No. 893,851. PATENTED JULY 21, 1908.

J. G. LEYNER.

AIR VALVE FOR AIR COMPRESSORS.

APPLICATION FILED MAY 28, 1906.

2 SHEETS—SHEET 1.

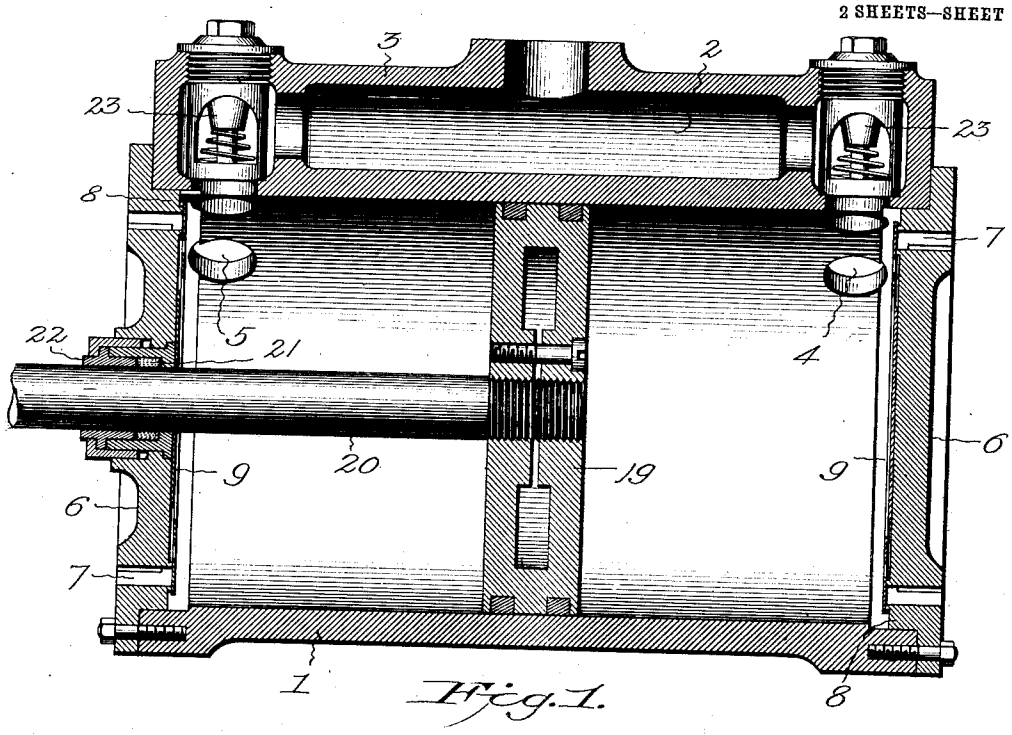


Fig. 1.

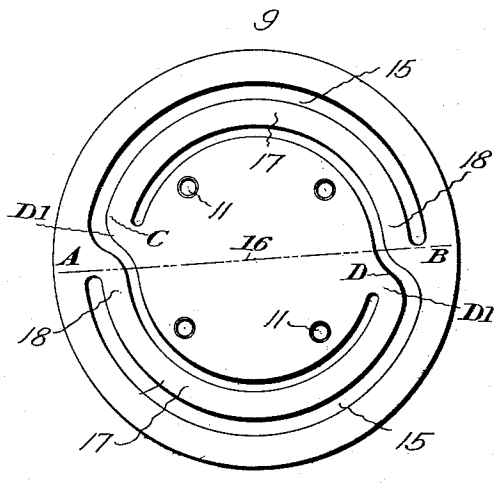


Fig. 2.

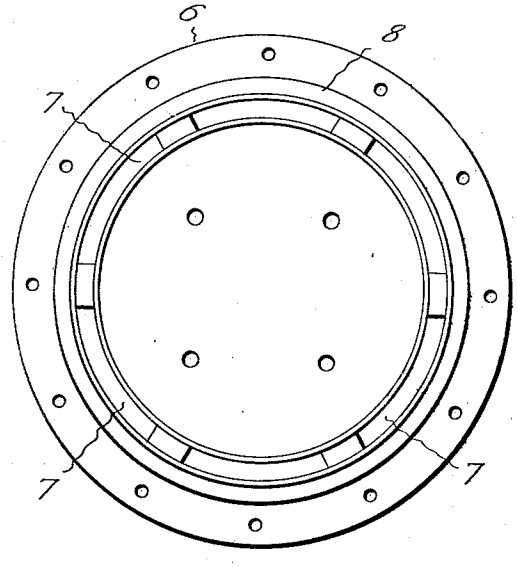


Fig. 3.

