No. 776,907. PATENTED DEC. 6, 1904.

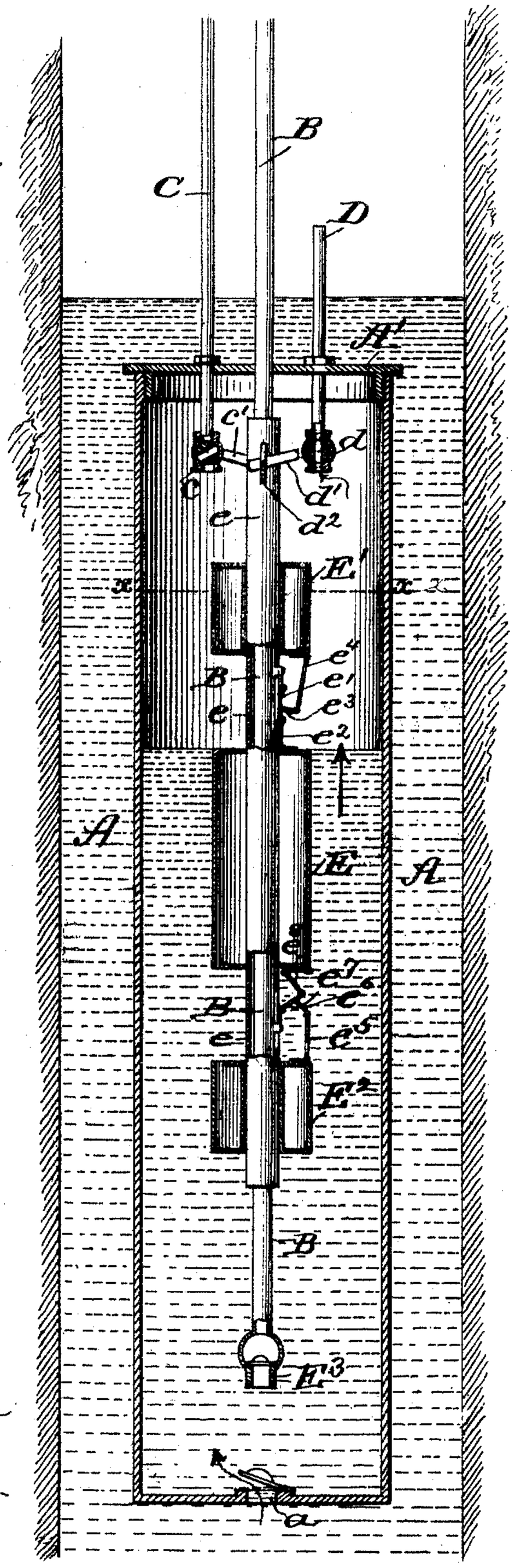
E. HASTAIN.

# PNEUMATIC LIQUID ELEVATOR.

APPLICATION FILED MAR. 12, 1904.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.

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NO MODEL. 2 SHEETS—SHEET 2.

Fig. 2.

