(No Model.)

T. O. PERRY.

PNEUMATIC WATER ELEVATOR.

No. 398,184. Patented Feb. 19, 1889.

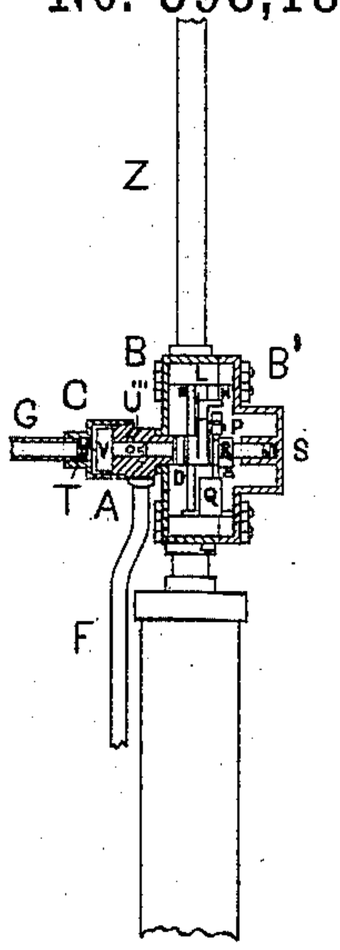
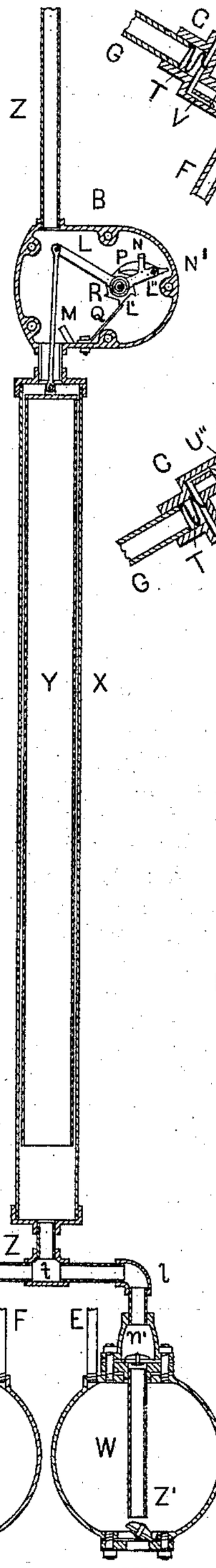


Fig. 4.



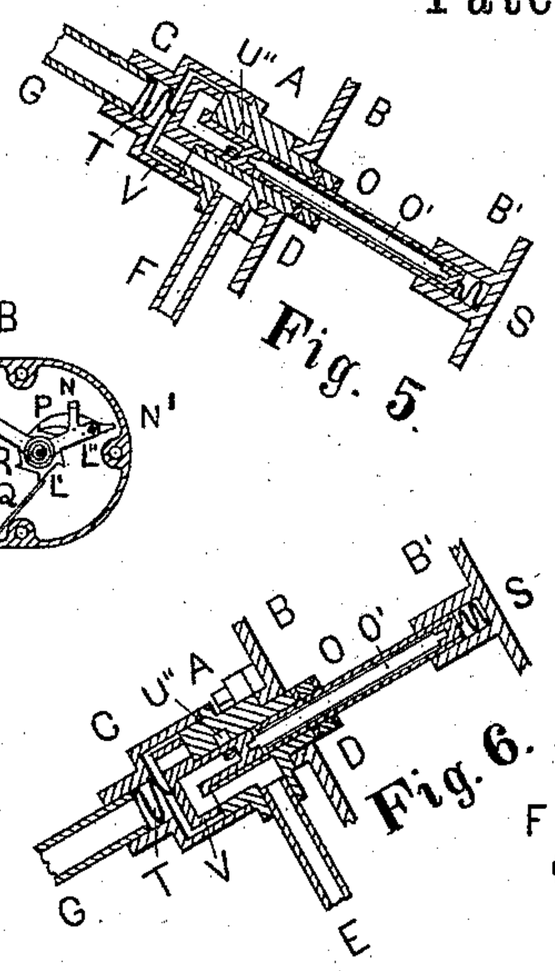
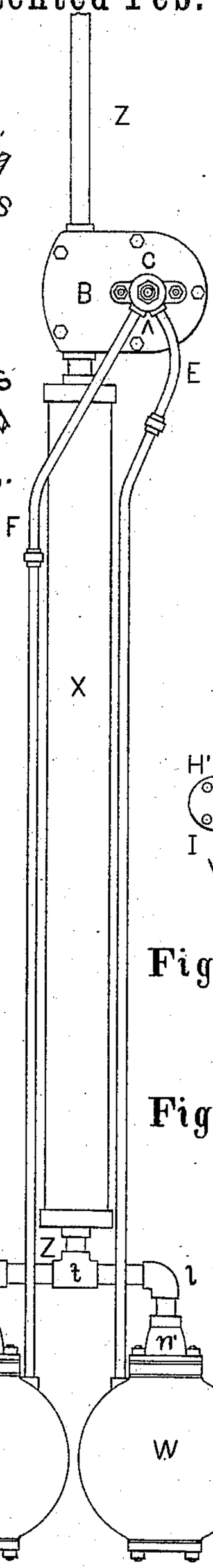