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2 SHEETS—SHEET 2.

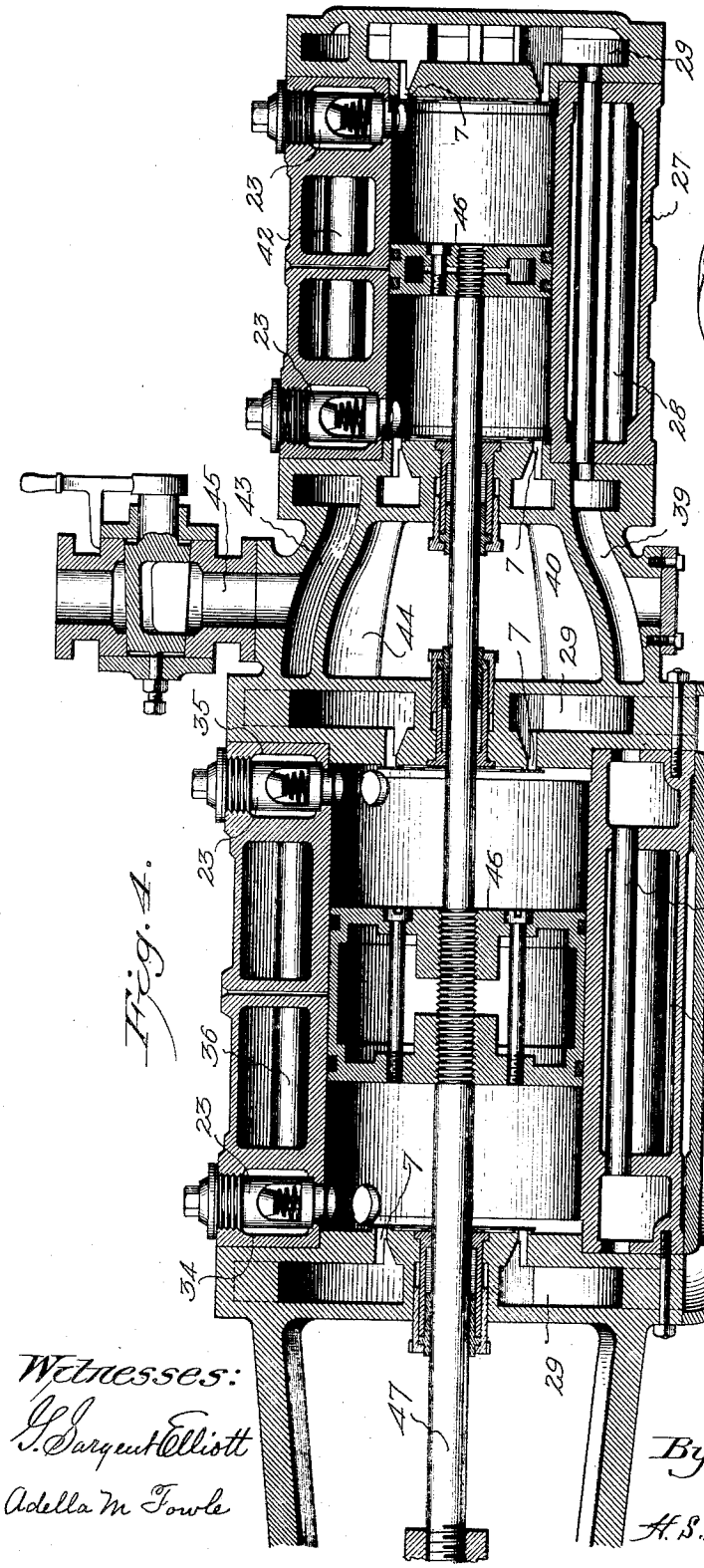


Fig. 4.

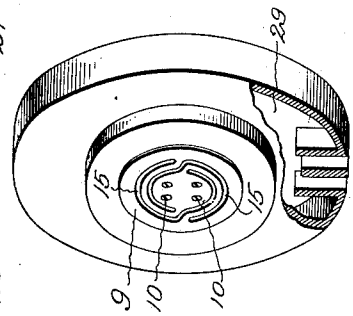


Fig. 6.

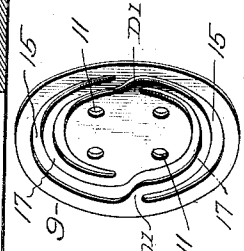


Fig. 5.

