W. H. SMITH.

AUTOMATIC LIQUID ELEVATOR.

APPLICATION FILED OCT. 21, 1909.

1,009,349.

Patented Nov. 21, 1911.

2 SHEETS—SHEET 1.

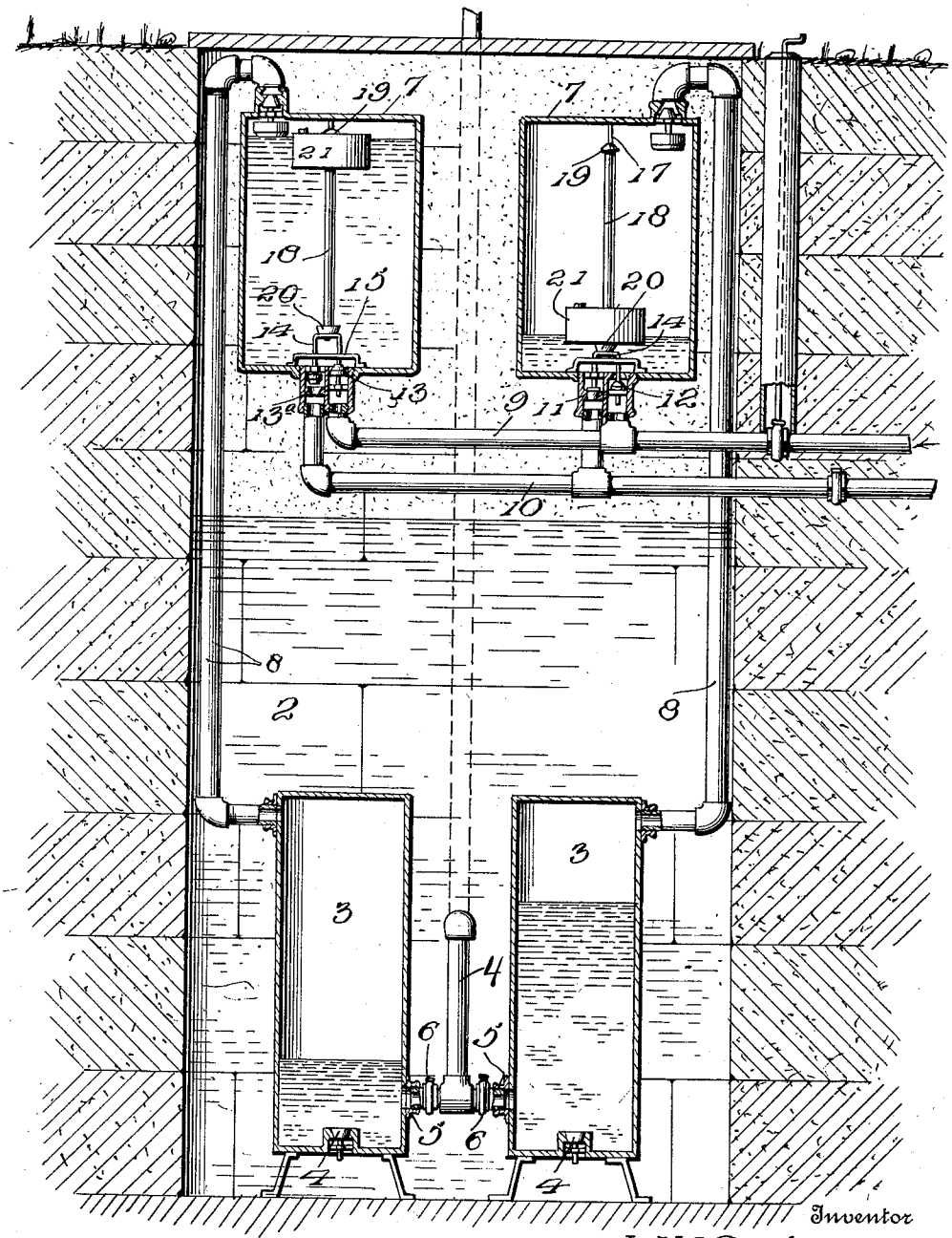

FIG. 1.

