(No Model.)

T. O. PERRY.

PNEUMATIC WATER ELEVATOR.

No. 382,324. Patented May 8, 1888.

Fig. 8.

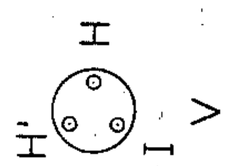


Fig. 7.

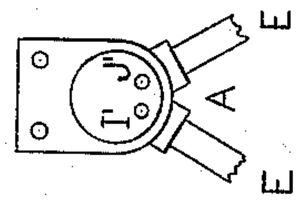


Fig. 4.

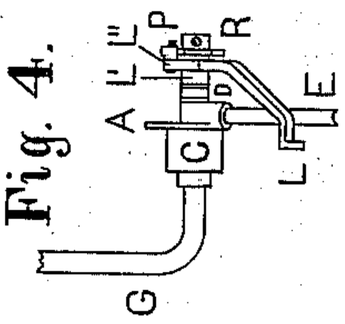


Fig. 5.

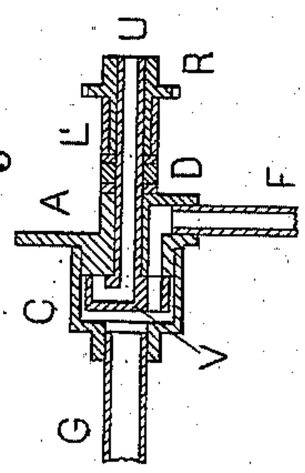


Fig. 6.

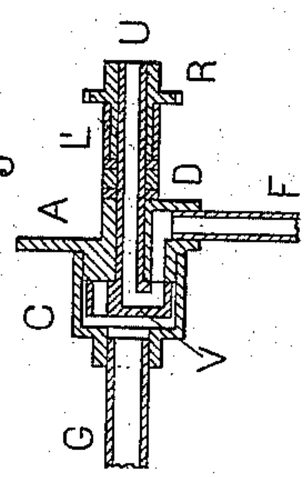


Fig. 9.

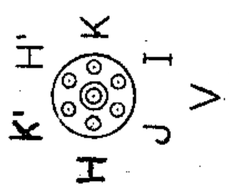


Fig. 10.

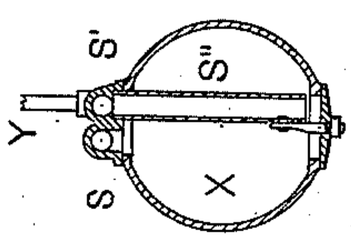


Fig. 11.

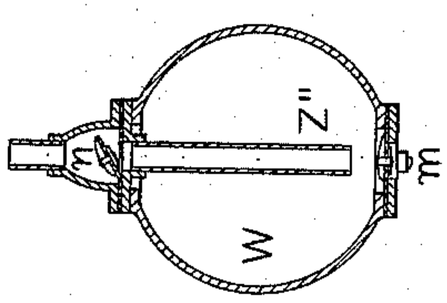


Fig. 3.

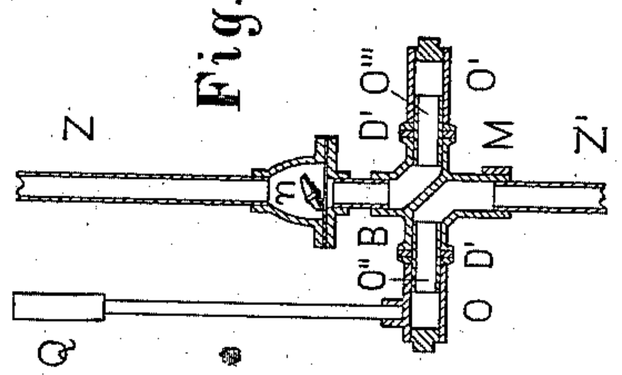


Fig. 2.

