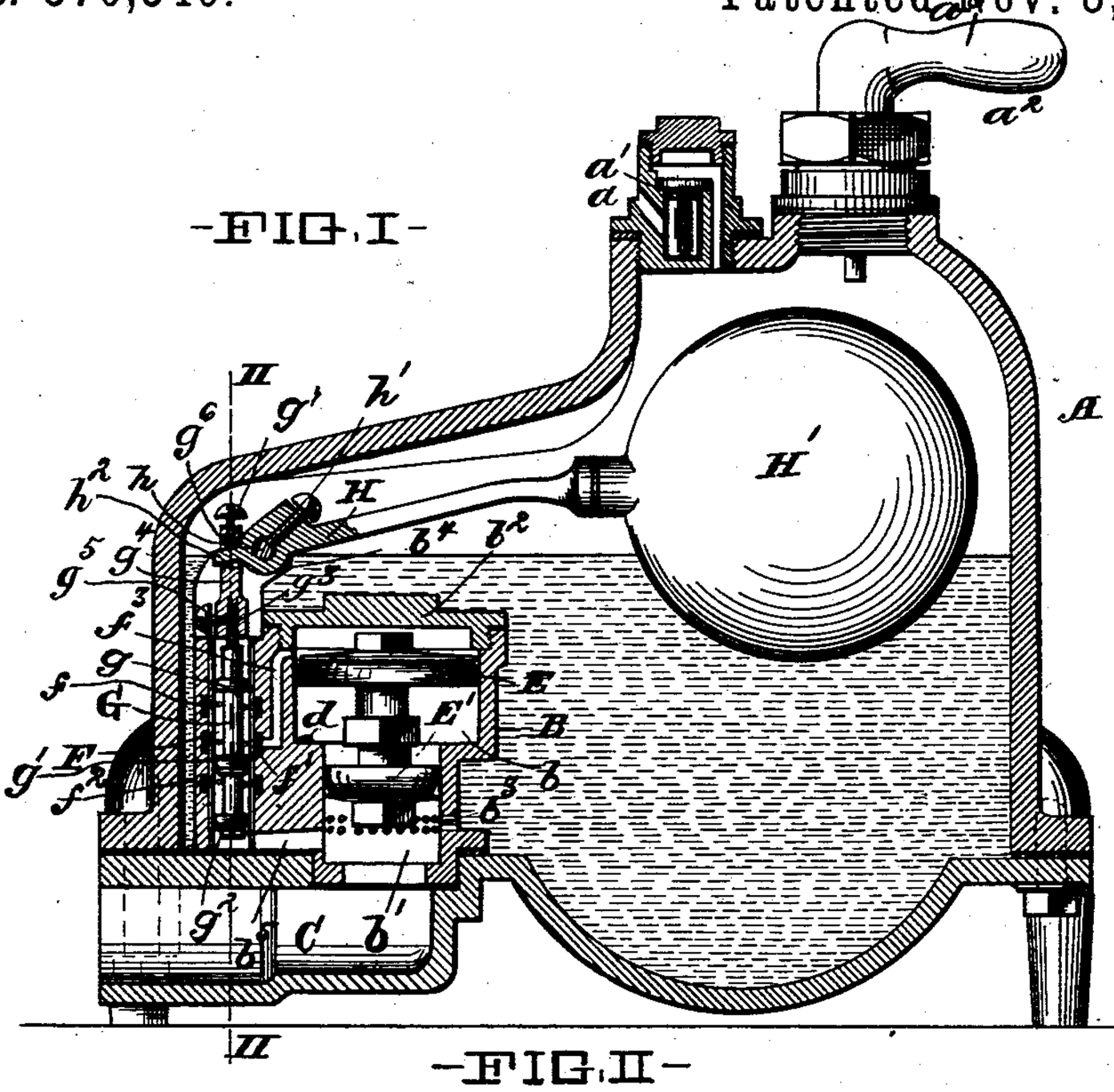
(No Model.)

J. H. CHAMP.

HYDRAULIC AIR COMPRESSOR.