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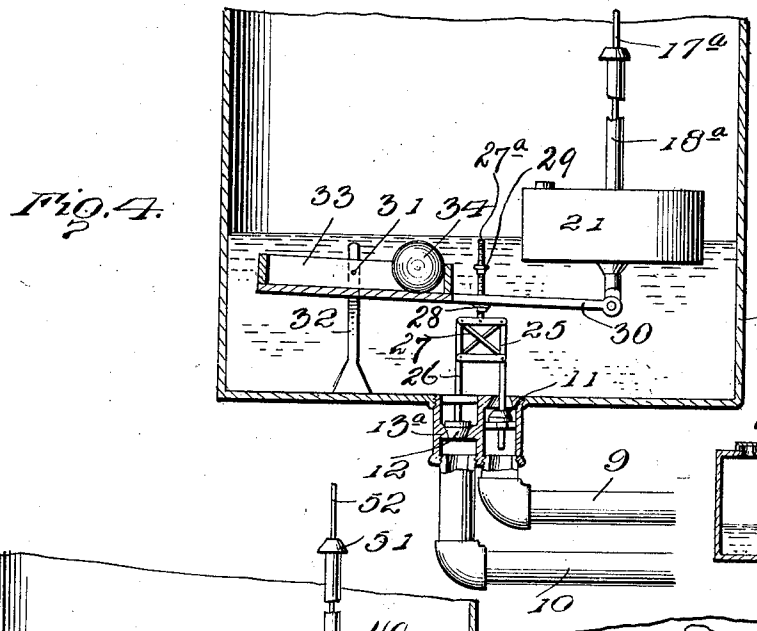

Fig. 4.

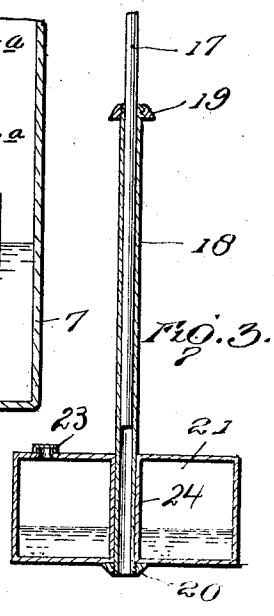

Fig. 3.

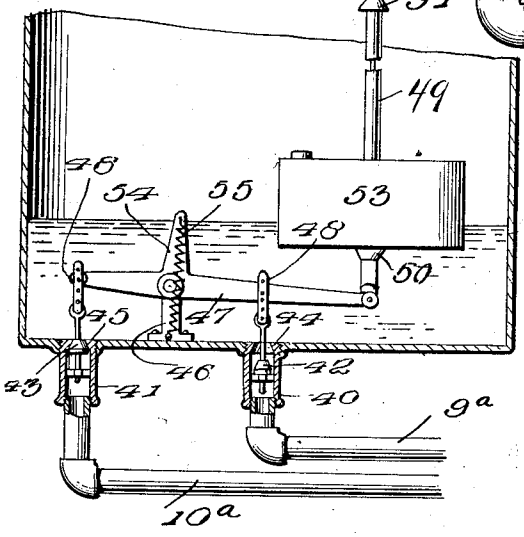

Fig. 5.