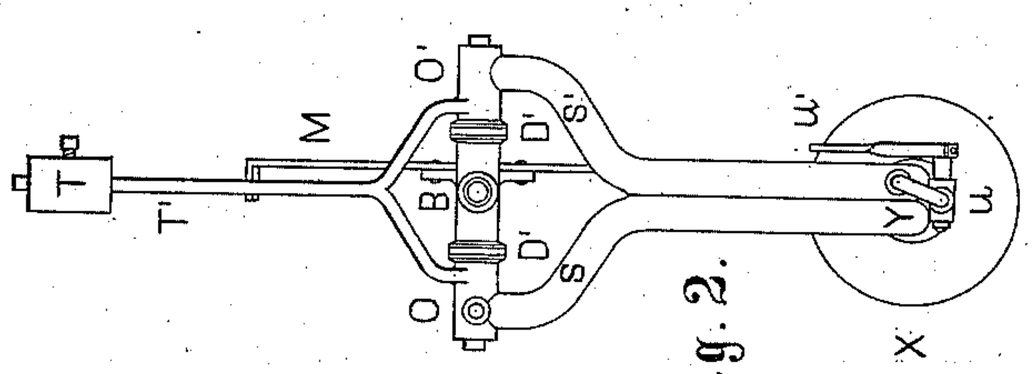
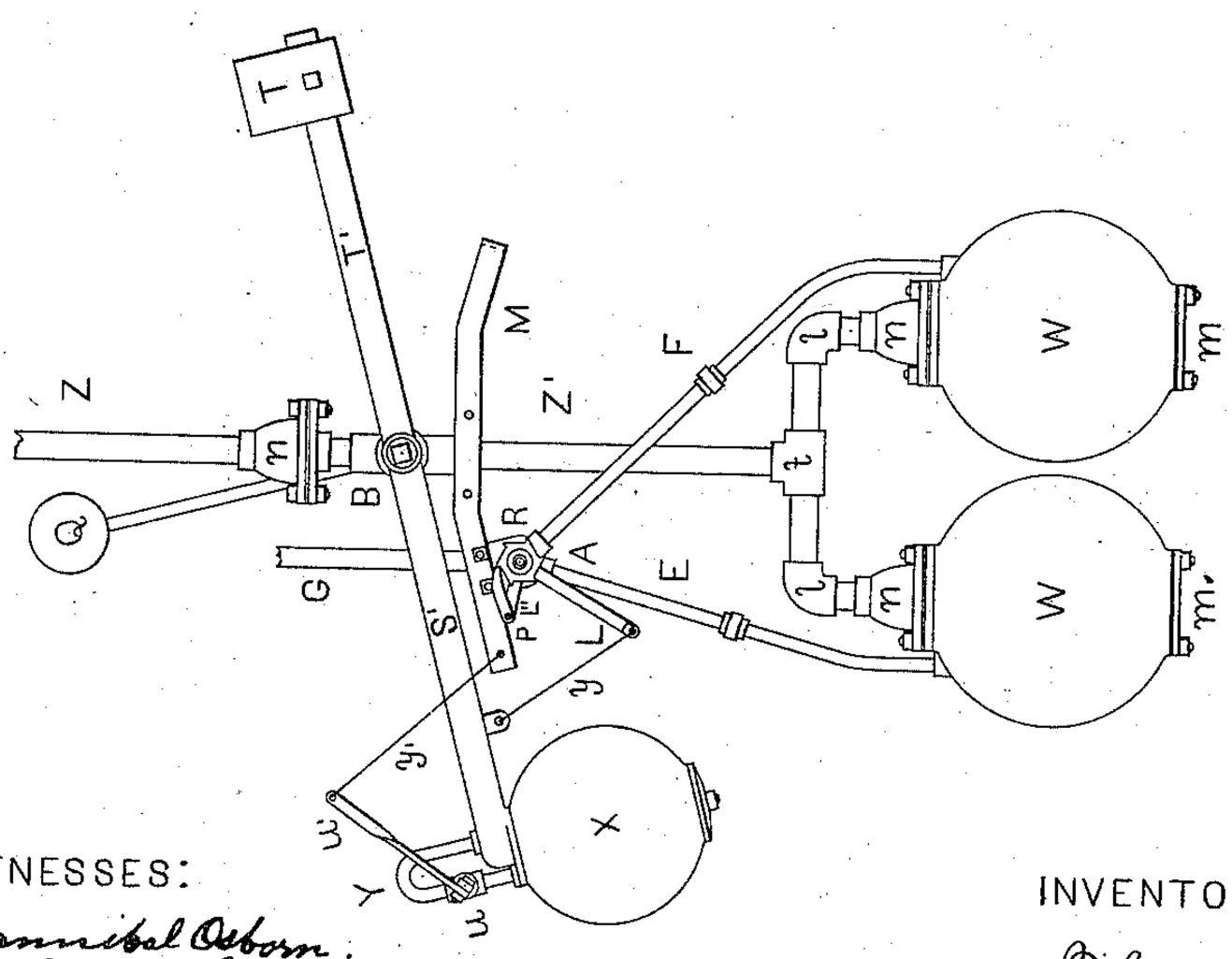


Fig. 1.