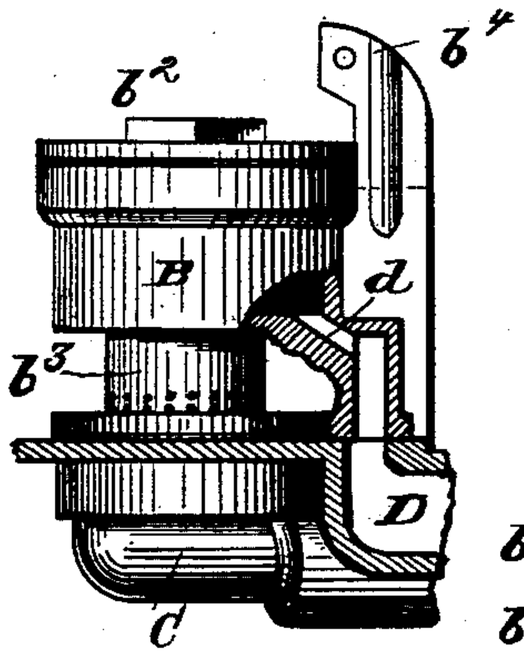
No. 570,540. Patented Nov. 3, 1896.

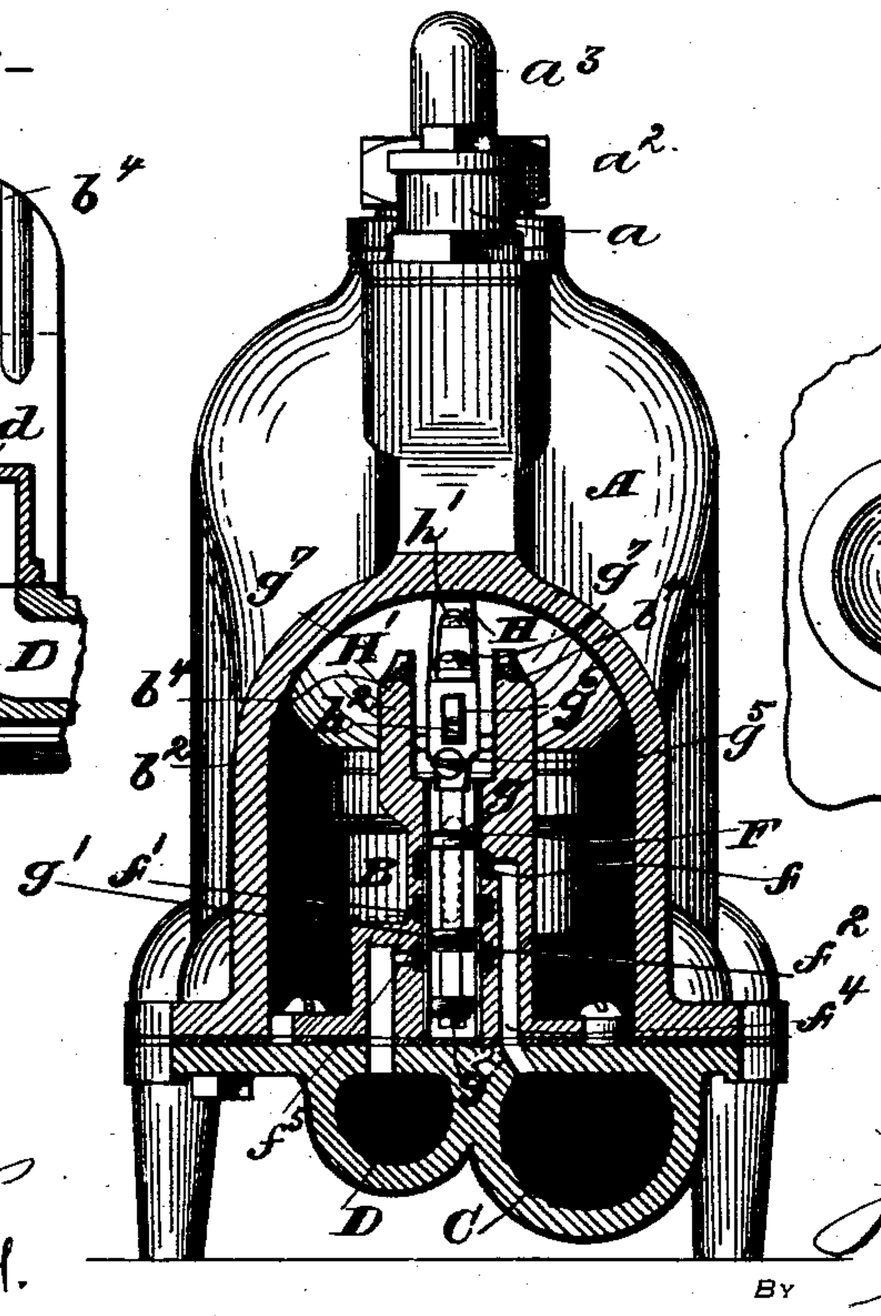
-FIG. I-



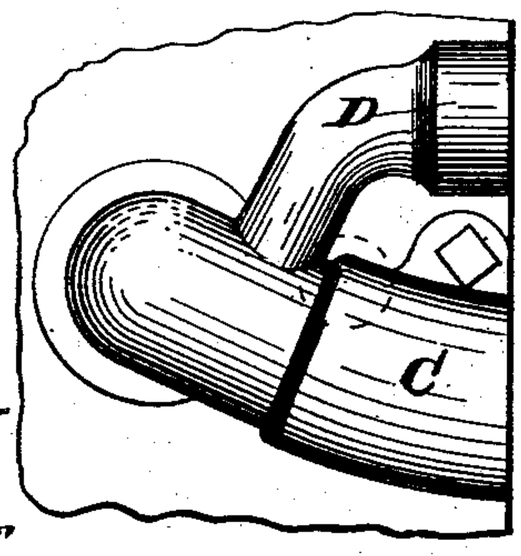
-FIG. II-

-FIG. III-





-FIG. IV-



WITNESSES:

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UNITED STATES PATENT OFFICE.

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HYDRAULIC AIR-COMPRESSOR.

SPECIFICATION forming part of Letters Patent No. 570,540, dated November 3, 1896.

Application filed March 9, 1896. Serial No. 582,304. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH H. CHAMP, a citizen of the United States, and a resident of Cleveland, county of Cuyahoga, and State of Ohio, have invented certain new and useful Improvements in Hydraulic Air-Compressors, of which the following is a specification, the principle of the invention being herein explained, and the best mode in which I have contemplated applying that principle, so as to distinguish it from other inventions.

The annexed drawings and the following description set forth in detail one mechanical form embodying the invention, such detail construction being but one of various mechanical forms in which the principle of the invention may be used.

In said annexed drawings, Figure I represents a longitudinal vertical section of my improved hydraulic air-compressor; Fig. II, a transverse vertical section on the line II II in Fig. I, of the primary-valve mechanism; Fig. III, a detail side view of the valve-casings, illustrating a portion of the casing broken away and removed, and Fig. IV a bottom plan view illustrating the inlet and outlet channels.

