No. 688,042. Patented Dec. 3, 1901.

F. C. WEBER.

FLUID COMPRESSOR.

(Application filed July 3, 1901.)

(No Model.) 4 Sheets—Sheet 1.

Fig. 1

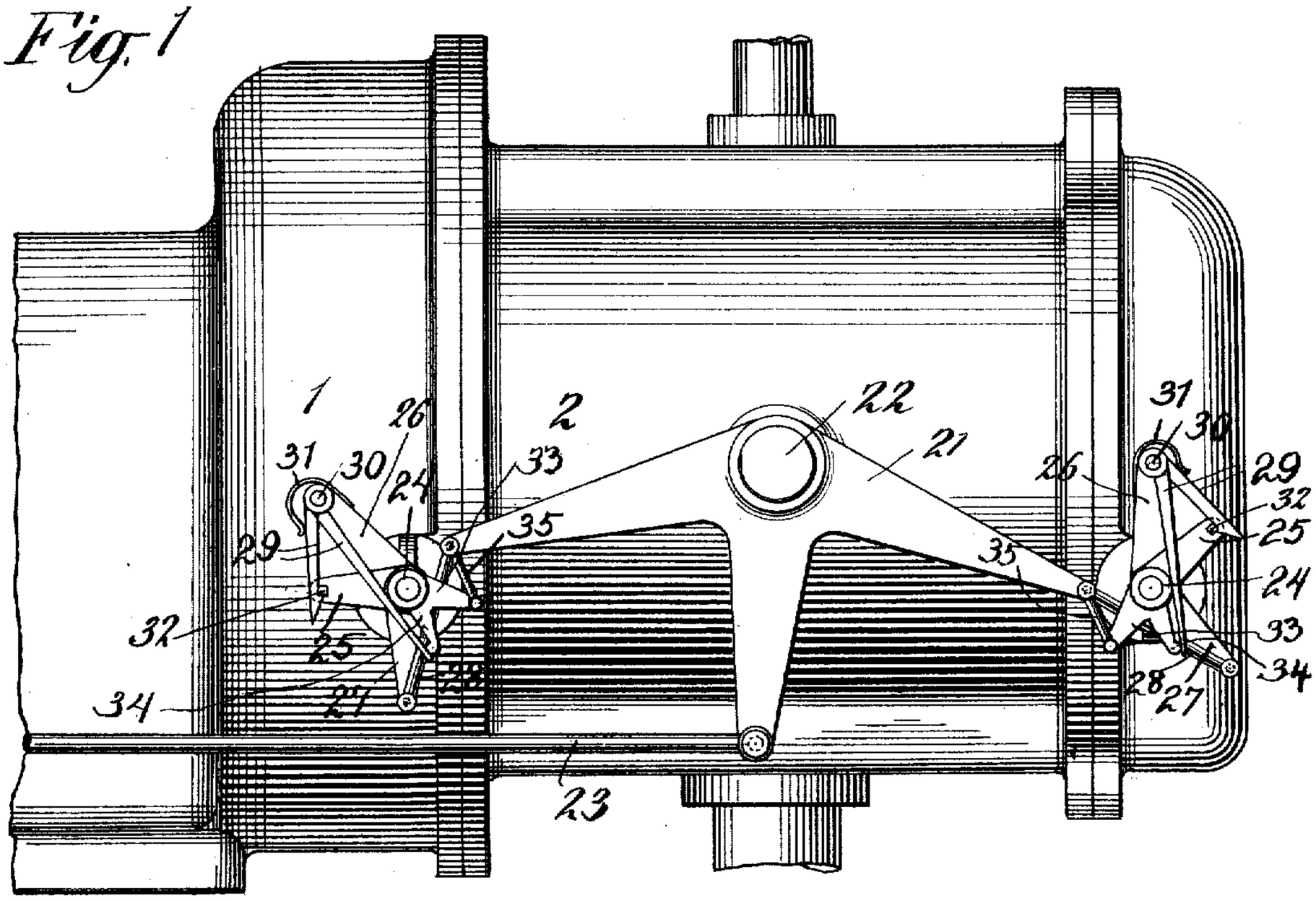
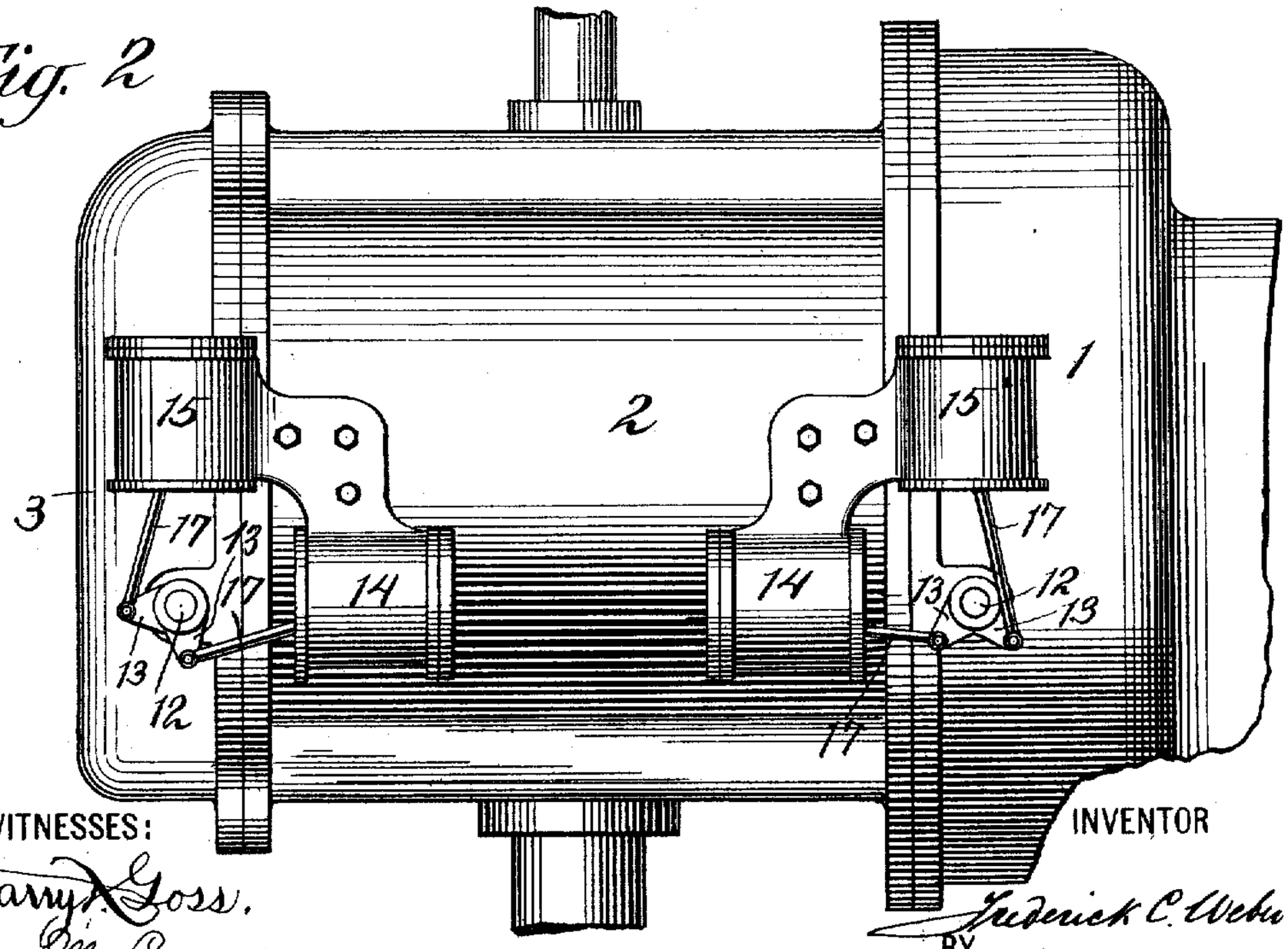


Fig. 2



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No. 688,042. Patented Dec. 3, 1901.

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(No Model.) 4 Sheets—Sheet 2.

Fig. 3.

