No. 684,954. Patented Oct. 22, 1901.

H. STRATER.

AIR COMPRESSOR.

(Application filed Mar. 16, 1901.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

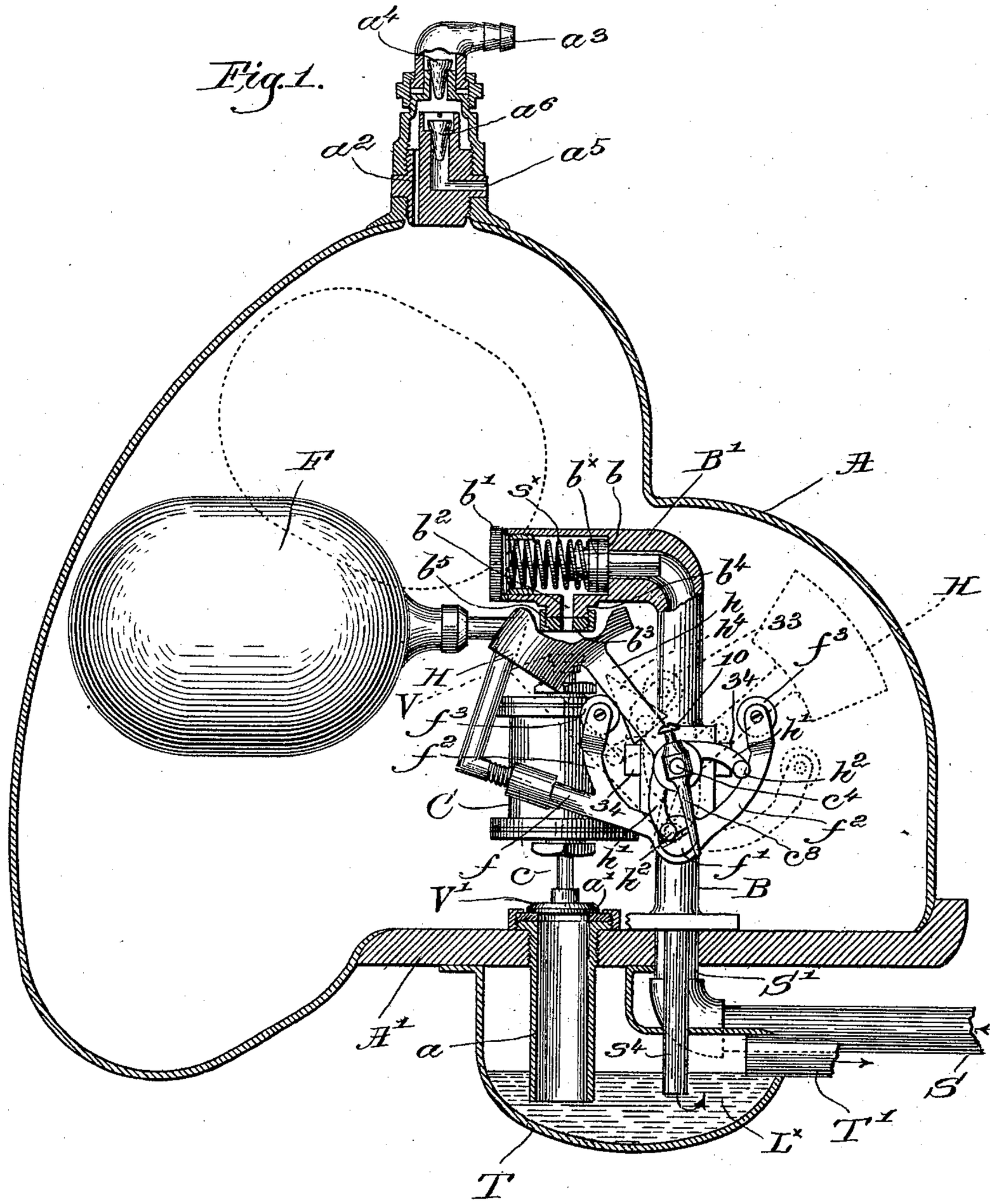

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Fig. 2.

