(No Model.) 2 Sheets—Sheet 1.

H. STRATER.

AIR FORCING APPARATUS.

No. 533,097. Patented Jan. 29, 1895.

Fig. 1.

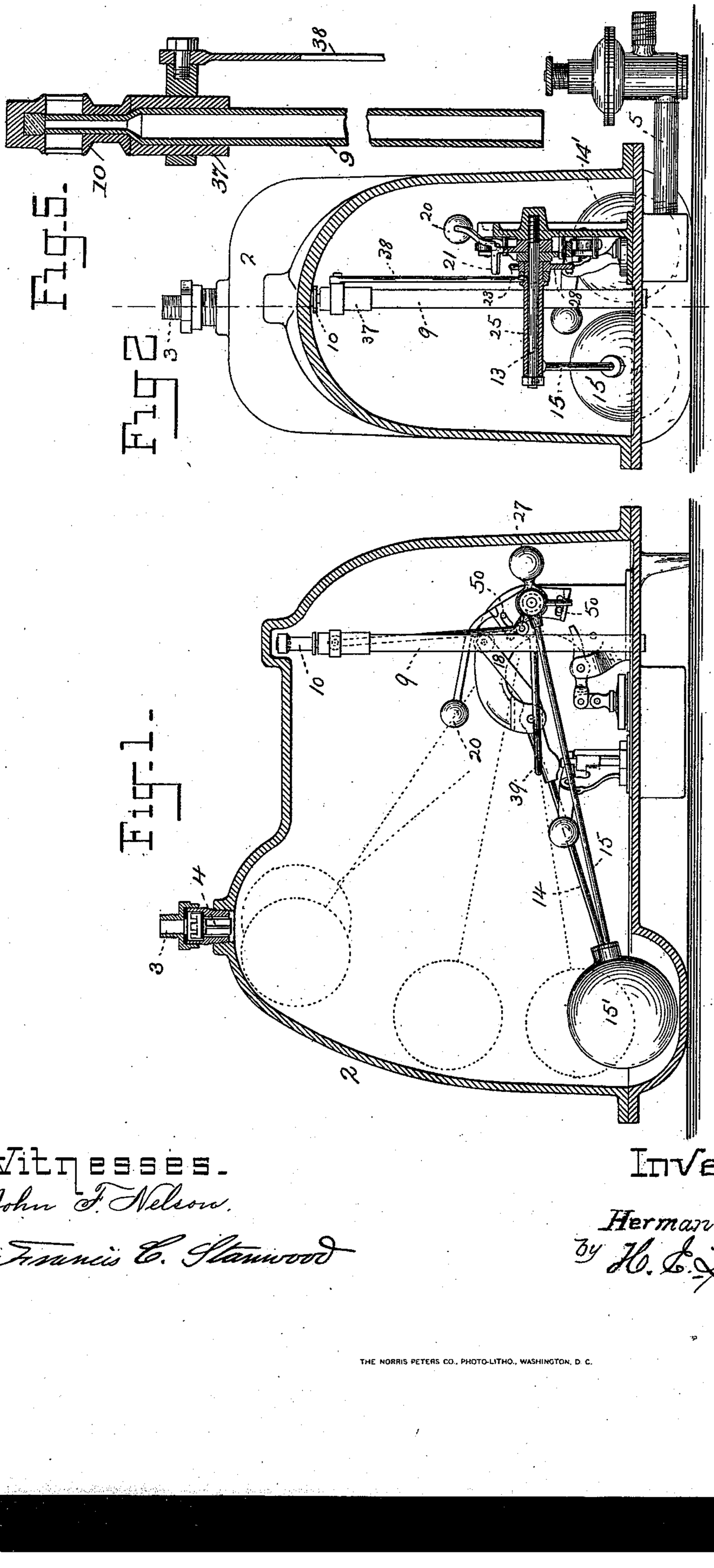

Fig. 2.

Witnesses.
John F. Nelson.
Francis C. Stanwood

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by H. L. Lodge Atty.

(No Model.) 2 Sheets—Sheet 2.

