N. A. CHRISTENSEN.

COMPRESSOR VALVE.

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914,699. Patented Mar. 9, 1909.

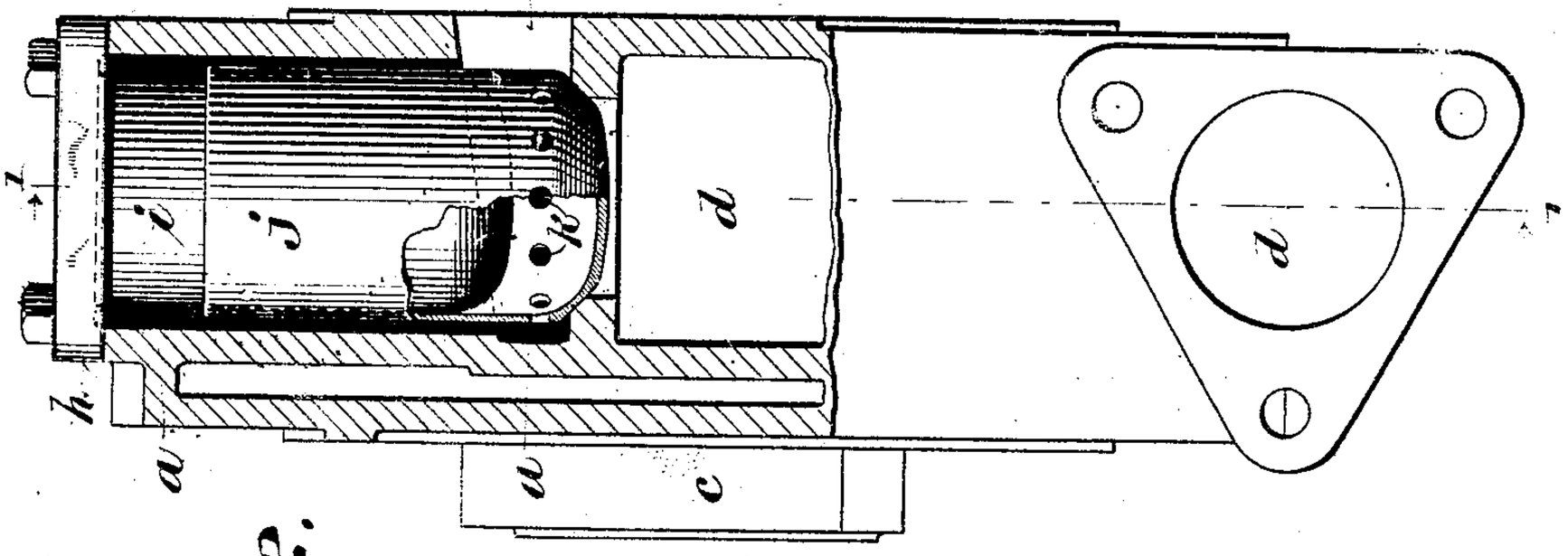

Fig. 2.