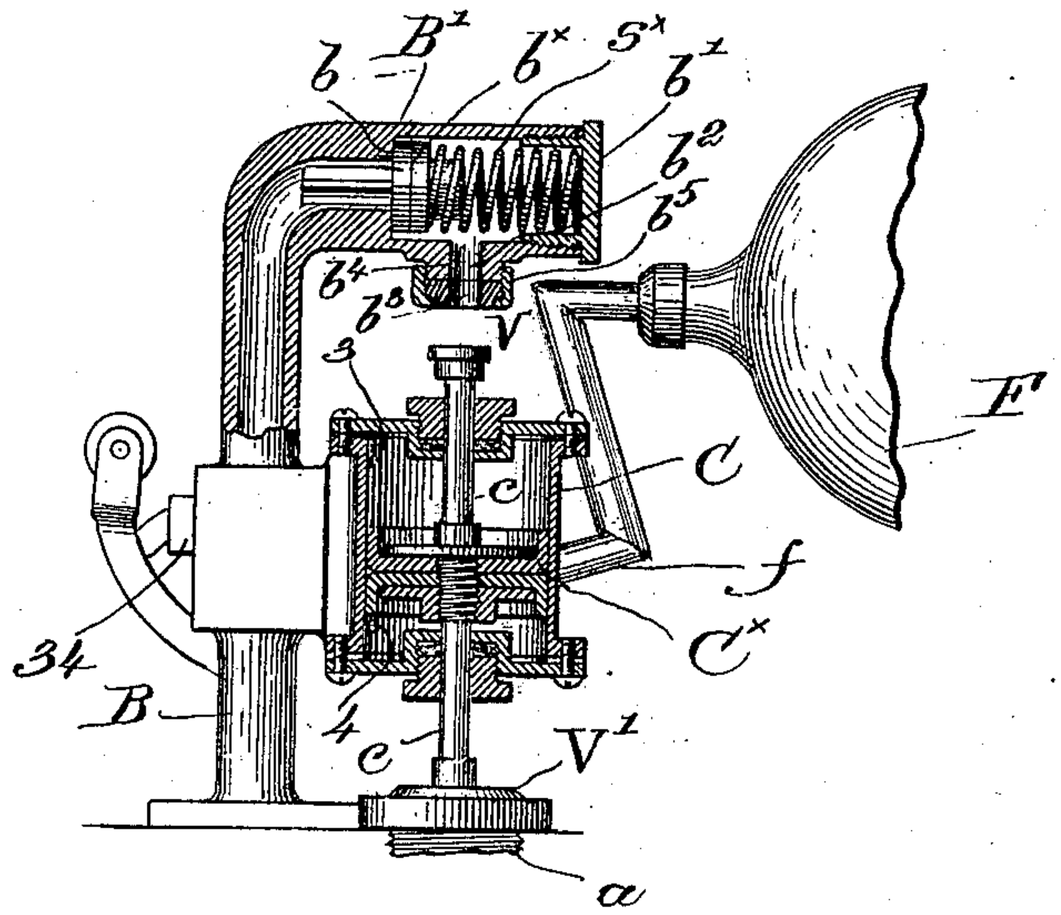


Fig. 3.

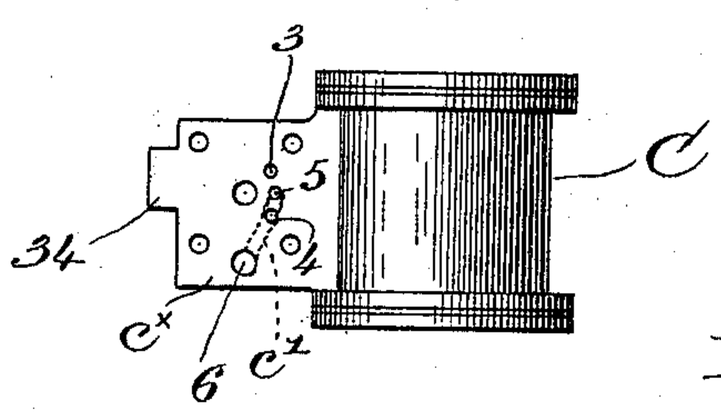


Fig. 4.