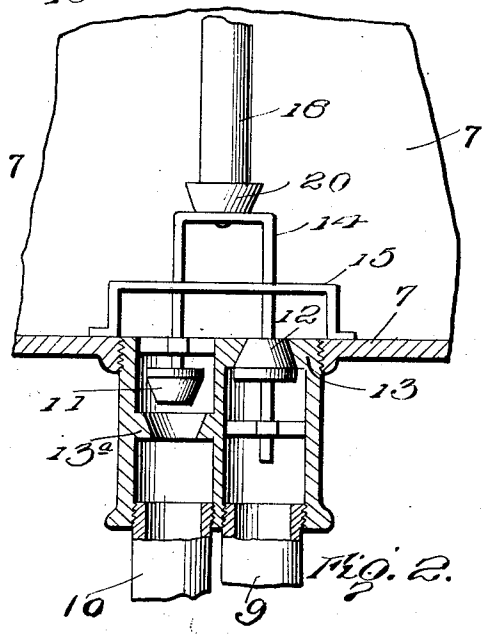

Fig. 2.

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UNITED STATES PATENT OFFICE.

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AUTOMATIC LIQUID-ELEVATOR.

1,009,349. Specification of Letters Patent. Patented Nov. 21, 1911.

Application filed October 21, 1909. Serial No. 523,859.

To all whom it may concern:

Be it known that I, WILLIAM H. SMITH, a citizen of the United States, residing at Windsor, in the county of Henry and State of Missouri, have invented certain new and useful Improvements in Automatic Liquid-Elevators, of which the following is a specification.

My invention relates to devices for raising liquid from a lower level to a higher level, and particularly to a means for lifting liquid by water power.

I have shown my invention as applied to raising water from a cistern, well or other water receptacle, but I do not wish to be limited to this application of my invention.

The object of the invention is to provide a construction whereby the water from a city water supply or from any other source, may be used to automatically elevate water from a cistern or other receptacle to a higher level, and the invention includes what may be termed a pumping chamber. This pumping chamber is connected to the upper portion of the reservoir, and also connected at its lower end to a water inlet pipe and a water discharge pipe. Water is admitted into the chamber and gradually rises therein, forcing a column of air from the upper portion of the chamber into the reservoir. The water in the reservoir is forced out therefrom through a discharge pipe by the incoming air from the pumping chamber. When the water has risen to its full height in the pumping chamber, the water inlet valve thereto is closed and the discharge valve is automatically opened, the water passes out of the pumping chamber, and the air returns from the reservoir into the pumping chamber. When water has been entirely discharged from the pumping chamber, the outlet valve therefrom is automatically closed and the inlet valve automatically opened at the same time, whereupon the water will again enter the chamber, force out the air therefrom into the reservoir, and force out the water which has meanwhile entered the reservoir from the supply thereto. It will be seen that a construction of this character requires no attention, that it is automatic in its operation, and that it may be operated by water from the main city supply or from any suitable source.

The mechanism is extremely simple and, as before remarked, entirely automatic in its action, and requires no attention such as has to be paid to pumps and other power driven pumping means.

I have shown in Figure 1 a double pumping apparatus for the purpose of getting a continuous elevation of water, but inasmuch as the two halves of the apparatus are precisely similar only operating alternately, I will first describe the construction whereby an intermittent supply of water is secured, in other words, one half of the double mechanism shown.

For a full understanding of the invention and the merits thereof and also to acquire a knowledge of the details of construction, reference is to be had to the following description and accompanying drawings, in which:

Fig. 1 is a transverse section of the cistern or like construction, the pumping and receiving tanks being in section; Fig. 2 is an enlarged detailed sectional view of the valve mechanism shown in Fig. 1; Fig. 3 is a view of the float detached; Fig. 4 is an enlarged transverse sectional view of the lower portion of one of the pumping cylinders with the modified form of valve gear; and, Fig. 5 is a like view showing another modification in the valve gear.

Corresponding and like parts are referred to in the following description and indicated in all the views of the drawings by the same reference characters.

Referring to the figures, 2 designates a well, cistern or other reservoir of water, and 3 designates a receptacle therein forming a collection chamber. This chamber 3 has an opening at its lower end connecting with the reservoir 2, but provided with a check valve 4 for preventing the back flow of water from the chamber 3 into the cistern 2. Extending from the lower end of the chamber 3 is a discharge pipe 5 which extends to the locality to which water is to be elevated or discharged. This pipe 5 is provided with the check valve 6 preventing the back flow of water in the pipe 5.

