4 Sheets—Sheet 1.

J. PATTEN.

Compressed-Air Water-Elevator.

No. 211,774. Patented Jan. 28, 1879.

Fig. 1

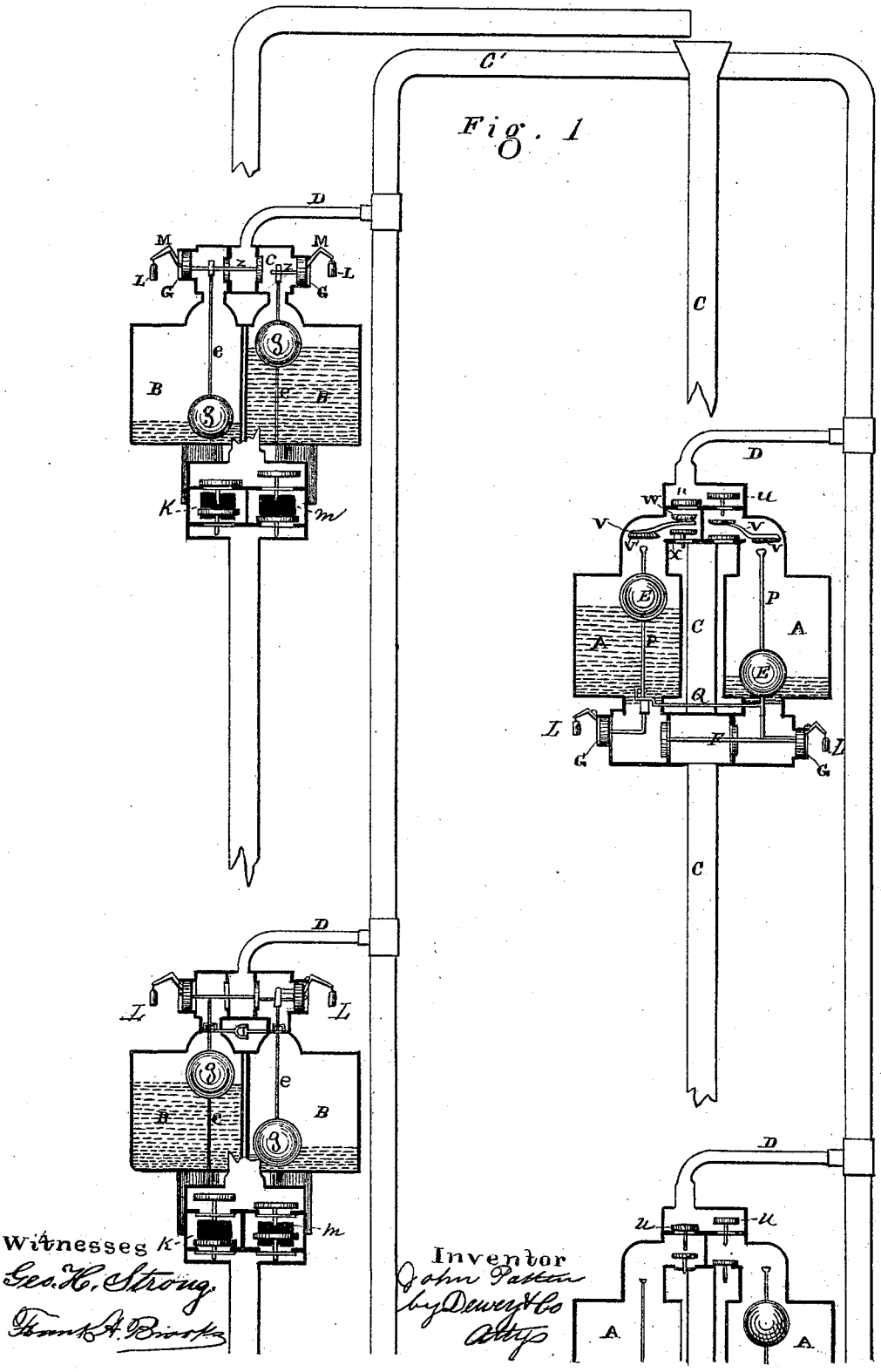