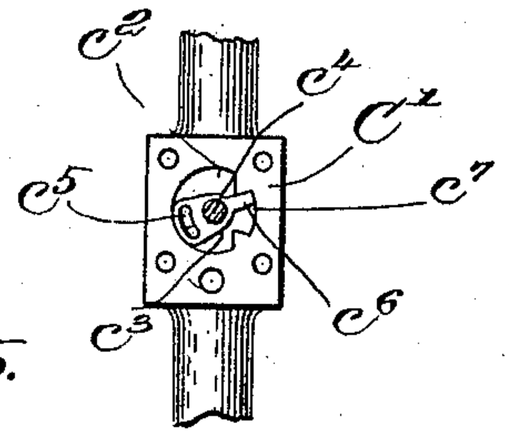
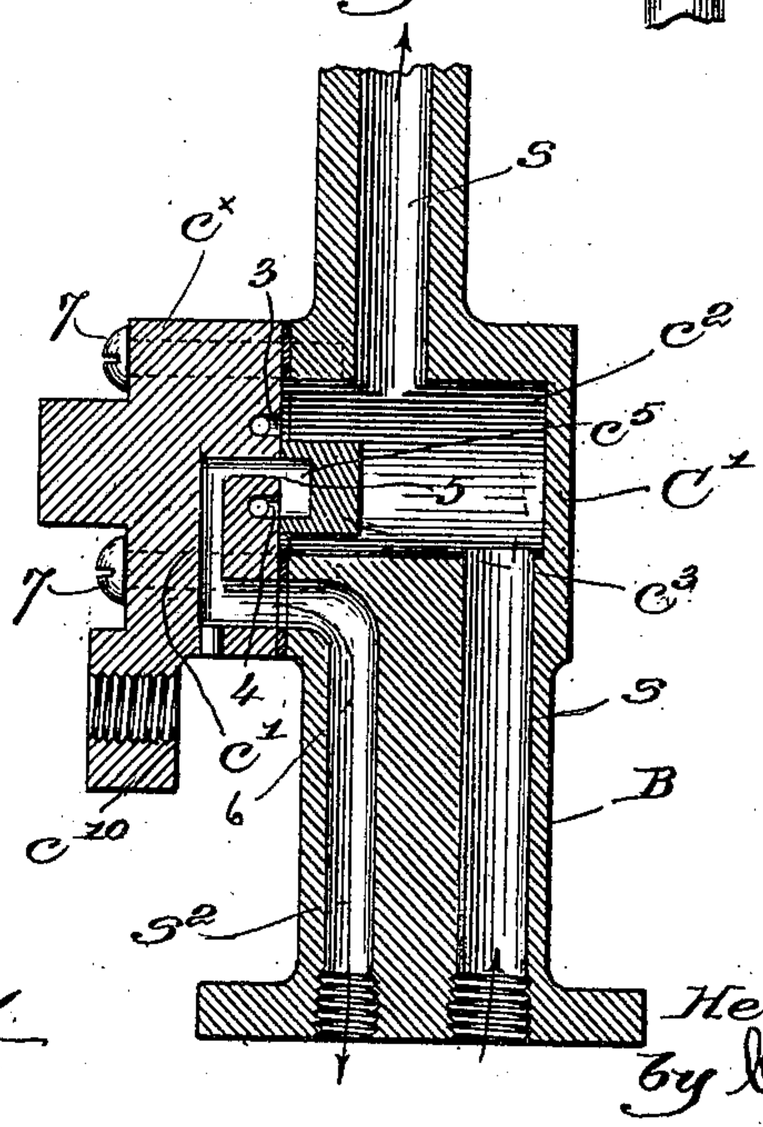


Fig. 5.



Witnesses:
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UNITED STATES PATENT OFFICE.

HERMAN STRATER, OF BOSTON, MASSACHUSETTS.

AIR-COMPRESSOR.

