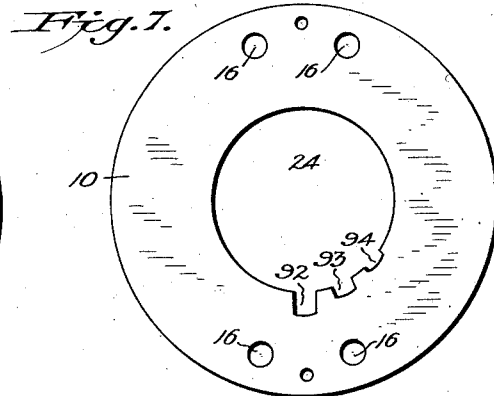
By John George Leyner
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5 SHEETS—SHEET 3.



Witnesses:

John A. Farwell
Clarence H. Jackson

Inventor:

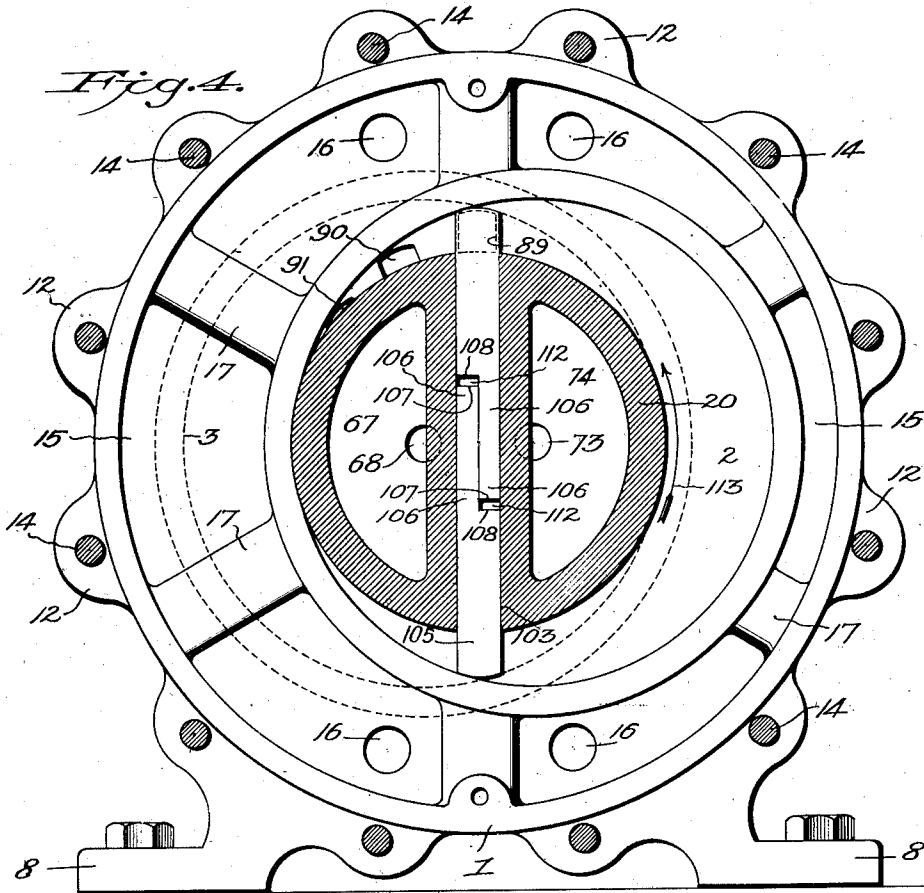
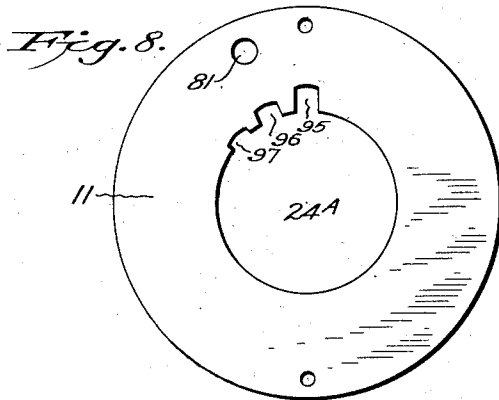
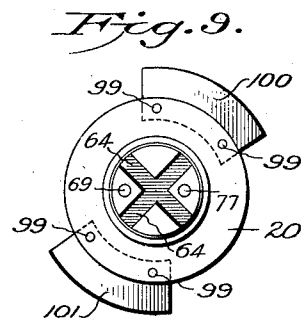
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Patented Oct. 20, 1908.