Fig. 5.

Fig. 6.



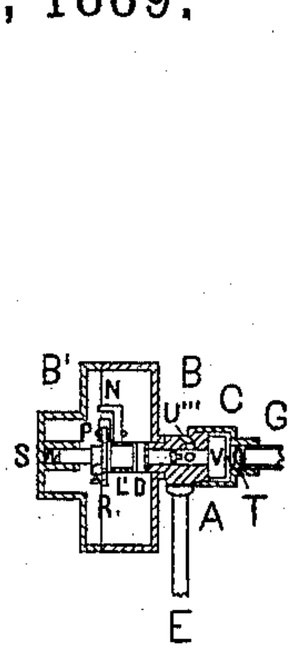


Fig. 3.

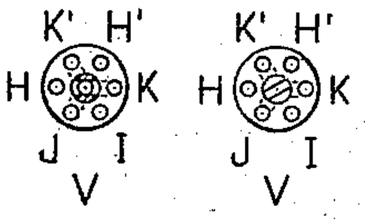
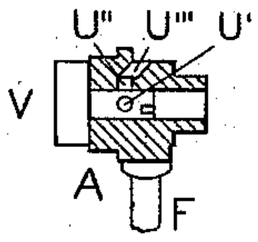


Fig. 12. Fig. 11.



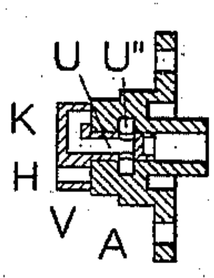
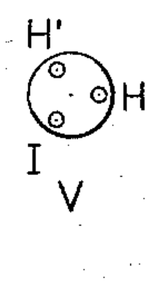


Fig. 8.



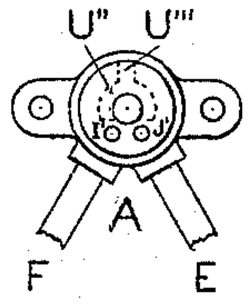


Fig. 9. Fig. 10.

Fig. 2.

Fig. 1.

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Walter C. Burridge.

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UNITED STATES PATENT OFFICE.

THOMAS O. PERRY, OF TECUMSEH, MICHIGAN.

PNEUMATIC WATER-ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 398,184, dated February 19, 1889.

Application filed August 13, 1886. Serial No. 210,761. (No model.)

To all whom it may concern:

Be it known that I, THOMAS O. PERRY, a citizen of the United States, residing at Tecumseh, in the county of Lenawee and State of Michigan, have invented a new and useful Pneumatic Water-Elevator, of which the following is a specification.

My invention relates to improvements in that class of water-elevators in which water is elevated by direct pressure on the water, exerted by the tension of compressed air or other gaseous fluid; and the object of my invention is to provide improved automatic mechanism for controlling the ingress and egress of air to and from the chambers from which the water is driven and elevated.

