No. 622,344. Patented Apr. 4, 1899.

F. W. GORDON.

VALVE FOR COMPRESSORS.

(No Model.)

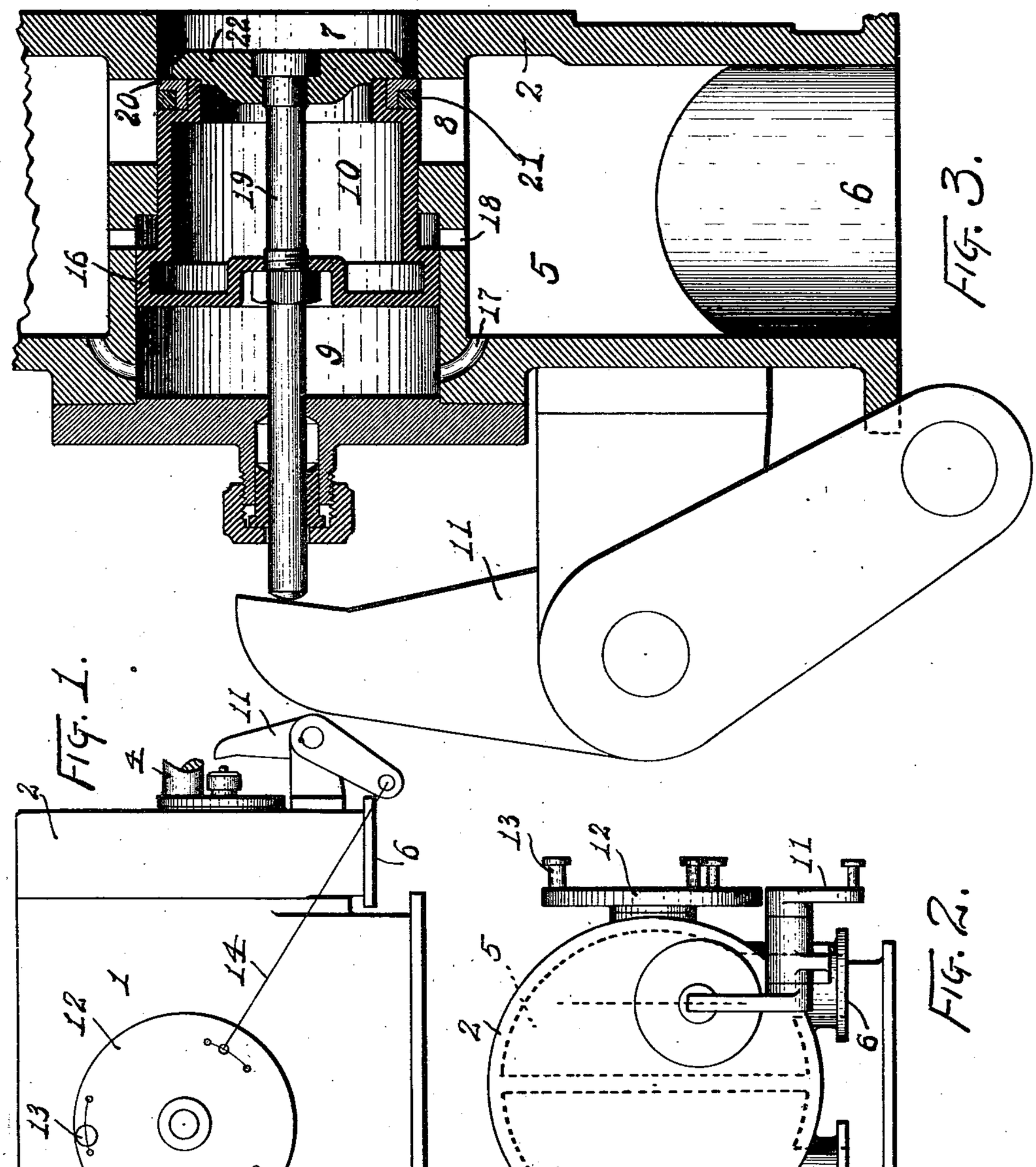

FIG. 3.

FIG. 1.

FIG. 2.

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VALVE FOR COMPRESSORS.

SPECIFICATION forming part of Letters Patent No. 622,344, dated April 4, 1899.

Application filed October 24, 1898. Serial No. 694,488. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK W. GORDON, of Philadelphia, Philadelphia county, Pennsylvania, have invented certain new and useful Improvements in Valves for Compressors, (Case B,) of which the following is a specification.