SPECIFICATION forming part of Letters Patent No. 684,954, dated October 22, 1901.

Application filed March 16, 1901. Serial No. 51,563. (No model.)

To all whom it may concern:

Be it known that I, HERMAN STRATER, a citizen of the United States, and a resident of Boston, county of Suffolk, and State of Massachusetts, have invented an Improvement in Air-Compressors, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

This invention relates to "hydraulic air-compressors" of the type wherein a liquid, such as water, is used as the compressing agent, the valves controlling admission and discharge of the liquid to and from the compressing-chamber being automatically operated by or through the agency of a float within the said chamber.

One of the objects of my present invention is to provide simpler, stronger, and more powerful means for actuating the valves with a quick opening or closing of the latter, as the case may be.

Another object of my invention is the practical utilization of the float as a controller for the valve-actuating mechanism, the latter including a powerful hydraulic motor, and in order to provide for the quick and effective operation of the latter I have provided for a difference in pressure between the liquid-compressing agent as it is admitted to the compressing-chamber and the motor, respectively, so that the shutting and opening of the admission and discharge valves will be practically instantaneous, no matter what the pressure of the liquid.

Various novel features of my invention will be fully described hereinafter and particularly pointed out in the following claims.

Figure 1 is a vertical sectional view of the air-compressing chamber of an apparatus embodying my invention, the automatic means for controlling the inlet and outlet of the liquid for effecting air-compression being shown partly in elevation and partly in section. Fig. 2 is a vertical sectional view of the valve-actuating motor viewed from the back of the apparatus. Fig. 3 is a detail in elevation of the cylinder forming a part of such motor, with the valve-ports thereof to be described. Fig. 4 is a detached detail in elevation of the valve and valve-chest, and Fig. 5 is an enlarged vertical sectional view showing the main inlet-passage for the liquid and the outlet-passage for the exhaust from the motor.

Referring to Fig. 1, a compressing-chamber A is shown, preferably of the general shape shown to permit the operation of devices, hereinafter to be described, which are contained in the chamber, the latter having a dome-shaped upper portion and being mounted upon a base A′, which has extended through it a discharge-conduit a, the upper open end of which forms a discharge-port a' for the chamber, said conduit opening into a liquid seal or trap T of suitable construction and communicating with the main discharge or waste pipe or conduit T′ in such a manner that the level of the liquid $L^{\times}$ in the trap will always be above the lower end of the conduit a, thus preventing the passage of any foul air to the compressing-chamber or of any air admitted through the waste-pipe T′.

A supply-pipe S is connected by a suitable coupling S′, Fig. 1, with the lower end of an inlet-conduit s, formed in a standard or pipe B, secured to the base A′ and extended up into the chamber, the upper end of the standard or pipe being bent over, as at B′, and provided with a seat b for a pressure-reducing valve $b^{\times}$ of any suitable construction, said valve being held against its seat by a spring $s^{\times}$, Fig. 1, the outer end of the spring being held in place by a cap b', tightly closing the end of the overhang B′. The overhang at its under side and directly above the discharge-port a' is provided with an admission-port b^2, a ring-like valve-seat b^3 being suitably secured to a nipple b^4 on the overhang by means of a coupling b^5.

The compressing liquid, which may be and preferably will be water, is admitted to the chamber A through the admission-port b^2, the inlet-pipe S being connected to a water-supply having a suitable head—such, for example, as ordinary city water—the gradual accumulation of the water in the chamber compressing the contained air in the dome thereof, the air so compressed passing through an outlet-passage a^2 and nozzle a^3 to any suitable storage-receptacle or to the apparatus which is to utilize the compressed air, a check-valve a^4 of any suitable construction preventing the return of the compressed air to the chamber. After the air has been com-

pressed to the desired extent the admission-port will be closed and the outlet-port a' opened by means to be described, permitting the liquid in the chamber to flow out, and at the same time fresh air will flow into the chamber through an air-inlet a^5, a suitable check-valve a^6 permitting the inlet of fresh air, but preventing the escape of compressed air during compression.

