E. A. RIX.

AIR COMPRESSOR.

APPLICATION FILED DEC. 5, 1910.

**1,001,305.** Patented Aug. 22, 1911.

2 SHEETS—SHEET 1.

Fig. 1.

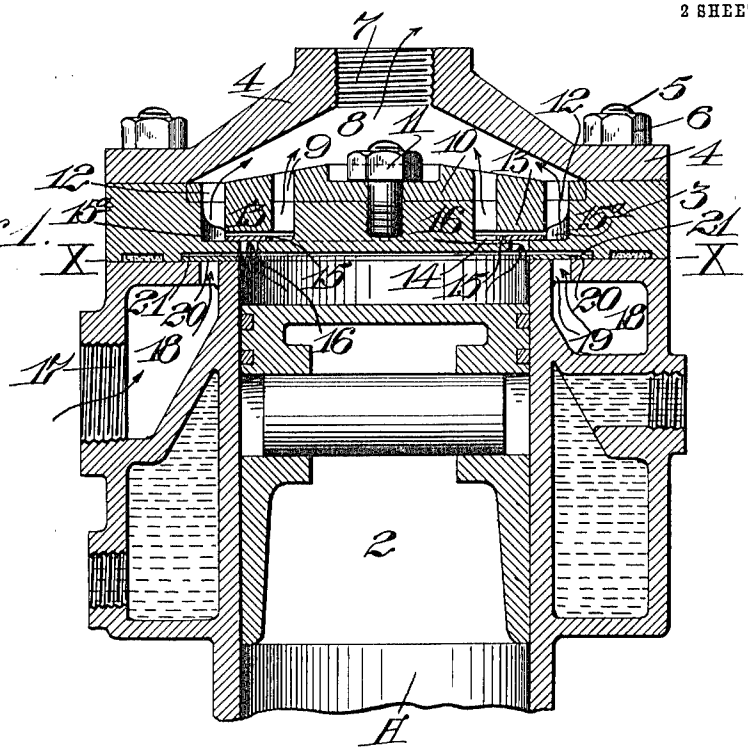
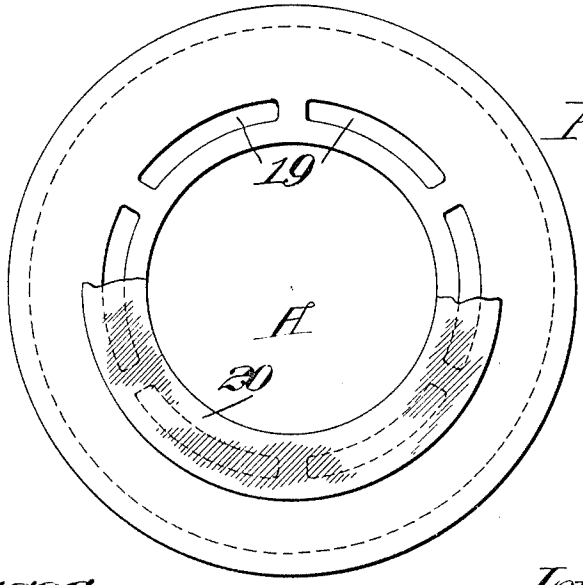



Fig. 2.




Witnesses.
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2 SHEETS—SHEET 2.

Fig. 3.