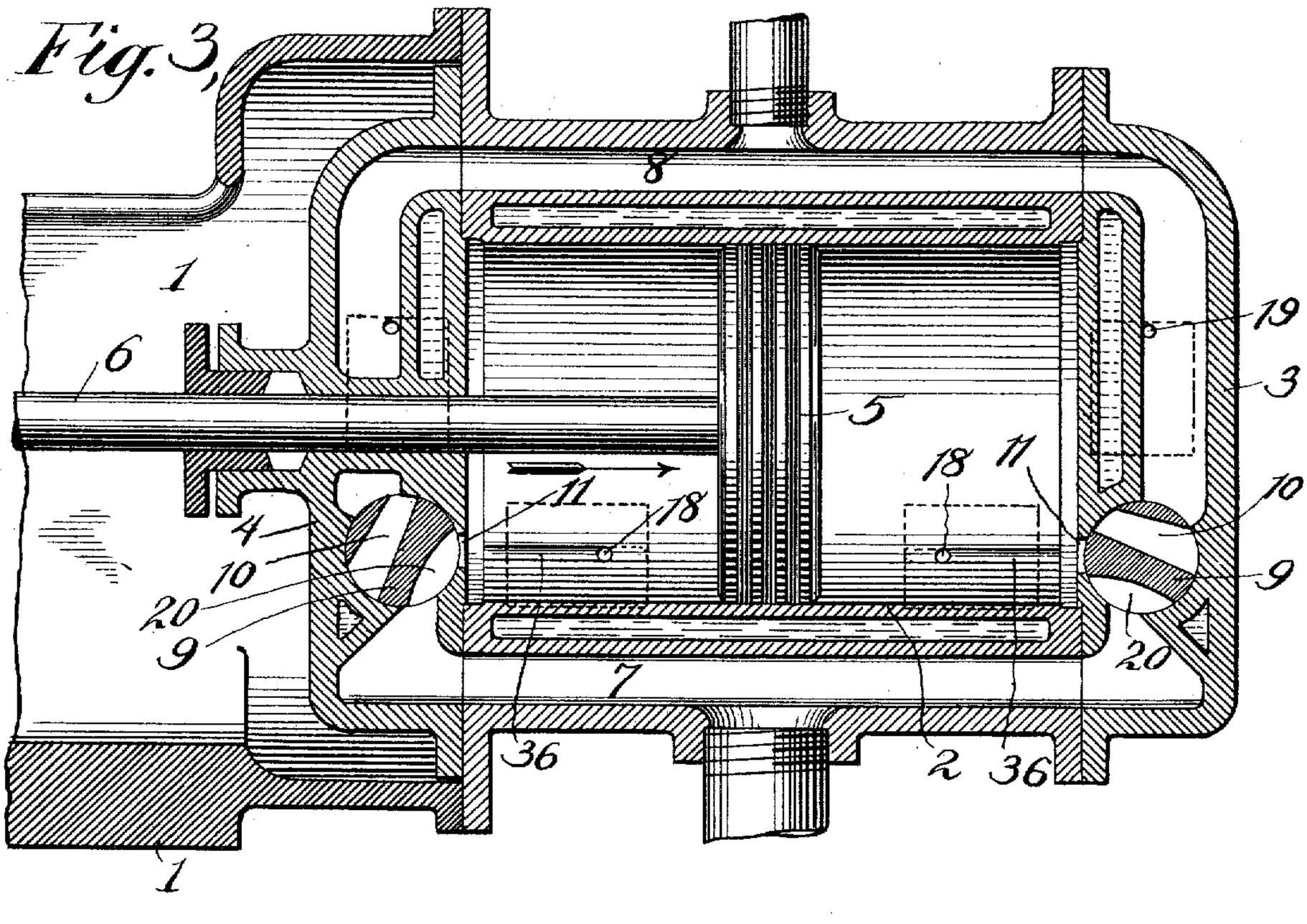
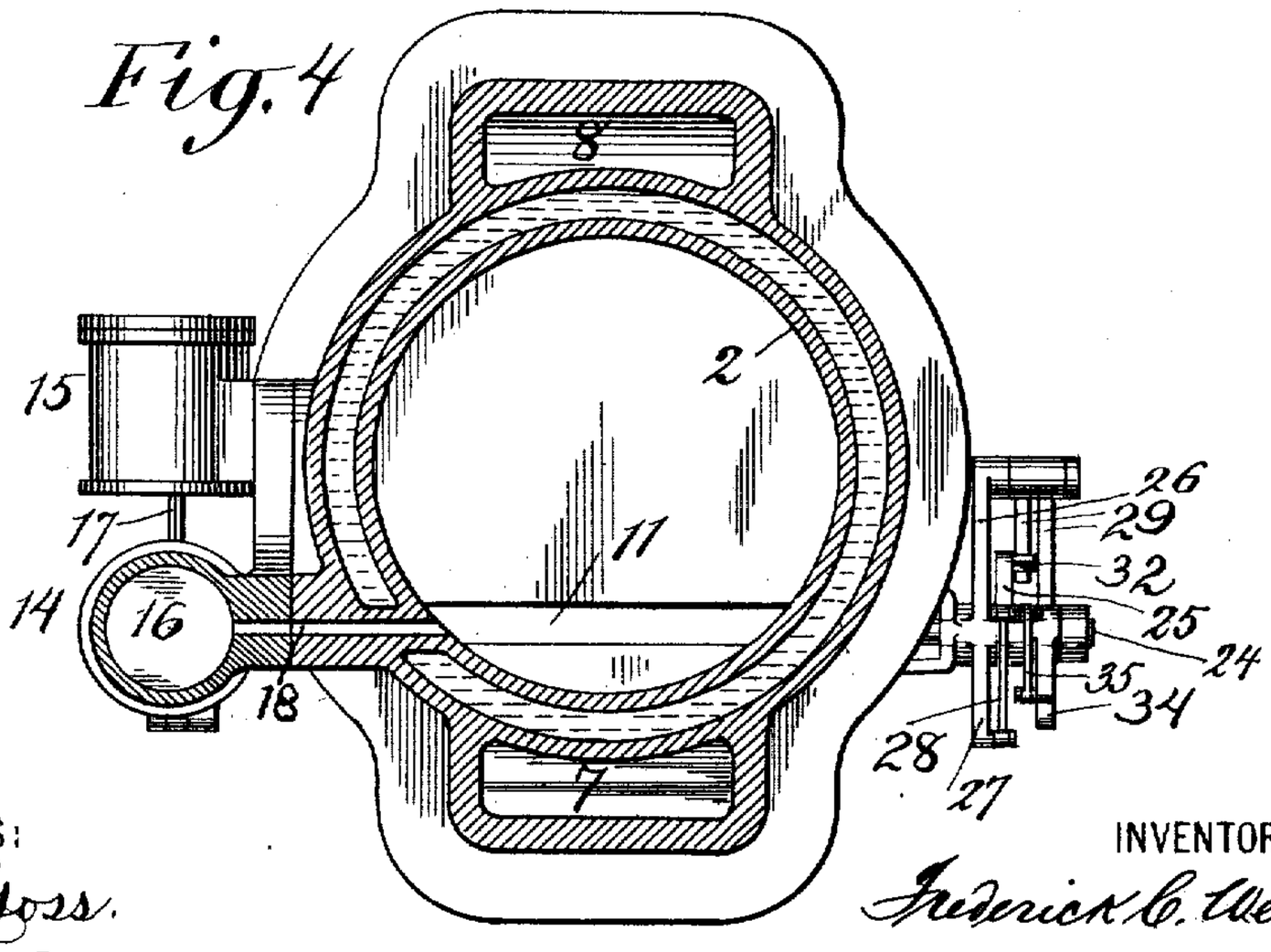


Fig. 4.



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(No Model.) 4 Sheets—Sheet 3.