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Fig. 2

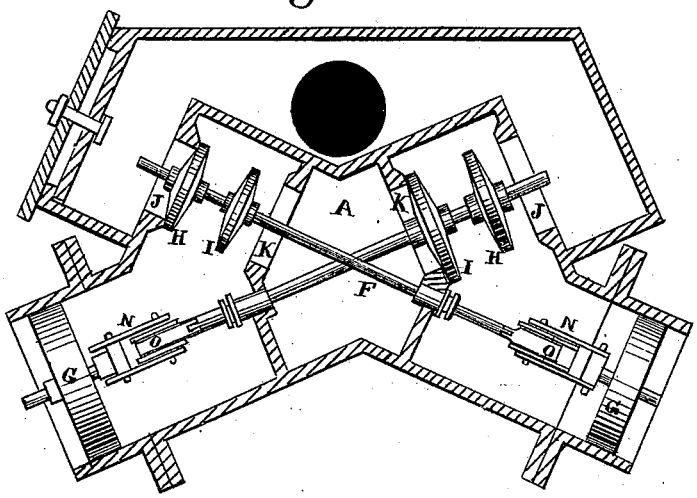
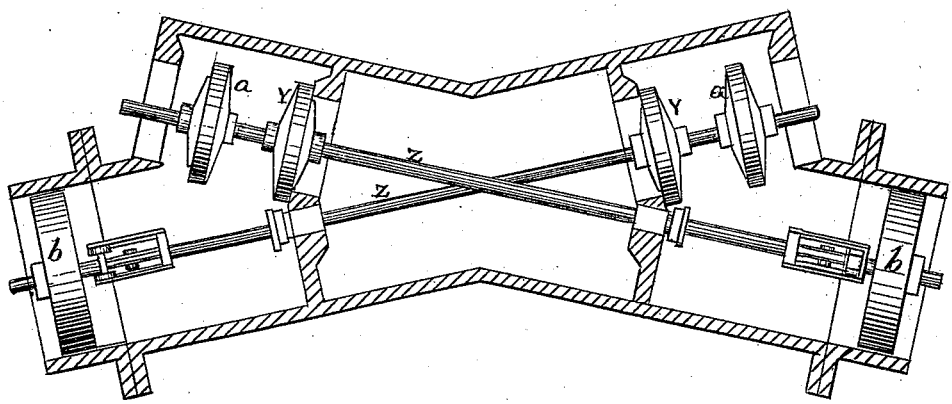


Fig. 3.



Witnesses

Geo. H. Strong.