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UNITED STATES PATENT OFFICE.

JOHN GEORGE LEYNER, OF DENVER, COLORADO.

AIR-VALVE FOR AIR-COMPRESSORS.

No. 893,851. Specification of Letters Patent. Patented July 21, 1908.

Application filed May 28, 1906. Serial No. 319,137.

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 Air-Valve for Air-Compressors, of which the following is a specification.

My invention relates to improvements in valves and especially air inlet valves for air compressors, and the objects of my invention are: first, to provide a sensitive valve that will respond to the slightest piston air suction through its parts into the cylinder, and to the slightest piston air pressure against it. Second, to provide a thin resilient disk valve that is composed of one integral piece of spring metal. And third, to provide a simple, inexpensive, durable, and thoroughly practical air inlet valve for air compressors. I attain these objects by the mechanism illustrated in the accompanying drawings, in which:

Figure 1, is a vertical, longitudinal, sectional view of an air compressing cylinder, showing my improved air valve secured upon the inner side of each cylinder head, in position to normally cover the air inlet ports therein. Fig. 2, is a plan view of the valve detached from the cylinder head. Fig. 3, is a view of the inner face of one of the cylinder heads, showing the air inlet ports and the projecting valve seats surrounding the ports. Fig. 4, is a vertical, longitudinal, sectional view of a compound, intercooling, air compressor, equipped with my improved air valves. Fig. 5, is a perspective view of the valve, showing the outer rim moved out beyond the disk portion, as when operated by the inflowing air in a cylinder. And Fig. 6, is a perspective view of a cylinder head, removed, showing one of the valves secured thereto.

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

Referring to the drawings, the numeral 1, in general, designates an air compressing cylinder, showing my improved air inlet valve operatively connected thereto. The cylinder 1, is provided with an outlet air port 2, which is formed along the side of the cylinder in a lug 3, and which communicates with the bore of the cylinder by ports 4 and 5, at opposite ends of the cylinder close to the cylinder heads 6. The cylinder is provided at its opposite ends with cylinder heads 6, which are detachably secured to it, and in each cylinder head air inlet ports 7, are formed, which are arranged in a circle, and are preferably arranged in the form of short curved slots, positioned at equal distances apart throughout the circle. On the inner side of each cylinder, I form a raised circular hub 8, which fits snugly but projects loosely into the cylinder, and the ports 7, project through it. On the surface of this boss, on each side edge of the ports 7, I preferably form two slightly raised ring shaped bosses, which extend entirely around the surface of the projecting hub on the opposite edges of the ports. The top surfaces of these ring-shaped bosses, are machine finished, and form the valve seat. The inner side surfaces of both cylinder heads, are alike, and are consequently both provided with the air inlet ports and with the raised valve seats, although if desired these raised valve seats may be dispensed with.

The whole surface of the face of the hub, is finished perfectly smooth and flat, within and without these raised valve seats; and against the face of each hub I secure a spring plate disk valve 9, by means of screws 10, which fit in countersunk holes 11, formed in the central portion of the valve, and are threaded into the cylinder heads. This valve consists of a thin circular disk of thin spring steel, the central portion of which is secured to the central portion of the hub, but the outer circumferential edge of which is arranged and adapted to resiliently bear and seat against the raised valve seats of the hubs, and as the valve disk is made perfectly flat, its center is sprung in slightly by the screws, which causes its circumferential rim portion to bear with a slight resilient or spring pressure against the circular valve seats, all around its circumferential peripheral surface. It is essential however, that the valves bearing against the valve seat be so sensitive that the slightest suction pressure through the ports will open it, and also so that the slightest air pressure from within the cylinder will close it tightly and evenly all around its peripheral valve seat bearing face. Consequently it is essential that the disk be thin enough to be very elastic and pliable enough to always evenly seat against the port's seat rings. It is also essential that the valve when rising or opening to admit air into the cylinder through the ports 7, should lift or rise straight throughout its circumferential peripheral rim surface, and not