Fig. 5,

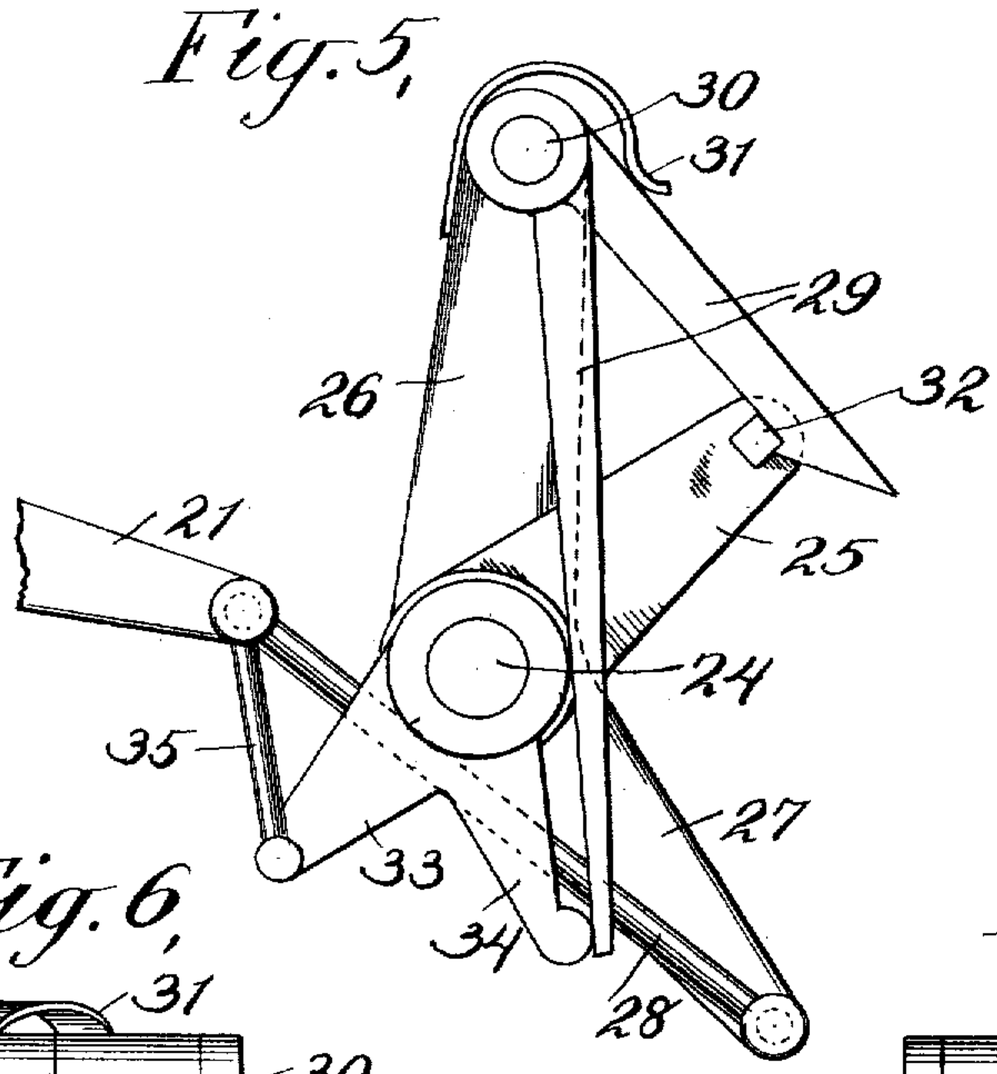


Fig. 6,

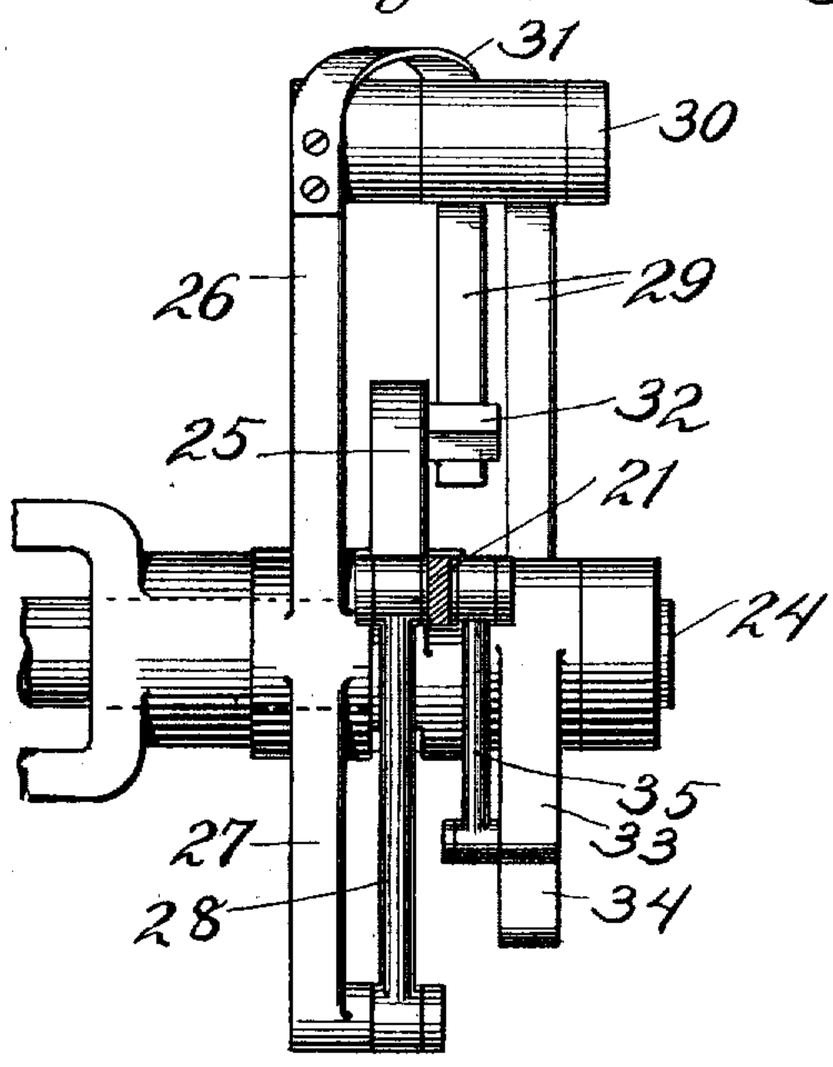
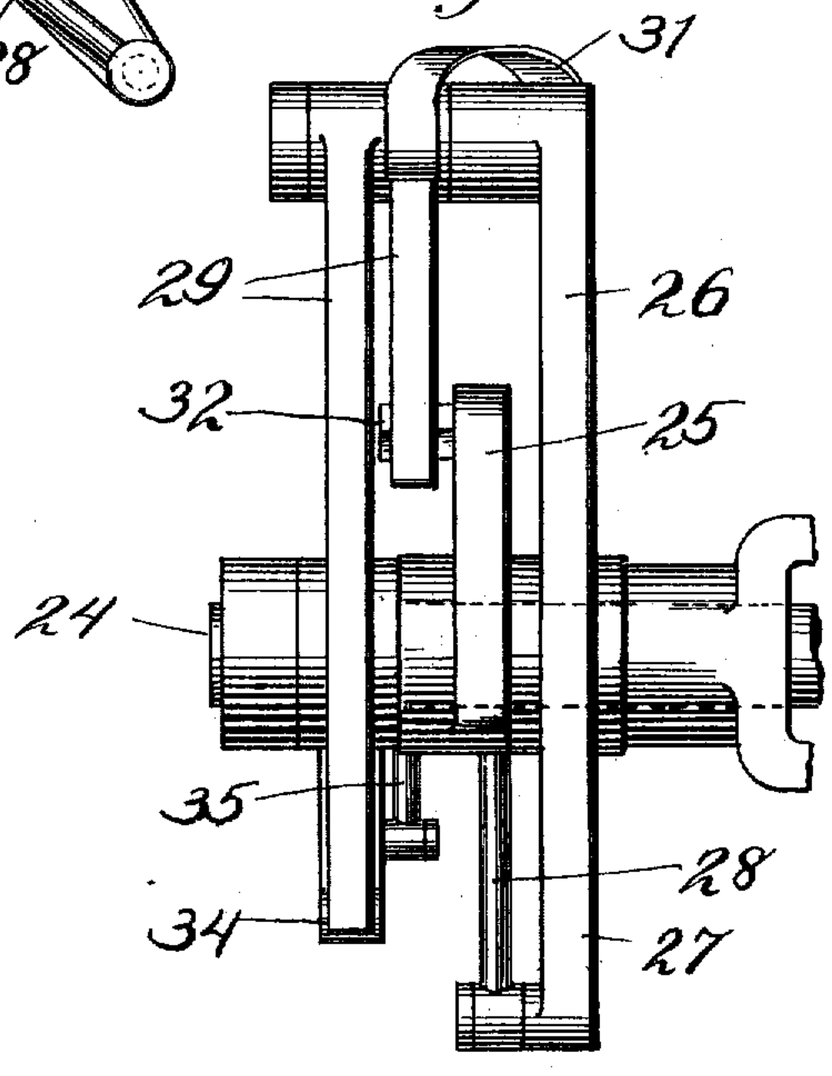


Fig. 7,



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FLUID COMPRESSOR.