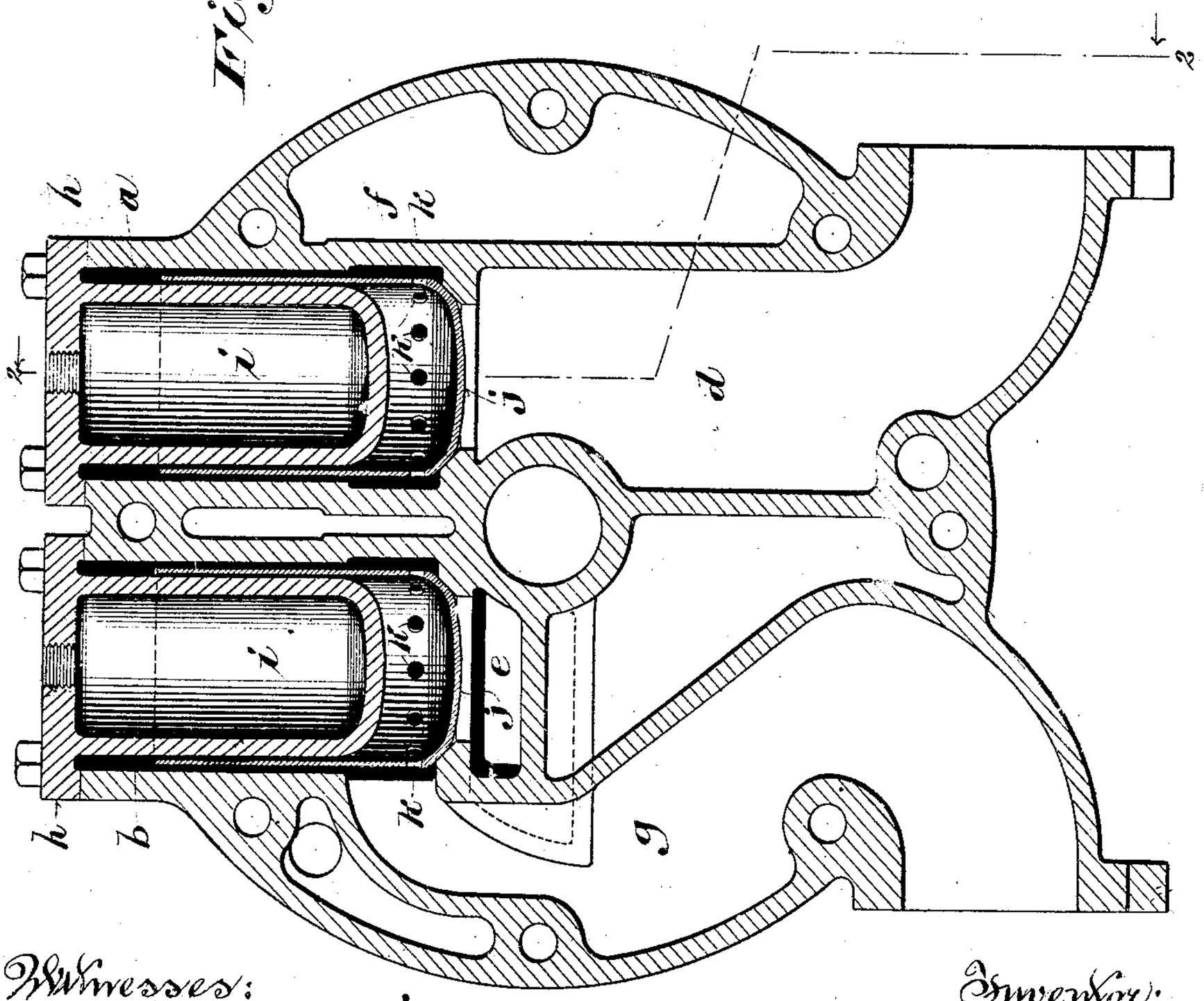

Fig. 1.

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UNITED STATES PATENT OFFICE.

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COMPRESSOR-VALVE.

No. 914,699. Specification of Letters Patent. Patented March 9, 1909.

Application filed March 21, 1904. Serial No. 199,227.

To all whom it may concern:

Be it known that I, NIELS A. CHRISTENSEN, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Compressor-Valves, of which the following is a specification, reference being had to the accompanying drawing, forming a part thereof.

This invention relates more particularly to compressors which have automatic valves actuated by changes in pressure, and are designed to operate on air or elastic fluids and in which it is desirable to reduce the clearance space as much as possible, particularly when high pressures are to be produced and maintained.

The main objects of the invention are to reduce the clearance space; to make the suction and discharge valves interchangeable, thus avoiding the necessity of making and keeping in stock or at hand, different kinds of valves for use when needed, and preventing increase of the clearance space by accidental interchange or misplacement of the valves; to make the valves sensitive or responsive to slight variations in pressure and prompt in action; and generally to improve the construction and operation of valves of this class.