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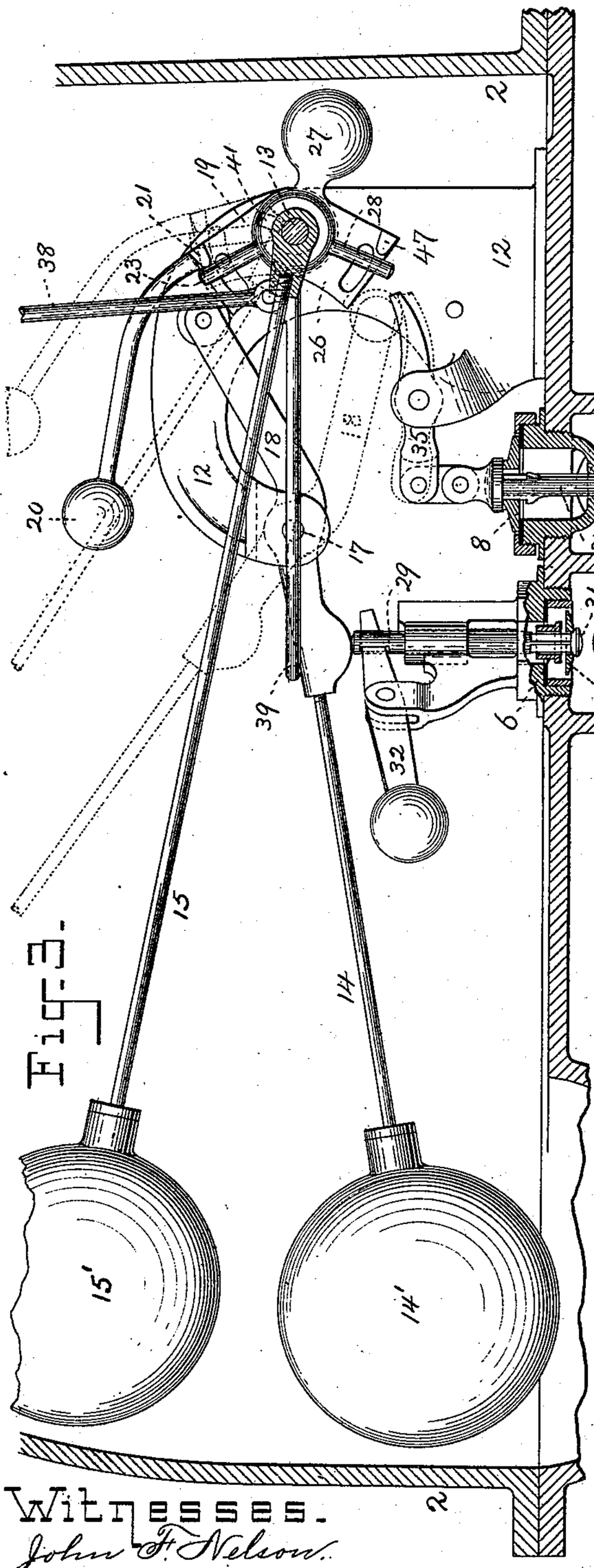

Fig-3.

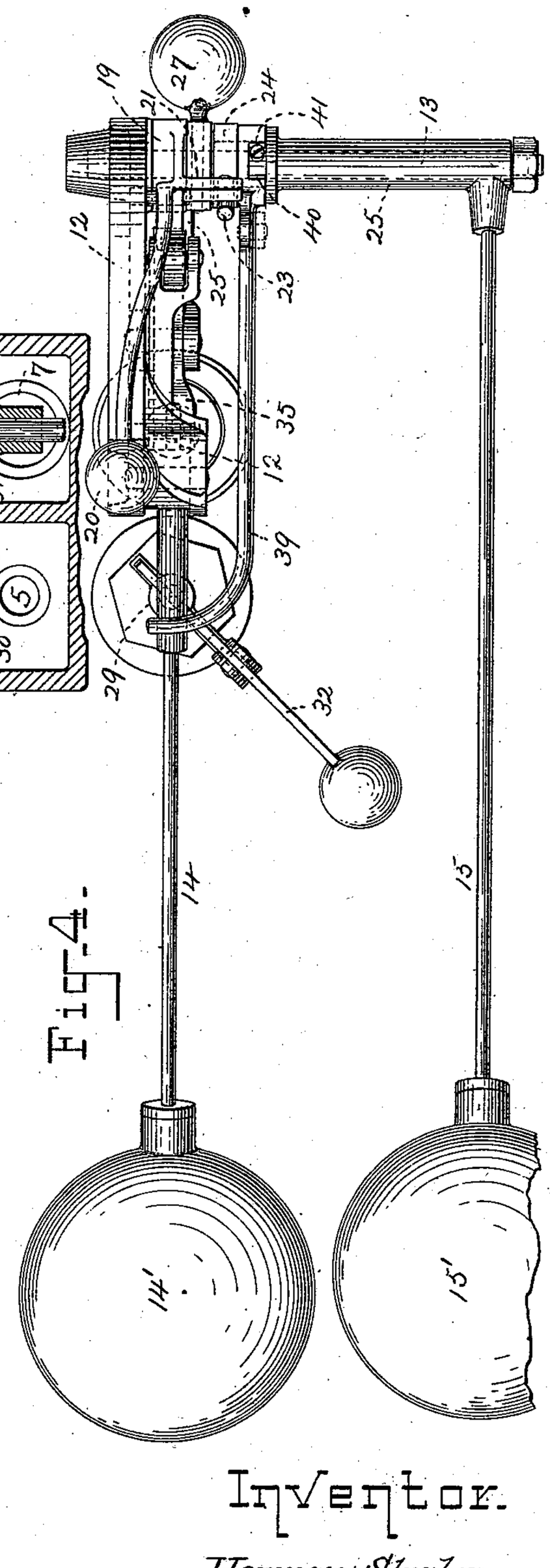

Fig-4.