5 SHEETS—SHEET 4.



Witnesses:

John A. Farwell
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UNITED STATES PATENT OFFICE.

JOHN GEORGE LEYNER, OF DENVER, COLORADO.

MULTIPLE-STAGE AIR-COMPRESSOR.

No. 901,539.

Specification of Letters Patent.

Patented Oct. 20, 1908.

Application filed June 14, 1905. Serial No. 265,267.

To all whom it may concern:

Be it known that I, JOHN GEORGE LEYNER, a citizen of the United States of America, residing in the city and county of Denver and State of Colorado, have invented a new and useful Multiple-Stage Air-Compressor, of which the following is a specification.

My invention relates to a new type of air compressor, and the objects of my invention are: First, to produce an air compressor that will compress air in successive stages of continuously increasing pressure. Second, to provide a multiple stage air compressor. Third, to produce a multiple cylinder and multiple stage air compressor. Fourth, to produce a multiple cylinder and piston rotary air compressor. Fifth, to provide a multiple cylinder and multiple rotary piston air compressor. Sixth, to provide an air compressor having a plurality of cylinders of different areas, containing multiple pistons of different areas. I attain these objects by the mechanism illustrated in the accompanying drawings, in which:

Figure 1 is a longitudinal vertical section through the axial center of my multiple stage air compressor. Fig. 2 is a central horizontal sectional view of my multiple cylinder air compressor. Fig. 3 is an end elevation of the front end of my new air compressor. Fig. 4 is a vertical, transverse section of Fig. 2 on line 4—4. Fig. 5 is a similar view of Fig. 2 on line 5—5. Figs. 6, 7, and 8 are views, on a reduced scale, of the partition plates between the cylinders, and Fig. 9 is an end elevation of the rotary piston shaft.

Similar letters of reference refer to similar parts throughout the several views.

Referring to the drawings, my improved air compressor consists of a plurality of independent casings, 1, which are provided with air compressing cylinders or compartments, 2, 3, and 4, respectively, to which are secured a front cylinder head, 5, and a rear cylinder head, 6. These two cylinder heads are provided with supporting base portions, 7 and 8, respectively. The cylinders are separated from one another by partitions 9 and 10, and the rear cylinder head is separated from the cylinder 4 by a partition 11.

The sides of the cylinders and of the partitions, and the sides of the cylinders joining the adjacent sides of the front and rear cylinder heads, are machine finished to fit air and steam tight together, side by side, and are secured in direct alinement with one an-

other by dowel pins, 11^A, which are fitted in holes in the partitions and in the joining sides of the outside cylinders and the cylinder heads, and the cylinder heads are also provided with projecting lugs, 12, which are provided with bolt holes and are bolted together into one substantially integral air compressing machine, by bolts 14. These independent air compressing cylinders are of different lengths, that is, parallel with their axes, the length of each relative to the others being determined by the proportional area desired to be attained in each independent cylinder, and the relative areas required to attain the ratio of compression desired in any particular size of air compressing machine. These three casings are bored out to form cylinders of preferably the same diameter. These independent casings, and their cylinder heads, are all preferably made round, and of the same external diameter, and in each casing between its inside diameter and the outer peripheral surface of its cylinder, I form a water cooling space, 15, and the water cooling spaces of the several casings are connected by holes, 16, formed in the partitions 9 and 10. (See Figs. 4 and 5.)