Frank A. Brooks

Inventor

John Patten

by Dewey & Co

Attys

4 Sheets—Sheet 3.

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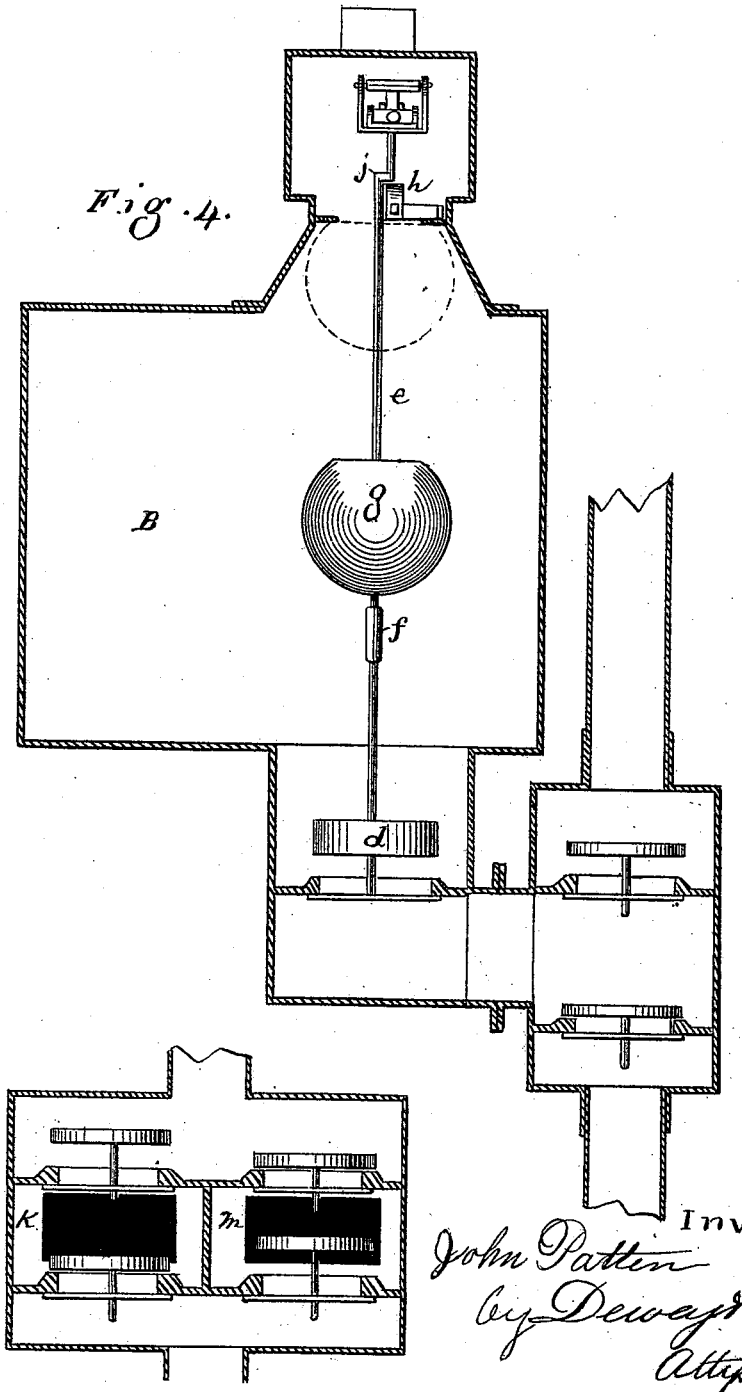
Fig. 4.



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Frank A. Brooks

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John Patten

by Dewey & Co

Attys.

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Fig. 6.

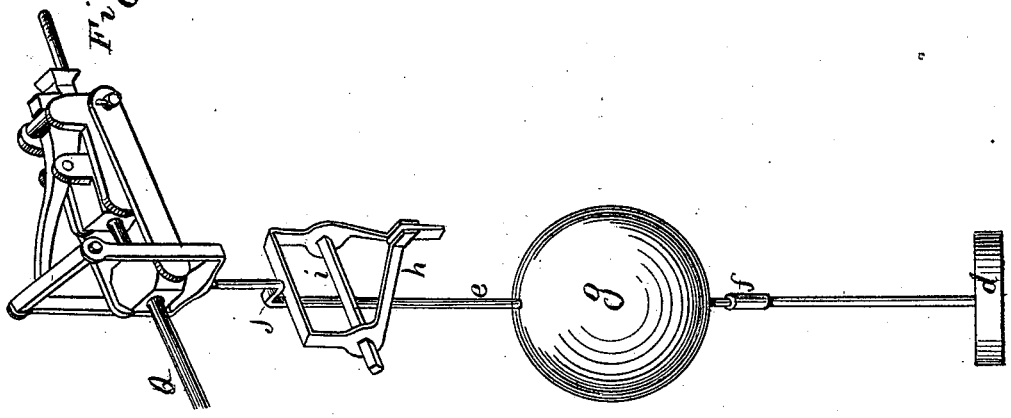
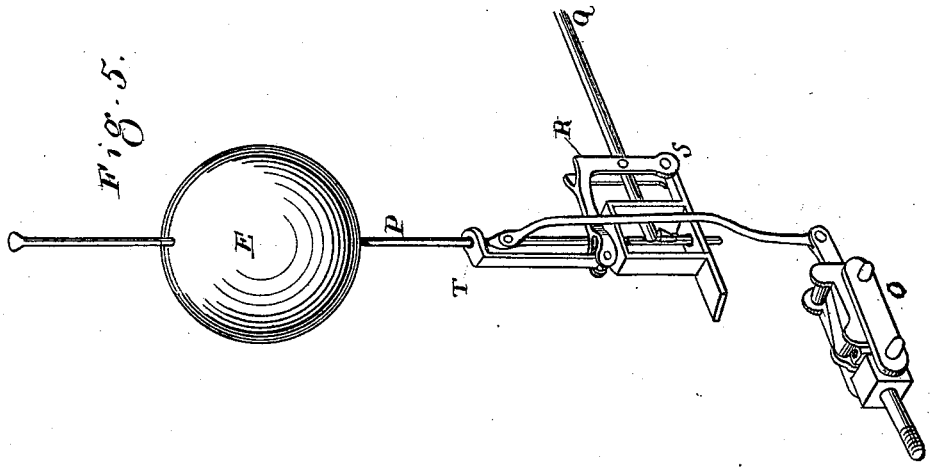


Fig. 5.