Valves V V′ coöperate, respectively, with the admission and outlet ports, and I have herein provided novel and powerful valve-actuating mechanism to close and open said ports at the proper times, said mechanism including a hydraulic motor. The motor comprises, essentially, a cylinder C, having a piston-rod c, which passes through suitable stuffing-boxes in the cylinder heads or ends and is rigidly connected with the valves V V′, as clearly shown in Fig. 2, the cylinder having ports 3 4 at opposite ends thereof communicating at their other ends with the interior of a valve-chest C′.

Referring to Fig. 3, the extension $c^\times$ of the cylinder-casting has the ports or passages 3 and 4 therein, as well as an exhaust-passage c', one end or port being shown at 5 and the other end thereof at 6. The valve-chest C′ is secured to the extension $c^\times$ by suitable bolts 7, Fig. 5, and the chamber c^2 of the said chest contains the valve c^3, best shown in Fig. 4 as segmental in shape and rigidly secured to an oscillating spindle c^4, the valve having a recess c^5 therein, adapted to establish communication between the exhaust-port 5 and one or other of the cylinder-ports 3 4, according to the position of the valve. The valve is provided with an extension or lug c^6, Fig. 4, which plays in a recess c^7 in the wall of the valve-chamber to positively limit the throw of the valve, the valve-spindle c^4 being extended through the wall of the extension $c^\times$ and having secured to its outer end a finger c^8, (see Fig. 1,) adjustably held in position by a set-screw 10. The valve-actuator is shown as a swinging arm h, mounted to rock on the valve-spindle between the finger c^8 and the outer face of the extension and having at its upper end a weight H, the lower end of the actuator being bifurcated or forked to present two branches h', provided each with a tappet or lug h^2, the two tappets being located on opposite sides of and to alternately coöperate with the finger c^8.

Referring to Fig. 1, if the actuator be swung from its full-line position toward the right it will as soon as it passes dead-center be carried by gravity quickly into dotted-line position, and the right-hand tappet h^2 will engage and impart a quick blow to the finger c^8 to turn it from full to dotted line position, and thereby change the position of the motor-valve c^3. The initial movement of the valve-actuator—that is, its movement from a position of rest to just past dead-center—is effected by or through a float F within the chamber A and governed as to its position by the level of the compressing liquid in said chamber, the float being mounted on the free end of an arm f, fulcrumed at f' on a lug or projection c^{10}, depending from the cylinder extension $c^\times$, said arm having branches f^2 extended upwardly and divergently from its fulcrum and preferably provided with friction-rolls f^3, (see Fig. 1,) located in the path of movement of and on opposite sides of the actuator h. By gradual movement of the float F from full to dotted line position, Fig. 1, the left-hand roll f^3 will swing the actuator into vertical position and then slightly beyond dead-center, the movement of the actuator past dead-center occurring at or about the time the liquid has risen to the proper height in the chamber, and after passing dead-center the weight H will complete the swinging movement of the actuator, as has been described, to change the position of the motor-valve. On the other hand, a fall in the level of the liquid will depress the float to descend until the right-hand roll f^3 will operate to swing the actuator from right to left, viewing Fig. 1, into vertical position and past dead-center, the completion of the swinging movement of the actuator being effected by its weight H.

I have shown in Fig. 1 a friction-block h^4 secured to the actuator h and having oppositely beveled and divergent sides toward the fulcrum of the actuator, the rolls f^3 engaging said beveled sides when imparting movement to the actuator.

In Figs. 1 and 2 the admission-port b^2 is open and the valve V′ is seated to close the outlet-port a' of the compression-chamber, and at such time the cylinder-port 4 will, by means of the recess c^5 in the valve c^3, be in communication with the exhaust-passage c' and port 3 will be open to admit fluid to the cylinder C; but when the valve is shifted by movement of the actuator from full to dotted line position, Fig. 1, the valve c^3 will be moved to open the cylinder-port 4 and to connect the port 3 with the exhaust-port, and a quick movement of the piston $C^\times$ will be effected to simultaneously open the outlet-port a' and close the admission-port b^2.

