No. 660,793. Patented Oct. 30, 1900.

# T. GRANT.

## SINGLE CYLINDER COMPOUND COMPRESSOR.

(Application filed June 12, 1899.)

(No Model.) 2 Sheets—Sheet 1.

Fig 1

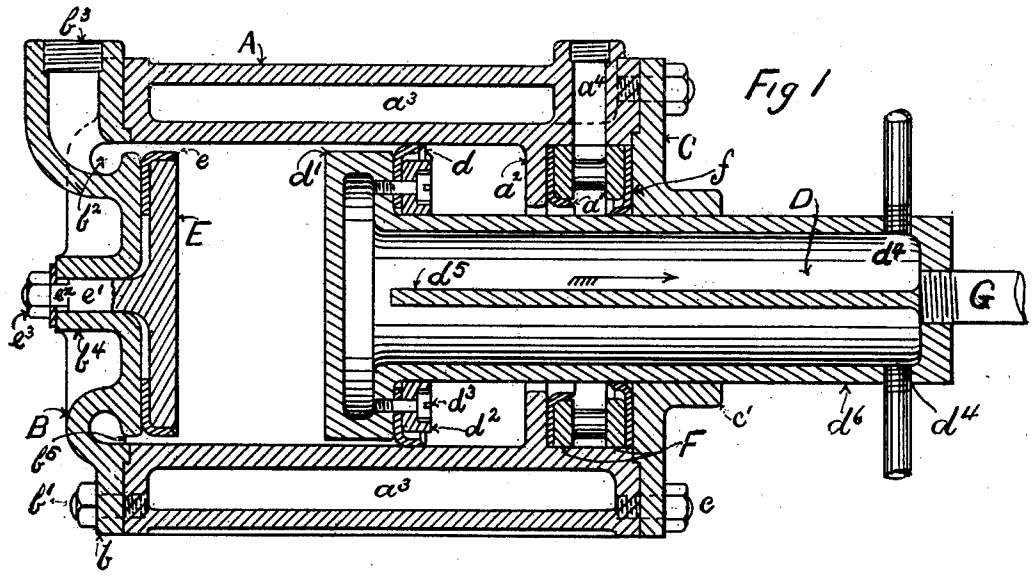



Fig 2

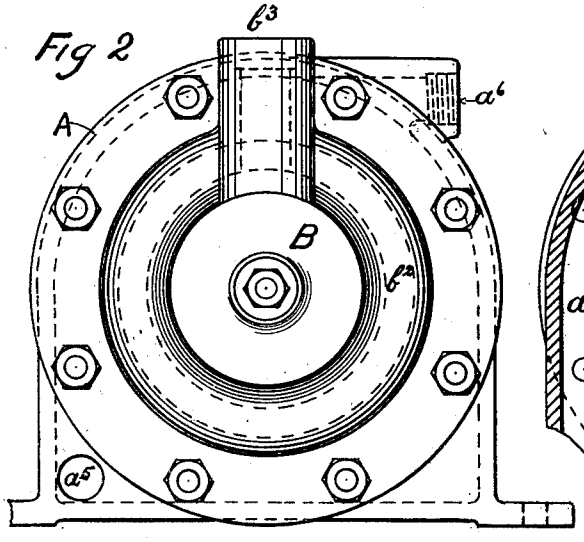



Fig 3

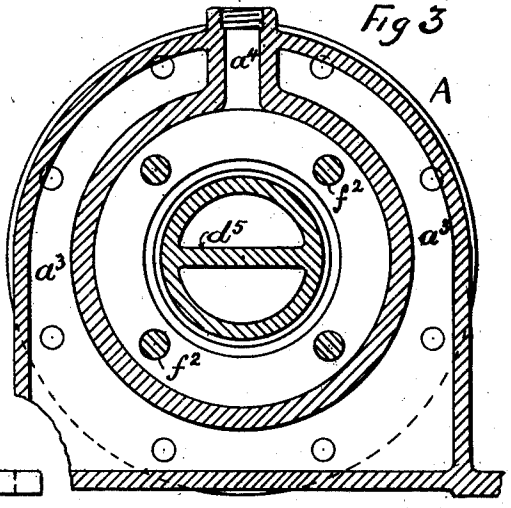



Fig 4

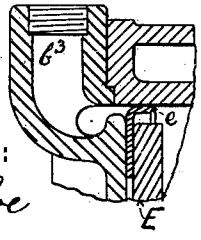



Fig 5

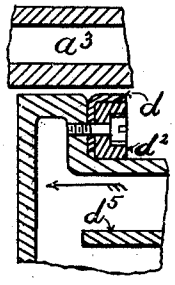
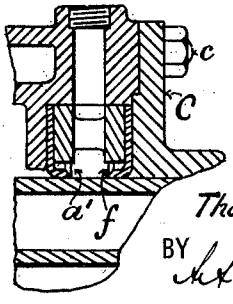



Fig 6

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No. 660,793. Patented Oct. 30, 1900.