The invention consists in the novel construction and arrangement of parts hereinafter particularly described and pointed out in the claims.

In the accompanying drawing like letters designate the same parts in both figures.

Figure 1 is a vertical section of a cylinder head to which my improved valves are applied in a plane indicated by the line 1—1, Fig. 2, cutting the suction and discharge valves and valve chambers axially perpendicular to the axis of the cylinder; and Fig. 2 is a vertical longitudinal section in a plane indicated by the line 2 2, Fig. 1, cutting the suction valve chamber lengthwise and centrally.

a and *b* are the suction and discharge valve chambers, which in the present instance are shown as formed side by side in the head *c* of a compressor. These chambers are open at their upper ends, and at their lower ends valve seats are formed or provided around ports, one of which on the suction side communicates with the air inlet or supply passage *d*, and the other on the discharge side with a cylinder port *e*, opening directly into the compressor cylinder. Just above the valve seat the suction valve chamber communicates directly through a port *f* with the compressor cylinder, and just above its seat the discharge valve chamber communicates with a discharge passage *g*. The valve chambers are closed by caps or covers *h* bolted or otherwise secured to the cylinder head. These caps are formed or provided with plugs or extensions *i*, which correspond in shape with and project downwardly into and nearly fill the valve chambers within a short distance of the valve seats.

j j are seamless cup-shaped valves preferably made of cold drawn steel, open at their upper ends and closed at their lower ends, which are fitted to the valve seats and constitute the working faces of the valves. They extend upwardly into and work freely in the spaces between the plugs *i* and the walls of the valve chambers which are of corresponding shape, being guided either by said plugs, by said walls or by both. The distance between the lower ends of the plugs *i* and the valve seats, determines the lift of the valves, their upward movement being arrested by the lower ends of the plugs instead of by the thin upper edges of the valves themselves striking against the caps *h*. As there is a tendency of carbon to collect upon and adhere to the outside but not the inside of both suction and discharge valves, greater clearance space is preferably left outside of the valves, as shown in Fig. 1, so that they will work perfectly free and at the same time be guided and held in place by the plugs *i*, upon which they may have a comparatively close fit.

It will be understood that the plug, when used, will serve to guide the valve, but if the plug be omitted the walls of the valve chamber will be sufficiently close to the valve to guide it effectively with the plug omitted.

To enable the changes in pressure, which are constantly taking place in the compressor cylinder and valve chambers when the compressor is in operation to be instantly communicated to the air in the spaces between the closed ends of the valves and the lower ends of the plugs *i*, and to prevent air confined in said spaces from interfering with the free operation of the valves, the valves are perforated just above their seats with a series of holes *k*. Free communication is thus

established between the air outside and the air inside of the valves, and variations in the pressure outside are instantly followed by like variations in the pressure inside of the valves, so that they are always free to operate.

The holes *k* are so located that they will be closed or partially closed by the plugs *i* when the valves are opened and the closed ends of the valves will thus be cushioned and prevented from striking forcibly against the lower ends of the plugs.

The valves *j* and preferably the caps *h* with the plugs *i*, are made alike, so that if they are accidentally interchanged or misplaced the clearance will not be increased and the operation of the compressor will not be affected. The plug *i* may however be omitted on the discharge side without increasing the clearance space or affecting the operation of the compressor, if care is taken to keep the parts in their proper places. On the suction side, where the valve chamber is in constant communication with the compressor cylinder, the plug *i*, nearly filling said chamber, reduces the clearance space to a minimum, just enough being allowed for the necessary movement of the valve. The valve chambers arranged as shown in the drawing, are brought close to the end of the working stroke of the piston and the contents of the passages connecting them with the cylinder are thus reduced to a minimum; springs are dispensed with, and the valves are easily reached for inspection and repairs.