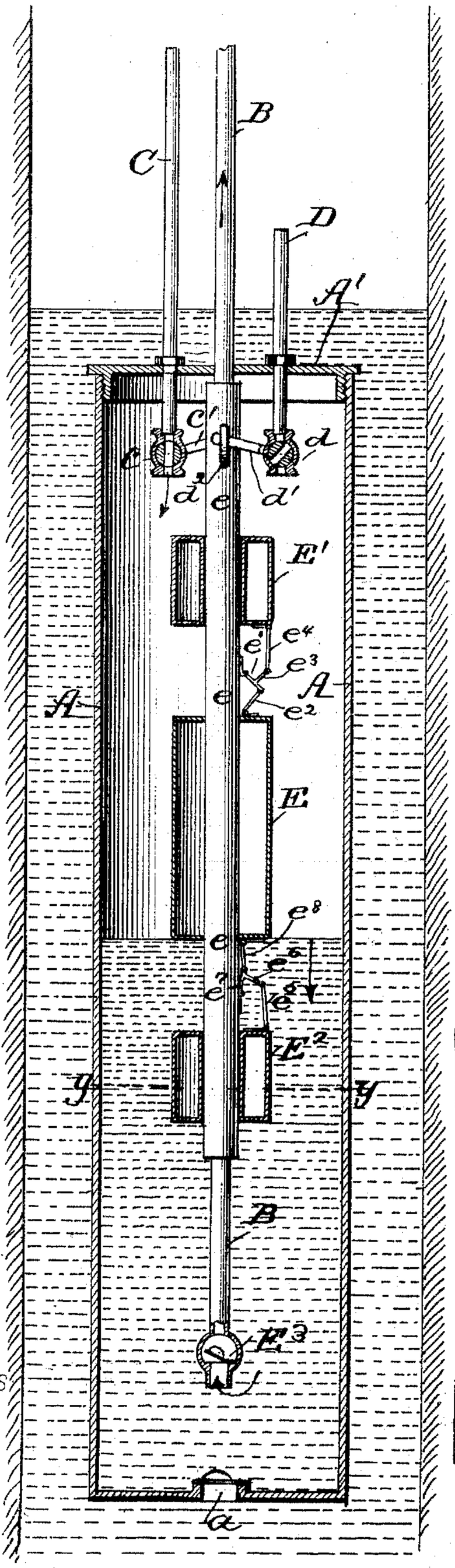



Fig. 3.

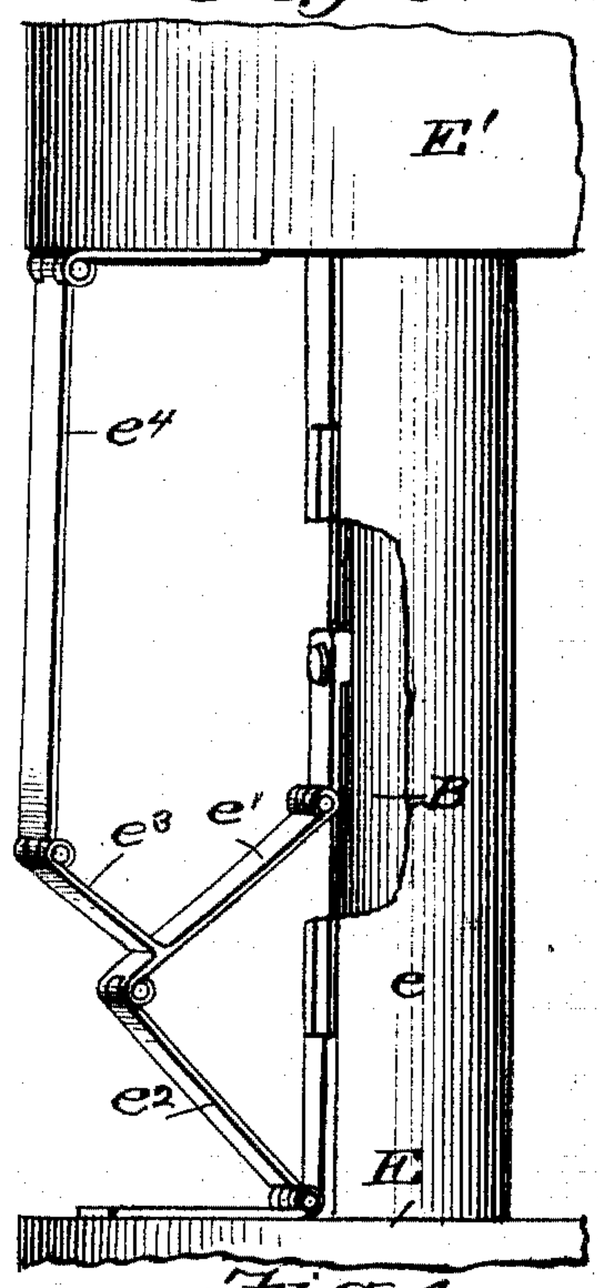
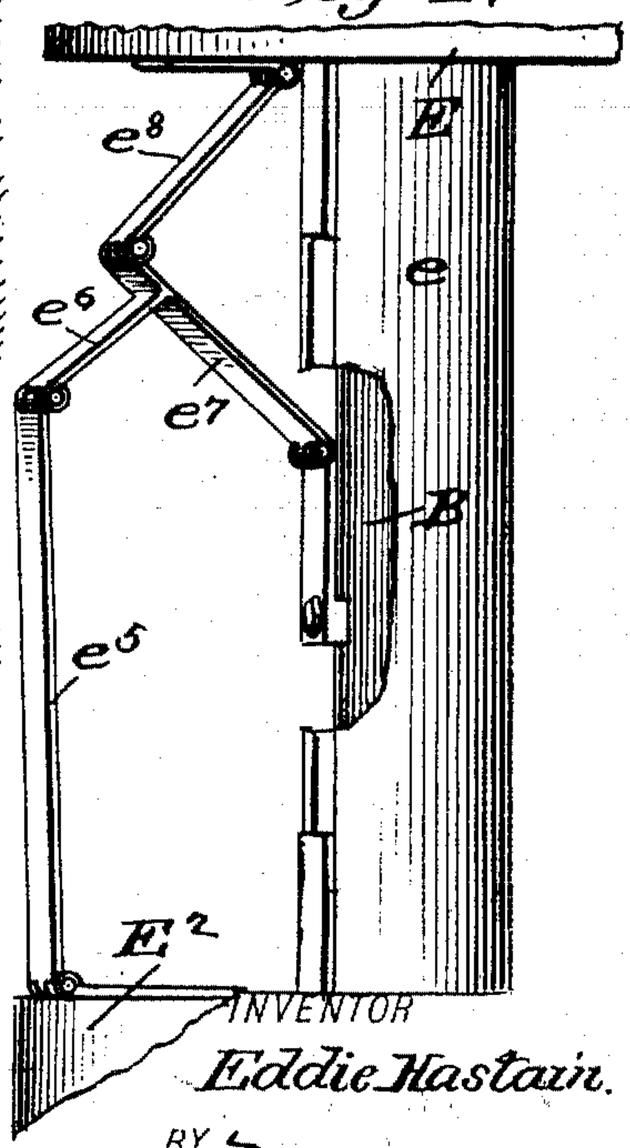