T. GRANT.

SINGLE CYLINDER COMPOUND COMPRESSOR.

(Application filed June 12, 1899.)

(No Model.) 2 Sheets—Sheet 2.

Fig 7

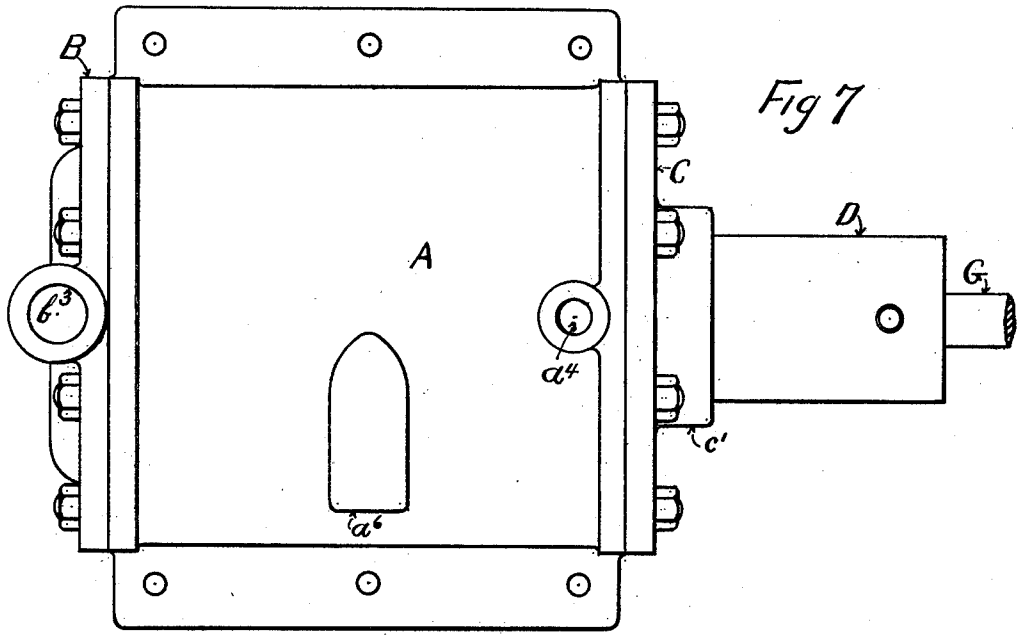


Fig 8

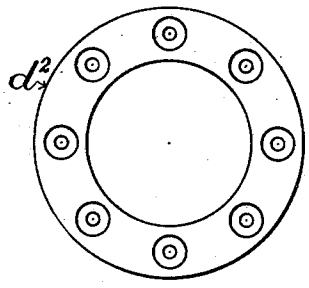


Fig 9

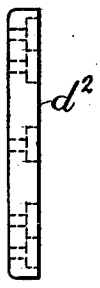


Fig 10

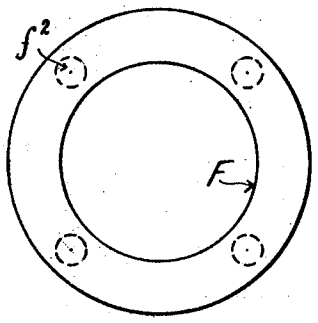


Fig 11

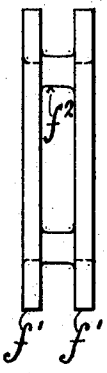


Fig 12

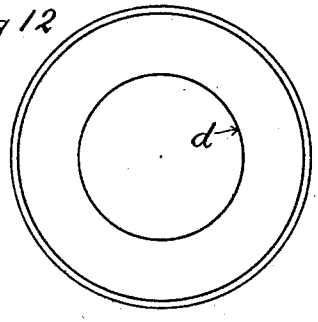


Fig 13


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# UNITED STATES PATENT OFFICE.

