No. 606,732. Patented July 5, 1898.

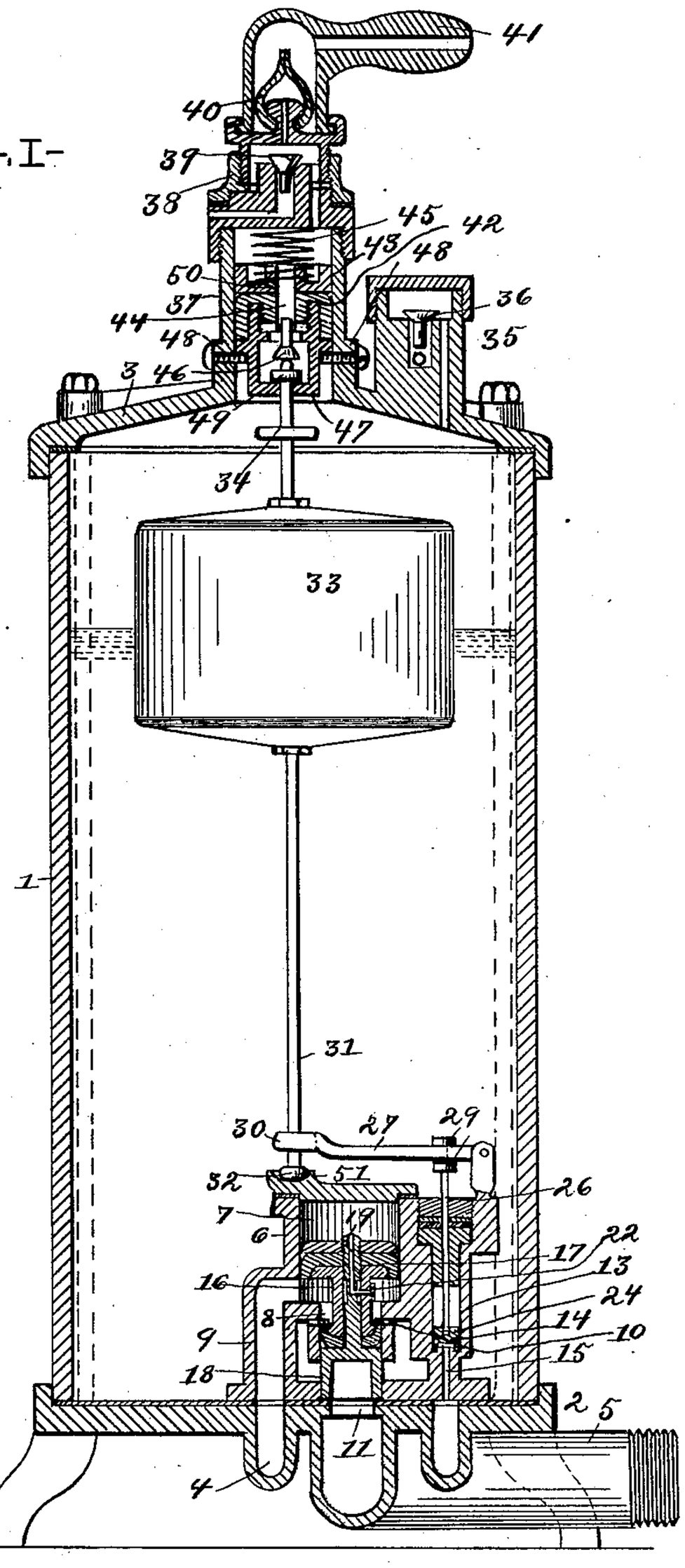
A. G. NOACK & L. S. GROSSMAN.

HYDRAULIC AIR COMPRESSOR.

(Application filed Dec. 24, 1896.)

(No Model.) 2 Sheets—Sheet 1.