lift quicker or higher at one point than at another. I carry out this feature of my invention in the following manner: At diametrically opposite portions of the disk and between its peripheral valve seat portion and its central portion, I form two concentrically arranged slots 15, of preferably the same length, and area, and position one end of them at diametrically opposite points A and B, on any diametrical line of the disk, as for example line 16, extending each of said slots around the disk the same size and area in a concentric curve to close to the diametrical center line 16, and on the same side of this line as the slot started from, and at these points C and D, also diametrically opposite each other, the slots are preferably reduced in width and are also curved in towards the center of the disk enough to avoid the opposite slot and then extended around the disk inside of the opposite outside slot to close to where its own slot started, where it terminates at a short distance from where it started, but on the opposite side of the diametrical line 16, both slots being alike and formed concentric to the center of the disk, and at the same distance from the center of the disk, and each arranged to curve in towards the center of the disk to avoid the other when it meets it. These slots thus almost entirely encircle the disks in opposite directions from each other, and the first half portion of each slot on its own half side of the disk is arranged eccentric to axis of the disk and at the same distance from its center, after which they turn towards the center a short distance and then run around the opposite half of the disk from the half where each started from within each other. This arrangement of slots forms a narrow peripheral rim portion that is held to the central portion of the disk only by a narrow portion of the plate D^1, on opposite sides of the plate; consequently as the plate is raised the tongues 17 rise at an angle, their ends 18 rising first and the tongues incline downward to their ends D^1, where they join the fixed central portion of the disk, and the peripheral rim all around will rise horizontally level away from the valve seats when a suction of air flowing into the cylinder causes it to move away or rise from its ring seats evenly all around a sufficient distance to allow air enough to instantly enter to fill the cylinder, and when the peripheral rim moves away from its ring seats instead of moving straight up it turns slightly towards the fixed ends of the tongues, which act as a center from which the free ends of the tongues radiate, and as the free ends of the tongues rise their free ends move slightly towards the fixed end and draw the peripheral rim around, and as they both operate in the same direction, a slight turning movement is given the rim as it lifts from its seats, and this turning movement acts to give the valve rim a frictional contact with the seat rings when the valve seats instead of a straight flat contact; consequently the valve will seat closer and better, as the slight turning movement causes the face of the peripheral rim to strike the seat rings with a very slight sliding pressure when a pressure of air in the cylinder causes it to take its seat instantaneously and tightly. The cylinder is provided with a reciprocating piston 19, from which a piston rod 20 extends through a stuffing box 21 and gland 22, forming part of the cylinder head. The cylinder is provided with air outlet valves 23, which are placed to control the air outlet apertures at each end of the cylinder, which may be of any suitable type.

If desired, the very slightly raised seat rings may be dispensed with, and the entire surface face of the hub be made perfectly smooth. The valve may be made reversible so that both sides of it may be used against the seat in case after long use on one side its tension has been slightly relaxed, so that the peripheral rim does not seat, and as the valve disk is quite thin it is preferable to form another set of screw holes and countersink them on the opposite side, as the disk is too thin to countersink one set of holes from both sides, if flush headed screws are used, but of course if overlapping headed screws are used, one set of plain holes may be used.

In Fig. 4 I have illustrated my improved disk valve operatively attached to an air intercooling compound air compressor, only the air compressing cylinders are shown, the steam driving cylinder being left off. In this type of compressor, the cylinder is provided with a water jacket 27, which is provided with a series of air conducting tubes 28, that extend through it from end to end, and the cylinder heads are provided with air chambers 29, which connect by suitable passages with an air inlet chamber 31, which is positioned in the supporting base plate 32, and which connects with the atmosphere. The inner wall of each of the cylinder heads, is provided with the circular row of air inlet ports 7, and the valve is attached to the inner face of the hub of this inner wall the same as in Fig. 1, the arrangement of the inner wall of these chambered cylinder heads and of the disk valves and ports being the same for this intercooling compound compressor, as above described and as shown in Fig. 1. The outlet valves are also the same, but the air passages are arranged differently, and as they do not form a part of my present invention, and as they are fully described in my pending application No. 123,539, filed October 1, 1902, for an improved air compressor, the following brief description of them is all that is necessary. The air entering the chamber of the base plate flows into the air chambers of both the front and rear cylinder heads of the largest or low pressure cylinder, and is drawn into

the cylinder through the circular row of port holes in the inner wall of these cylinder heads through the disk valve into the cylinder at each stroke of the piston, and is compressed and forced out of the cylinder through the outlet valves into ports 34 and 35, from which it flows into tubes 36, and from them into independent chambers formed in the cylinder heads, and then into the port 39 of the lower connecting piece 40, from which it flows into the front cylinder head of the high pressure cylinder, and through the tubes 28 to the rear cylinder head of the high pressure cylinder, from which the piston draws it into the cylinder through the ports 7 and disk valves 9, in the inner walls of the cylinder heads, and the air is compressed there and forced out through the air outlet valves and through the cooling tubes 42 into the port 43 of the upper connecting piece 44, into the outlet pipe 45, which conveys it to a storage tank or to use. The high and low cylinders are provided with pistons 46, and a piston rod 47 connects them together, and the piston rod 47 also extends from the low pressure cylinder through its front head.