7 designates a tank or chamber made preferably of galvanized iron and located within the cistern, which I shall hereinafter term the pumping chamber. The upper portion of this chamber is connected to the upper portion of the chamber 3 by the pipe 8. An intake pipe 9 enters the lower portion of the chamber, and a discharge pipe 10 extends therefrom. This intake pipe is to be connected to any suitable source of constant water supply, such as the city water system

wherein the water is supplied at a constant pressure, and the discharge pipe may be connected to the sewer, or extended to any suitable point of discharge. The openings to these pipes 9 and 10 are controlled by valves 11 and 12. The valve 12 upon an upward movement seats against a valve seat 13 so as to close the inlet pipe against an inlet of liquid into the pumping chamber 7, while the valve 11 seats against a valve seat 13[a] upon a downward movement of the valve, thus the valve 12 closes against pressure from the outside while the valve 11 closes against pressure from the inside of the tank 7. These valves are both attached to a yoke 14 movably supported in a frame 15, so that the valves shall rise and fall simultaneously. It will be seen that the downward movement of the yoke closes the valve 11 against its seat 13[a] and opens the valve 12, while an upward movement of the yoke 14 closes the valve 12 and opens the outlet or discharge valve 11. Extending downward from the top of the chamber 7, is the depending guide 17, which guide enters the upper end of a tubular rod 18. The upper end of this rod is formed with a shoulder 19, while the lower end of the rod is formed with a shoulder 20. Slidably mounted upon the tubular rod 18 is the float 21, which may be of any suitable character, but is preferably formed as an annular chamber having a central sleeve 24 which loosely surrounds the rod 18, so that the float can move freely up and down upon the rod. The float chamber is provided with a filling opening closed by a cap 23, so that the proper amount of water or other weighty material may be placed within the float chamber, so that the buoyancy of the float may be varied as necessity demands.

The operation of this form of my invention is as follows:—When the inlet valve 12 is closed and the outlet or discharge valve 11 is open, then water is passing out from the tank 7 and into the discharge pipe whereby it is carried to a sewer or any other discharge point. The pressure against the inlet valve will hold it in position because of the fact that when the outlet valve is open, the pressure upon the inlet valve 12 is removed. When the float reaches the lower shoulder 20 on the rod 18 and the water has so far fallen in the tank that the whole weight of the float comes upon the rod 18, then the inlet valve 12 will be pushed down or opened, the outlet valve at the same time being closed. The inlet valve being open and the tank filling with water, it will be seen that the pressure is upon the valve 11 to hold it closed, and that the valve 11 will be held closed until the float reaches the shoulder 19, whereupon when the float rises the rod 18 will be lifted, the inlet will be closed and the outlet pipe opened.

The principle of the double valve as shown in Figs. 1, 2 and 4 is as follows. Referring for instance to the parts as shown in Fig. 1, it will be seen that water is now entering from the water main and therefore the full force of the water in this supply pipe or main is in the tank and therefore acts against the outlet valve 11 to hold it to its seat, the full force of the city water pressure, say 30 lbs. to the square inch, acting against this valve. When the float reaches the shoulder 19 it must have enough elevating force to overcome the city water pressure on the valve 11. As soon, however, as the valve 11 has been lifted from its seat, the pressure in the water main acts to force the valve 12 to its seat. It will be seen that this is a very quick action and that the action of the valve to a very large extent depends upon the pressure in the water main. Pressure in the pumping chamber 7 is now relieved and the water passes out through the outlet pipe. The valve 12 is now held firmly to its seat by the full pressure of the city water in the pipe 9. The pressure against this valve holding it to its seat is the same per inch as the pressure on the other valve when it is in its seat. To reverse the valves, the float must each time overcome the pressure of the water in the pipe 9. This valve construction is particularly effective in practice, and tends to operate the valves quickly and completely. The valves do not open gradually and close gradually but open at once to their full extent.