-FIG. 1-



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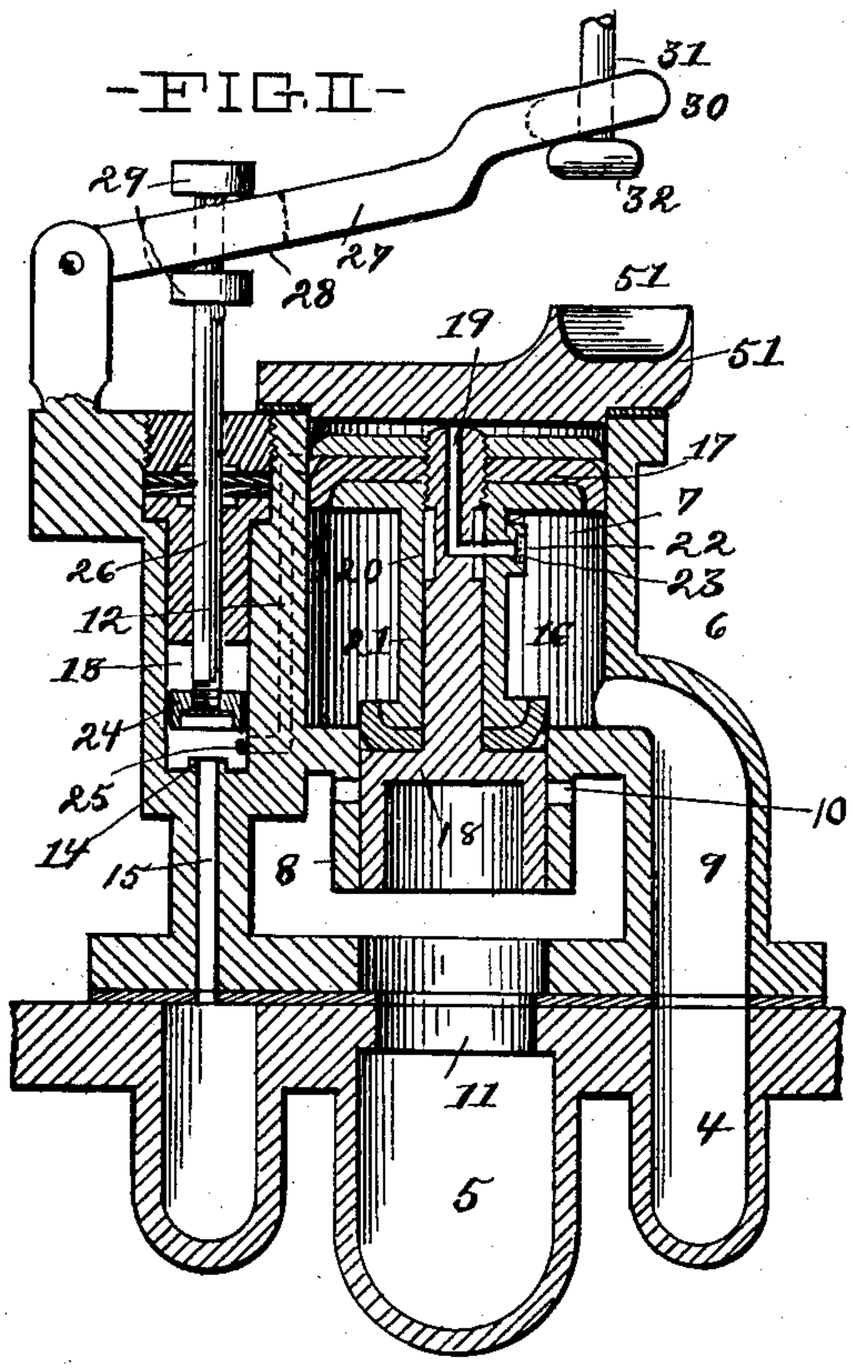
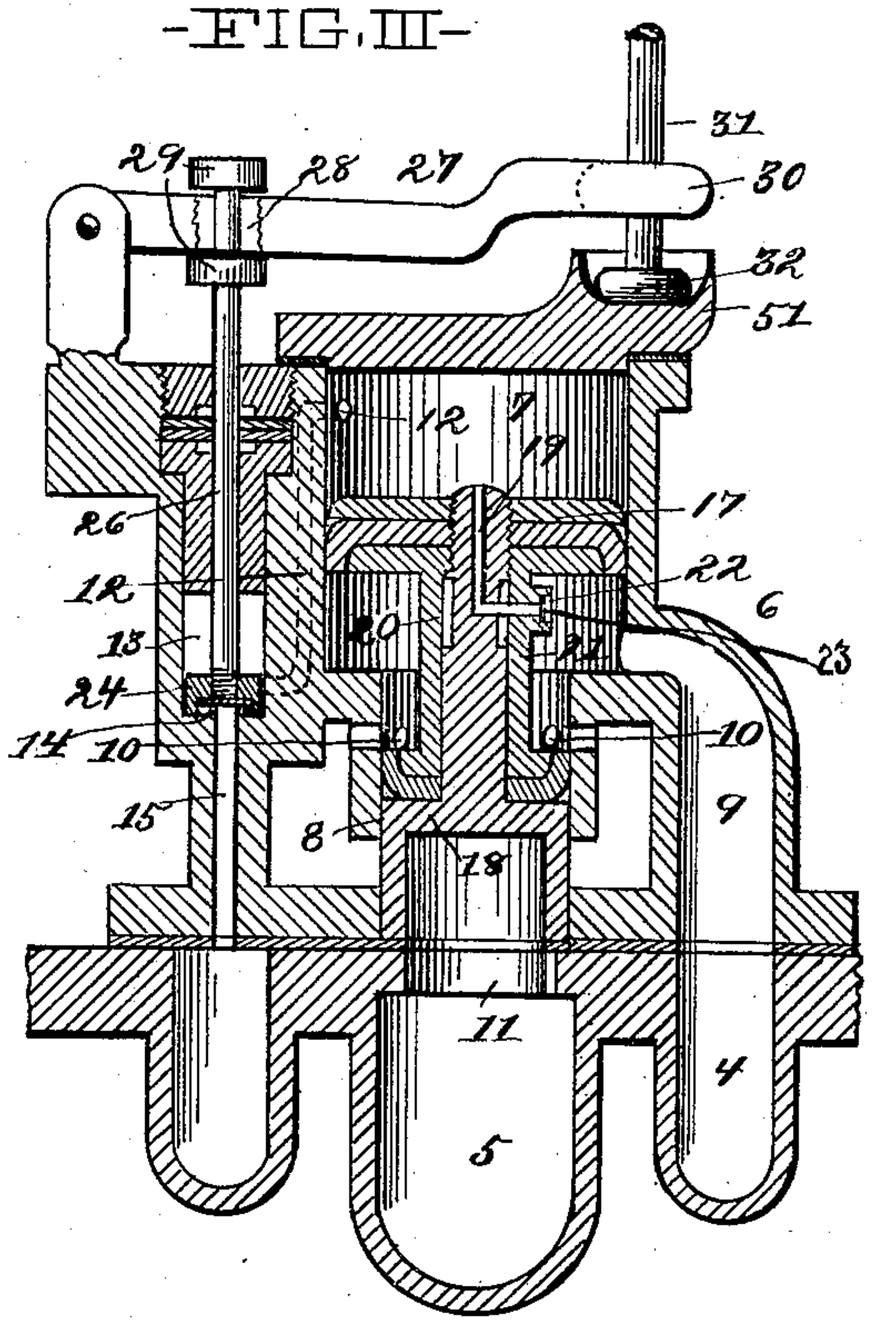