Witnesses.
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UNITED STATES PATENT OFFICE.

HERMAN STRATER, OF BOSTON, MASSACHUSETTS.

AIR-FORCING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 533,097, dated January 29, 1895.

Application filed March 29, 1893. Serial No. 468,189. (No model.)

To all whom it may concern:

Be it known that I, HERMAN STRATER, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Air-Forcing Apparatus; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to figures of reference marked thereon, which form a part of this specification.

This invention relates to apparatus designed for accumulating air under pressure and accomplished by means of water under a high head entering a closed vessel filled with air and communicating with the air reservoir. After the vessel is filled with water this liquid is discharged, air again allowed to enter and a subsequent displacement of the air again occurs due to the entrance of the water. Thus at every filling of the vessel with liquid an amount of air equal to the cubic contents of the vessel employed is forced into the air reservoir.

My invention relates particularly to the apparatus or mechanism which is grouped together in order to render the process of air-forcing entirely automatic, that is, it provides for, first, admission of air within the operating vessel; secondly, for closing of the said vessel to compel the air within to be expelled into the reservoir when the water commences to enter; thirdly, for opening of the water-supply valve and closing of the water-discharge valve when the act of forcing takes place, and, fourthly, provides for closing of the supply and opening of the discharge water-valves simultaneously with the opening of the air-valve for admission of air as the vessel empties.

The drawings accompanying this specification represent in Figure 1 a longitudinal vertical sectional elevation of an air-forcing apparatus embodying my invention, the apparatus being inactive and the vessel empty. Fig. 2 is a similar view transversely. Fig. 3 is likewise a longitudinal vertical section showing the act of forcing air, the valve lever being locked to hold the water-supply valve open, while the tripping lever is in the act of rising. Fig. 4 is a plan of the same. Fig. 5 is a vertical longitudinal section of the air valve and air-supply tube enlarged.

In said drawings 2 represents an air and water tight vessel fitted with an air discharge 3 to storage reservoir and with a check valve 4, likewise with a water supply pipe 5, a valve 6 therefor, a fluid discharge 7 and valve 8, while a vertical pipe 9 equipped with an air valve 10 controls the admission of external air within the vessel.

The operating parts to regulate and properly time the inflow and outflow of water as likewise the filling of the vessel with air and its forcible expulsion to the reservoir will now be fully described.

An upright goose-neck casting 12 secured to the base of the vessel and formed with a lateral arm 13 supports the operating parts consisting of a valve operating lever 14 pivoted upon the arm 13, as likewise a tripping lever 15 both of which are equipped at their free extremities with floats or air bulbs 14′ 15′. In the case of the valve lever its float is employed to impart a distinct active impulse during inflow of water to the lever, since it is held submerged beneath the liquid until the time occurs to close the supply, when it rises with a strong positive movement. In the case of the tripping lever its float is intended to compel the lever to follow the rise and fall of the water and to time the proper movement of the valve lever. The valve lever 14 is pivoted to the end of the goose-neck casting at 17 and has a rearwardly extending piece 18 equipped with an anti-friction roll adapted to engage a latch 19 loosely mounted upon the arm 13, and gravity weighted at 20. Said latch has a lug or boss 21 formed upon it to engage a prong 23 projecting upwardly from a hub 24 fast upon the rocker sleeve 25 of the valve lever. This latch 19 serves to lock and hold the valve lever submerged during inflow of water, while a similar latch 26 gravity weighted at 27 is loosely mounted upon the arm 13 and is operated by a second prong 28 projecting downwardly and attached to said hub 24. Said latch 26 is rounded to engage the extension 18 and uphold the valve lever when the water commences to discharge. The latches are slotted as shown in Fig. 3 to

allow of stops 50 engaging therein, said stops serving to limit the movement occasioned by the gravity weights 20, 27. After this act to wit: the discharge of water, is complete, the descent of the tripping lever releases the latch 26 and the lever drops, thereby striking the valve rod 29 of the supply valve. This valve is a compound one, the main valve-head 30 being loose on the rod and the latter being equipped with a smaller head 31 which seats on the main head. Since the main head when under full pressure of the service at the time the vessel is empty requires quite a blow to start it from its seat, therefore I have combined with it the small head which can be started easily and the consequent movement of the rod 29 and the valve lever 14 serves to open the valve and the water quickly enters. This supply valve is normally held to its seat by the gravity arm 32. A similar construction is provided for the discharge valve, its own weight normally holding it closed while the valve rod 34 is pivotally supported by the latch 35 the free end of which is adapted to contact with the extension 18 of the lever 14. In connection with the operation of the water supply and discharge valves and mechanism for regulating the proper times for opening and closing of the same I have provided means by which the apparatus admitting external air to the vessel is likewise controlled and at proper intervals of time, viz: to be closed against the escape of air when the vessel is being filled with water and conversely to open when the water is being discharged in order to allow a fresh supply of air to enter and fill the space recently occupied by the water.