An air and water chamber A is provided with an air-inlet a, controlled by an air-inlet valve a', and with a valve-controlled outlet a^2, having a nozzle a^3, to which a tubular air-connection may be attached for conveying the compressed air to its point of destination.

A main-valve casing B is supported from the bottom of the air and water chamber, and said casing is formed with a cylindrical piston-chamber b and a cylindrical valve-chamber b' beneath the piston-chamber and of smaller diameter than the latter. The upper end of the piston-chamber is closed by a removable screw-cap b^2. An annular port b^3 is formed at about the middle of the valve-chamber, preferably by annular rows of perforations, and establishes communication between the valve-chamber and the air and water chamber. The lower end of the valve-chamber has open communication with a water-outlet C. A water-inlet D communicates with the bottom of the piston-chamber by means of a passage d. A main-valve-actuating piston E has play in the piston-chamber, and has rigid connection with a main controlling-valve E', which has play in the valve-chamber. A cylindrical primary-valve chamber F is formed parallel with the main controlling-piston and valve-chamber, and said primary-valve chamber is open at its upper end, communicating with the air and water chamber, and has three annular ports f, f', and f^2. The middle port f' has connection to the upper portion of the main-valve-actuating piston-chamber through a channel f^3. The upper port f has connection to the outlet by means of a channel f^4, and the lower port f^2 has connection to the inlet-channel by means of a channel f^5. Said ports may therefore be respectively termed the distributing-port, the outlet-port, and the inlet-port of the primary-valve chamber.