Fig. 4.

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# UNITED STATES PATENT OFFICE.

EDDIE HASTAIN, OF TISHOMINGO, INDIAN TERRITORY.

## PNEUMATIC LIQUID-ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 776,907, dated December 6, 1904.

Application filed March 12, 1904. Serial No. 197,747. (No model.)

*To all whom it may concern:*

Be it known that I, EDDIE HASTAIN, a citizen of the United States, residing at Tishomingo, Chickasaw Nation, Indian Territory, have invented a new and useful Improvement in Pneumatic Liquid-Elevators, of which the following is a specification.

My invention relates to pneumatic liquid-elevators of that form in which a submerged chamber is provided with valves by which water, oil, or other liquid is allowed to enter said chamber and is then forced up and out through a stand-pipe by means of the pressure of compressed air, gas, or steam admitted to the surface of the liquid in the chamber.

My invention consists in a novel arrangement of floats and valves by which the apparatus is made to work automatically with a very positive and efficient action, which I will now proceed to describe with reference to the drawings, in which—

Figure 1 is a vertical section of the apparatus arranged in a well and showing the position of the parts during the filling of the submerged chamber. Fig. 2 is a somewhat similar view showing the position of parts during the discharge of the liquid from the submerged chamber and its elevation through the stand-pipe. Fig. 3 is an enlarged detail showing the connecting mechanism between the upper and middle floats, and Fig. 4 is a similar detail showing the connecting mechanism between the lower and middle floats.

In the operation of my apparatus a valve which admits compressed air to a submerged chamber and a valve that allows the alternate escape of this air are worked alternately by a float, so that the compressed-air valve is opened when the escape-valve is closed and the escape-valve opened when the compressed-air valve is closed. Inasmuch, however, as it is desirable to have these valves operated not gradually, but as nearly instantaneously as possible at the times when the submerged chamber is filled and is emptied, I have devised a special arrangement of three floats for doing this, one main float and two supplementary floats, one supplementary float above and the other below the main float, and which supplementary floats are designed to act initially to bring the main float into action only at the complete filling and complete emptying of the submerged chamber, and then with a quick, positive, and vigorous action.

I will first describe the construction of my apparatus and afterward its operation, reference being had more particularly to Figs. 1 and 2 of the drawings.

A is the submerged chamber, which is to be placed in any kind of a well below the level of the liquid contained therein, as seen in the drawings. This chamber has in its bottom or lower end an upwardly-opening valve *a*, which will allow the surrounding liquid to pass into the chamber A, but will not allow it to escape therefrom. The chamber A has a detachable cover A′, secured by screw-threads, as shown, or by bolts, and fitting with an air-tight joint. Through this cover there rises a stand-pipe B, which extends up to the top of the well or to any desired elevation. This stand-pipe B extends nearly to the bottom of the submerged chamber A and has at its lower end an upwardly-opening check-valve $E^3$. Sliding on this stand-pipe within the chamber A is a long sleeve *e*, carrying about its middle a large float E, preferably of cylindrical form, which is rigidly attached to the sleeve *e* and moves it up and down.

Through the cover A′ of the submerged chamber there extend the two pipes C and D, rigidly fixed in the cover with tight joints. C is the compressed-air pipe, which extends up to the top of the well or to any desired point and communicates with a compressed-air reservoir, a pump, a blower, or other means for supplying through the pipe a flow of compressed air.