(Application filed July 3, 1901.)

(No Model.) 4 Sheets—Sheet 4.

Fig. 8,

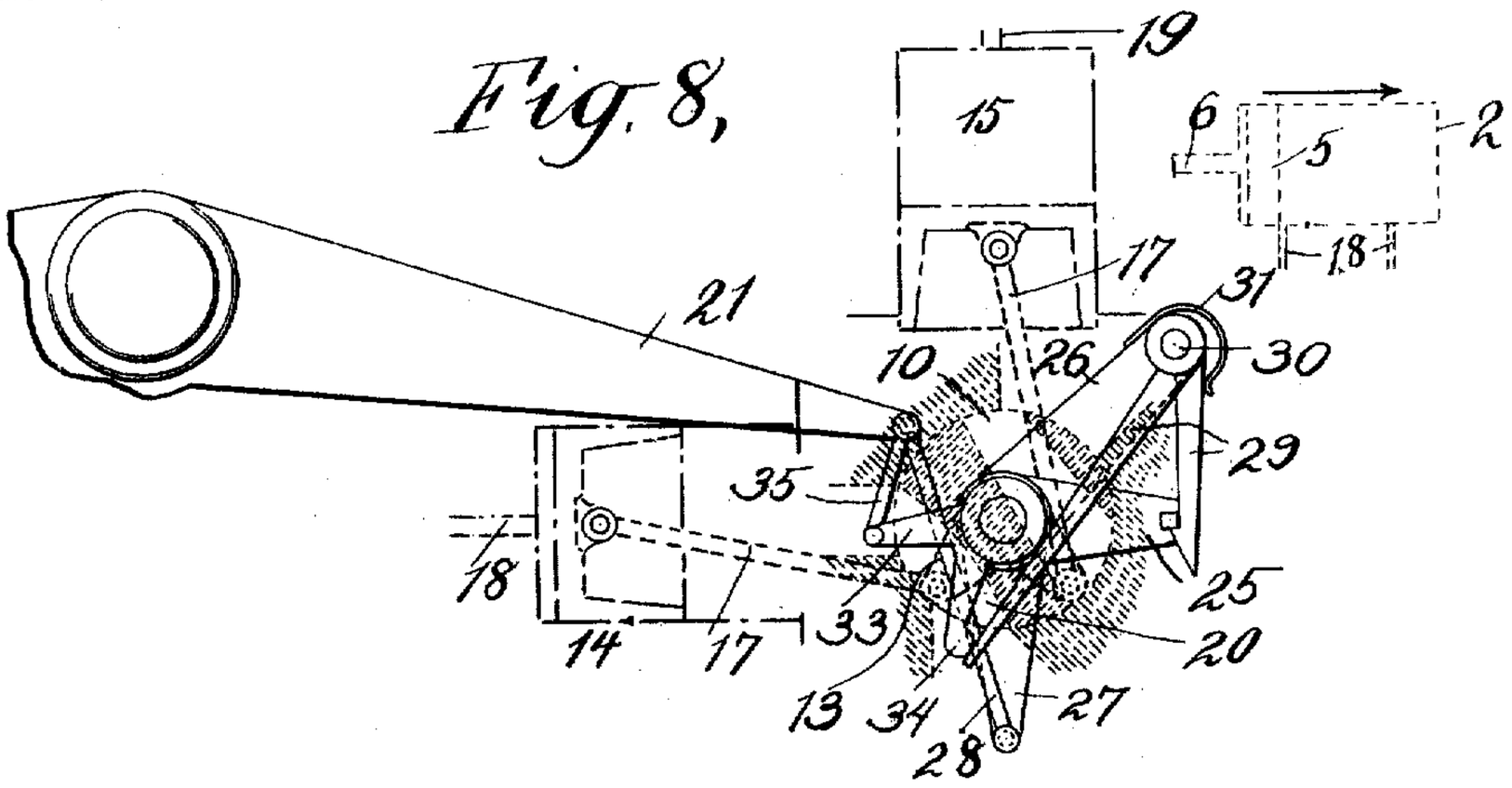


Fig. 9,

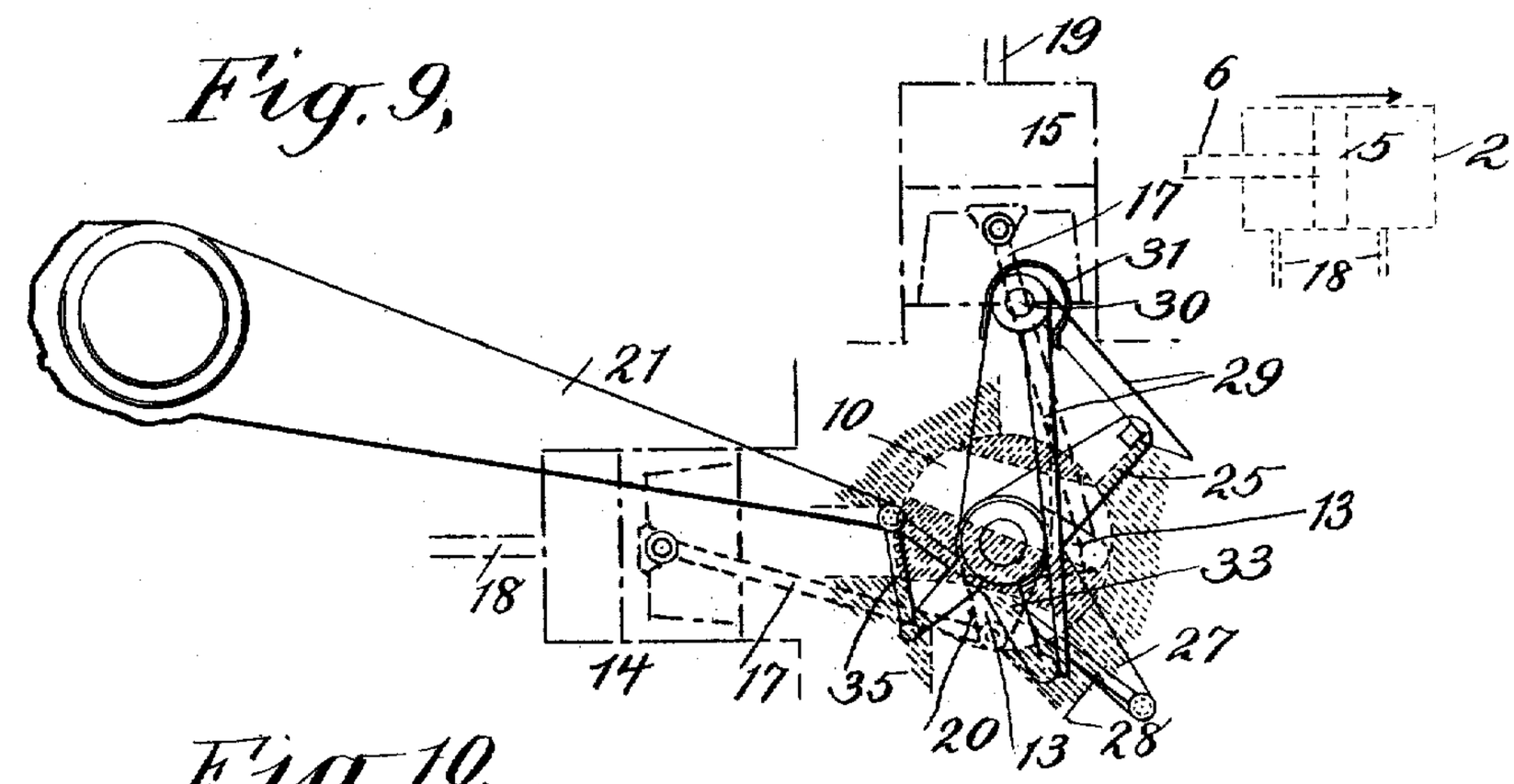
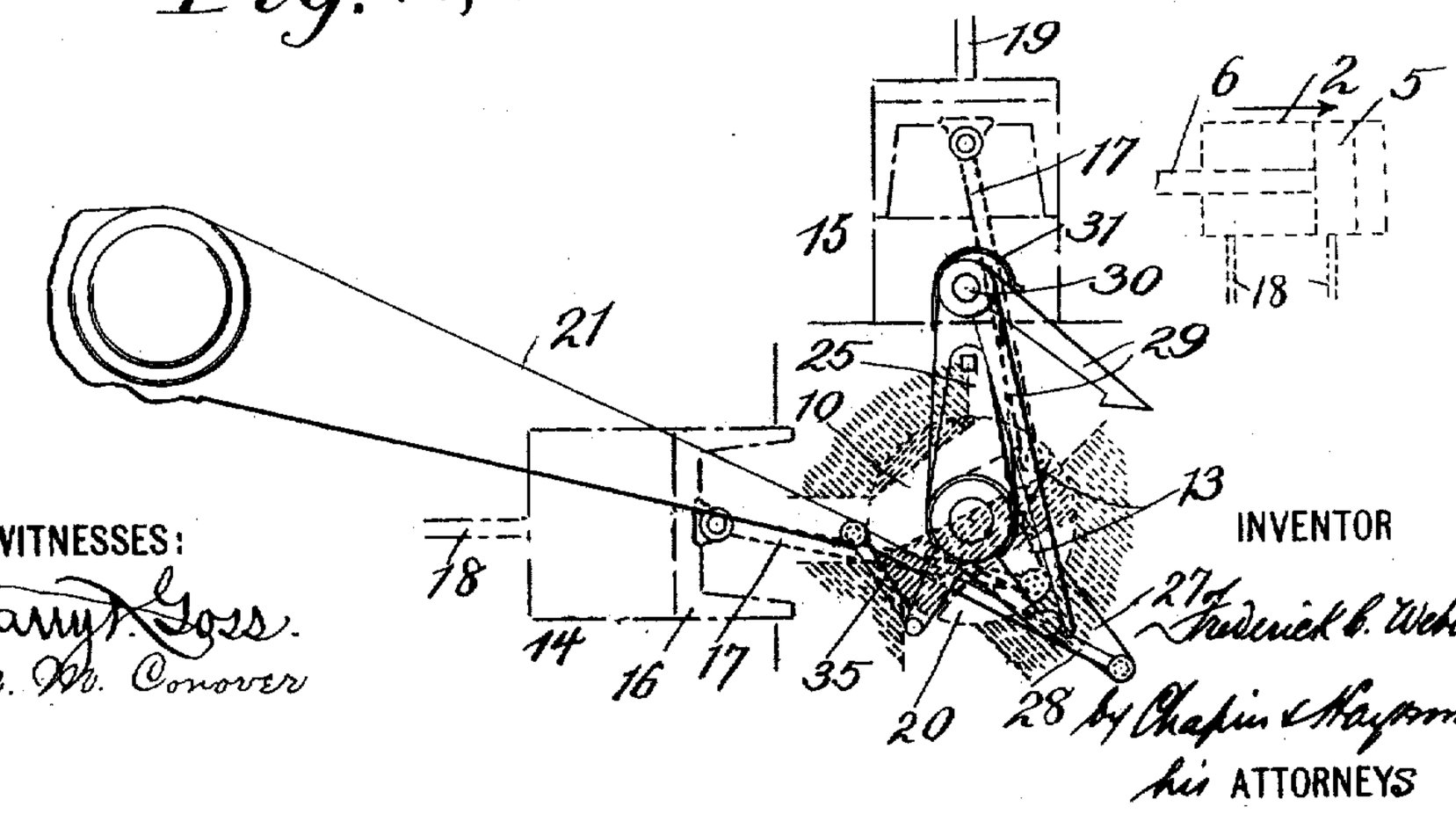