A valve G, having three pistons g, g', and g^2, has play in the primary-valve chamber, and will be termed the "primary" valve. The pistons upon said valve are so spaced in their relation to one another and to the ports of the valve-chamber that the distributing-port and the outlet-port may be connected when the valve is depressed, and the distributing-port and the inlet-port may be connected when the valve is raised. The lower portions of the main-valve chamber and the primary-valve chamber are connected together by a channel b^5, such channel being formed independent of the water connection between the main-valve chamber and the air and water chamber, and it connects with the main-valve chamber at a point of the latter nearer the waste-water outlet C and farther from the supply-water inlet d than is the water connection b^3 of the main-valve chamber with the air and water chamber. The upper end of the primary valve is reduced at g^3 and fits into a socket g^4, being there secured by means of a set-screw g^5. The stem of the socket has a slot g^6, through the upper end wall of which passes an adjusting-screw g^7. A lever H is fulcrumed between ears b^4 upon the upper end of the primary-valve chamber, a pin h being inserted through said ears and lever and having the lever secured upon it by means of a set-screw h'. The short and reduced arm

h^2 of the float-lever H projects into the slot g^6. The long arm of the float-lever has a float H′ secured to its end.

In practice the water-inlet is connected to an ordinary water-service pipe or other source of water under pressure, and the waste-outlet is connected to a sewer or other waste. A suitable fluid-pressure regulator is preferably connected to the inlet, so as to regulate the pressure under which the actuating water is desired to enter the air-compressor. When water is admitted through the inlet, (the air and water chamber being presumed to be empty, and consequently the float at its lowermost position and the primary valve in its raised position,) the actuating water will pass up through the inlet-channel into the bottom of the valve piston-chamber, pressing downward upon the valve and upward against the piston. The inlet water will also enter the lower port of the primary-valve chamber and pass from said port to the distributing-port, and thence to the space above the main-valve-actuating piston, pressing downward upon the latter. As inlet water is thus on both sides of the main-valve-actuating piston, the pressure upon the latter will be equalized, and the downward pressure upon the main controlling-valve will force the latter downward past the annular port in the main controlling-valve chamber. The inlet water may thus pass into the air and water chamber, gradually filling the latter and compressing the air within the same and forcing it out through the air-outlet. At the same time the supply water passes through channel b^5 into the lower portion of the primary-valve chamber, so that there is an equal pressure of inlet water respectively at the top and bottom portions of the primary-valve chamber. As the water rises in the air and water chamber it will raise the float, and the float will, when it arrives at the required height, force the primary valve down into the position illustrated in Fig. I. When the primary valve is forced down, the communication in the primary-valve chamber between the inlet-port and the distributing-port in the same will be cut off and communication will be established between the outlet-port and the distributing-port. This will admit of the actuating water in the valve-actuating piston-chamber exerting upward pressure against the large valve-actuating piston, so that it may force said piston and the main controlling-valve upward, the water above the main-valve-actuating piston escaping through the distributing channel and port and out through the waste. When the main controlling-valve is raised past the annular ports in the main controlling-valve chamber, communication will be established between the air and water chamber and the waste, allowing the water to escape from the air and water chamber. When the water arrives at its lowest level, the float will have reached its lowermost position and will have raised the primary valve, when the operation will be again repeated. The independent water-channel b^5 admits of water beneath the primary valve escaping through the waste after the main controlling-valve has been raised a short distance from its lowermost position, so that the force of the water against the upper piston of the primary valve may force said valve downward and shift it into the position illustrated in Fig. I, in which full communication is established between the upper portion of the main-valve-actuating piston-chamber and the waste, so that the main controlling-valve may be raised and full communication established between the air and water chamber and the waste. If this last-mentioned channel b^5 were not provided, the float might rise to a certain level and might push the primary valve downward to just sufficient distance to partly uncover the distributing-port and establish a partial connection between said port and the outlet-port. This would admit of the main valve and its controlling-piston being but slightly raised, when absolute free communication between the air and water chamber and the waste would not be established. As, however, the slight rising of the main controlling-valve establishes communication between the lower portion of the primary-valve chamber and the waste, the force of the actuating water upon the upper piston of the primary valve will be sufficient to force said valve down, irrespective of the downward-forcing action of the float and float-lever.