In the casing of the large cylinder I form two rows of spokes, 17, which extend from the shell of the cylinder to its casing; a row of spokes, 18, is placed between the shell of the cylinder 3 and its casing; and a row of spokes, 19, is placed between the shell of the cylinder 4 and its casing. Consequently, a large water space is formed in each casing around its cylinder and between its spokes, and the water spaces are all connected with one another by the apertures, 16. A piston shaft 20, of two diameters, is rotatably mounted in axial apertures 21 and 22, formed in the front and rear cylinder heads, and in apertures 23 and 24 and 24^A, formed through the partitions 9 and 10 and 11. The larger diameter of this piston shaft fits rotatably in the axial apertures 23 and 24 and 24^A, formed in the partitions 9 and 10 and 11, and extends through all of the cylinders into counter-bores 25 and 26, formed in the front and rear cylinder heads. Two smaller counter-bores, 27 and 28, are formed in the front and rear cylinder heads, and intersect the counter-bores 25 and 26, in which ball bearings, 29 and 30, are respectively formed. These ball bearings are preferably formed by two concentrically arranged rings, 31 and 32, and 33 and 34, which have formed partially in

each and between them circumferential ball races in which a circumferential row of balls 37 is placed. The rings 31 and 32 are seated tightly on the opposite ends of the piston shaft adjacent to its enlarged portion, and the rings 33 and 34 are seated in the counter-bores 27 and 28, opposite to and in operative relation to the rings 31 and 32, to form a race-way between them for the row of balls 37.

The front end of the piston shaft extends beyond the adjacent ball bearing, through and beyond the adjacent end of the front head, and a thin renewable sleeve 38, of any metal suitable for a wearing surface, is fitted tightly on it. This sleeve extends from near the end of the piston shaft to near the adjacent ball bearing, and forms a renewable wearing surface on the shaft, and a hollow collar 39 is placed loosely on the shaft, and the sleeve, close against a hub portion 40, formed on the front cylinder head, in which the counter-bore 27, having the ball bearing 29 of the piston shaft, is formed. This collar is secured to the hub by cap screws 41, shown in Fig. 3, which extend through lugs 42, formed on the collar, and screw into the hub of the cylinder head. The side of the collar adjacent to the hub contains an annular water chamber 43, that extends into the collar to near its opposite side, and surrounds the piston shaft. The joint between the hub and shaft inside of the collar, is packed by a cupped leather or rubber packing ring 44, which is clamped against the hub by a ring 45, secured by screws, which are threaded to the hub. The joint between the opposite side of the collar and the shaft, is also packed by a cupped leather or rubber washer, 47, which is also secured by a ring 48, which is screwed to the inside wall of the water chamber in the collar, to bear against the shaft. This water inlet collar is provided with a threaded water inlet aperture, 49, to which a pipe or hose 50 is connected that leads to a supply of water under pressure. These two packing rings prevent any objectionable leakage of water from the water inlet collar around the shaft.

Upon the piston shaft, at the side of the water inlet collar, I mount on the sleeve a water outlet collar, 51, which contains an aperture through it much larger than the shaft, and is also provided with a water chamber, 52. To both sides of this collar, sheet metal flanges, 53, are secured by screws 54. These flanges extend to close to the shaft, and are curved inward to form an inverted lip on each, and upon the sleeve of the shaft two rings 55 and 56 are formed, that contain flanges 57 and 58, the peripheral edges of which extend above the curved lips of the collar's flanges, and are turned over the edges of the lips, thus forming a joint that will prevent objectionable leakage of water from the collar around the shaft. This collar

is provided with lugs 59, which are bolted to the forward ends of brackets 60, which are screwed into the cylinder head. These brackets project far enough from the cylinder head to support the water outlet collar on the shaft at the outside of the water inlet. The bottom of the outlet collar is provided with an outlet aperture, 62, to which a waste pipe 63 is threaded. The extreme end of the piston shaft is provided with key-ways, 64, to enable a transmitting device to be securely fastened to its end to drive the air compressor by either steam or electric or water power. I do not illustrate any of these power transmitting devices connected to the end of the piston shaft, as they do not form a part of my invention. The forward end of the piston shaft is provided with a water inlet aperture, 65, which is formed in the side of the shaft within the water inlet collar. This inlet aperture intersects an axial aperture, 66, which extends into the end of the shaft at one side of its axial center, and connects with a water chamber 67, formed in the enlarged part of the piston shaft at one side of its center (see Fig. 4.) This chamber extends through the enlarged part of the piston shaft, and connects with an aperture 68 that is drilled axially into the rear end of the shaft at one side of its axial center.