Fig. 10,



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UNITED STATES PATENT OFFICE.

FREDERICK C. WEBER, OF NEW YORK, N. Y.

FLUID-COMPRESSOR.

SPECIFICATION forming part of Letters Patent No. 688,042, dated December 3, 1901.

Application filed July 3, 1901. Serial No. 66,967. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK C. WEBER, a citizen of the United States of America, and a resident of New York city, county and State of New York, have invented certain new and useful Improvements in Fluid-Compressors, of which the following is a specification, reference being had to the accompanying drawings, forming a part thereof.

My invention relates to fluid-compressors, and particularly to valves and valve-operating mechanism therefor.

My invention consists in an improved means for operating valves for compressors, and particularly in an improved automatic means for operating valves on the discharge side of the compression cylinders or chambers therein.

My invention also consists in an improved means for operating valves on the inlet side of the said compression cylinders or chambers.

My invention also consists in the use, in connection with a single valve controlling both the admission of fluid to the compression cylinder or chamber and the discharge of compressed fluid therefrom, of improved and simplified valve-operating mechanism which automatically and rapidly opens and closes said valve at proper times and permits the use of a valve of the rotary type the motion of which is of one character only and is not compound in character; and my invention further consists of many other novel features, as hereinafter pointed out in the claims.

The objects of my invention are to produce clearance-space in the compression-cylinder of a fluid-compressor to a minimum, to operate the valve or valves of the compressor in the most economical and effective manner, to open and close said valve or valves rapidly, to employ a single valve having motion of a simple character for performing the functions of a combined inlet and discharge valve, and to supply simple, effective, and automatic valve-operating mechanism which shall be positive in its action, inexpensive and simple to manufacture, and not liable to get out of order.

My invention further consists in certain details of construction and combination of parts, as shall hereinafter be more fully set forth, and other advantages will appear hereinafter.

I will now proceed to describe a fluid-compressor embodying my invention and will then point out the novel features in claims.

In the drawings, Figure 1 is a side elevation of certain portions of a fluid-compressor embodying my invention. Fig. 2 is a side elevation, the point of view being taken from the other side of the machine. Fig. 3 is a central longitudinal sectional elevation through the center of the compression-cylinder. Fig. 4 is a transverse sectional view of the compression-cylinder. Figs. 5, 6, and 7 are respectively side, rear, and front elevations of certain operating mechanism employed in connection with my improved valves. Figs. 8, 9, and 10 are diagrammatic views illustrating the action of such operating mechanism of the valve and of certain other coacting and correlating parts.

In the embodiment of my invention illustrated in the drawings herein I have shown only such part of a compressor as will be necessary for the complete understanding of my invention. I have shown a portion of the frame 1 of a compressor, a compression-cylinder 2, forming a compression-chamber, a rear cylinder-head 3, a front cylinder-head 4, a piston 5, and a piston-rod 6. I have further shown a chamber 7, which communicates with the supply of fluid to be compressed, and a chamber 8, forming a receiving-chamber for the fluid after it has been compressed. I have provided each of the cylinder-heads 3 and 4 with a rotatably-mounted plug-valve 9, said valves being located between the said compression-chamber and the said receiving-chamber. Each valve has a passage 10 therethrough, which in the discharge positions of the said valves is adapted to communicate on one side with the receiving-chamber 8 and on the other side to register with a port 11, leading into the said compression chamber or cylinder. Each of the valves 9 has also a dead or blank space which in certain other positions of the said valves is adapted to entirely close the port 11, leading into the said compression chamber or cylinder 2. I have shown the valve 9 as being in such position in the diagrammatic Fig. 9 of the drawings and in the said discharge position in Fig. 10 of the drawings. Each of the valves 9 is provided with a valve-stem 12, which projects through the cylinder-heads and to which

arms 13 are rigidly secured. I have provided a fluid-pressure-actuated means for each valve, each fluid-pressure-actuated means comprising two expansible chambers having their movable walls connected with the arms 13 of a valve 9, one of such expansible chambers being in communication with the interior of said compression chamber or cylinder 2 and the other in communication with the said receiving-chamber 8. The said expansible chambers illustrated herein comprise cylinders 14 and 15, having pistons 16 therein, forming the movable walls thereof. Links or connecting-rods 17 connect the pistons 16 with the said arms 13. Passages 18, terminating in ports within the cylinder 2, at or near opposite ends thereof, afford communication between the said cylinder and the cylinders 14 of the fluid-pressure-actuated means, and passages 19 afford communication between the receiving-chamber 8 and the cylinders 15 of the said fluid-pressure-actuated means. When the compressor is operating, the tendency of the fluid-pressure-actuated mechanism will be to hold the valves 9 in a position in which the discharge-passages 10 therethrough will be out of register with the ports leading into the receiving-chamber 8 until such time as the pressure in the compression chamber or cylinder 2 rises to a point substantially equal to or slightly above the pressure in the receiving-chamber 8. This is because until such pressure is attained in the compression-cylinder the preponderance of pressure within the cylinders 15 over the pressure within the cylinders 14 will operate to move or hold the valves 9 to or in the position just stated, through the link connection 17 and arms 13. When the conditions are reversed—that is to say, when the fluid within the compression chamber or cylinder 2 is compressed to a point slightly in excess of the pressure within the receiving-chamber 8—the pressure within the cylinder 14 will overcome the pressure within the cylinder 15 and the position of that valve 9 which is in advance of the movement of the piston 5 will be reversed. The effect will be to quickly move such valve 9 to a position in which the discharge-passage therethrough will be in register with the port 11 and the port leading to the interior of the receiving-chamber 8, so that in a continued movement of the piston 5 the fluid in the cylinder 2 will be discharged into the receiving-chamber 8.