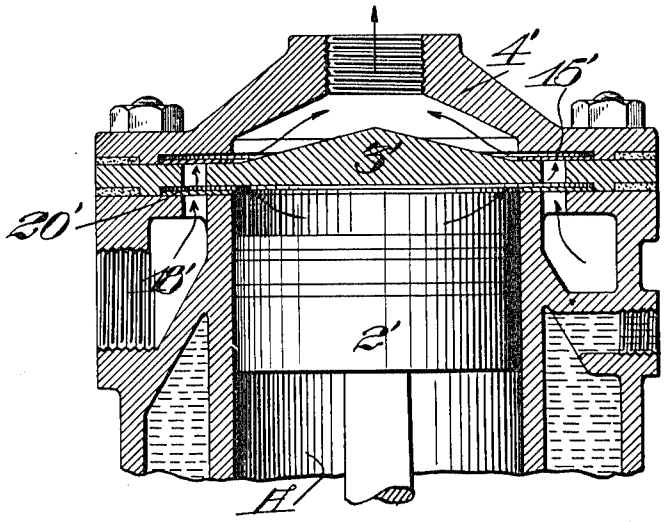
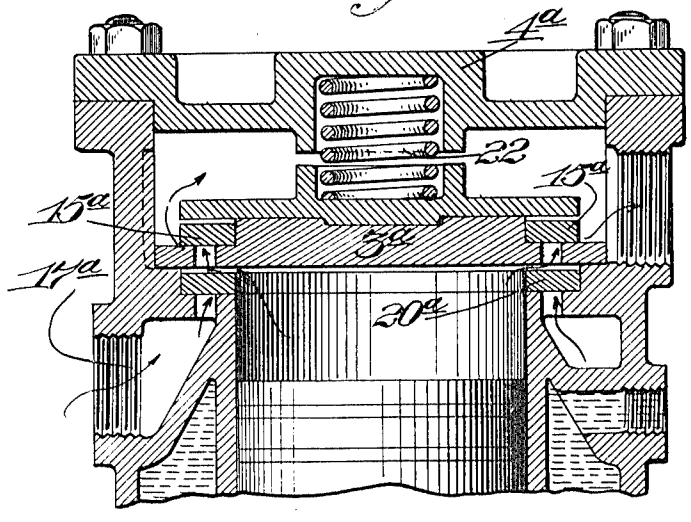



Fig. 4.

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By G. H. Strong

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# UNITED STATES PATENT OFFICE.

EDWARD A. RIX, OF OAKLAND, CALIFORNIA.

## AIR-COMPRESSOR.

1,001,305. Specification of Letters Patent. **Patented Aug. 22, 1911.**

Application filed December 5, 1910. Serial No. 595,564.

*To all whom it may concern:*

Be it known that I, EDWARD A. RIX, citizen of the United States, residing at Oakland, in the county of Alameda and State of California, have invented new and useful Improvements in Air-Compressors, of which the following is a specification.

This invention relates to air compressors and particularly pertains to valve mechanism therefor.

It is the desideratum in the construction and operation of air compressors to employ valves for the control of air through the ports of the compressor which will operate quickly, reliably and as noiselessly as possible, and which will permit of the passage of as large volumes of air as possible; and particularly to provide a valve construction for compressors operative without the use of springs to close the valves and which are not in any wise secured or connected to their seats but are loosely contained so that they may operate without restraint.

The object of this invention is to provide an extremely simple form of valve and valve construction for air compressors or other apparatus; to provide a valve for air compressors whereby the machine may be efficiently and successfully operated at high speed; and to provide a valve construction in which the valve mechanism affords accessibility, a maximum port area, and a minimum amount of movement, thus producing a valve which will be durable, noiseless and relatively inexpensive in initial installation cost and for operating; and in which the position of the valves is such that they may be readily examined and removed.

The invention consists of the parts and the construction and combination of parts as hereinafter more fully described and claimed, having reference to the accompanying drawings, in which—

Figure 1 is a vertical central section through a portion of an air compressor. Fig. 2 is a plan view of the upper end of the compressor cylinder showing a portion of the valve. Fig. 3 is a similar section of an air compressor showing a modified form of valve. Fig. 4 is a similar section of an air compressor showing another modification of the valve, illustrating a resiliently supported cylinder head.

To accomplish the purposes of this invention, I have shown in its present embodiment a suitable compressor cylinder A within which is a reciprocating piston 2; and upon the upper end of the cylinder A is secured a suitable cylinder head 3 retained in position by means of an outer cover or dome plate 4 through which project suitable bolts 5 appropriately fastened in the cylinder A and upon which may be screwed nuts 6.