The entrances to the apertures 68 and 66 at the opposite ends of the piston shaft, are threaded and plugged up by short threaded plugs 69 and 70. This aperture 68 intersects an aperture 71, formed transversely through the rear end of the piston shaft, the entrance of which is threaded and plugged up by a screw plug 72. This transverse aperture 71, intersects an aperture 73, that extends into the rear end of the shaft on the opposite side of the center of the shaft from the aperture 68, but substantially parallel with it. This aperture 73 connects with a chamber 74, formed in the opposite side of the enlarged part of the piston shaft from the chamber 67, and the chamber 74 connects with an aperture 75, formed in the front end of the shaft on the opposite side of its axial center from the aperture 66, and substantially parallel with it. The entrance ends of the apertures 73 and 75 are threaded and plugged by threaded plugs 76 and 77. The aperture 75 is intersected by a transverse aperture 78, which extends into the shaft within the outlet collar. The entrance to this aperture 78 is threaded and a short tube 79, which I call the discharge tube, is threaded to it. The water supply enters the inlet collar, 39, through the hose 50, from a source of cold water supply under pressure, and flows through the apertures 65 and 66 into chamber 67, thence through apertures 68, 71, and 73, into chamber 74, and through aperture 75 and the tube 79, from which it discharges

against the inner periphery of the collar 51, and flows out of it through the discharge tube 63, to waste, thus keeping the piston shaft cool.

5 An aperture 80, is formed, preferably through the lower part of the front head, which is threaded to receive a pipe or hose, that leads to a supply of cold water under pressure. The water flows into and fills the
10 circumferential spaces surrounding the cylinders, flowing from one to the other through the apertures 16, in the partitions 9 and 10, through an aperture 81 in the plate 11, and out through a discharge aperture 82, formed
15 preferably in the top part of the rear cylinder head 6. This discharge aperture is threaded, and a pipe 83 and elbow 84, is threaded to it, and leads the water to waste. The cylinders are thus completely surrounded continuously
20 by cold running water. The front cylinder head is provided with an air inlet aperture 85, and the rear cylinder head is provided with a compressed air outlet aperture 86, which I preferably arrange in the following manner:
25 The air inlet 85 is formed in a depending lug portion 87, formed on the lower side of the hub of the front cylinder head, and it enters the large cylinder 2 at its lowest part, while the compressed air outlet 86 is also formed in
30 a projecting lug 88, that is cast on the cylinder head, 6. The first or large cylinder 2, is connected with the second cylinder 3, by means of air ports, 89, 90, and 91, in the partition 9, that divides the large cylinder 2
35 from the middle cylinder 3. I preferably use three air discharge ports in each cylinder, but more or less than three ports may be used if desired, and I place the three ports of the initial cylinder 2, directly above the piston
40 shaft, the first port 89, being directly above the axial center of the shaft, the second port, 90, a short distance beyond, and the third port 91, between the port 90 and the point of the wedge-shaped space formed between
45 the piston shaft and the cylinder.

The piston shaft cuts slightly into one side of the inner periphery of each of the cylinders 2, 3, and 4, as shown, in order to close the space between the piston shaft and the adjacent points of the cylinders, and thus provide a long bearing which will prevent the escape of air between them. The middle cylinder 3, discharges its compressed air through three ports 92, 93, and 94. These
50 ports are placed in the bottom of the partition 10, and in the same relative position to the touching point of the piston shaft and the middle cylinder as the ports are in the large cylinder 2, and the cylinder 4, which is in
60 line with the cylinder 2, and discharges its compressed air through three ports 95, 96, and 97, formed in the partition 11 at the top of the cylinder 4, and in the same relative position and directly in line with the air discharge ports 89, 90, and 91, of the large or