The main and distinguishing feature of my invention is the operating of the valve which controls the ingress and egress of air through the instrumentality of the intermittent displacement of water by air in some portion of the pipe or passage-way through which the water is driven or elevated, thus enabling the automatic mechanism to be placed at such point in the water-pipe as may seem most convenient, and also allowing the expansive use of air in the water-pipe with increase of economy. I attain these objects by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 represents an exterior side elevation of the entire machine. Fig. 2 is an elevation of a section through the center of the water-chambers and water-pipe. Fig. 3 is a view, partially in section, of the air-valve and connections cut by and to the right of a vertical plane through the axis of the valve. Fig. 4 is a view, partially in section, of the valve and parts cut by and to the left of a vertical plane through the axis of the air-valve. Fig. 5 is an enlarged sectional view of the air-valve and parts in a plane containing the axis of the valve and center of pipe F. Fig. 6 is an enlarged sectional view of the air-valve and parts in a plane containing the axis of the valve and center of pipe E. Fig. 7 is an enlarged vertical section of the valve-seat, also showing the air-valve. Fig. 8 is an enlarged horizontal section through axis of air-valve and valve-seat. Fig. 9 is an enlarged front view of the air-valve. Fig. 10 is an enlarged front view of the valve-seat. Fig. 11 is an enlarged rear view of the air-valve. Fig. 12 is also an enlarged rear view of the air-valve with the end of its hollow stem cut off through the apertures U′.

Similar letters refer to similar parts throughout the several views.

The two water-chambers W are essentially the same as those of other water-elevators of this class. These are supposed to be submerged in water, and are filled through the valves *m m′* at the bottom. The water-pipe Z is connected with each of these chambers by branches Z′, which pass through the tops of the chambers and extend nearly to their bottoms. The air-pipes E and F connect with the tops of the chambers, whereby water is being constantly forced into the discharge-pipe. Now, if air is forced into the top of either of these chambers the water will be forced out and up into the water-pipe. The check-valves *n n′* prevent water from flowing back into the chambers. It is required to force air into one of these chambers until it is emptied of water. Then the air must be allowed to escape, so that the chamber may refill, and while one chamber is refilling air should be forced into the other chamber in the same manner as into the first, thus emptying first one chamber and then the other and allowing each to refill in turn.

So far I have described nothing new, but now proceed to describe what is my invention, viz: my automatic device for regulating the ingress and egress of air to and from the water-chambers in accordance with the requirements above indicated.

X is a float-chamber, which usually constitutes an enlargement of some part of the water-pipe unless the pipe itself should be of sufficient size to make room for a float inside.

Y is a float inside of the float-chamber or water-pipe, and may be simply a piece of wood or cork, or, as shown in the drawings, may be a thin metal cylinder closed at its upper end, so that air contained therein may not escape. The float is made to fill the float-chamber transversely, with the exception of such space around it as may be needed for the passage of water, and there must be sufficient room longitudinally for the float to rise and fall. The upper end of the float is connected by means of a rod or link to the end

of a lever, L L′ L″, whose fulcrum is concentric with the axis of the air-valve V. A pawl, P, is pivoted to the lever at L″ and engages the teeth of a ratchet-wheel, R, whose axis coincides with that of the air-valve prolonged, and the ratchet-wheel is so connected with the air-valve that rotation of the one also causes the other to rotate in like manner. The lever, pawl, and ratchet-wheel are contained and mounted within a suitable case, B B′, constituting another enlargement of the water-pipe, as shown in the drawings. The valve-seat A is either bolted to or forms a part of one side of the case B B′, projecting in front, and the hole through its center forms a bearing both for the valve-stem U and for one end of the short shaft O, upon which the ratchet-wheel R is mounted. The other end of the shaft O has its bearing in the opposite side of the case B′ B.