My improved air inlet disk valve is adapted for use with all kinds and types of air compressors. It is extremely sensitive to act either to open or to close to the slightest air pressure. It is simple, durable, and reliable, and takes the place at each end of the cylinder of a plurality of independent air inlet valves that are much more expensive, more liable to get out of order, and are not so sensitive to air pressures.

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

1. In an air-compressor, a valve comprising a resilient sheet-metal disk cut to provide central and peripheral portions joined by two oppositely disposed substantially concentric curved strips.

2. In an air-compressor, a valve comprising a resilient sheet-metal disk cut to provide central and peripheral portions joined by two oppositely disposed substantially concentric curved strips, and securing means for said central portion.

3. In an air-compressor, an annular valve-port, a resilient sheet-metal disk valve cut to provide central and peripheral portions joined by two oppositely disposed substantially concentric curved strips, said peripheral portion disposed over said port and said central portion secured within said port.

4. In an air valve for air compressing cylinders, the combination of the cylinder, the piston, and the piston rod, of the cylinder heads having a valve seat surface projecting into said cylinder, having a slightly raised valve seat, said seat comprising two circular rings, curved ports circumferentially arranged through said cylinder head between said rings and separated by metal lugs, a thin disk of spring metal secured at its center to the axial center portion of said valve seat in such a manner as to be reversible thereon, and having a narrow strip portion of its peripheral rim arranged to seat evenly and with a slight resilient pressure on said seat rings, and oppositely disposed concentrically arranged slots extending through said disk between its secured axial center portion and a narrow strip around its peripheral rim portion, said slots being of predetermined area and arrangement and adapted to form oppositely arranged elastic tongues of metal to allow said peripheral rim portion to be raised uniformly throughout its circumference with a resilient tension on said tongues, and adapted to be opened by the air suction strokes of said piston and to be closed by the air pressure strokes of said piston.

5. In an air inlet valve for air compressors, the combination with the water jacketed air intercooling compound low and high pressure cylinders, the piston and piston rods, the air outlet valves and passages, and the air inlet base box, the air chambered cylinder heads, comprising outer and inner walls, the cylinder heads of said low pressure cylinder connected to said air inlet base box, and the air inlet passage extension pieces and cylinder heads between said low and high pressure cylinders arranged to convey the compressed air from said low pressure cylinders to said high distant cylinder, with air inlet ports in the inner walls of each of said cylinder heads therethrough into said cylinders, a pair of slightly raised valve seats in the form of circular rings surrounding the opposite side edges of said air inlet ports on the inside face of the inner walls of said cylinder heads, and a thin circular disk of any suitable spring metal secured to each of said valve seats to seat against said port ring seats and control with a narrow circumferential peripheral rim portion said air inlet ports, and having the peripheral rim port seat portion of said valve so flexibly and resiliently connected with its fixed central portion by means of slots and freed resilient tongue portions as to be resiliently moved to open said air inlet ports by the air suction strokes of said pistons, and to be closed by the air pressure strokes of said pistons, said resilient flexibility of the peripheral seat rim of said disk valve being accomplished by oppositely and concentrically arranged freed tongues of metal from the body of said disk between its fixed central portion and its peripheral portion.

6. In an air inlet valve for air compressors, the combination with the cylinder and the piston and piston rod, of a cylinder head for said cylinder, having the circular row of air inlet ports, the raised ring valve seats on the opposite edges of the cylinder side of said cylinder head, and the spring metal circular

disk valve arranged and adapted to seat at its peripheral edge on said ring seats and to be secured at its center to bear with a very slight pressure against said ring seats, and having its peripheral rim surface so arranged relative to its fixed central portion that it possesses a flexible resilient relation thereto to such an extent that it very sensitively rests firmly and evenly on said ring seats through its circumference, and is instantly opened or moved away from said seat by the air suction strokes of said piston, and instantly closed by the air pressure strokes of said piston, said resilient flexibility being accomplished by freeing from the body of said disk valve oppositely and concentrically arranged tongues of metal between its central fixed portion and its seat covering rim portion by means of slots of predetermined length, width, and radius relative to said tongues, which are also of relative predetermined length, width, and radius.

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

JOHN GEORGE LEYNER.

Witnesses:

G. SARGENT ELLIOTT,

BESSIE THOMPSON.