initial cylinder. The discharge passage of the cylinder 3 is placed at the bottom of the partition 10, as owing to the eccentric position of this cylinder to both the piston shaft and to the other two cylinders, as it is placed
70 on the opposite side of the piston shaft from the cylinders 2 and 4, the wedge space of this cylinder is positioned at the bottom of the cylinder 3, and the air of this cylinder is compressed at the lowest part of it, while the air
75 is compressed at the top of the cylinders 2 and 4. The eccentric arrangement of these three cylinders to the piston shaft, forms a progressively decreasing wedge-shaped space in the path of the pistons, in which the air is
80 compressed by the rotating movement of the pistons, as will be described hereinafter. The partition 11, is placed between the rear cylinder head and the cylinder 4, and at the side of this partition I secure to the piston
85 shaft and at diametrically opposite points on its surface, in suitable recesses 98, by screws 99, two projecting blades 100 and 101, which I term slide valves. These slide valves rotate with the piston, and in contact with the
90 adjacent side of the partition 11, and cover the compressed air discharge ports, and they are preferably arranged to project into a recess 102 formed in the cylinder head. These slide valves are independent of each other,
95 and they each comprise a short blade of steel or other suitable metal, each of which is in length about a fifth of the circumference of the piston shaft, and they act as slide valves to close the discharge apertures 95, 96, and
100 97, in alternate order, their function being to close these discharge ports and prevent the air already compressed and in the discharge outlet 86, from flowing back into the cylinder, except where air is compressed in the cylinder 4, at the point of these ports to the
105 same or to greater pressure than that in the discharge pipe, when these valves owing to the rotation of the piston pass away from the ports, and the air flows through them into the
110 discharge outlet 86. The enlarged part of the piston shaft that lies in each cylinder, is provided with piston slots 103, 104, and 104^A which are formed diametrically through the center of the piston shaft between the water
115 chambers 67 and 74. These piston slots each extend the entire length of each cylinder, and in them I place pistons 105, 105^A and 105^B, each of which consists of a blade of metal which is constructed in two equal
120 halves, and is arranged to yieldingly and resiliently expand and contract to fill the eccentrically arranged bores of the cylinders as the piston's shaft rotates in them. A lap-over half and half joint 106, is formed partially in each, which is provided with square
125 ends, 107, and square shoulders, 108, and in the edges of the shoulders, 108, and in the ends, 107, I form holes 109 and 110, in each half, and arrange them in pairs to register op-

posite each other, and in each two oppositely arranged and registering holes, I place a coiled expansive spring 111. I preferably place four pairs of holes in the large piston, near its opposite side ends, and two in the center of the smaller pistons. These springs by their expansive resilient pressure, force and hold the two halves of each piston against the inner periphery of their respective cylinders, a small clearance space 112 being provided between the half parts of each piston to permit them to be compressed slightly smaller than the cylinder to allow them to be easily inserted in the cylinders, and each piston slides reciprocally in its respective recess, and expands and contracts, as it rotates through the varying orbit of its revolution, owing to the eccentricity of its cylinder to the axis of the piston shaft.

The operation is as follows: The piston shaft is rotated by steam, electrical, water or any other suitable motive power machinery, which is connected to the cross slots in the end of its shaft, and the pistons are rotated with the piston shaft, and as they rotate they expand and contract, and keep in bearing contact with the inner peripheral surface of their respective cylinders. As they rotate in the direction of the arrow, 113, air flows into the initial cylinder 2, through the air inlet aperture 85 in front of the piston 105, which pushes it in front of it and compresses it as it moves upward and over, as the piston forces the air into the decreasing wedge-shaped space to the point where the piston rotates in operative bearing contact with the inner peripheral surface of the cylinder, and when the piston 105 approaches the air discharge ports 89, 90, and 91, a portion of the air flows through the discharge aperture 89 into the cylinder 3, and after the piston 105 passes the discharge port 89, the compressed air in the narrow wedge space is forced through the discharge aperture 90 into the cylinder 3, and after the piston passes the port 90, practically all of the remaining compressed air in the remaining very narrow tapering point of the wedge-shaped space is forced into and through the discharge aperture 91, into the cylinder 3, as the long bearing between the piston shaft and the inner periphery of the cylinder formed by the curved recess, prevents practically any air from escaping from the narrow wedge space except through the air escape ports into the next cylinder. The cylinder 3 is positioned in the same eccentric relation to the piston shaft as the cylinder 2, but on the opposite side of the piston shaft from the cylinder 2. Consequently, its piston 105^a, which is mounted in the piston shaft, in the same relative plane, and in direct alinement with it, and moves in unison with it, catches and pushes the compressed air as it is forced from the cylinder 2 through that cylinder's air dis-