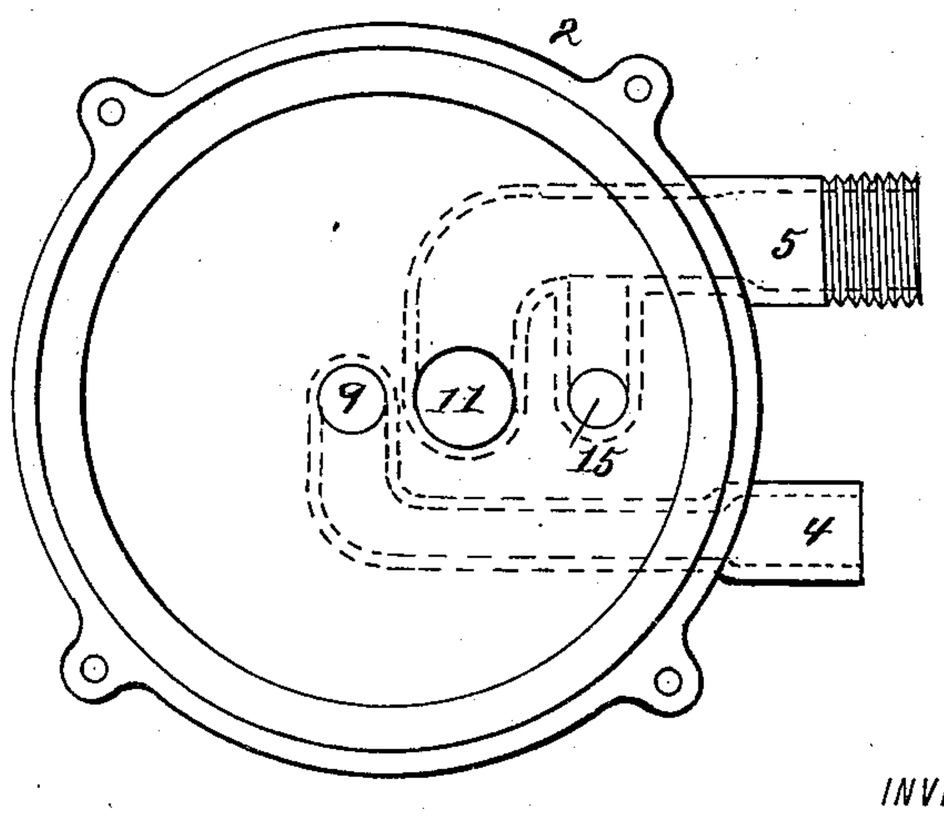
-FIG. II-