Witnesses

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UNITED STATES PATENT OFFICE.

JOHN PATTEN, OF SPRUCE MOUNTAIN, NEVADA.

IMPROVEMENT IN COMPRESSED-AIR WATER-ELEVATORS.

Specification forming part of Letters Patent No. **211,774**, dated January 28, 1879; application filed March 28, 1878.

To all whom it may concern:

Be it known that I, JOHN PATTEN, of Spruce Mountain, county of Elko, and State of Nevada, have invented an Air-Compressor and Water-Elevator; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawings.

The object of my invention is to provide a novel mechanism which is employed principally to compress air by means of the action or pressure of a column of water; and it may act, secondarily, to elevate another column of water to any desired point by the action and force of the air thus compressed through the medium of suitable mechanism.

The principle of action of my apparatus is to employ the compressed air to force the water upward in a succession of short lifts, in which the air shall not be condensed in bulk within the operating-chambers to so great an extent as to injuriously lessen the proportion of water lifted; and it is accomplished by the employment of a series of double-acting chambers, from which the water flows alternately to another series below, and so on as far as there is fall, or as may be desired; and this column of water compresses the air alternately in each of these lower chambers, and allows it to discharge into a pipe, which carries it to the chambers, in which it is to act to raise the water.

The apparatus will be more fully described by reference to the accompanying drawings, in which—

Figure 1 is a general view of my apparatus. Fig. 2 is a view of the valve-motion of the discharge-chambers. Fig. 3 shows the induction or lifting chambers. Figs. 4 and 5 are detailed views of parts of my invention. Fig. 6 is a view of the valve-stem, valve, and operative mechanism.

In the operation of my apparatus I place the chambers in pairs, A A being the water-discharge or air-compressing chambers, and B B the lifting-chambers.

The compressing-chambers have a water-pipe, C, leading down between or past them and opening into them from below through suitable chambers and valves, which will be more fully described hereinafter. These valves are automatic in their action, and their office is to allow the water to alternately fill and be discharged from the chambers A, so that the action will be continuous. Each pair of these chambers is situated at a considerable distance below the preceding pair or the source of supply, and the pressure of the water as it descends and flows into the bottom of one of the chambers will compress the air in the upper part of the chamber and force it out through suitable valves at the top into a pipe, D, which extends along beside all the chambers, so as to receive the compressed air from each and convey it to the lifting-chambers B.

While one chamber, A, is filling with water and compressing air into the air-pipe, the other chamber of the pair is discharging its water, which descends to the chambers below to perform the same office again, while an inwardly-opening valve allows the discharging-chamber to refill with air for another compression, and so on.

The compressed air from the pipe D is admitted alternately into the chambers B, the lowest pair being so placed that they will be filled by having the head of water a little over them. The air then forces the water from one chamber to one of the pair next above, while its counterpart is being filled from below.

The action of the various valves is automatic, and it will be seen that, by having one or more compression-chambers in excess of the pumping or lifting chambers, a constant flow of water may be provided to any height.

The valves of the compression-chambers A consist of two sets of water and two sets of air valves, a float, E, in each chamber connecting with the stems of the water-valves, so that they are automatically operated by the filling and emptying of the chambers. The valve-stem F of each set of valves has a piston, G, at one end, and two valves, H I, at its opposite end, one of which closes the outlet-opening J, while the other closes the inlet-opening K. The valves are situated in a chamber between the inlet-opening and the outlet-opening, so that when one valve is open the other is closed. The piston G is of larger diameter and area than either of the valves,

so that it will, under an equal pressure of water, operate to close the inlet and open the outlet valve.