The dome plate 4 is internally screw threaded, as at 7, for the reception of a discharge pipe through which air from the compressor may be delivered to a suitable point. The interior of the plate 4 is concaved or dome-shaped so as to form a chamber 8 into which the compressed air is received through the double series of ports 9 in the circular bonnet 10; the bonnet 10 being securely fastened to the cylinder head 3 by suitable means as the bolt 11.

Formed in the top of the cylinder head 3 is a suitable annular channel or groove 12 of suitable depth and width into which projects a relatively narrow, downwardly extending, circular flange 13 formed upon the bonnet 10; the bottom of the flange 13 being separated slightly all around from the bottom 14 of the groove 12 to allow just enough clearance for the operation of the thin sheet metal ring valve 15. This ring valve 15 has an exterior diameter substantially even with that of the flange 13, which latter acts as a stop to the opening or upward movement of the valve. The valve is properly centered by suitable guide lugs $15^a$ on the cylinder head. Beneath and normally covered by the valve 15 are a series of ports 16 in the cylinder head which open into the cylinder so that when the piston 2 is moved outwardly toward the cylinder head 3, the volume of air in the cylinder A will be discharged through the several circular ports 16, thus lifting the valve 15 which allows the air to pass freely on either side of the flange 13 and through the ports 9 in the bonnet 10 into chamber 8 and thence out at 7.

The relative amount of movement which the valve 15 has, is determined by its thickness and the distance between the valve seat 14 and the bottom face of the flange 13, and I have found that this form of valve may be practically and efficiently made operable by using a very thin sheet of material, such as tin or other substance, and

allowing it to have a motion a approximately $\frac{1}{32}$ of an inch away from the valve seat 14. It need lift only the amount of its thickness because the aggregate port area for discharge is very considerable when it is considered that the air escapes from port 16 out at each side from beneath valve 15 in a continuous ring or film.

Intake to the cylinder is through a port 17, annular space 18 in the cylinder walls, and ports 19 in the end of the cylinder under the head 3. Valve 20 is similar in all respects to valve 15 only larger in diameter; its diameter being greater than the diameter of the piston and piston chamber. Valve 7, when seated, rests upon the smooth end of the cylinder A and covers the ports 19 formed in the end of the cylinder A.

The number and size of the ports 19 are sufficient to give ample inlet area. The valve 20 is adapted to have a very limited movement between the cylinder head 3 and the end of the cylinder A by machining in the face of the cylinder head 3 a comparatively shallow counterbore or recess 21, having a diameter sufficient to allow the valve 20 to play freely, but keep it always central over the ports 19. The use of these large diameter ring disk valves is important and believed to be novel, for they allow for a minimum of clearance, a maximum of port area, quick action and high efficiency; very important desiderata in small compressors.

The operation of the compressor as constructed is as follows: When the piston 2 starts its downward stroke away from the cylinder head 3, the vacuum created, together with gravity, quickly and firmly seats the valve 15 upon its seat 14 in the cylinder head 3 so as to effectually close the ports 16. The vacuum thus created allows the pressure of air in the annular inlet chamber 18 to lift the large inlet sheet metal disk valve 20 from the series of ports 19 over which it normally rests; the lifting of the valve 20 allowing the passage of air through the ports 19 into the piston chamber of the cylinder.

By reason of the great diameter of the valve 20 and the large area afforded by the series of ports 19, a large volume of air may freely and quickly pass into the piston chamber; and while this valve 20 may only have a motion away from its seat on the cylinder head of approximately $\frac{1}{32}$ of an inch, more or less, the area of the ports 19 is such as to form a free passage of air. At the instant of the reversal of motion of the piston 2 toward the cylinder head 3, the pressure of air in the piston chamber and gravity are effective upon the valve 20 to instantly close the ports 19; and the pressure is also effective against the under side of the valve 15 through the ports 16 to lift this valve so that the compressed air may flow through the ports 9 in the bonnet 10 and out of the compressor.

The counterboring at 21 of the cylinder head 3 not only forms a pocket in which the valve 20 may move, but also provides a proper clearance for the piston 2 since the counterbore 21 opens directly into the cylinder.