It is to be noted that in either position of the piston the cylinder-port which last admitted the actuating liquid to the cylinder remains open, so that the full pressure of the liquid is utilized to act upon the piston $C^\times$ and maintain the valves V V′ in desired position entirely irrespective of any pressure within the compression-chamber, and in this connection it may be stated that the ports 3 and 4 open directly into the chamber c^2 of the valve-chest, such chamber forming an enlargement of the passage or conduit s.

The pipe or standard B is provided with a second conduit or passage s^2, Fig. 5, which communicates at its upper end with the exhaust-passage c', and at its lower end it is connected by an extension s^4, Fig. 1, with the seal or trap T, the lower end of the extension

s^4 projecting below the level of the liquid in the trap. The exhaust from the motor is thus entirely separate from and independent of the exhaust and discharge passage or conduit of the compression-chamber, and hence is entirely unaffected by any pressure within the latter.

The pressure-reducing device hereinbefore referred to is interposed between the admission-port b^2 of the compression-chamber and the branch or chamber c^2 in the valve-case, which communicates with the cylinder of the hydraulic actuator through the ports 3 or 4, so that while the cylinder will receive the compressing liquid at its full pressure, due to the head of the supply, the pressure of such liquid in the compression-chamber will be less, due to the presence of the reducing-valve, so that a differential pressure for the motor and the compressing-chamber will be provided. I am thus enabled to operate the valves V V′ against the pressure in the chamber by a comparatively small, yet powerful, actuator operated by the compressing liquid at full pressure.

The throw of the weighted actuator is positively limited by means of a pin 33, Fig. 1, extended rearwardly therefrom and adapted to engage one or the other of two fixed projections 34 on the cylinder extension $c^{\times}$.

It is very desirable for many reasons to thoroughly wash the air in the compression-chamber, so that when compressed the air will be very clean and pure, and this washing is thoroughly effected by the apparatus herein shown.

The liquid-admission port b^2 is downturned, as shown, and when said port is open the entering liquid impinges with considerable force, depending upon the head of the supply, upon the top of the valve V and is thrown laterally and upwardly in the form of finely-divided streams or spray. Such spray is thus brought into thorough and intimate contact with the air in the chamber, washing it and removing various impurities held in suspension by the incoming fresh air, such impurities being collected by the spray and carried down to the main body of liquid in the chamber, to be withdrawn therewith when the outlet-port is opened.

My invention is not restricted to the precise construction and arrangement herein shown and described, as the same may be modified and rearranged in various particulars without departing from the spirit and scope of my invention.

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

1. In an air-compressor, a compressing-chamber having admission and discharge ports for the compressing liquid, coöperating valves, actuating mechanism therefor, including a hydraulic motor operated by the compressing liquid, means to admit the liquid to the chamber at a pressure lower than that acting upon the motor, and controlling means for the motor, governed by the level of the liquid in the compressing-chamber.

2. In an air-compressor, a compressing-chamber having admission and discharge ports for the compressing liquid, coöperating valves, actuating mechanism therefor, including a hydraulic motor, a liquid-supply conduit communicating with the motor and said admission-port, pressure-reducing means interposed between the latter and the liquid-inlet for the motor, and controlling means for the motor, governed by the level of the liquid in the compressing-chamber.

3. In an air-compressor, a compressing-chamber having admission and discharge ports for the compressing liquid, coöperating valves, actuating mechanism therefor, including a hydraulic motor, a liquid-supply conduit communicating with the motor and said admission-port, pressure-reducing means interposed between the latter and the liquid-inlet for the motor, an exhaust-passage leading from the motor and independent of the discharge-port of the chamber, and controlling means for the motor, governed by the level of the liquid in the compressing-chamber.

4. In an air-compressor, a compressing-chamber having admission and discharge ports for the compressing liquid, coöperating and connected valves, to simultaneously open one and close the other of said ports, a cylinder having a piston reciprocable therein and provided with ports at opposite ends thereof, the admission and discharge ports and their valves being wholly outside of the cylinder, a rigid connection between the piston and the said valves to effect movement of the same in unison, mechanism to govern the inlet and exhaust of liquid to and from the cylinder, and actuating means for said mechanism, controlled by or through the level of the liquid in the compressing-chamber.