-FIG. III-



-FIG. IV-



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UNITED STATES PATENT OFFICE.

ADOLPH G. NOACK AND LORENZ S. GROSSMAN, OF CLEVELAND, OHIO, ASSIGNORS, BY MESNE ASSIGNMENTS, TO CLEMENT L. V. EVANS, TRUSTEE, OF THE BERNER-MAYER COMPANY, OF SAME PLACE.

HYDRAULIC AIR-COMPRESSOR.

SPECIFICATION forming part of Letters Patent No. 606,732, dated July 5, 1898.

Application filed December 24, 1896. Serial No. 616,839. (No model.)

To all whom it may concern:

Be it known that we, ADOLPH G. NOACK and LORENZ S. GROSSMAN, citizens of the United States, and residents 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 therein explained and the best mode in which we 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 vertical section of our improved hydraulic air-compressor; Fig. II, an enlarged vertical section of the valve mechanism of the same, illustrating the main controlling-valve in position for exhausting the water out of the cylinder; Fig. III, a similar section illustrating the main controlling-valve in position for admitting water into the cylinder, and Fig. IV a plan view of the base of the compressor.

The air-compressor has a cylinder 1, a base 2, and a top 3. The cylinder is preferably of glass, although it may be made of any suitable material. The base is formed with a water-inlet 4, which may be connected to a water-service pipe or other source of water under pressure, and with a water-outlet 5, which may be suitably connected to a waste-pipe. A valve-casing 6 is secured to the base within the cylinder and has an actuating-piston chamber 7 and a valve-chamber 8, said valve-chamber being arranged below the piston-chamber and in axial alinement with the same and being of a smaller diameter than said piston-chamber. The water-inlet is connected to the lower end of the piston-chamber by a water-passage 9, and the valve-chamber has a series of openings 10, which extend through the walls of the chamber and form a port communication between the valve-chamber and the cylinder. The lower end of the valve-chamber is open and is a short distance above the base of the valve-casing, so as to form a water-outlet port, which is controlled by the main controlling-valve and which communicates with the waste-port 11, through which the water-outlet communicates with the cylinder, through the bottom of the same. A port 12 extends from the upper end of the piston-chamber to near the lower end of a primary-valve chamber 13, which has a valve-seat 14 at its lower end, which connects with the water-outlet through a port 15. A valve 16 has an actuating-piston 17, which reciprocates within the actuating-piston chamber, and has a piston 18 at its lower end which reciprocates within the valve-chamber. The water-inlet opens into the lower end of the actuating-piston chamber. The stem of the valve has an axial bore 19, which extends out through one side of the same into a circumferential groove or recess 20, which is covered by a sleeve 21, which secures the packing of the actuating valve-piston. Said sleeve has a nipple 22, provided with a strainer 23, which nipple communicates with the axial bore, so that water may pass through said strainer, nipple, and bore into the upper end of the actuating-piston chamber. The valve 18 has a seat against the base of the pump and will when in its lower position close the outlet-port of the valve-chamber and will cover the water-outlet. A valve 24 has a seat at the lower end of the primary-valve chamber 13 and has sufficient play, besides being of a less diameter than the said valve-chamber, to admit of the port 25 of the passage 12 to connect with the passage out through the bottom of the primary-valve chamber. The valve 18 has a stem 25, which slides in a packing-box at the top of the valve-chamber. A lever 27 is fulcrumed at one end upon the valve-casing and has a slot 28, through which the primary-valve stem projects. Said stem is provided with two shoulders 29 or any other similar style of shoulders, so that the valve-stem will be shifted when the lever is either raised or lowered. The outer end of the lever is formed with an eye 30, through which the lower end of a rod 31 passes. Said lower end is provided

with an enlargement 32, which will engage the eye of the lever and raise the same when the rod is raised. A float 33 has play upon said rod and may rise and fall with the water which passes into the cylinder. The upper end of the rod has a stop or shoulder 34, which may be engaged by the float, so that the rod may be raised when the float arrives at the uppermost end of its stroke. The top 3 of the pump has an air-inlet 35, which is controlled by a valve 36, and has also at its center a valve-casing 37, the upper end of which is provided with an air inlet and outlet 38, controlled by an inlet-valve 39 and an outlet-valve 40. A nipple 41 is provided for convenient connection of a tube or whatever other connection may be made between the air-compressor and the place where compressed air is required. A piston 42 plays within the valve-casing 37 and is formed with a cup 43 at its upper end, which has communication with an axial bore 44 through the piston. A spring 45 bears against the upper end of said piston, serving to force it down. A valve 46 has a seat against the lower end of the axial bore 44 and rests against the upper end of the float-rod 31. A yoke 47 extends from the under side of the piston and has the float-rod passing through it. Stop-screws 48 are provided in the valve-casing, so as to stop the piston at its downward movement, caused by the spring. The float-rod is provided with a nut 49, which may be engaged by the yoke, so that the float-rod may be drawn upward when the piston is forced upward.