THOMAS GRANT, OF NEW YORK, N. Y., ASSIGNOR OF ONE-HALF TO HARTWIG A. COHEN, OF DALAMAR, NEVADA.

## SINGLE-CYLINDER COMPOUND COMPRESSOR.

SPECIFICATION forming part of Letters Patent No. 660,793, dated October 30, 1900.

Application filed June 12, 1899. Serial No. 720,310. (No model.)

*To all whom it may concern:*

Be it known that I, THOMAS GRANT, a citizen of the United States, and a resident of the borough of Richmond, New York city, in the county of Richmond and State of New York, have invented certain new and useful Improvements in Single-Cylinder Compound Compressors, of which the following is a specification.

The object of my invention is the production of a single-cylinder compound compressor of novel construction devoid of complicated mechanism and without necessarily using the expensive valves generally employed with compressors, avoiding also expensive stuffing-boxes.

To this end my compressor consists of the novel combination of parts described in the specification, illustrated in the drawings, and pointed out in the claims herewith.

My invention comprises a water-jacketed cylinder with an outlet-opening, a piston of two diameters reciprocating in the cylinder with a valve attached thereto, an inlet-valve attached to the back cylinder-head, and an outlet-valve secured to the cylinder at opposite end from the inlet-valve.

Figure 1 represents a longitudinal vertical section of my compressor, taken through its axis. Fig. 2 shows a back end view. Fig. 3 is a vertical cross-section taken through the center of the air or vapor outlet opening. Figs. 4, 5, and 6 show fragmentary vertical sections of the compressor, taken through the longitudinal axis. Fig. 7 shows a plan view of compressor. Figs. 8 and 9 represent, respectively, an elevation and a side view of the follower-ring. Figs. 10 and 11 show an elevation and a side view of ring-cage. Figs. 12 and 13 show an elevation and a side view of the valve attached to the piston.

An inspection of the drawings clearly shows that my compressor consists of the cylinder A, with cylinder heads B and C; the hollow piston D, with the valve $d$; the inlet-valve $e$, with retaining-plate E, and the outlet-valve $a'$, with retaining-cage F, which also secures the packing $f$ for the piston when reciprocating through the cylinder-head C. The cylinder A is shown with its water-jacket $a^3$ and water-openings $a^5$ and $a^6$, air-outlet opening $a^4$, and internal circular flange $a^2$. The back cylinder-head B is shown bolted to the cylinder through its flange $b$ by the bolts $b'$ in the ordinary way. A circular cavity $b^2$ is cast in the cylinder-head, which constitutes a reservoir or receiving-chamber for the inlet-opening $b^3$, the said cavity communicating with the inside of the cylinder through the circumferential port $b^5$, which is obtained by making the inside end of cylinder-head smaller in diameter than the internal diameter of the cylinder.

The retaining-plate E terminates in the spindle $e'$, which is turned down at $e^2$ and secured by the nut $e^3$ to the hollow boss $b^4$ of the cylinder-head B. The plate E is made small enough in diameter to allow the opening and closing of the inlet-valve $e$. The inlet-valve $e$ is secured between the cylinder-head B and the retaining-plate E, hugging the plate E when open, as shown in Fig. 1, and fitting the inside of the cylinder when closed, as shown in Fig. 4. It is cup-shaped, preferably made of leather, although any other suitable material can be used.

The piston D is made of two diameters, as shown, the larger diameter at $d'$ being smaller than the inside diameter of the cylinder to enable it to actuate as a transfer-piston. The valve $d$ is secured by means of the follower-ring $d^2$, which is bolted to the piston with the bolts $d^3$. The valve $d$ is cup-shaped and preferably made of leather. The outside diameter of the follower-ring $d^2$ is made small enough to permit the opening and closing of the valve $d$, it being shown closed in Fig. 1 and open in Fig. 5. The piston D is made of two diameters to secure the compression of the air or other vapor during both forward and backward strokes of the piston and at the same time to obtain a piston-rod large enough in diameter to secure its proper maintenance through the extended cylinder-head C, cast with throat $c'$. The piston is made hollow for lightness and at the same time to allow a circulation of water through the same by means of the openings at $d^4$ with the division-plate $d^5$. A rod G is fastened to the hollow piston, by which it is actuated through any suitable source of power.