The pipe D opens into the well preferably a little above the level of the liquid therein and is merely a waste-pipe through which the air may escape from the submerged chamber when the latter is filling with liquid.

At the bottom of the pipe C there is a valve or cock *c*, which has a lever-arm *c′*, which is loosely connected to the sleeve *e* of the main float E. This valve or cock is designed to alternately open and close communication be-

tween the pipe C and the interior of the chamber A and is operated by the rise and fall of the sleeve *e* of the main float. A similar valve or cock *d* is arranged at the lower end of pipe D and has a lever-arm *d'*, which has a loose connection $d^2$ with the sleeve *e* of the main float. This valve or cock alternately opens and closes communication between the chamber A and the air above the level of the liquid in the well. This valve or cock *d* is also operated by the rise and fall of the sleeve *e* of the main float, and the two valves are so arranged in relation to the said sleeve that they are operated reversely by the same movement of the sleeve and float—that is to say, when the compressed-air valve is open the escape-valve is closed, and vice versa. Now if the chamber A be assumed to be empty and the compressed-air valve *c* is closed and its escape-valve *d* is operated it will be seen that the liquid outside the chamber A will raise the valve *a* and fill the chamber A, the air above the water passing out through the valve *d* and pipe D. Now if the valve *d* is closed and the compressed-air valve *c* is opened, as in Fig. 2, the pressure of the compressed air on the surface of the water in the chamber A will cause the inlet-valve *a* at the bottom of the chamber A to close, and the water will be forced up through valve $E^3$, which opens upwardly, and will rise in the stand-pipe to the top of the well or to any elevation desired, dependent upon the pressure of the air employed. As the valves *c* and *d* are connected to the sleeve *e* and the latter is attached to the main float E, it will be seen that the rise and fall of the latter in the chamber will supply the power to work said valves. It is not desirable, however, to have the valves *c* and *d* worked gradually and slowly by the gradual and slow rise and fall of the float E, as a very imperfect action would result. I have therefore devised means by which the main float E is held stationary and unaffected by the rise and fall of the level of the liquid in the chamber until the chamber is either about full or about empty. These means consist of the supplementary floats E' and $E^2$, one above and the other below the main float and connected with it, so as to lock the main float and hold it stationary until the liquid-level reaches and acts upon either the float E' or $E^2$, which are near the top and bottom of the chamber. Then the action of the liquid upon either the float E' or $E^2$, as the case may be, unlocks the main float and allows the latter to positively, vigorously, and quickly rise or fall with a forceful movement to shift the valves just as the chamber is about empty or is about full. This not only gives a strong and forceful movement to operate the valves, but it allows the chamber to be emptied and filled to its fullest capacity and to be emptied and filled in a much shorter space of time, as there is no gradual closing of the valves, as would be the case were they directly and constantly moved by a slow rise and fall of the main float E.

The particular means for connecting the supplementary floats E' $E^2$ to the main float E in reaching the above results are shown in Figs. 3 and 4, and the mechanism is substantially the same for both the supplementary floats. Each of these floats has a central hole through which passes the long sleeve *e* of the main float, the supplementary floats sliding freely up and down on said sleeve. The upper float E has a downwardly-projecting arm $e^4$, which is jointed to an offset $e^3$ from a pair of toggle-arms *e' e²*. These two toggle-arms are jointed to each other in the middle. The upper arm *e'* is at its upper end hinged to the stationary stand-pipe B, the sleeve *e* being slotted longitudinally at this point to permit such connection. The lower arm $e^2$ is at its lower end hinged to the top of the main float E.

Referring now to Fig. 1, if the parts be in the position shown and the water be entering the chamber A and has risen to the level indicated by the arrow it does not lift main float E, because the latter is held down by the weight of upper float E, which, through arm $e^4$, holds the toggle-arms *e' e²* in straight vertical alinement, which locks and holds down float E. When, however, the rising water-level reaches the line *x x*, the weight E' is buoyed up, arm $e^4$ pulls out the toggle-arms *e' e²* and, breaking the lock, allows the submerged but now released float E to rapidly and forcefully rise, carrying its sleeve *e* with it and giving a quick and positive movement to the valves *c* and *d* just about the time the chamber is full. This movement closes the escape-valve and opens the compressed-air valve, and the water begins to be forced up the stand-pipe by the incoming compressed air. Now when the liquid reaches the level of the bottom of the main float E, as seen in Fig. 2, the float E does not drop to shift the valve until the liquid is practically all out of the chamber A, because the toggle-arms $e^7$ and $e^8$ are held straightened and locked in vertical position by the buoyancy of supplementary float $E^2$, acting through arm $e^5$ and the offset $e^6$ of toggle-arms $e^7$ and $e^8$. The float E will therefore be held up in the air until the level of the liquid falling to dotted line *y y* allows supplementary float $E^2$ to descend. The descent of $E^2$ then pulls out the toggle $e^7$ $e^8$ and allows the main float E to drop with its full dead-weight with a quick and forceful movement, which instantly shifts the valves for filling again just about the time the chamber is practically empty.