Now as the water rises within the tank 7 it forces a column of air through the pipe 8 into the upper end of the tank 3 which has previously been filled with water. As the air passes from the tank 7 to the tank 3 it acts as a piston forcing the water from tank 3 out through the discharge pipe 5 to the house or place to which the water is to be delivered. As the water flows out of the tank 7 upon a reversal of the valves 11 and 12, the column of air will be drawn back into the tank 7 from the tank 3, whereupon the pressure of water in the cistern 2 will open the check valve 4 and the water will be forced into the tank 3 filling the same. The relative capacities of the tanks 3 and 7 are such that when the float has dropped to its lowest position the tank 3 will be filled and when the float has risen to its highest position the tank 3 will be emptied.

While I have shown a pair of tanks 3 and a pair of tanks 7 all located within the cistern 2, I do not wish to limit myself to this, as it will be obvious that the tanks 7 might be located exterior to the cistern without affecting the principle of my invention. The mechanism heretofore described will of course operate intermittently in discharging water from the pipe 5, and in order to

secure a continuous discharge of water, I duplicate the apparatus described providing however a common discharge pipe 4 into which the discharge pipes 5 of each pumping tank 3 empty. By using two systems operating alternately the tanks can be made smaller in proportion and the cost will not be greatly in excess to using one system. These systems, of course, operate reversely so that one of the tanks 3 is filling while the other tank 3 is emptying. Attention is particularly called to the fact that the air in the upper portion of the tank 7 returns into the tank 3 after each reverse movement of the inlet and outlet valves. The air simply acts as a piston rod connecting a motor chamber with a pumping chamber, the arrangement for reversing the motion of the piston being automatic in its action and requiring no attention. The same column of air is used again and again. It will be seen that my device is not a system of compressing air for the purpose of operating a mechanism or transmitting power, but a system for pumping liquids, wherein the air is merely an intermediate agent between the rising water in one tank and the water being forced out in the other tank.

The construction previously described is preferably used in situations where the pressure of the liquid in the inlet pipe 9 is not too great for the float to reverse the valves. If the pressure in the inlet pipe is however too great for this operation, then I preferably use the construction shown in Figs. 4 or 5.

Referring to the construction shown in Fig. 4, 7 designates the tank heretofore referred to which is alternately filled and emptied of water for the purpose of forcing air into and withdrawing air from the tank 3. 9 designates the inlet pipe and 10 the outlet pipe, 11 designating the outlet valve and 12 the inlet valve, while, 13 and 13ª designate respectively the inlet valve seat and the outlet valve seat, all arranged as previously described. The valve stems 25 and 26 are connected rigidly to each other by a yoke 27, a stem 27ª on the yoke projecting upward and being provided with shoulders 28 and 29. This stem 27ª passes freely through an opening in a lever 30, which lever is pivoted at 31 in a standard 32 mounted on the bottom of the tank 7. One end of the lever is provided with a trough 33 or runway closed at its ends and mounted so that it projects equidistantly on each side of the pivotal point 31. Carried within this trough 33 is the freely rolling ball weight 34. The other extremity of the lever beyond the valve stems is pivotally attached to a float rod 18ª which is constructed precisely similar to the rod 18 previously described, the rod being tubular and being guided upon a member 17ª. The tubular rod 18ª is provided at its upper and lower ends with the shoulders 19 and 20 as previously described. The float 21 is as before described and slides freely upon the rod 18ª. The operation of this form of my invention is practically the same as previously described, but the movement of the valves is aided by reason of the ball 34. Thus when the float falls to its lowest position and strikes against the shoulder 20, the ball 34 will roll down the trough toward the float end of the lever 30 and will assist the float in forcing downward the valve stems 25 and 26, thus opening the inlet valve and closing the outlet valve. The ball 34 will hold the valves in this position until the float has risen to its full extent. As the float rises it will lift the lever without however, lifting the rods 25 and 26, because they slip through the lever. As the lever 30 rises and becomes inclined toward its free end the ball 34 will roll downward to the free end of the trough, thus carrying the lever 30 upward with a rush, whereupon it will engage with the shoulders 29 and quickly lift the valves 11 and 12, closing the inlet pipe and opening the outlet pipe.