WITNESSES:

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Mary E. Keeney

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UNITED STATES PATENT OFFICE.

THOMAS O. PERRY, OF TECUMSEH, MICHIGAN.

PNEUMATIC WATER-ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 382,324, dated May 8, 1888.

Application filed August 26, 1886. Serial No. 211,888. (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 water is driven and elevated, and also to insure greater economy of power in the use of compressed air by allowing a portion of the air which elevates water to work expansively within the water-pipe.

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 a float-chamber, which constitutes an enlarged portion of the pipe through which water is driven or elevated, and is so flexibly connected therewith as to admit of an upward and downward movement of the float-chamber. I attain these objects by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is an external elevation of the entire machine. Fig. 2 is a plan of the float-chamber and connections with water-pipe, supposing the hinged water-ways S S′ to be in horizontal position. Fig. 3 is a vertical section through the center of the water-pipe and in a plane containing the axis of the float-hinge. Fig. 4 is a side view of the parts immediately connected with the revolving air-valve, looking perpendicular to a plane intersecting the angle between the converging pipes E and F. Fig. 5 is an enlarged sectional view of the air-valve and parts immediately connected therewith, taken in a plane containing the axis of the air-valve and center of pipe F. Fig. 6 is an enlarged sectional view of the air-valve and parts immediately connected therewith, taken in a plane containing the axis of the air-valve and center of pipe E. Fig. 7 is an enlarged rear view of the valve-seat, looking at its ground face. Fig. 8 is an enlarged rear view of the revolving air-valve. Fig. 9 is an enlarged front view of the revolving air-valve, looking at its ground face. Fig. 10 is a central sectional view of the float-chamber, taken in a plane parallel with the axis of the float-hinge and perpendicular to the passage-ways S S′. Fig. 11 is a sectional view of one of the water-chambers, taken in a vertical plane through its center.

Similar letters refer to similar parts throughout the several views.

The water-chambers W are both alike and essentially the same as those of other water-elevators of this class. They are supposed to be submerged in water, and are filled through the valves *m* at the bottom of each. The water-pipe Z 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 water-chambers. Now, if air is forced into the top of either of these chambers, water will be driven out and up into the water-pipe. The check-valves *n* prevent water from flowing back into the water-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 water-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. These requirements are common to other pneumatic water-elevators; but I will now describe 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 constituting a vessel closed except at the top, where it communicates directly with the water-way S, and also with the water-way S′, which has an extension, S″, inside of the vessel extending nearly to the bottom. The water-ways S and S′ are connected rigidly to the float-chamber and to each other, but branch and terminate on opposite sides of the casting B in short tubular ends O O′, having a common axis. These tubular ends fit over tubular projections O″ O‴ on opposite sides of casting B, forming water-

tight joints, which serve as a hinge, allowing the float-chamber to rise and fall in an arc of a circle about the axis of the hinge. The casting B forms a double elbow, connecting the tubular end O with the water-pipe Z', entering from below, and also connecting the tubular end O' with the water-pipe Z, entering from above, and interposing a partition between the parts of the water-pipes Z and Z' joined by the casting, so that the water is conveyed up through the pipe Z' and around the partition by way of the water-ways S S' into the pipe Z, passing on its way through the float-chamber X. On the opposite side of the hinge from the passage-ways S S', and attached rigidly therewith, extends an arm, T', upon which is a weight, T, which should be heavy enough to overbalance the weight of the passage-ways S S' and float-chamber X when empty, but should itself be overbalanced when the float-chamber is full or partly full of water, as will be further explained. An arm, M, rigidly attached to and extending on each side of the casting B, serves to limit the angular movement of the arm T' and water-ways S S'. The arm M also serves as a support for the valve-seat A, which is bolted thereto.

The air-valve consists of a perforated disk, V, with a central hollow stem, U, which is inserted and turns freely in a hole through the center of the valve-seat. The adjacent faces of the valve-disk and valve-seat are ground together, so as to be air-tight. The ground face of the disk is perforated by six equidistant openings arranged in a circle concentric with the axis. Three of these openings, H I H', pass directly through the disk, and are alternate with the other three openings, J K K', which communicate with the hollow stem U. (See Figs. 5 and 6.)