By the foregoing it will be seen that I am enabled to use a rotatably-mounted plug-valve of a type exceedingly advantageous for use in connection with compression-cylinders and to automatically control same to open only at such times as the pressure of the fluid in the compression-cylinder is substantially equal to or slightly in excess of that within the receiving-chamber.

In the embodiment of my invention herein I have not only supplied the compression-cylinder 2 with rotatably-mounted valves upon the discharge side thereof, but I have so constructed the said valves and have provided such suitable operating mechanism as to enable me to employ the said valves for permitting the ingress of fluid therethrough into the compression-cylinder, as well as the discharge therethrough from the said cylinder. For this purpose I provide each of the said valves with an inlet-passage 20, as well as the discharge-passage 10, previously referred to, and I provide mechanism which shall rotate each of the said valves to a position in which the said inlet-passage 20 shall register with a port 11 and a port leading to the inlet-chamber 7 at such times as it is desired to draw fluid into the said compression-cylinder. A space between the two said passages 10 and 20 in each of the valves 9 forms the blank or dead space before referred to as being adapted to close the ports 11 when desired. In Fig. 3 of the drawings the valve 9 in the rear head 3 is shown with its dead-space opposite the port 11 of the said cylinder-head, while the valve 9 of the front head 4 is turned so that the inlet-passage 20 therein affords communication between the supply-chamber 7 and the interior of the cylinder through the port 11 in the said cylinder-head. When the valves are in such position, the piston 5 will be moving in the direction of the arrow in Fig. 3 and the cylinder will be receiving fluid through the inlet-passage 20 of the valve 9, in the front head thereof, while the fluid which has been taken into the rear end of the cylinder during a reciprocation of the piston in the opposite direction will be compressed in said end of the cylinder. The valve 9, in the rear head 3 thereof, at such times is held closed in the position at which it is shown in Fig. 3 of the drawings and will be held so closed until the pressure within the rear end of the cylinder is substantially equal to or slightly in excess of that within the receiving-chamber 8.

I have provided certain valve mechanism by which the valves 9 9 may operate as inlet-valves during substantially the entire stroke of the piston in one direction and may operate as discharge-valves while the piston is moving in the other direction and after the fluid which is being compressed by the movement of the piston has been compressed to a point substantially equal to or slightly above the pressure of the fluid within the receiving-chamber. The mechanism for operating the valves 9 in accordance with the foregoing comprises an oscillating wrist-plate 21, supported upon a stationary pin 22 and operated through a link connection 23, which may be connected with an eccentric or other means for causing the oscillation of the said wrist-plate in a manner well known. In the following description I will specifically describe one of the said valves 9 9 and its operating and actuating mechanism, it being understood that

the action of the two valves and the construction of the mechanism coacting therewith are substantially similar in both.

Each valve 9 is provided with a stem 24, which projects through the side of the cylinder-head, in which it is mounted, at the opposite side to which the stems 12 protrude and upon which an arm 25 is rigidly secured. An operating-head having two arms 26 and 27 is loosely mounted upon the valve-stem 24 and will freely turn thereon. The arm 27 of the operating-head is connected with the wrist-plate 21 by means of a link 28. The upper end of the arm 26 carries a bell-crank lever 29, pivotally mounted thereon at 30 and spring-actuated in one direction by means of a leaf-spring 31. The short arm of the bell-crank lever has a hooked end which is adapted to engage with a projection 32 upon the side of the arm 25. A tripping-head having two arms 33 and 34 is also loosely mounted upon the valve-stem 24, the arm 33 being connected to the wrist-plate 21 by means of a short link 35 and the arm 34 forming a cam or tripper to bear against the long arm of the bell-crank lever 29 and at certain times to operate same, so as to permit the projection 32 of the operating-arm 25 to pass clear of the said hooked end without being caught thereby. I will now proceed to describe the action of the said operating mechanism with particular reference to the three diagrammatic views, Figs. 8, 9, and 10. The valve 9 (shown in each of Figs. 8, 9, and 10) may be either of the said valves 9 9 before referred to; but we will assume for purposes of this specification that the said valve is that one which is mounted in the rear cylinder-head. In Fig. 8 the valve is shown in the position in which it will be when the piston is at the most forward end of its stroke. During the travel of the said piston to such a point—that is to say, during the time it is traveling in a direction opposite to that designated by the arrow in said figure—the said valve will have been operating as an admission-valve and will have permitted fluid to enter the cylinder through the admission-passage 20. When the piston 5 is at the end of its stroke, as shown in said figure, the compression-cylinder 2 will contain fluid under no greater pressure than atmospheric pressure, and hence there will be no pressure above atmospheric pressure in the cylinder 14. The cylinder 15, however, being in direct communication with the receiving-chamber will have therein a pressure equal to that of the receiving-chamber. The tendency of the two pistons 16 in the cylinders 14 and 15 will be at such times to hold the valve in the position in which it is shown in Fig. 8. At this time, however, the arm of the wrist-plate 21 is at substantially the highest point of its movement. During the movement of the piston 5 rearwardly the action will be to depress that arm of the wrist-plate 21 which is shown in Fig. 8, and this movement, communicated to the operating-head 26 and 27 through a link 28, will at first cause a rapid movement of the said operating-head and later a slower movement in the same direction. The movement of the operating-head is very rapid at first compared with the movement in the same direction of the arm of the wrist-plate 21, by reason of the fact that the said arm of the wrist-plate 21 and the link 28 together form a toggle, and as the two parts approach more nearly a straight line the relative movement of the operating-head at first much in favor of the operating-head is later in favor of the wrist-plate 21. During the first movement of the piston 5 in the direction of the arrow in Fig. 8 and while the piston moves through a very small proportion of its total stroke the operating-head will therefore move from the position in which it is shown in Fig. 8 to the position in which it is shown in Fig. 9. As the operating-head carries the bell-crank lever 29 and the bell-crank lever is in engagement at such time with the stud or projection 32 upon the arm 25, secured to the valve 9, it follows that the said valve will partake of the movement of the operating-head and will be moved to the position in which it is shown in Fig. 9, even though in so moving it moves against the pressure in the cylinder 15. In such position the blank space between the two passages 10 and 20 in the valve 9 will be opposite the port 11, and a further movement of the piston 5 will compress the fluid within the cylinder 2, for the reason that all outlet therefrom is now closed. The piston will continue in its movement, and in its movement will continue to compress the fluid within the compression-cylinder until finally the pressure therein will reach a point substantially equal to or slightly above the pressure in the receiving-chamber. At such point the cylinder 14 will have a slight preponderance of pressure over the cylinder 15 and the valve 9 will be thrown quickly from the position in which it is shown in Fig. 9 to the position in which it is shown in Fig. 10. This will bring the outlet-passage 10 in register with the port 11 and with the receiving-chamber 8. The pressure upon the pistons of cylinders 14 and 15 will now be substantially the same, but the valve 9 will remain in the position to which it has just been moved and in which it is shown in Fig. 10 until the pressure in the receiving-chamber again predominates over that within the compression-cylinder. The compressed fluid in the compression chamber or cylinder 2 will be discharged into the receiving-chamber. During the latter part of the movement of the piston 5 in this same direction the wrist-plate 21 will continue its downward movement. The wrist-plate will, however, by this time have imparted to the operating-head almost all of the movement which it is capable of imparting, and if the valve and the arm 25 carried thereby had not been carried around by the fluid-pressure-actuated means such movement would not be