It will be observed that free communication is established between the supply passage *d* and the suction port *f* by way of a passage through the suction valve chamber, and that free communication is also established between the cylinder port *e* and discharge *g* by way of a passage through the discharge valve chamber, the passage through each valve chamber being independent of the clearance space in each chamber, that is, the passage is other than or aside from the clearance space above or outside of the limits of such passage although such passage may be in communication with the clearance space.

Constructed as herein shown and described, valves controlling ports of large area are made extremely light and sensitive.

Various changes in minor details of construction may be made without departing from the principle and intended scope of the invention.

I claim:

1. The combination with a suction valve chamber, of a cup-shaped valve nearly filling said chamber in cross section, said chamber having a passage through it independent of the clearance space between the valve and chamber, for the passage of fluid to a port for cummunication with a compressor cylinder, substantially as described.

2. The combination with a suction valve chamber, of a cup-shaped valve therein, said chamber being provided with a port above the valve-seat for communication with the compressor cylinder, the walls of the valve chamber being sufficiently close to the valve to guide it effectively, and a passage provided for the passage of fluid independent of the clearance space in which the valve works, substantially as described.

3. In a compressor, the combination with a valve chamber, of a cup-shaped valve therein, said chamber being provided with a port in its wall above the valve-seat and below the top of the valve, the walls of the valve chamber being sufficiently close to the valve to guide it effectively, and a passage provided for the passage of fluid independent of the clearance space in which the valve works, substantially as described.

4. The combination of a valve-chamber, a plug projecting into said chamber within a short distance of the valve-seat and filling said chamber in cross section with the exception of a working clearance space for a valve, and a cup-shaped valve fitted to work in the annular clearance space between the plug and the wall of the valve chamber, the walls of the valve chamber being in close proximity to the cup-shaped valve and the plug on which it is guided to reduce clearance space, and a passage provided for the passage of fluid independent of the clearance space in which the valve works, substantially as described.

5. In a compressor, the combination of a valve chamber, a cover having a plug projecting into said chamber within a short distance of the valve-seat and filling said chamber in cross section with the exception of a working clearance for a valve, and a cup-shaped suction valve loosely fitting at its open end into the clearance space between said plug and the wall of the valve chamber, said chamber being provided with a cylinder-port above the valve-seat, substantially as described.

6. In a compressor, the combination of a valve chamber, a plug projecting into said chamber within a short distance of the valve seat, and a cup-shaped valve extending at its open end into the annular space surrounding said plug and perforated adjacent to its working face, said vlave chamber having a port in its wall above the valve seat, the walls of the valve chamber being in close proximity to the cup-shaped valve and the plug on which it is guided to reduce clearance space, and a passage provided for the passage of fluid independent of the clearance space in which the valve works, substantially as described.

7. In a compressor, the combination of suction and discharge valve chambers, a plug projecting into the suction valve cham-

ber within a short distance of the valve seat and filling said chamber in cross section with the exception of a working clearance for a vlave, and interchangeable cup-shaped suction and discharge valves, each adapted to work at its open end in the space between said plug and the wall of the suction valve chamber, which has a port in its wall above the valve seat, substantially as described.

8. In a compressor, the combination of suction and discharge valve chambers having interchangeable covers provided with plugs each of which is adapted to project into the suction valve chamber within a short distance of the vlave seat and to fill said chamber with the exception of a working clearance space for a valve, and interchangeable cup-shaped suction and discharge valves, each adapted to work in the clearance space between either of said plugs and the wall of the suction valve chamber, substantially as described.

9. In a compressor, the combination of suction and discharge valve-chambers, a plug projecting into the suction valve chamber within a short distance of the valve seat and filling said chamber in cross section with the exception of a working clearance space for a valve, and interchangeable cup-shaped suction and discharge valves, each adapted to work in the clearance space between said plug and the surrounding wall of the suction valve-chamber and perforated adjacent to its working face, substantially as described.

In witness whereof, I hereto affix my signature in presence of two witnesses.

NIELS A. CHRISTENSEN.

Witnesses:
E. C. H. BOTHUN,
CHAS. L. GOSS.