In the ground face of the valve seat are two apertures, I' J', the same distance from the axis and the same distance apart as any consecutive two of the six openings in the ground face of the valve-disk. These apertures I' and J' form the terminals, respectively, of the air-pipes F and E, which are screwed into the valve-seat and communicate with the tops of the water-chambers W. The valve-disk is shut in by a cap, C, which screws onto the valve-seat A and forms a terminal to the air-supply pipe G. On the end of the valve-stem U is rigidly secured a ratchet-wheel, R, having six teeth, which are engaged by a pawl, P, pivoted to a short arm, L'', of the lever L L' L'', fulcrumed at L' about the hub of the ratchet-wheel concentrically with the axis of the valve-stem. The longer arm, L, of the lever is connected with an ear on the under side of the water-ways S S' by a link, *y*.

Between the hub of the ratchet-wheel and valve-seat are two metal washers, between which is an elastic ring, D, of rubber or cork, which serves to keep the valve-disk pressed against the valve-seat. Similar elastic rings, D', and washers are interposed about the tubular projections O'' O''' between the casting B and tubular ends O O' as a convenient way of preventing leakage at the hinge-joints. The faces of the metal washers bear against the tubular ends O O'. The teeth in the ratchet-wheel R correspond in number with the openings in the face of the valve-disk and are six in number, as illustrated, though of course other even numbers could be used. As connected, the lever L L' L'' will oscillate with the water-ways S S', and the oscillation must be sufficient to allow the pawl P to engage successive teeth of the ratchet-wheel and may be something more. The ratchet-wheel must be so placed with reference to the valve-disk that whenever the arm T' comes against the stop-arm M the valve-disk shall be so turned about its axis as to bring some consecutive two of the six openings in the face of the disk in conjunction with the two apertures I' J' in the face of the valve-seat. Now, if air be 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'' Z' Z through the float-chamber X, which will partially fill with water, so as to overbalance the weight T, and consequently settle down until its movement is arrested by the stop-arm M. This downward movement allows the pawl P to engage the succeeding tooth of the ratchet wheel R. The air previously contained in the float-chamber would be compressed into smaller compass by the pressure of the column of water in the water-pipe Z above. The flow from the water-chamber W 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, driving the water therefrom until, the weight becoming overbalanced by the opposing weight T, an upward movement of the float-chamber takes place until arrested by the stop-arm M, and this movement causes the valve-disk V to be rotated through one-sixth of a revolution about its axis, rearranging the conjunction of apertures of valve-disk V and valve-seat A, so that air will next be conducted from the pipe G into the other of the pipes E F to be conveyed to the other water-chamber, from which water will be driven in like manner as from the first; but in order that the float-chamber X may again partially fill with water, so as to repeat its downward movement, some of the air with which it was filled when water was driven therefrom must be let out. This is accomplished by the expansion of the air in the water-pipe Z' beneath and in the float-chamber after the surface of the water therein has been driven down to a level with the bottom of the pipe S'', when air escapes into the water-pipe Z above, displacing water, rendering the con-

tents of the pipe Z lighter, so that the air still further expands, making the column still lighter, and escapes from the float-chamber until its tension is sufficiently reduced to permit the required partial refilling of the float-chamber with water when its attenuated air has become again compressed by a solid column of water in the pipe Z above. This operation is repeated whenever one of the water-chambers W is emptied of water, and thus the air which enters the water-pipe by displacing water therein and in the float-chamber furnishes the power for periodically rotating the air-valve, which regulates the admission and escape of air alternately to and from the water-chambers, in accordance with the requirements already stated.