sufficient to bring the passage 10 of the valve 9 into register with the port 11. During this latter movement of the wrist-plate, however, the tripping-head 33 34 will be moved, and by reason of the relationship of the link 35 with the arm of the wrist-plate 21 such movement will be sufficient to cause the arm 34 to force outwardly the long arm of the bell-crank lever 29 and to move the hooked end of the short arm of the said bell-crank lever 29 from the path of movement of the stud or projection 32 of the arm 25. The arm 25 and the bell-crank lever 29 will at such times be permitted to be moved independently of each other about the axis of the valve without interfering with each other. When the piston 5 arrives at about the end of its said stroke and has delivered substantially all of the compressed fluid from within it, it will at the last moment uncover the cylinder-port of the passage 18, leading to the cylinder 14, permitting the fluid under pressure within the said cylinder to discharge into the compression-cylinder and the pressure therein hence to immediately drop down to atmospheric pressure. The preponderance of pressure in the cylinder 15 over that in the cylinder 14 will now quickly throw the valve 9 clear from the position in which it is shown in Fig. 10 to the position in which it is shown in Fig. 8, the stud or projection 32 passing clear of the hooked end of the short arm of the bell-crank lever 29 by reason of the fact that it is held outwardly by the tripping-arm 34 at such times, as just explained. During the entire movement of the piston in the other direction—that is to say, in a direction opposite to that shown by the arrows in Figs. 3, 8, 9, and 10—the valve will remain in this position, while the operating-head and the tripping-head will be gradually brought back to their initial positions by the movement of the wrist-plate 21. During such return movement the tripping-head will have a somewhat greater angular advance than will the operating-head, and the bell-crank lever 29 will therefore be permitted to move inwardly under the influence of the leaf-spring 31. In the final movement of the operating-head the hooked end of the short arm of the bell-crank lever 29 will snap past the stud or projection 32 and will be in a position to engage same for the return movement.

It will be understood, of course, that the valve 9, which is provided in the front head of the cylinder, is operated in a similar manner to that just described for the valve 9 of the rear head, but at a time alternate with the movement of the last said valve—that is to say, the valve in the front head will during a movement of the piston 5 in one direction be first closed and then opened to outlet or discharge, while the valve in the rear head is open to admission, and, vice versa, for a movement of the piston 5 in the other direction.

I have shown grooves or passages 36 connecting, respectively, with passages 18 and with the extreme front and rear ends of the cylinders. This is in order to prevent the locking of the compressed fluid in the cylinders 14 after the piston has moved to a position opposite the ports of the passages 18 and to permit compressed fluid from the compression-cylinder 2 to enter the said cylinders 14 during later movements of the said piston in traveling over the said ports.

I do not desire to be limited only to the exact construction or combination of parts as set forth in the embodiment of my invention herein shown. Many and wide modifications of the same may be made within the spirit and scope of my invention, and I have only shown the embodiment herein as one form or construction of an apparatus in which my invention may be carried out.

In the foregoing I have described my improved valves and valve mechanism as applied to single-stage compressors or to the low-pressure cylinders of multistage or compound compressors. It will of course be understood that the valves and valve mechanism are equally applicable to the high-pressure cylinders of compound compressors, and in such case the pressure in the cylinders 14 will reduce down to the intake pressure of the compression-cylinder instead of to atmospheric pressure.

A valve-gear for compressors has been devised heretofore in which a single valve having both a rotary and a longitudinal or endwise movement is caused to perform the functions of a combined inlet and discharge valve. By my invention, however, I avoid the complication incident to imparting to a valve such a compound movement, besides obtaining ample port-opening without excessively large valves and exceedingly rapid opening and closing of the valves. In certain of the following claims the valve is stated to have motion in one plane only to distinguish from mechanisms in which the valve in order to perform the functions both of an inlet and of a discharge valve must have motions in two planes, such as a rotary motion, or motion in a plane at right angles to its axis of rotation and likewise and endwise motion or motion in a plane at right angles to said plane of rotary motion.

What I claim is—

1. In a fluid-compressor, the combination with a compression-chamber and means for compressing fluid therein, and a receiving-chamber, of a combined inlet and discharge valve, having motion in one plane only, valve mechanism for moving said valve from inlet to closed position, and means, actuated by variation in pressure in the compression-chamber with reference to that in the receiving-chamber, for moving said valve to discharge position.

2. In a fluid-compressor, the combination with a compression-chamber and means for compressing fluid therein, and a receiving-

chamber, of a combined inlet and discharge valve, having motion in one plane only, valve mechanism for moving said valve from inlet to closed position, and means, actuated by variation in pressure in the compression-chamber with reference to that in the receiving-chamber, for moving said valve to discharge position and also to inlet position at proper times.

3. In a fluid-compressor, the combination with a compression-chamber and means for compressing fluid therein, and a receiving-chamber, of a combined inlet and discharge valve, of rotary character, having motion in one plane only, valve mechanism for moving said valve from inlet to closed position, and means, actuated by variation in pressure in the compression-chamber with reference to that in the receiving-chamber, for moving said valve to discharge position.

4. In a fluid-compressor, the combination with a compression-chamber and means for compressing fluid therein, and a receiving-chamber, of a combined inlet and discharge valve, of rotary character, having motion in one plane only, valve mechanism for moving said valve from inlet to closed position, and means, actuated by variation in pressure in the compression-chamber with reference to that in the receiving-chamber, for moving said valve to discharge position and also to inlet position at proper times.

5. In a fluid-compressor, the combination with a compression-chamber and means for compressing fluid therein, and a receiving-chamber, of a combined inlet and discharge valve, having motion in one plane only, valve mechanism for moving said valve from inlet to closed position, and fluid-pressure-actuated valve-actuating means for moving said valve to discharge position and also to inlet position, said valve-actuating means including connected and opposing pressure-operated members, one exposed to the pressure in the receiving-chamber and the other to the pressure of the compression-chamber.

6. In a fluid-compressor, the combination with a compression cylinder and piston, and a receiving-chamber, of a combined inlet and discharge valve, having motion in one plane only, valve mechanism for moving said valve from inlet to closed position, and a fluid-pressure-actuated valve-actuating device for moving said valve to discharge position and also to inlet position, comprising chambers connected one with the receiving-chamber and the other with the compression-cylinder, having movable and connected but opposing walls connected to said valve, the connection of one of said chambers with the compression-cylinder being by a port which the compression-piston overrides and opens to a pressure lower than that on the active side of said piston.

7. In a fluid-compressor, the combination with a compression cylinder and piston, and a receiving-chamber, of a combined inlet and discharge valve, having motion in one plane only, valve mechanism for moving said valve from inlet to closed position, and a fluid-pressure-actuated valve-actuating device for moving said valve to discharge position and also to inlet position, comprising chambers connected one with the receiving-chamber and the other with the compression-cylinder, having movable and connected but opposing walls connected to said valve, the connection of one of said chambers with the compression-cylinder being by a port which the compression-piston overrides and opens to a pressure lower than that on the active side of said piston, said port having an extension toward its end of the cylinder.

8. In a fluid-compressor, the combination with a compression cylinder and piston, and a receiving-chamber, of a combined inlet and discharge valve, having movement in one plane only, valve mechanism for moving said valve from inlet to closed position, and a fluid-pressure-actuated valve-actuating device for moving said valve to discharge position and also to inlet position, comprising two cylinders having connected but opposing pistons connected to said valve, one of such cylinders connected to the receiving-chamber and the other connected to the compression-cylinder by a port which the compression-piston overrides and opens to the space on the inactive side of said piston.

9. In a fluid-compressor, the combination with a compression-chamber and means for compressing fluid therein, and a receiving-chamber, of a combined inlet and discharge valve having movement in one plane only, and having separate inlet and discharge ports, valve mechanism for moving said valve from inlet to closed position, and means, actuated by variation in pressure in the compression-chamber with reference to that in the receiving-chamber, for moving said valve to discharge position.

10. In a fluid-compressor, the combination with a compression-chamber and means for compressing fluid therein, and a receiving-chamber, of a combined inlet and discharge valve having movement in one plane only, and having separate inlet and discharge ports, valve mechanism for moving said valve from inlet to closed position, and means, actuated by variation in pressure in the compression-chamber with reference to that in the receiving-chamber, for moving said valve to discharge position and also to inlet position at proper times.