In practice when the compressor has its water-inlet connected to a source of water under pressure and the waste is suitably connected to discharge the exhaust-water we will, for the sake of illustration, presume that the parts of the compressor are in the position illustrated in Fig. 1. When the parts are in such position, the water enters through the water-inlet into the lower end of the piston-chamber and upper end of the valve-chamber and passes through the openings 10 into the cylinder, raising the float. The primary valve is seated against its seat, being held there by the pressure from above of the inlet-water, and the inlet-water passes through the passage in the actuating-piston of the main controlling-valve, so that the pressure against said piston will hold the main valve against its seat, closing the outlet. When the float arrives at the uppermost end of its stroke, it will strike the shoulder 34 and raise the float-rod. This will cause the upper end of said rod to raise the valve 46 against its seat, so that the water still rising in the cylinder may force the piston 42 upward against the force of the spring. The rising of said piston by the action of the water will cause the yoke of the piston to engage the nut 49, so that the float-rod will be positively raised. By the arrangement of the piston and valve for the same at the outlet for air from the cylinder water will be prevented from passing up through the air-outlet valve. Should water, by some accident or other, pass the valve and rise upward into the air-outlet, the cup of the piston will receive such water, which may thereupon be drawn back into the cylinder through small passages 50, provided in the bottom of the cup. When the float-rod is raised, the enlargement at the lower end of said rod will engage the primary-valve-controlling lever and raise the same, thereby raising the primary valve. As soon as the primary valve is raised connection is made between the upper end of the valve-actuating-piston chamber and the waste, so that the pressure of the inlet-water from below will raise the main controlling-valve piston and the valve. This will open the outlet through the base of the cylinder, causing the water to flow out and the float to sink with the water. As soon as the float strikes the primary-valve-controlling lever the primary valve will be seated, closing the outlet from the primary-valve chamber. This will cause the inlet-water to pass through the main controlling-valve-actuating piston and stem, causing the piston and valve to move downward, closing the water-outlet. As soon as the water-outlet is closed the water-inlet into the cylinder is uncovered by the main controlling-valve, and the float will again rise.

The air-inlet 35 is provided so as to admit air into the cylinder as soon as the waste for the actuating-water has been opened. If said inlet were not provided, the compressed air at the top of the cylinder might keep the air-inlet valve 39 closed, so that the water would not exhaust, and no air would come into the pump. A cup-shaped guide 51 is formed upon the top of the valve-casing, and the lower end of the float-rod rests in said guide when the rod is lowered. The guide will prevent the rod from being displaced when the compressor is transported from one place to another and will retain the rod in its upright position. The channel which connects the upper portion of the main controlling-piston chamber with the primary-valve chamber has a sufficient capacity exceeding the capacity of the passage through the actuating-piston to admit of water being discharged from the chamber faster than it can enter.

The main controlling-valve is at both extremes of its throw within the valve-chamber, so that it will at all times be fully and truly guided in its stroke and will not be liable to get out of alinement and to thus either fail to close the water-outlet upon its downstroke or to get caught by the edge of the valve-chamber upon its upstroke. As the by-pass provided for the inlet-water through the axial bore in the main controlling-valve-actuating-piston stem permits said actuating-piston to be packed and to thus snugly fit within its cylindrical chamber the piston and valve will be perfectly guided in their stroke without danger of deviating from the axial line and the consequent jamming and stopping of

the piston and valve, such as is liable to happen and does happen in similar valve structures where the controlling-valve is not at all times guided by a chamber and where a water by-pass from the opposite sides of the actuating-piston is formed by making such piston of a smaller diameter than its chamber and thereby rendering it liable to wabble.

As the primary valve is of smaller diameter than the valve-chamber, it is only necessary to raise the valve in the slightest degree to uncover the outlet-port and thereby connect the outlet-port from the valve-controlling-piston chamber. This fact admits of the employment of the lever for increasing the slight power of the rising or falling float at the extremes of its stroke to overcome the frictional and other resistance to the movement of the primary valve and its stem. The slight degree of movement required for the primary valve also insures a very sensitive action of the compressor, as the primary valve may be raised and seated even though the float should not on account of back pressure by air decrease in the actuating-water pressure or for other reason fully complete its stroke.

Other modes of applying the principle of our 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.

We therefore particularly point out and distinctly claim as our invention—

1. In a hydraulic air-compressor, the combination of an air-and-water chamber provided with a water waste-port in its bottom, a main controlling-valve chamber supported a distance above said waste-port to form a water-outlet between its lower edge and the waste-port and having communication at its upper end with the water-inlet and having a port in its side communicating with the interior of the air-and-water chamber, a main controlling-valve having play in said valve-chamber and constructed of such length as to remain partly or entirely within the valve-chamber when lowered to close the water-outlet and cover the waste-port and to uncover the port in the side of the valve-chamber or raised to uncover the outlet and waste-port and to cover the port in the side of the valve-chamber, a piston and chamber connected to actuate said main controlling-valve, and a primary valve controlling the water for said piston and chamber and connected to be actuated by the rise and fall of the water in the air-and-water chamber, substantially as set forth.