The foregoing operation is dependent upon the fact that there is always a slight leakage in the distributing-piston g' of the primary valve, such leakage permitting of the water on the upper side of the main-valve piston passing sufficiently out through channel f^3 at the proper time into the outlet-port f to cause such piston to take a slight rise, so as to give the said water connection between the channel b^5 and the waste-water outlet.

Other modes of applying the principle of my invention may be employed for the mode herein explained. Change may therefore be made as regards the mechanism thus disclosed, provided the principles of construction set forth respectively in the following claims are employed.

I therefore particularly point out and distinctly claim as my invention—

1. In a hydraulic air-compressor, the combination with a main-valve chamber having a water connection with the air and water chamber, and a primary-valve chamber, of a water-channel between said two valve-chambers, such channel being independent of said water connection between the main-valve chamber and the air and water chamber, substantially as set forth.

2. In a hydraulic air-compressor, the combination with a main-valve chamber, and a primary-valve chamber, of a water-channel between the two; such channel connecting with the main-valve chamber at a point of

the latter nearer the waste-water outlet than is the water connection of the main-valve chamber with the air and water chamber, substantially as set forth.

3. In a hydraulic air-compressor, the combination with a main-valve chamber, and a primary-valve chamber, of a water-channel between the two; such channel connecting with the main-valve chamber at a point of the latter farther from the supply-water inlet than is the water connection of the main-valve chamber with the air and water chamber, substantially as set forth.

4. In a hydraulic air-compressor, the combination of an air and water chamber, a main-valve chamber with its main valve, a piston-chamber with its piston connected to such valve, a primary-valve chamber with its primary valve, and a supply-water inlet between such main valve and its connected piston; together with a water-channel connecting one end of the primary-valve chamber with the main-valve chamber at a point of the latter nearer the waste-water outlet and farther from the supply-water inlet than is the water connection of such main-valve chamber with the air and water chamber, substantially as set forth.

5. In a hydraulic air-compressor, the combination of an air and water chamber, a main-valve chamber with its main valve, a piston-chamber with its piston connected to such valve, a primary-valve chamber with its primary valve, said valves and piston having reciprocating vertical movement; together with a water-channel connected at its upper extremity with said piston-chamber at a point constantly above the piston, a constant-supply water-inlet between the piston and the main valve, water connection between the main-valve chamber and the air and water chamber, an independent water-channel connecting together the lower portions of the two valve-chambers at a point of the main-valve chamber below its water connection with the air and water chamber, and a waste-water outlet leading from the main-valve chamber below said independent water-channel, substantially as set forth.

6. In a hydraulic air-compressor, the combination of an air and water chamber, a valve-casing formed with a large piston-chamber having communication at its lower end with the water-inlet, and a smaller valve-chamber having a port which communicates with the air and water chamber, and a water-outlet at its bottom, said piston-chamber and valve-chamber being axially alined and communicating with each other; a primary-valve chamber having a distributing-port at its middle which communicates with the upper end of the piston-chamber, and an outlet-port at its upper portion, and an inlet-port at its lower portion, and having a channel which extends from the bottom of the primary-valve chamber to the main-valve chamber beneath the distributing-port in the latter; a main controlling-valve having play in the main controlling-valve chamber, and provided with a valve-actuating piston having play in the piston-chamber; a primary valve having three pistons, the middle one of which has play at both sides of the distributing-port in the primary-valve chamber, and the end pistons of which are permanently to the outside of the inlet and outlet ports; and a suitable float mechanism connected to the primary valve, to actuate the latter at the extremes of the rise and fall of water within the air and water chamber, substantially as set forth.

In testimony that I claim the foregoing to be my invention I have hereunto set my hand this 5th day of March, A. D. 1896.

JOSEPH H. CHAMP.

Witnesses:

THOS. B. HALL,

A. EMERKEL.