This invention was patented in Great Britain October 14, 1898, No. 21,647; in France October 14, 1898, No. 282,142; in Belgium October 14, 1898, No. 138,395, and an application for patent was filed in Germany October 14, 1898, which German application has not yet been allowed.

This invention pertains to discharge-valves for fluid-compressors and will be readily understood from the following description, taken in connection with the accompanying drawings, in which—

Figure 1 is a side elevation, part vertical section, of a compressor-cylinder provided with discharge-valves embodying my present improvement; Fig. 2, an end elevation of the same; and Fig. 3, a vertical section, on an enlarged scale, in duplication of a portion of the vertical section appearing in Fig. 1.

The compressor shown is double-acting and supplied with one of the improved discharge-valves at each end. The two valves being alike, the description will be confined to the singular.

In the drawings, 1 indicates the compressor-cylinder; 2, the cylinder-head; 3, the compressor-piston; 4, its piston-rod; 5, a discharge-chamber formed in the cylinder-head; 6, the discharge-outlet from said chamber; 7, a valve-cylinder formed within the cylinder-head, its axis being parallel with that of the compressor-cylinder and the inner end of the valve-cylinder being fully open to the compressor-cylinder; 8, a circumferential series of ports placing discharge-chamber 5 in communication with valve-cylinder 7; 9, an enlargement at the outer end of valve-cylinder 7, this enlargement forming a cushion-cylinder and having a bonnet at its outer end; 10, a valve-piston fitting valve-cylinder 7, its inner end being adapted to open and close ports 8, the valve-piston being closed—that is to say, no fluid passes through it—and the inner end of the valve-piston being adapted at the inner extremity of its stroke to be about flush with the inner surface of cylinder-head 2 of the compressor; 11, a rocker-tappet adapted to engage the outer end of the stem of the valve-piston; 12, a wrist-plate; 13, a wrist by means of which the wrist-plate may be rocked—as, for instance, by means of a rod from an eccentric on the shaft of the compressor-engine; 14, a link connecting the wrist-plate with rocker 11; 15, inlet-chamber in the cylinder-head, wherein may be located the inlet-valves for the compressor, with which inlet-valves, however, my present invention is not concerned; 16, the cushion-piston, working in cushion-cylinder 9 and shown as an integral enlargement on the outer end of valve-piston 10; 17, cushion-ports leading from discharge-chamber 5 to near the outer end of cushion-cylinder 9 and adapted to be overrun and closed by piston 16 at its outer extremity of movement; 18, similar cushion-ports adapted to be overrun by piston 16 at its inner extremity of motion; 19, the stem of the valve-piston, the same projecting out through a suitable stuffing-box in the bonnet, its outer end being in position to be engaged by tappet 11; 20, an L-shaped packing-ring seated in a groove in the inner end of valve-piston 10, the inner edge of this ring, that end toward the compressor-cylinder, forming the functional valve edge of the valve-piston in coöperating with ports 8; 21, a packing-ring of rectangular section seated in the angle of ring 20, and 22 a flange seated against the inner end of the valve-piston and clamped thereto by the valve-stem, this flange forming one wall for the groove in which the packing-rings are seated and the diameter of the flange being less than that of the valve-cylinder, so as not to interfere with the functional performance of the edge of the packing-ring 20 in coöperating with the inner ends of ports 8, or, in other words, flange 22 does not add to the functional length of the valve-piston.

While the peculiarities of the packing do not form the subject-matter of claims herein and while other forms of packing may be employed and while packing-rings may in some cases be entirely dispensed with, it may not be out of place to explain that rings 20 and

21 are each sawed open and so doweled to the valve-piston that the sawed cut in one of the rings will traverse one of the bridges separating ports 8, while the cut in the other ring traverses another one of the bridges, the two bridges thus traversed by the cuts in the packing-rings being preferably at or near the bottom of the valve-cylinder.

Motion is to be given to rocker 11 in such manner and time that when compressor-piston 3 has completed its compressive stroke and is ready to start on its suction-stroke the valve-piston will be pushed to at least line-and-line position of closure, the rocker having only this duty to perform. At the time this mechanical closure of the valve takes place the valve is in equilibrium, and consequently the tappet requires only to overcome the mechanical friction of the valve. The drawings show the valve as thus having been pushed to line-and-line position of closure by the action of the rocker.