The air-valve V consists of a cylindrical disk having a stem, U, which serves for a support about which it revolves. The inner face of the disk is ground against the valve-seat A, so as to be air-tight, and is pierced by six openings arranged equidistantly in a circle concentric with the axis. Three of these openings, I I′ I, pass directly through the disk and are alternate with the three other openings, J K K′, which communicate with the hollow stem U, as illustrated.

In the face of the valve-seat A are two openings, I′ J′, the same distance from the center and the same distance apart as any consecutive two of the openings in the face of the valve-disk. These openings I′ and J′ communicate, respectively, with the air-pipes F and E, which lead to the water-chambers W. The disk of the air-valve is inclosed by a cap, C, which screws onto the valve-seat A and forms a terminal to the pipe G, through which compressed air is conveyed to the air-valve. The hollow stem U of the air-valve always communicates through the apertures U′ with a semicircular recess, U″, inside of the valve-seat and close about the stem U, and this semicircular recess communicates with outside air through the aperture U‴.

The downward movement of the lever-arm L is limited either by the stop M, attached to the case B B′, or by the float Y striking the bottom of the float-chamber, and the upward movement of the lever-arm must be sufficient to allow the pawl P to engage succeeding teeth of the ratchet-wheel.

In order to insure that the pawl P shall fall into engagement with the tooth of the ratchet-wheel, said pawl is extended beyond its pivot to form the tail *p*, which will collide with the boss *b* on the inner side of the case B when the lever has been rocked over far enough to carry the point of the pawl past the point of the tooth of the ratchet-wheel. The same means—viz., the collision of the tail *p* with the boss *b*—prevents the float Y from rising farther in the float-chamber, and the length of the link *y* is such that said collision will occur before the float reaches the top of the chamber, as will be seen by inspection of Fig. 2.

The teeth of the ratchet-wheel and the openings in the face of the valve-disk must correspond in number, there being six of each, as illustrated, though other even numbers might be used. The ratchet-wheel R and valve-disk V are so relatively arranged upon the same axis that whenever the lever L is carried down against the stop M some two consecutive openings in the valve-disk will be brought to coincide with the two openings I′ J′ in the valve-seat, and will be left in such conjunction until the arm L is again raised and depressed. The shaft O, which might be simply an extension of the valve-stem U, should turn freely in its bearings, but should be made water-tight where it enters the valve-seat. Now, if air is forced through the pipe G into the air-valve, its course will be directed through conjoining apertures of valve-disk and valve-seat into one of the pipes F E and to the corresponding water-chamber W, from which the water will be driven up the water-pipe Z, filling the float-chamber X, and causing the float Y to rise until the pawl P will engage the next succeeding tooth of the ratchet-wheel R. The flow from the water-chamber will continue until the surface of the water therein is driven down to a level with the lower end of the pipe Z′, after which water will cease to flow from the chamber and air will enter the pipe Z′, and, following up the pipe Z, will enter the float-chamber, displacing water therein, and, diminishing the buoyancy of the float, cause it to descend, bringing the lever-arm L against the stop M. This movement causes the air-valve to turn about its axis through one-sixth of a revolution, rearranging the conjunction of apertures of air-valve with those of valve-seat, so that air will next be conducted from pipe G to the other of the pipes E F, to be conveyed in like manner to the other water-chamber, repeating the operation already described; and it will be observed that whenever one of the pipes E F is in communication with the pipe G the other of the pipes F E will communicate with the hollow stem U of the air-valve, and through the apertures U′, recess U″, and aperture U‴ with the outer air, so that while air is being forced into one of the water-chambers air can also escape from the other water-chamber, as required for allowing it to refill with water. Thus the two water-chambers are successively emptied and refilled.

It will be observed that the air-valve V is rotated progressively about its axis always in the same direction. So soon as air commences to enter the water-pipe the displacement of water renders the contents of the pipe Z lighter, and the column of air and water grows lighter as more air enters. Consequently the air expands, displacing still more water, and the expansion of air in the

water-chamber W sends more air into the water-pipe, so that even if the supply of air from the pipe G were shut off the expansion of the air already in the water-chamber when air commences to enter the pipe Z′ would supply enough air to depress the float; also this expansion of air does useful work in elevating water, which would otherwise be lost if air were not allowed to enter the water-pipe. Furthermore, the presence of air in the water-pipe, by making the total contents lighter, makes possible the elevation of water to a great height with less tension of air than would otherwise be necessary. The aerification and purification of the water may be mentioned as another advantage of this system.