The piston G is forced outward by this pressure of water, as above stated, and is forced inward, when the piston is relieved of its pressure, by means of a weight, L, operating in the present case upon a bell-crank lever, M. A spring might be substituted, if desired. The piston is connected with the valve-stem by an intervening link, N, having an elbow-joint, O, which allows the distance between the piston and the valves to be increased or diminished, when desired.

From the elbow-joint a stem, P, projects upward into the pressure-chamber A, and has a head or stop upon its upper end. The float E slides upon this stem, and, as the chamber fills with water, it rises until it strikes the stop, when it will lift the arm of the elbow-joint O, so as to allow it to pass a center and turn over, so as to lengthen the distance between the valves and the piston. This permits the outlet-valve connected with this piston to close independent of any movement of the piston.

It may here be stated that the outlet and inlet valves of one chamber are connected with the piston which is actuated by the pressure of water in the opposite chamber, so that when one chamber is full and the other empty the action of the float in the full chamber allows the outlet-valve of the empty chamber to close, and this brings the water-pressure in the supply-pipe to bear upon the piston in the same chamber, but which actuates the valves in the full chamber, and by its greater area it will open the outlet-valve of that chamber.

In order to prevent one chamber from commencing to fill before the other one is entirely empty, a stem or shaft, Q, extends from the lower part of one chamber to the other, having a guide at each end. A bell-crank lever, R, is hinged at one end to a cross-bar or support, as at S, and is pinned to the stem Q at a point near its angle. The other end of the lever is connected with a sliding ring, T, which clasps the stem P, and when the float in either chamber descends so as to strike this ring it will, by its operation upon the bell-crank lever R, force the stem Q to move inward, which action elevates the ring in the opposite chamber, where it remains until that chamber is emptied. As the water fills one of the chambers the air is compressed, and escapes through the valve U into the conveying-pipe C until the chamber is filled with water and the float has reached the top, where it strikes the stop upon the stem P, as before described.

A lever, V, extends into the chamber just above the end of the stem, and connects with a check-valve, W. A small float, V′, is secured to the inner end of this lever, and when the float E has risen to the top before the opposite chamber is quite empty this small float raises the lever and closes the check-valve, so that no water will escape into the air-pipe. When the water begins to escape from the chamber an inlet-valve, X, will be opened by the exterior pressure of air, and will thus admit a new charge of air to the chamber. The compressed air passing through the pipe D is conveyed to the lifting-chambers, where it enters a pair of these chambers, B, alternately, and by means of a set of valves constructed similarly to those employed in the opposite part of the machine already described.

The ingress-valves Y, for the compressed air, are mounted upon a stem, Z, having an extenal valve, A, opposite to them, which is opened to allow the air to escape after it has done its work and while the chamber is being again filled with water.

A piston, *b*, is secured to the opposite end of the stem Z, and this piston is situated in the opposite chamber, so as to be moved by pressure in its chamber and actuate the valves in the other chamber, similarly to the method already described for the water-chambers. In the present case these valves are all situated in the upper part of their chambers, as they are to operate in air instead of water.

A link and-elbow joint, at C, is operated so as to lengthen out the valve-stem Z by a float, *d*, which moves upon a stem, *e*, so as to lift the stem and operate the link, and this will allow the valves *a* to close, when desired, notwithstanding the pressure of the piston *b*, in a manner similar to the operation of the water-valves H, before described. The float *d* strikes a stop, at *f*, about half-way up the stem, and this raises the stem so as to operate the link. Another float, *g*, above the float *d*, continues to rise until it reaches the top of the chamber, and at that point it strikes a bell-crank lever, *h*, which is secured to a shaft, *i*. One of these levers is fitted into each chamber, and its office is to hold the stem *e* up until the float in the opposite chamber has risen so as to strike the arm of the lever in that chamber.

There are two floats, *d* and *g*, in each one of the lifting-chambers B, and one of these serves as a check-valve to prevent the air from getting into the water-pipe after the air has forced all of the water out of one chamber and the other chamber has not yet filled. While the chamber is partly filled with water, the same float *d* lifts upon the rod that the other float slides on, and keeps the link in the right position. The float *g* reverses the valves and forms a valve in the upper part of the chamber B, which prevents the water from getting into the air-valves in case one chamber should fill before the other is empty.