In Fig. 5, I show another form of my invention, which however operates in the same manner as that just previously described. In this form the tank 7 is provided in its bottom with the inlet and outlet valve chambers 40 and 41 which are separated from each other instead of being adjacent to each other, as illustrated in the other figures. 9ª designates the inlet pipe and 10ª the outlet or discharge pipe corresponding with the pipes 9 and 10 previously described. Carried within the valve chambers 40 and 41 are the valves 42 and 43, 42 being the inlet valve and 43 the outlet valve. The inlet valve seats against a seat 44 located in the upper portion of the chamber 40, while the valve 43 seats against a seat 45 also located in the upper portion of the chamber 41. 46 designates a standard attached to the bottom of the tank and 47 designates a lever pivoted on the standard and corresponding with the lever 30 just previously described. The valve stems of the valves 42 and 43 are connected to said lever by elongated links 48, so that the lever may have a certain amount of motion before moving the valves. The extremity of the lever is connected to a tubular float rod 49 formed with the shoulders 50 and 51 and guided by the pivoted guide rod 52. A float 53 of the kind previously described is slidably mounted on the float rod 49. Mounted upon the upper edge of the lever is an extension 54 approximately triangular in form and having its apex immediately over the pivot of the float when the float is in a horizontal position, and attached to the apex of this extension

54 is the spring 55 which extends down each side of the standard supporting the lever and is attached to the bottom of the tank 7. The operation of this spring is precisely similar to that of the ball 34. The spring holds the lever in one or the other of its inclined positions and resists any movement of the lever. When however, the lever has been moved past the horizontal position, the upper end of the spring will be thrown beyond the pivotal point of the lever and will act to move the lever quickly to its extreme position to open or close one or the other of the valves. The operation of this form of my invention is similar to that previously described. When the lever is in one position the inlet pipe is closed and the outlet valve opened. When the float falls so as to strike the lowermost shoulder the lever will be turned and when it has passed this horizontal position will be moved quickly and will suddenly open the valve 42 and close the valve 43. As the tank fills with water the float will rise until it strikes the uppermost stop or shoulder whereupon the lever will be reversed in its movement and quickly open the discharge pipe and close the inlet pipe. It is particularly important that the valves shall move quickly and be reversed at once. The valves should not move at all until there is sufficient power exerted to instantly reverse them. This is the object of the moving weight 34 and of the spring 55.

While I have shown what I believe to be the preferred details of my invention, I do not wish to be limited to these details, as it is obvious that various modifications may be made without departing from the spirit of the invention.

Having thus described the invention, what I claim is:—

1. An apparatus for elevating liquids including a chamber having a connection to a source of liquid supply and a discharge pipe extending from said chamber, a pumping chamber, a pipe connecting the upper end of the pumping chamber with the upper end of the first named chamber, an integral double valve chamber extending from the bottom of the pumping chamber and divided into two parts by an intermediate wall common to both chambers, one of said parts forming a chamber for an inlet valve and the other forming a chamber for an outlet valve, the inlet valve chamber being formed with a valve seat at its upper end and the outlet valve chamber being formed with a seat below its upper end, both of said chambers having transversely extending guides, a connection between the inlet valve chamber and a source of liquid under constant pressure, an inlet valve in the inlet valve chamber opening upon an inward movement, a valve controlling the passage of liquid through the outlet valve chamber and opening upon an outward movement, a yoke rigidly connecting the two valves so that they shall move simultaneously in the same direction, said yoke engaging said guides, a vertical rod extending upward in the pumping chamber and formed with two oppositely disposed shoulders, and a float vertically movable upon the rod and engaging with the upper or the lower shoulder on the rod at opposite extremes of its movement to raise or depress the rod and actuate the valves.