All of the valve members are substantially circular pieces of symmetrical structure punched out of ordinary sheet tin or other metal thus permitting them to be easily and inexpensively made, and being light in structure, act quickly and noiselessly. This method of valve construction gives the greatest possible area of opening and consequently renders it possible to give the valves a minimum lift.

A particular feature of this invention is that I place the inlet valve at one end of the cylinder and by making it this shape am enabled to provide a valve being larger in diameter than the diameter of the piston, and by forming in the end of the cylinder A a suitable number of ports, as 18, a great volume of air is freely admitted with a minimum expenditure of power.

In Fig. 3 I have shown a modification of the valve structure in which the inlet valve 20′ and the outlet valve 15′ are of substantially the same diameter and are, therefore, interchangeable in their respective chambers which are formed upon opposite sides of the cylinder head 3′, and in this modification the inlet ports 19′ are in line with the outlet ports 9′ formed in the cylinder head 3. In this case the bonnet 10 of Fig. 1 is dispensed with and the dome 4′ acts as a guide and top stop to the discharge valve 15′.

In Fig. 4 I have shown a further modification of my valve structure in which the inlet valve $20^a$ and the outlet valve $15^a$ are of equal diameters but made somewhat thicker and heavier than the valves 20—20′ and 15—15′ previously shown, and admitted to seat by gravity. In this modification the cylinder head $3^a$ is not securely fastened to the cylinder of the compressor but is retained in its seat on the end thereof by means of a spring 22 of suitable strength acting between the cylinder head $3^a$ and the cover plate $4^a$ so that the cylinder head may yield in case it were struck as by anything dropped into the cylinder ahead of the piston or in case the piston stroke was not carefully timed.

The clearance or lift of the valves in all instances is very slight, being scarcely perceptible to the touch and insufficient generally to permit a knife edge to be put under a valve.

It will be understood that the clearance, which is here shown formed as a depression

in the cylinder head in which the valve moves, may be made, if desired, by counterboring the end wall of the cylinder itself.

Having thus described my invention, what I claim and desire to secure by Letters Patent is—

1. In an air compressor, the combination of a cylinder having a head, said cylinder and head inclosing an annular valve chamber of larger diameter than the cylinder bore, said chamber having its inside periphery open directly to the cylinder bore, said cylinder having ports into said chamber, and a thin annular detached plate valve of greater diameter than the cylinder bore in the cavity operative puppet-fashion solely by the forces of gravity suction and compression to control said ports.

2. The combination in an air compressor of a cylinder and cylinder head, inlet ports in the cylinder between the end of the cylinder and the head, and a metal ring valve normally closing said ports, said head being counterbored to form a chamber for said valve.

3. A valve structure for air compressors comprising the combination with a cylinder having inlet ports in one end, of a thin annular plate adapted to rest upon said ports and being of greater diameter than the bore of the cylinder and covering the ports, a counterbored cylinder head, in the counterbore of which said plate may move, said cylinder head being provided with an annular recess on the side opposite the counterbore, and an outlet disk valve of annular form movable in said recess and adapted to close outlet ports in the cylinder head.

4. The combination with a cylinder having inlet ports open at the end of the cylinder, an annular plate valve between the head and cylinder and controlling said ports, said valve of greater diameter than the bore of the cylinder, means by which said valve has only a knife edge lift, outlet ports opening into an annular recess on top of the head, a bonnet secured to said head and having a flange projecting into said recess, and an annular valve plate movable between the bottom of said flange and the bottom of the recess to close said outlet ports.

5. In an air compressor, the combination of a cylinder having inlet ports disposed at one end around the cylinder bore, a cylinder head fitting over said ported end of the cylinder, an annular inlet valve of larger diameter than the cylinder bore and loosely retained between the head and cylinder and normally closing said ports, an annular series of outlet ports in the head, and an annular outlet valve for said outlet ports and normally resting loose thereover, and means to hold said outlet valve in operative position.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

EDWARD A. RIX.

Witnesses:
M. B. LEASURE,
A. W. WOOD.