It will be seen that each pair of toggle-arms has one of its members hinged to the stationary stand-pipe B through a slot on the

sleeve *e*, and this stationary hinge-point gives the locking anchorage to hold the main float against upward or downward movement until the toggle is tripped and the lock broken by one or the other of the supplementary floats.

In carrying out my invention I do not confine myself to any particular form of valves or shape of floats, as many such details may be varied without departing from my invention.

Some of the advantages of my water-elevator are as follows: When there is a small supply of oil or water, it will pump all of it out as fast as it runs in, and no time or energy is lost. It does away with the cylinder and rod, which in a deep well is of great weight. Several wells can be run from one power by connecting air-supply by pipes. The power need not be at the well, but wherever most convenient and carried to the elevator by a pipe. In supplying water it can be carried to all parts of a building and is always ready to be turned on by faucet. A well may be constantly emptied of its water, and thus be converted into a running spring, so that pure cold water can always be obtained from the bottom of the well.

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

1. A pneumatic liquid-elevator, comprising a closed chamber having an inlet-valve and a central valved stand-pipe, a compressed-air valve and escape-valve opening into the top of said chamber, a main float surrounding the stand-pipe for operating the said compressed-air and escape valves, means for locking said float against rising and falling, and two supplementary floats also surrounding the stand-pipe and arranged one above and the other below the main float and acting to release the locking devices substantially as described.

2. A pneumatic liquid-elevator, comprising a closed chamber having an inlet-valve and a valved stand-pipe, a compressed-air valve and escape-valve opening into said chamber, a main float having an attached sleeve sliding on the stand-pipe for operating said valves, two supplementary floats sliding freely on the sleeve of the main float, and means for locking the main float to the stand-pipe, said locking devices being arranged to be tripped and unlocked by the action of the supplementary floats substantially as described.

3. A pneumatic liquid-elevator, comprising a vertically-elongated closed chamber with an inlet-valve at the bottom and a central valved stand-pipe opening into the bottom of said chamber, inlet and escape valves for compressed air, three concentrically-arranged and superposed floats sliding on the central stand-pipe, the middle one being connected to the air-valves and being provided with locking devices, and the upper and lower floats being provided with tripping devices for unlocking the middle float substantially as described.

4. In a liquid-elevator of the kind described, the combination with the valves and the float for operating the same; of a supplementary float arranged in vertical alinement with the main float, a locking-toggle having one end jointed to the main float and the other end to a fixed anchorage and tripping device connecting the supplementary float to the locking-toggle to release the same and bring the main float into action substantially as described.

5. In a liquid-elevator of the kind described, the combination with the valves; of a float having a vertically-extended sleeve connected to the valves, a stand-pipe passing through said sleeve, a supplementary float sliding on the outside of said sleeve, and locking and tripping devices for locking the main float and tripping it by the supplementary float substantially as described.

6. In a liquid-elevator, the combination with a closed chamber having an inlet-valve; of an air-inlet valve and air-outlet valve opening into the top of the closed chamber and having operating lever-arms projecting inwardly, and a float having an upwardly-extending sleeve passing between the valves and loosely connected to their arms, and a stand-pipe passing upwardly through said sleeve substantially as and for the purpose described.

7. In a liquid-elevator of the kind described, the combination of the air inlet and outlet valves, a stationary stand-pipe, a main float with sleeve sliding on the stand-pipe, means for connecting said sleeve to the valves, a supplementary float sliding on the sleeve, a locking device connecting the stand-pipe and main float and means by which said locking device is connected to and operated upon by the supplementary float substantially as described.

8. A liquid- elevator, comprising a closed chamber having an inlet-valve at the bottom, a stand-pipe opening into the lower part of said chamber and having an upwardly-opening valve, air-inlet and air-escape valves arranged in the upper part of said chamber, a main float having a central sleeve surrounding the stand-pipe and connected to the air-valves, upper and lower supplementary floats sliding on the sleeve, and locking and tripping devices for causing the supplementary floats to lock and unlock the main float substantially as described.

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Witnesses:
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