11. In a fluid-compressor, the combination with a compression-chamber and means for compressing fluid therein, and a receiving-chamber, of a rotary combined inlet and discharge valve having movement in one plane only, and having separate inlet and discharge ports, valve mechanism for moving said valve from inlet to closed position, and means, actuated by variation in pressure in the com-

pression-chamber with reference to that in the receiving-chamber, for moving said valve to discharge position.

12. In a fluid-compressor, the combination with a compression-chamber and means for compressing fluid therein, and a receiving-chamber, of a rotary combined inlet and discharge valve having movement in one plane only, and having separate inlet and discharge ports, valve mechanism for moving said valve from inlet to closed position, and means, actuated by variation in pressure in the compression-chamber with reference to that in the receiving-chamber, for moving said valve to discharge position and also to inlet position at proper times.

13. In a fluid-compressor, the combination with a compression-chamber and means for compressing fluid therein, and a receiving-chamber, of a combined inlet and discharge valve, valve mechanism for moving said valve from inlet to closed position, said mechanism including a trip and latch, whereby the valve may be moved independently of said valve mechanism from closed to discharge position and means, actuated by variation in pressure in the compression-chamber with respect to that in the receiving-chamber, for moving said valve to discharge position.

14. In a fluid-compressor, the combination with a compression-chamber and means for compressing fluid therein, and a receiving-chamber, of a combined inlet and discharge valve, valve mechanism for moving said valve from inlet to closed position, said mechanism including a trip and latch, whereby the valve may be moved independently of said valve mechanism from closed to discharge position, and from discharge to inlet position, and means, actuated by variation in pressure in the compression-chamber with respect to that in the receiving-chamber, for moving said valve to discharge position and also to inlet position at proper times.

15. In a fluid-compressor, the combination with a compression-chamber and means for compressing fluid therein, and a receiving-chamber, of a combined inlet and discharge valve, a latch suitably driven adapted to engage said valve and move the same from inlet to closed position, means, actuated by variation in pressure in the compression-chamber with reference to that in the receiving-chamber, for moving said valve, in advance of the latch, to discharge position, and for moving said valve to inlet position, and a trip for holding the latch out of engagement with said valve during movement thereof to inlet position.

16. In a fluid-compressor, the combination with a compression cylinder and piston, and a receiving-chamber, of a combined inlet and discharge valve, a latch suitably driven adapted to engage said valve and move the same from inlet to closed position, valve-operating cylinders having opposing pistons connected with said valve, one of said cylinders connected to the receiving-chamber and the other connected to the compression-cylinder by a port which the compression-piston overrides and opens to the pressure on its inactive side during its stroke, whereby the valve is moved in advance of the latch to discharge position and is then moved to inlet position when said port is uncovered, and a trip which holds the latch out of engagement with said valve during movement thereof to inlet position.

17. In a fluid-compressor, the combination with a compression-chamber and means for compressing fluid therein, of a combined inlet and discharge valve, a wrist-plate suitably driven, a valve-arm, a latch adapted to engage the same, and link-connected with the wrist-plate, a trip operated by said wrist-plate, and adapted at times to hold the latch out of the path of the valve-arm, and means, independent of the wrist-plate, likewise adapted to move the valve.

18. In a fluid-compressor, the combination with a compression-chamber and means for compressing fluid therein, of a combined inlet and discharge valve, a wrist-plate suitably driven, a valve-arm, a pivoted latch-arm carrying a latch adapted to engage said valve-arm, a link connecting said latch-arm and wrist-plate, said link being nearly at a dead-center with respect to the latch-arm when the valve is in inlet position and the motion of the point of connection of such link with the wrist-plate being such that said link retains substantially such angular relation to the latch-arm while the valve moves from inlet to closed position; the angle of said link with respect to the radius of its point of connection with the wrist-plate approaching a straight line during such movement of the valve; a trip, pivotally mounted, adapted to hold said latch out of the path of said valve-arm during motion of the valve from discharge to inlet position, and means for operating said trip from the wrist-plate.

19. In a fluid-compressor, the combination with a compression-chamber and means for compressing fluid therein, of a valve controlling inlet to said chamber, valve-gear for moving said valve from inlet to closed position, and fluid-pressure-actuated valve-actuating means for moving said valve to inlet position.

20. In a fluid-compressor, the combination with a compression cylinder and piston, and a receiving-chamber, of a valve controlling inlet to said cylinder, valve-gear for moving said valve from inlet to closed position, and fluid-pressure-actuated valve-actuating means for moving said valve to inlet position, comprising chambers connected one with the receiving-chamber and the other with the compression-cylinder, having movable and connected but opposing walls connected to said valve, the connection of one of said chambers with the compression-cylinder being by a port which

the compression-piston overrides and opens to a pressure lower than that on the active side of said piston.

21. In a fluid-compressor, the combination with a compression cylinder and piston, and a receiving-chamber, of a valve controlling inlet to said cylinder, valve-gear for moving said valve from inlet to closed position, and fluid-pressure-actuated valve-actuating means for moving said valve to inlet position, comprising chambers connected one with the receiving-chamber and the other with the compression-cylinder, having movable and connected but opposing walls connected to said valve, the connection of one of said chambers with the compression-cylinder being by a port which the compression-piston overrides and opens to a pressure lower than that on the active side of said piston, said port having an extension toward its end of the cylinder.

22. In a fluid-compressor, the combination with a compression cylinder and piston, and a receiving-chamber, of a valve controlling discharge from said cylinder, and means for operating said valve comprising chambers connected one with the receiving-chamber and the other with the compression-cylinder, having movable and connected but opposing walls connected to said valve, the connection of one of said chambers with the compression-cylinder being by a port which the compression-piston overrides and opens to a pressure lower than that on the active side of said piston, said port having an extension toward its end of the cylinder.

23. In a fluid-compressor, the combination with a compression-chamber of a rotatably-mounted valve therefor, said valve adapted to be used as an inlet and a discharge valve, of fluid-pressure-actuated mechanism for operating said valve at certain times, and a wrist-plate and connections between said wrist-plate and said valve, whereby said valve may be operated by said wrist-plate at certain other times.

24. In a fluid-compressor, the combination with a compression-chamber of a rotatably-mounted valve therefor, said valve adapted to be used as an inlet and a discharge valve, a wrist-plate, means for actuating said valve from said wrist-plate, means for disconnecting said actuating means, and fluid-pressure-actuated means for actuating the said valve independently of said wrist-plate.

25. In a fluid-compressor, the combination with a compression-chamber of a rotatably-mounted valve therefor, said valve adapted to have three positions, namely, a position open to intake, a closed position, and a position open to discharge, an operating-head adapted to rotate the said valve from an intake to a closed position, and a fluid-pressure-actuated means adapted to rotate the said valve from a closed to discharge position.

26. In a fluid-compressor, the combination with a compression-chamber of a rotatably-mounted valve therefor, said valve adapted to be used as an inlet and a discharge valve, a wrist-plate, means for actuating said valve from said wrist-plate, a trip for disconnecting said actuating means, and fluid-pressure-actuated means for actuating the said valve at times when the said first-named actuating means is disconnected.

27. In a fluid-compressor, the combination with a compression-chamber, of a rotatably-mounted valve therefor, said valve adapted to be used as an inlet and a discharge valve, an operating-head, a wrist-plate for actuating same, means whereby said operating-head may engage said valve, and in its movement impart a rotary movement thereto, a trip for disengaging the said operating-head from said valve, and fluid-pressure-actuated means for moving said valve independently of said operating-head.

FREDERICK C. WEBER.

Witnesses:
D. HOWARD HAYWOOD,
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Correction in Letters Patent No. 688,042.

It is hereby certified that in Letters Patent No. 688,042, granted December 3, 1901, upon the application of Frederick C. Weber, of New York, N. Y., for an improvement in "Fluid-Compressors," an error appears in the printed specification requiring correction, as follows: In line 34, page 1, the word "produce" should read *reduce;* and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed, countersigned, and sealed this 24th day of December, A. D., 1901.

[SEAL.]

F. L. CAMPBELL,
Assistant Secretary of the Interior.

Countersigned:

F. I. ALLEN,
Commissioner of Patents.