A double-ring cage F is shown in sectional elevation in Fig. 1 and an elevation and side

view of the same are shown in Figs. 10 and 11. It consists of the two rings $f'$ $f'$, connected by the separating-pieces $f^2$, and its office is to keep the outlet-valve $a'$ and packing $f$ in place. The valve $a'$ and packing $f$ are both cup-shaped and preferably made of leather. The valve $a'$ butts against the internal flange $a^2$ of the cylinder and the packing $f$ against the cylinder-head C. The cage F, which separates them, is situated opposite the outlet-opening $a^4$. The rings $f'$ $f'$ easily slip into the cylinder A and are of small enough internal diameter to allow the valve $a'$ to open, as shown in Fig 1, and to close, as shown in Fig. 6. The bolts $c$ secure the cylinder-head C in place and at the same time the packing $f$, cage F, and valve $a'$.

The operation of the compressor is novel. The piston is reciprocated by a suitable source of power through the rod G, and when the piston is moving in the direction shown by the arrow in Fig. 1 the inlet-valve $e$ is opened by the suction of the piston, the valve $d$ is closed by the pressure on the front side of the piston, and the outlet-valve $a'$ is open. A quantity of air or vapor is drawn into the cylinder between the cylinder-head B and the piston, and the air or vapor on the other side of the piston is both compressed and forced through the outlet-valve $a'$ and opening $a^4$. On the return stroke of the piston in the direction shown in Fig. 5 the pressure in the cylinder closes the inlet-valve $e$, as represented in Fig. 4, the transfer-valve $d$ being opened, as shown in Fig. 5, and the outlet-valve $a'$ is closed by the pressure on its outlet side, as shown in Fig. 6. While the piston is moving in this direction, the air or vapor is transferred from the inlet to the outlet end of the cylinder and is at the same time compressed because of the volume displaced by the entering of the portion $d^6$ of the piston into the cylinder. When the piston moves in the direction shown by the arrow in Fig. 1, the air or vapor between the piston and cylinder-head C is again compressed, and when it reaches a higher pressure than the air or other vapor contained beyond the outlet-valve $a'$ the said valve is opened to allow the escape of the compressed air or gas. It will plainly be seen that by this novel combination of parts a compound compressor is obtained with only one cylinder.

Having described my invention, I claim and desire to secure by United States Letters Patent—

1. In the cylinder of a compressor, the combination with an annular cup-shaped valve located with its turned-up edge at or near the cylindrical surface of the cylinder, of a retaining-plate E, facing the piston of the cylinder and bearing against the base of said valve, which in turn bears against the end of the cylinder, a spindle $e'$ terminating the central portion of the retaining-plate E, and turned down to form a smaller portion $e^2$, for receiving a fastening-nut $e^3$, and a back cylinder-head B, having a boss $b^4$, through which passes said spindle $e'$.

2. A compressor consisting of the combination of a single cylinder of uniform internal diameter, having an inlet-valve at one end and an outlet-valve at the other end, a plunger whose diameter is less than said internal diameter and having an enlarged head whose forward compressing-surface faces the inlet-valve and is equal to the cross sectional internal area of the cylinder, and whose rear compressing-surface faces the outlet-valve and is substantially equal to the difference of the cross-sectional cylinder area and the cross-sectional plunger area, and a valve carried by the enlarged head, between the spaces of the cylinder divided off by the said head, and forming an inlet from the larger area space to the smaller space.

3. In a compressor, the combination with the front cylinder-head thereof, of an internal circular flange $a^2$, a piston passing within said flange and through the front cylinder-head C, a cage consisting of two parallel rings $f'$, separated by separating-pieces $f^2$, and bearing upon the inner surface of said cylinder and located between said flange $a^2$, and said cylinder-head C, and packing-ring $f$, bearing upon said piston and located between said cage and said head, a cup-shaped valve $a'$, having its base between said cage and said flange $a^2$, and having its edge between said cage and said piston to form a valve between the interior of the cylinder and the space between the rings $f'$, the cylinder A, of the compressor having an outlet-port $a^4$, which opens into the space between the rings $f'$.

Signed at New York, in the county of New York and State of New York, this 10th day of June, A. D. 1899.

THOMAS GRANT.

Witnesses:
SHERMAN W. FORD,
WILLIAM C. KIDD.