5. In an air-compressor, a compressing-chamber having oppositely-located admission and discharge ports for the compressing liquid, coöperating and rigidly-connected valves, valve-actuating mechanism, including a cylinder having a piston reciprocable therein and provided with ports at its opposite ends, a piston-rod extended through the cylinder ends and connected with said valves to constitute a rigid connection therebetween, mechanism to govern the admission and exhaust of liquid to and from the cylinder, to thereby move the piston to open one and close the other of the controlling-valves for the chamber, and actuating means for said mechanism, controlled by or through the level of the liquid in the compressing-chamber.

6. In an air-compressor, a compressing-chamber having admission and discharge ports for the compressing liquid, coöperating valves, valve-actuating mechanism, including a direct-acting hydraulic motor, a differential-pressure connection between the liq-

uid-supply and the admission-port and the motor, to provide a higher pressure for operating the latter, and automatic controlling means for the motor, governed by or through the level of the liquid in the compressing-chamber.

7. In an air-compressor, a compressing-chamber having admission and discharge ports for the compressing liquid, coöperating valves and actuating means therefor, including a hydraulic motor, the latter and the chamber having a common liquid-supply conduit, a pressure-reducer interposed between the admission-port of the chamber and the motor-inlet, a liquid seal or trap into which the liquid is discharged from the chamber, a separate exhaust-conduit for the motor, also connected with the seal, and means governed by or through the level of the liquid in the chamber to effect intermitting operation of the motor.

8. In an air-compressor, a compressing-chamber having a discharge-outlet in its bottom, a liquid-inlet conduit extended upwardly into the chamber, and having a downturned port, to admit liquid therefrom in a downward stream directly into the upper part of the chamber, valves coöperating with said ports, the admission-valve being located directly below and movable toward and from the downturned port, the entering liquid impinging on such coöperating valve when the admission-port is open, to spray the liquid into the upper part of the chamber, and valve-actuating mechanism controlled by or through the level of the liquid in the chamber to automatically open and close the admission and discharge ports alternately.

9. In an air-compressor, a compressing-chamber, having admission and discharge ports for the compressing liquid, coöperating valves, valve-actuating mechanism including a hydraulic motor, a liquid-inlet conduit extended into the chamber and communicating with the said admission-port, a reducing-valve adjacent the latter, a branch directly connecting the inlet-conduit with the valve-chest of the motor, and an exhaust-conduit for said motor independent of the chamber discharge-port, combined with controlling means for the motor including a float, whereby the operation of the motor is governed by or through the level of the liquid in the compressing-chamber.

10. In an air-compressor, a compressing-chamber having oppositely-located admission and discharge ports for the compressing liquid, coöperating valves, valve-actuating mechanism including a hydraulic cylinder interposed between said ports and having a reciprocable piston of greater cross-sectional area than either of said valves, a piston-rod oppositely extended through the cylinder-heads and to which the valves are secured, a valve-chest having ports communicating with the opposite ends of the cylinder and provided with an exhaust-port, a controlling-valve in said chest, means to operate said valve to effect the movement of the piston in the cylinder in one or the other direction, said valve-chest being connected with the source of supply of compressing liquid, and a controller for said means including a float within the chamber and governed as to its position by the level of the liquid therein.

11. In an air-compressor, a compressing-chamber having admission and outlet ports for the compressing liquid, valves coöperating with said ports and movable directly toward and from them, and automatic valve-actuating mechanism, the admission-port being located in the upper part of the chamber to deliver liquid directly thereinto, and its coöperating valve being at all times opposite and external to said port, the latter and its valve being located wholly exterior to the valve-operating mechanism, whereby the liquid entering the chamber through the admission-port will impinge on the exposed admission-valve when the port is open to thereby forcibly spray the liquid in all directions within the chamber.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

HERMAN STRATER.

Witnesses:
JOHN C. EDWARDS,
AUGUSTA E. DEAN.