Referring to Fig. 1, the valve being in line-and-line position the compressor-piston 3 starts to the right. Fluid in the clearance-space of the compressor-cylinder expands as the compressor-piston moves to the right, and when the pressure in the compressor-cylinder shall by expansion have been reduced sufficiently the preponderating pressure in the discharge-chamber 5, acting on the left of the valve-piston, will overcome the mechanical friction of the valve and suddenly move it to the right to position of full lap, any shock of the movement being checked by the cushioning action of piston 16 overrunning ports 18. The valve, having gone to position of full lap, remains held in that position by the preponderating pressure in the discharge-chamber, and under these conditions the compressor-piston makes its suction-stroke, the compressor-cylinder becoming filled with fluid at pressure of reception—atmospheric pressure in case of simple compressors and greater pressure in the case of the second element of a compound compressor. The compressor-piston, being at the extreme right, starts on its compression-stroke, the valve being still closed. As compression takes place in the compressor-cylinder the pressure of the fluid therein approaches and reaches and finally exceeds that in the discharge-chamber. When the excess of pressure in the compressor-cylinder shall have become sufficient to overcome the mechanical friction of the valve, then the valve will suddenly move to the left to full-open position, the shock of the movement being checked by the cushioning action of piston 16 overrunning ports 17. The compressed fluid now passes to the discharge-chamber through the inner end of the valve-cylinder and through ports 8. Upon the completion of the compressive stroke in question and as the piston begins its following suction-stroke the tappet has pushed the valve to line-and-line position, as before.

As before mentioned, the valve will move to the left and go to full-open position as soon as the pressure in the compressor-cylinder shall exceed that in the discharge-chamber sufficiently to overcome the mere mechanical friction of the valve; but the stem of the valve, projecting out through the bonnet, may have its diameter enlarged sufficiently to counterbalance the valve, and thus cause the opening motion of the valve to coincide with or somewhat anticipate the pressure in the main cylinder reaching that in the discharge-chamber.

It is to be observed in Fig. 1 that the inner end of the valve-piston stands a trifle at the left away from the inner face of the cylinder-head, the valve being in line-and-line position. When the valve moves to the right, going to full lap, the inner end of the valve-piston is about flush with the inner face of the cylinder-head. Consequently there is but a minimum of clearance chargeable to the discharge-valve system. These valves have the advantage of simplicity of construction, smoothness of action, ready accessibility, easy repair, perfection of control in time of opening, and they particularly lend themselves to closing actuation from a simple eccentric on the engine-shaft.

I claim as my invention—

1. The combination, substantially as set forth, of a compressor-cylinder, a valve-cylinder with an end opening directly to the compressor-cylinder and having discharge-ports in its wall near such end, the opposite end of said valve-cylinder being in communication with the discharge-chamber, a closed valve-piston fitted to reciprocate within said valve-cylinder and to have its end coöperate with said discharge-ports, and a tappet adapted to move said valve-piston to position to cover said ports.

2. The combination, substantially as set forth, of a compressor-cylinder, a valve-cylinder with an end opening directly to the compressor-cylinder and having discharge-ports in its wall near such end, the opposite end of said valve-cylinder being in communication with the discharge-chamber, a closed valve-piston fitted to reciprocate within said valve-cylinder and to have its end coöperate with said discharge-ports, a tappet adapted to move said valve-piston to position to cover said ports, and a cushioning-piston connected with said valve-piston.

3. A valve for compressors, comprising a valve-cylinder open at one end, discharge-ports in the wall of said valve-cylinder near its open end, a cushioning-cylinder formed by a concentric enlargement at the opposite end of the valve-cylinder, cushioning-ports in the wall of said cushioning-chamber near its ends, a closed valve-piston fitting within said valve-cylinder and adapted to have its end coöperate with said first-mentioned ports, an enlargement on the opposite end of said valve-piston fitting said cushioning-cylinder and adapted to overrun and close said cushioning-ports, and a tappet adapted to move

said valve-piston to position to close the first-mentioned ports, combined substantially as and for the purpose set forth.

4. The combination, substantially as set forth, of a compressor-cylinder, cylinder-heads therefor containing discharge-chambers, a valve-cylinder in each head opening directly into the compressor-cylinder and having discharge-ports communicating with the respective discharge-chambers, a closed valve-piston in each of said valve-cylinders, a tappet-rocker at each of said cylinder-heads and adapted to move its appropriate valve-piston to position of closure, a wrist-plate, and links connecting said tappet-rockers with wrists on said wrist-plate.

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