In case of a deep well only the water-chambers W are let down into the water. The automatic mechanism, consisting of the air-valve, float, &c., may be placed at the top of the well or in whatever portion of the water-pipe may be most convenient.

The float Y is preferably made quite long in proportion to its diameter, so that it shall act promptly through its entire range of descent after it commences to move. Otherwise this promptness of descent may be promoted by a spring, Q, fastened rigidly to the case B B′, so that its free end engaging the backs of the ratchet-teeth points shall retard the starting of the float until sufficient force is accumulated to carry it promptly down after the starting resistance of the spring has been overcome.

A projection, N, reaches up from the lever-arm L″ and overhangs the pawl P to prevent the pawl from rising too high or becoming displaced, and a spur, N′, on the pawl at the rear of the pivot, by coming in contact with an internal projection of the case B B′ as the float rises, will serve to force the pawl down, so as to insure its catching the ratchet-teeth in case it should fail to fall of its own weight; but N and N′ are only emergency devices, and not ordinarily needed.

As already stated, the short shaft O could be merely an extension of the valve-stem U; but a flexible connection between the valve-stem and shaft O is deemed preferable and is conveniently effected, as shown in the drawings, by making the shaft O hollow except at its rear end, which is tightly closed by a plug grooved across its inner end, into which groove is inserted the flattened end of a rod, O′, some smaller than the bore of the shaft O, so as to allow of a little side play. The other end of the rod O′ is also flattened and in like manner inserted into a groove across the end of the valve-stem U. (See Fig. 11.) With this connection the rotary motion of the ratchet-wheel is communicated to the air-valve the same as though the connection were rigid; but the seating of the air-valve will not be disturbed by a slight displacement of the shaft O. To prevent leakage where the shaft O enters the valve-seat A, a metal washer surrounding the shaft is pressed against the rear of the valve-seat. This washer is backed by a flexible ring, D, of cork or rubber, closely fitting the shaft, and is confined between the first washer and a second metal washer. This second washer is backed directly by the hub of the ratchet-wheel, which is secured to the shaft by means of a set-screw or in any convenient manner. The lever L L′ L″ is conveniently pivoted about the hub of the ratchet-wheel. A spring, S, inserted between the end of the shaft O and case-wall B′, may serve to keep the first metal washer close against the rear of the valve-seat, and a spring, T, interposed between the air-valve V and end of pipe G, serves to keep the valve pressed against its seat, though tension of the compressed air also serves the same purpose. The case B B′ consists of two parts, B and B′, bolted together.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a pneumatic water-elevator, a pair of submerged water-chambers, air-ducts opening into them, a common discharge-pipe leading from them, and within said discharge-pipe and operating together a reciprocating float and revolving air-valve adapted to be opened and closed by the reciprocation of the float, so as to feed each duct alternately, all combined substantially as and for the purpose set forth.

2. In a pneumatic water-elevator, a pair of submerged water-chambers, air-ducts opening into them, a common discharge-pipe leading from them, and within said discharge-pipe a reciprocating float, revolving air-valve, and a ratchet-wheel and pawl connected to the oscillating float, whereby the valve is opened and closed, so as to feed each duct alternately, all combined substantially as and for the purpose set forth.

3. In a pneumatic water-elevator, a revolving air-valve having the cap C, valve-seat A, having apertures I and J, forming terminals of the air-ducts E and F, and the hollow stem U of the air-valve, having an aperture, U′, always communicating through the semicircular recess U″ in the valve-seat A with the aperture U‴, whereby the ducts E and F are alternately relieved of air-pressure, substantially as and for the purpose set forth.

THOMAS O. PERRY.

Witnesses:
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WALTER C. BURRIDGE.