charge ports, and pushes it ahead of it, around to the discharge ports 92, 93, and 94, in the partition 10, at the end portion of the decreasing wedge-shaped space formed at the lower side of this cylinder between it and the piston shaft, and further compresses it and forces it through the air ports 92, 93, and 94, into the cylinder 4, the piston of which catches it and pushes it up and around exactly like the piston of the cylinder 2, and again further compresses it in the wedge-shaped space at the top of this cylinder, forcing it through the apertures 95, 96, and 97, into the discharge aperture 86, which leads to a compressed air receiving tank or conveys it to use. The forward end of the slide valves 100 and 101, of the piston shaft, are arranged opposite to the piston, and when the piston of the cylinder 4 passes the ports 95, 96, and 97, the forward end of these slide valves slides over them and closes them so that the compressed air that has been forced into the discharge outlet 86, can not flow back into the cylinder 4, and as the piston shaft is rapidly rotated, the air is compressed in progressively increased stages or steps of successively increased or higher pressure.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In an air-compressor, a plurality of cylinders arranged end to end but out of alinement, a partition between the ends of adjacent cylinders, a rotary piston in each cylinder, and a port extending through each partition, within the inner surfaces of the adjacent cylinders.

2. In an air-compressor, a plurality of cylinders arranged end to end but out of alinement, a partition between the ends of adjacent cylinders, a rotary piston in each cylinder, and a plurality of ports of different size extending through each partition, within the inner surfaces of the adjacent cylinders.

3. In an air-compressor, a plurality of connected cylinders arranged end to end but out of alinement, a rotary piston in each cylinder, an outlet from one end cylinder, and a revolving valve for said outlet.

4. In an air-compressor, a plurality of connected cylinders arranged end to end but out of alinement, a shaft extending longitudinally through said cylinders, an outlet from one end cylinder, and rotary pistons for said cylinders and a valve for said outlet, carried by said shaft.

5. In an air compressor, the combination of the cylindrical casings having eccentrically arranged cylinders therein, the piston shaft rotatably mounted in said casings and cylinders in rotary bearing contact with one point of the inner periphery of said cylinders, water circulating passages in said casings surrounding said cylinders, and a suitable water inlet and outlet in said casing into and

out of said water passages, water circulating passages in said piston shaft, a water inlet aperture in said shaft connecting with one end of said passages and a water outlet aperture in said shaft connecting with the opposite end of said water passages, as set forth.

6. In an air compressor, the combination of the piston shaft, the casing having cylinders arranged eccentric to said piston shaft and cooling spaces surrounding said cylinders, with air cooling passages in said piston shaft, arranged to receive a supply of cold water, a water inlet in said shaft to said air cooling passages, a hood surrounding said shaft, a water inlet to said hood arranged to be connected to a supply of cold water under pressure, suitable means for supporting said hood on said shaft over said water inlet, a water outlet in said shaft connecting with said water passages, a hood surrounding said water outlet, means for supporting said hood on said shaft over said water outlet, a water outlet aperture in said hood, and means, including cupped washers, for packing the joints between said water inlet and outlet hoods and said shafts, as set forth.

7. An air compressor, a rotary piston shaft, three eccentric cylinders each of a different predetermined length and area arranged to support said shaft and to bear against a point of their inner peripheral surfaces, two of said cylinders being arranged to bear against one side of said piston shaft and the third cylinder being arranged to bear against its opposite side, a front and rear cylinder head for said cylinders, a partition between said cylinders and also between said rear cylinder and said rear cylinder head, means for securing said cylinders and partitions and cylinder heads together, a piston in each cylinder slidably mounted in said piston shaft and arranged to adjustably engage at their opposite ends the inner periphery of each of said cylinders, an air inlet port through the front cylinder head into the largest cylinder, means for rotating said piston shaft and pistons to compress air in each cylinder, air ports in the partition between the largest cylinder and the next largest cylinder positioned to convey the compressed air from the largest cylinder into the next largest cylinder, air ports in the partition between the next smallest cylinder and the shortest cylinder positioned and arranged to convey the compressed air from the second largest cylinder into the shortest cylinder, an air discharge port in the rear cylinder head, air ports positioned in the partition between the smallest cylinder and the discharge port of the rear cylinder head positioned to convey the compressed air from the shortest cylinder into the discharge port, and having said pistons arranged to prevent the back flow of air from the second largest to the largest, and from the shortest to the second largest cyl-

inder, and a means for intermittently closing the discharge ports of said shortest cylinder to prevent the back flow of compressed air from the discharge ports into the shortest cylinder, water passages in said piston shaft provided with a suitable water inlet aperture arranged to connect to a supply of cold water, and a suitable water discharge outlet, water holding spaces surrounding said cylinders and connected together to form a continuous passage for cold water from the water holding space of each cylinder to the other, a water inlet aperture at one end of said cylinders adapted to be connected to a supply of cold water, and a water discharge aperture at the opposite end of said cylinders, as set forth.