Another way to dispose of the air which accumulates in the float-chamber X is to make the top of the float-chamber communicate with the water-way S′ through a small aperture. The bent tube Y serves such a purpose, and if the aperture be suitably small air will not escape through it with sufficient rapidity to prevent the accumulation in the float-chamber of enough air to drive out the water periodically as required, and yet the accumulated air may all escape from the float chamber before the period of accumulation recurs. This method of letting out the air through an aperture allows the float chamber to entirely fill with water, and consequently it may be considerably smaller than required to be when the previously-described method is used. The first method requires a larger float-chamber and nicer adjustment of the balancing-weight T, and the second method requires a small aperture, which is more liable to become clogged. So to obviate these objections, the tube Y is made sufficiently spacious, and in it is inserted a common service-cock, *u*, with a lever, *u′*, attached, by turning which the passage-way may be either closed or opened. A link, *y′*, connects the end of lever *u′* with one end of the stop-arm M in such a way that when the float-chamber is in its lowest position the passage Y is closed, and when the float-chamber rises to its highest position the passage Y is opened. This arrangement allows the float-chamber to entirely fill with water, if necessary, and permits the accumulated air to readily escape without danger of clogging. In this case, as the service-cock *u* will prevent waste of water, the tube Y need not connect at all with the water-way S′, but may terminate in the open air, so that no air will need to be conveyed through the water-pipe Z above the casting B, though by letting air into the water-pipe Z the contents of the pipe are rendered lighter and the air works expansively, insuring greater economy of power used in compressing the air, and making it possible to elevate water to a great height with less tension of air than would otherwise be necessary.

A retarding-weight, Q, rigidly connected, as shown, with the oscillating parts opposes the effort to oscillate in either direction; but its retarding influence grows continually less after the float-chamber commences to either rise or fall, and after its center of gravity passes the vertical plane containing the axis of the hinge the weight Q accelerates oscillation, thus causing greater promptness of movement after motion begins. The retarding-weight Q, however, is not regarded as either new or always essential. A check-valve, *n′*, in the water-pipe just above the casting B, may be useful to prevent water from flowing back into the float-chamber from the pipe Z above; but this check-valve is not indispensable.

Generally only the water-chambers W are submerged; but the float-chamber X may also be submerged in water, in which case the balance-weight T may be dispensed with, as the buoyancy of the water would cause the float-chamber to rise when filled with air.

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

1. In combination with a submerged water-chamber and discharge-pipe leading therefrom, having at a point higher than the level of the water in which said chamber is submerged an extending arm which forms a part of the course of discharge of the water through said pipe, and which is adapted to oscillate up and down and which comprises a float-chamber, an air-duct leading into said submerged chamber, a revolving valve controlling the passage of compressed air through said duct and alternately admitting and excluding the same, and suitable connections whereby the oscillating arm of the water-discharge pipe actuates said valve, substantially as and for the purpose set forth.

2. In combination with a pair of submerged chambers, discharge-ducts leading therefrom, respectively, and the common discharge-pipe into which the said ducts communicate, said discharge-pipe having at a point higher than the level of the water in which the said chambers are submerged an extending arm forming a part of the water-course through said discharge-pipe, and adapted to oscillate up and down and comprising a float-chamber, two air-ducts leading into the submerged chambers, respectively, a revolving valve at the junction of such ducts, admitting compressed air to the said chambers alternately, and suitable connections whereby the oscillating arm of the water-discharge pipe actuates the revolving valve, substantially as set forth.

3. In a pneumatic water-elevator, the water-way having an extending arm forming part of the water-course, adapted to oscillate up and down and comprising a float-chamber, in combination with a pair of submerged water-chambers, air-ducts opening into them, a revolving air-valve at the junction of said ducts, and a ratchet-wheel and pawl actuated by the oscillation of the float chamber, whereby the valve is rotated so as to feed each duct alternately, substantially as set forth.

4. In a pneumatic water-elevator, in combination with the water-way Z′, stop-arm M,

rigid with said water-way, the water-way Z, and the casting B, forming the connection between the water-ways Z′ and Z, the water-ways S and S′, hinged to the casting B, the float-chamber X at the junction of the water-ways S and S′, an air-passage, Y, service-cock *u*, and link *y*′, substantially as and for the purpose set forth.

5. In a pneumatic water-elevator, a pair of submerged water-chambers, a common water-way, Z, leading therefrom, the stop-arm M, rigid on said water-way, an extending arm comprising the water-ways S S′, hinged to the casting B, the float-chamber X at the end of said arm, air-ducts opening into the water-chambers, a revolving air-valve at the junction of said ducts, a ratchet-wheel and pawl actuated by the oscillation of the float-chamber, the air-vent *y*, service-cock *u*, and link *y*′, all combined substantially as and for the purpose set forth.

THOMAS O. PERRY.

Witnesses:
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J. N. SATTERTHWAITE.