2. In a hydraulic air-compressor, the combination of an air-and-water chamber, an actuating-piston chamber having the water-inlet at its lower end and a water-outlet at its upper end, a main controlling-valve chamber having its upper end open into the bottom of the piston-chamber and having a port in its side opening into the air-and-water chamber and forming a water-outlet at its lower end, a main controlling-valve in said valve-chamber and an actuating-piston provided with a packing and sliding in the piston-chamber and connected to the valve by a stem having a passage extending through its side and up through the top of the piston, and a primary valve controlling the outlet from the top of the piston-chamber and connected to be actuated by the rise and fall of water in the air-and-water chamber, substantially as set forth.

3. In a hydraulic air-compressor, the combination of an air-and-water chamber, a main valve controlling the inlet and outlet of the actuating-water into and out of the chamber, an actuating-piston chamber connected to the inlet at one end and having an outlet at the other end, an actuating-piston reciprocating in said chamber and connected to the main controlling-valve and provided with a water-passage through it, a primary-valve chamber having an outlet at its end formed with a valve-seat and having the outlet from the piston-chamber opening into it, and a primary valve of less diameter than the primary-valve chamber playing against the valve-seat and connected to be actuated by the rise and fall of water in 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 controlling the inlet and outlet of the actuating-water into and out of the chamber, an actuating-piston chamber connected to the inlet at one end and having an outlet at the other end, an actuating-piston reciprocating in said chamber and connected to the main controlling-valve and provided with a water-passage through it, a primary-valve chamber having an outlet at its end formed with a valve-seat and having the outlet from the piston-chamber opening into it, a primary valve of less diameter than the primary-valve chamber playing against the valve-seat, a lever fulcrumed at one end and having movable connection with the valve-stem near said end, and a float connected to said lever to raise the same at the upper end of its upstroke and to depress the same at the lower end of its downstroke, substantially as set forth.

5. In a hydraulic air-compressor, the combination of a valve-actuating lever, a float-rod and a float upon the same, said rod sliding through an opening in said lever and having a stop at its end for engaging said opening, and a cup-shaped guide which registers with the end of said float-rod and receives said stop when the rod is lowered, substantially as set forth.

6. In a hydraulic air-compressor, the combination with a float and float-rod constructed to actuate the valve mechanism, said rod having a stop at its upper end and constructed to be lifted and lowered at the two extremities

of the stroke of the float, of a valve-casing in the top of the compressor-cylinder and having valve-controlled air inlet and outlet, a piston in said casing and having an axial passage and a yoke upon its under side through which the upper end of the float-rod passes and which engages the stop upon the same, a spring bearing downward against the piston, and an upwardly-closing valve for the passage through the piston and resting against the upper end of the float-rod, substantially as set forth.

7. In a hydraulic air-compressor, the combination with a float and float-rod constructed to actuate the valve mechanism, said rod having a stop at its upper end and constructed to be lifted and lowered at the two extremities of the stroke of the float, of a valve-casing in the top of the compressor-cylinder and having valve-controlled air inlet and outlet, a piston in said casing and having an axial passage and a yoke upon its under side through which the upper end of the float-rod passes and which engages the stop upon the same, a spring bearing downward against the piston, an upwardly-closing valve for the passage through the piston and resting against the upper end of the float-rod, and an auxiliary air-inlet valve in the top of the cylinder, substantially as set forth.

In testimony that we claim the foregoing to be our invention we have hereunto set our hands this 12th day of October, A. D. 1896.

ADOLPH G. NOACK.
LORENZ S. GROSSMAN.

Witnesses:
WM. SECHER,
E. I. BROWN.