2. An apparatus for elevating liquids including a chamber having a connection to a source of liquid supply and a discharge pipe extending from said chamber, a pumping chamber, a pipe connecting the upper end of the pumping chamber with the upper end of the first named chamber, an integral double valve chamber extending from the bottom of the pumping chamber and divided into two parts by an intermediate wall common to both chambers, one of said parts forming a chamber for an inlet valve and the other forming a chamber for an outlet valve, the inlet valve chamber being formed with a valve seat at its upper end and the outlet valve chamber being formed with a seat below its upper end, both of said chambers having transversely extending guides, a connection between the inlet valve chamber and a source of liquid under constant pressure, an inlet valve in the inlet valve chamber opening upon an inward movement, a valve controlling the passage of liquid through the outlet valve chamber and opening upon an outward movement, a yoke rigidly connecting the two valves so that they shall move simultaneously in the same direction, said yoke engaging said guides, a vertical tubular rod extending upward in the pumping chamber and formed with two oppositely disposed shoulders, a float vertically movable upon the rod and engaging with the upper or the lower shoulder on the rod at opposite extremes of its movement, and a guide rod depending into the chamber and engaging the tubular rod.

3. In an apparatus for elevating liquids, the combination with a chamber having a connection to a source of liquid supply and a discharge pipe extending upward from said chamber to a point above the inlet to the pumping chamber, of a pumping chamber, a pipe connecting the upper end of the pumping chamber with the upper end of the first named chamber, a double valve chamber connected to the lower end of the pumping chamber and divided into two parts by an integral wall common to both chambers, one of said parts forming a liquid inlet passage and the other part forming a liquid outlet passage, a liquid inlet pipe discharging into the liquid inlet passage and connected to a source of liquid supply under

constant pressure, a liquid outlet pipe extending from the outlet passage, a valve in the inlet passage and seating at the upper end of the passage, said valve controlling the passage of liquid through the inlet pipe, a valve in the outlet passage controlling the outlet of liquid, said valve seating in the lower end of the passage, said valves being rigidly connected to each other by a yoke to move simultaneously in one direction or the other, said yoke being provided with a stem having oppositely disposed shoulders, a lever through one end of which the stem passes, said lever operatively engaging the shoulders at the extremities of its movement, a rod connected to one end of the lever and having oppositely disposed shoulders, a float vertically movable on the rod and adapted to contact with one or the other of the shoulders at the extremities of the movement of the float, and means mounted on the lever acting to hold it against movement from one extreme position to its neutral position and then acting to accelerate the movement of the lever from the neutral position to the other extreme position.

4. In an apparatus for elevating liquids, the combination with a chamber having a connection to a source of liquid supply and a discharge pipe leading therefrom, of a pumping chamber, a pipe connecting the upper portion of the pumping chamber with the first named chamber, an inlet and an outlet pipe extending into the pumping chamber, said inlet pipe being connected to a source of liquid under constant pressure a valve controlling the passage of liquid through the inlet pipe and opening upon an outward movement, a valve controlling the passage of liquid through the outlet pipe and opening upon an inward movement, a yoke connecting both of said valves so that they shall move simultaneously in one direction or the other, said yoke being provided with a stem having oppositely disposed shoulders, a lever mounted adjacent to the opening in said pipes, and through which said stem passes, a rod connected to one end of said lever and having oppositely disposed shoulders, a float vertically movable on the rod and adapted to contact with one or the other of the shoulders at the extremities of the movement of the float, and means mounted on the lever acting to hold it against movement from one extreme position to its neutral position, and then acting to accelerate the movement of the lever from the neutral position to its other extreme position.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIAM H. SMITH. [L. S.]

Witnesses:
B. L. HART,
J. H. HART.