8. In an air compressor, the combination with the cylinders and their surrounding casing, the cylinder heads, and the piston shaft, and the ball bearings mounted therein, of the piston shaft mounted in said ball bearings, the water passages in said piston shaft, the water inlet hood secured to said cylinder head and surrounding said piston, the water inlet aperture in said shaft connecting with said water passages, the packing rings secured to said hood and surrounding said shaft, the water outlet aperture in said shaft connected with said water passages, the hood surrounding said water outlet aperture, and the packing rings secured to said hood and surrounding said shaft.

9. In an air compressor, the combination of the cylinders, the partition, the cylinder heads, and the air inlet and discharge outlet, with the piston shaft and pistons, and the air discharge valve, comprising the curved blades secured circumferentially to said piston and arranged on opposite sides of it to extend a predetermined distance around it, and to form an alternating projecting blade valve portion, and a space portion between said blade portions of predetermined extent, and arranged to alternately open and close said air discharge outlet from said cylinders, as set forth.

10. In an air compressor, the combination of the cylindrical casings, and the cylinder, and the piston shaft and pistons, of a sleeve mounted on said piston shaft, water passages in said piston, a water inlet aperture into the water passages of said piston shaft through said sleeve, a water outlet aperture in said piston shaft through said sleeve, and a water inlet hood and a water outlet hood mounted on said sleeve, and piston shaft, and secured to said cylindrical casings, and means for packing said hoods on said piston shaft against leakage, as set forth.

11. In an air compressor, the combination with the cylindrical casings, having the eccentric cylinder therein, the water circulating air cooling chambers, the partitions between the cylinders, and the cylinder heads, with the piston shaft and pistons rotatably

mounted in said cylinders in operative air compressing relation to said eccentrically arranged cylinders, the air passage ports in said partition, the air inlet and discharge ports leading into and from said cylinders, and a valve for intermittently opening the discharge port from said cylinder into said air discharge port to allow the air from said cylinders to be compressed therein, and for intermittently closing said ports against the return pressure of the air, and consisting of blades of metal secured to said piston shaft to extend circumferentially around it a predetermined distance, and arranged to alternately open and close said air discharge port in unison with the operative air compressor's rotary movement of said pistons, in said cylinders.

12. An air compressor, comprising three cylindrical casings, secured together, and separated from each other by partitions, a cylinder formed eccentrically in each casing, of three different lengths, the outside cylinders of said casings being arranged in alignment with each other and being respectively the largest and the smallest cylinders, and the center cylinder being arranged in the opposite side of its casing from the cylinders of the outside casings, cylinder heads secured to the outside casings, a rotary shaft mounted in said cylinder heads and arranged to bear in rotary contact at one point of the inner peripheral surface of said cylinders, an expanding and contracting compensating

piston slidably arranged diametrically through said piston shaft in each cylinder and arranged to rotate in bearing contact with the inner peripheries of said cylinders, means for rotating said piston shaft, and pistons, an air inlet port into the largest cylinder, air ports arranged in the partition separating this end cylinder from the center cylinder, to permit the air compressed in this end cylinder to flow into the second or middle cylinder, ports arranged in the partition separating this center cylinder from the smallest cylinder to permit the air compressed in the center cylinder to flow into the smallest end cylinder, a partition between said small cylinder and its adjacent cylinder head, a compressed air discharge port in said cylinder head, air discharge ports in said partition registering with said cylinder head's air discharge port, arranged to permit the air compressed in the smallest cylinder to flow into the discharge port of said cylinder head, and means, including rotary blades attached to said piston shaft for preventing the air from flowing back from said discharge port into said small cylinder, and from one cylinder back into the other larger cylinders, as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

JOHN GEORGE LEYNER.

Witnesses:

JOHN A. FARWELL,
CLARENCE A. LAWSON.