The shaft *i*, if not in line, may be united by a universal joint, *j*, or other device, and when the arm of one of these levers *h* is moved by the float striking it the opposite arm of the corresponding lever in the other chamber will be disengaged from the stem *e*, so as to allow it to drop and the link to couple or shorten up the valve-stem Z again.

The discharge-valve *k* allows the water to escape into the conveying-pipe I, and the in-

gress-valves *m* allow the water to enter the chamber from the next station below. These valves are fitted to work in a double-acting valve-chamber of any suitable form, at or below the bottom of the operating-chambers. The operation of this part of the device will then be as follows: The air enters a chamber, B, which is full of water, through the ingress-valve *a*, this having been allowed to open and the egress-valve Y to close by the action of the float *g* in the chamber, which has risen so as to release the link, as before described; and the air-pressure thus introduced forces the water out through the valve K connected with this chamber, while the other chamber of the pair is filling with water. The operation is thus made continuous by the alternate action of the chambers, and it will be manifest that the water may be raised to any height by securing the proper fall, so that the air-compressing chamber will be suitably operated. It will also be manifest that the water-supply may be either that derived from the lifting-chambers, or, if employed for the compression of air for other purposes, it may be all or partly derived from other sources.

Various modifications of my apparatus may be made to produce the results above described. In some cases it may be necessary to bring air to high pressures; and if this were attempted by simply filling the chambers with ordinary air, the compression would be so great that very little air would be forced out of the chambers at each operation, and the process would be a practical failure. I, however, overcome this difficulty by introducing air which has already been compressed into the chamber where the finishing compression is to take place, and when the water is then introduced with a higher pressure the already compressed air will not be too much reduced in bulk by the further compression.

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

1. The chambers A A, with their water-pressure pipe C, and the air-pipe D and operating-valves, in combination with the chambers B B, provided with valves and the receiving-pipe C′, the whole operating substantially as shown, and for the purpose herein described.

2. The valve-stems F, having the valves H and I at one end, and the pistons G at the other, and operating in combination, substantially as shown and described, and for the purpose herein set forth.

3. The valves H and I and pistons G, united by the stems F, as shown, in combination with the weights L, or their equivalent devices, to move the piston back, substantially as shown, and for the purpose herein described.

4. The link N, with its elbow-joint O, in combination with the valves, piston, and stem, for the purpose of lengthening and shortening the stem, substantially as shown, and for the purpose herein described.

5. The link N and elbow-joint O in the valve-stem F, in combination with the stem P and movable float E, for the purpose of operating the link, substantially as shown, and for the purpose herein described.

6. The stem Q, and bell-crank lever R pinned to it and to the sliding ring T, in combination with the stem P and float E, substantially as shown, and for the purpose herein described.

7. The float V′, in combination with the check-valve W and lever V, in combination with the chambers A and automatic valves, substantially as shown, and for the purpose herein described.

8. The combination of the exit air-valve U, inlet-valve X, and check-valve W with its lever V and float V′, to prevent the passage of water, substantially as shown, and for the purpose herein described.

9. The lifting-chambers B, having the valves *a* and Y, and the piston *b*, united by the stem Z, and provided with the link and joint C, substantially as shown, and for the purpose herein described.

10. The valves *a* and Y, piston *b*, stem Z, and link *c*, in combination with the stem *e* and float *g*, and chamber B, substantially as shown, and for the purpose herein described.

11. The floats *d* and *g*, upon the stem *e*, acting first to hold the link in proper position, and to reverse the valves after the chambers are filled, in combination with the chamber B, substantially as shown, and for the purpose herein described.

12. The float *d*, sliding upon the stem, and acting as a valve at the bottom, and the float *g*, serving the same purpose when it arrives at the top of the stem, in combination with the chamber B, substantially as shown, and for the purpose herein described.

13. The shaft or shafts *i*, carrying the bell-crank levers *h*, said levers serving to hold up the stems *e* alternately in one chamber and the other until released by the action of the opposite float, substantially as shown, and for the purpose herein described.

14. In combination with the chambers B, with their automatic valves operating as shown, the ingress and egress valves K and *m*, substantially as shown, and for the purpose herein described.

In witness whereof I have hereunto set my hand and seal.

JOHN PATTEN. [L. S.]

Witnesses:
GEO. H. STRONG,
EDWARD A. RIX.