The air valve is shown at 10 as mounted upon an upright post or hollow rod 9, and about the latter is fitted a movable sleeve 37 which is actuated by a connecting rod 38 pivotally attached to a finger bar 39 loosely mounted upon the rocker sleeve 25. The hub of this finger bar is notched or recessed at 40 to receive a stud 41 inserted in the sleeve. Thus the valve is held closed by the internal air pressure while the vessel is filling. During this act the tripping lever rises by means of its float until just before all the air has been expelled, the stud 41 engages the hub and by lifting the finger bar actuates the connecting rod and lifts the valve relieving the internal pressure. In this way the water valves are more readily operated. The extremity of the finger bar is curved to overlap the valve lever. Hence when the latter is released and allowed to rise where it is now held in a locked position it engages with said finger bar. The latter now rests upon it and the air valve 10 is in this way held open during the discharge of water from the vessel, air taking the place of the water as the latter escapes. As soon as the tripping lever has reached its lowest position and simultaneously with the release and drop of the valve lever to shift the valves by opening the supply and closing the discharge the air valve is likewise closed by the finger bar following the downward movement of the valve lever. This allows the connecting rod to lower the sleeve 27 when the air valve closes.

Reference to Fig. 1 shows the apparatus in an inactive position the vessel 2 being empty of water but filled with air the floats of the two levers resting in a pocket, which always contains water, in order to cushion and prevent wear which would otherwise ensue provided they came in contact with the metal bottom of the vessel. Furthermore the air valve is closed and the valve lever locked, while the upper latch 19 bears against the extension 18. Since the valve lever now rests upon the valve rod 29 the effects of the gravity weighted arm 32 are overcome and the supply valve 6 is held open, while the discharge valve 8 is shut. Under these conditions and with the several elements in the positions relatively as shown in Fig. 1, I will proceed to explain the operation of filling the vessel with water and discharging the same.

Upon opening of the supply valve water enters the vessel and at once the tripping lever begins to rise by aid of its float 15′. The inflow of water continues, the float assuming, as it rises, the several positions indicated in broken lines in Fig. 1. During this movement the hub 24 fast upon the sleeve 25 is carried therewith until its upper prong 23 meets the boss 21 on the latch 19 loosely mounted on the arm 13. The rise in the level of the water causes the tripping lever by aid of the pronged hub to swing the latch back until the anti-friction roll in the extension 18 of the valve lever is free to pass by. Immediately the submerged float 14 imparts a sudden rapid impulse to said lever which rises at once and assumes the position shown in dotted lines in Fig. 3 the extension wiping past the lower latch 26 and forcibly striking the valve rod lever 35 of the discharge valve 8, which is opened. As soon as the extension 18 has passed the latch 26, the latter rides over and holds the valve lever locked.

Coincident with the rise of the tripping lever before described its upward swinging movement causes the stud 41 to lift the finger bar 39 and so actuate the connecting rod 38 which lifts the sleeve 37 and trips the air valve. This act is timed to occur just prior to the shifting in the position of the valves which are thus relieved from pressure and in this way they can be operated more easily. When the valve lever was released just as the act of filling the vessel is completed the said lever engaged with the finger bar 39 and the latter now rests upon said lever while the said lever is in its uppermost position, and the air valve is kept open during the outflow of the water which now fills the vessel.

Immediately upon opening of the discharge valve 8 the water commences to discharge and as its level drops the tripping lever follows until just prior to the entrance of the float

into the pocket the lower prong 28 has met the lug 47 on the gravity latch 26. The latter is thrust back until the arm 18 of the valve lever is free to pass by when the said lever drops and the momentum occasioned by the effects of gravity, since the vesel is now filled only with air, produces a sudden blow upon the end of the valve rod 29 to trip and open the supply valve 6. At the moment the latch 26 releases the valve lever the latter allows the discharge valve to close, while the fall of the valve lever itself permitted the finger bar to follow its descent and the air valve is allowed to shut the vessel against outside atmospheric conditions. Upon completion of these last changes in the positions of the several elements which comprise this apparatus the various instrumentalities have again assumed their places as shown in Fig. 1. Since the air valve 10 is shut it is evident that the air which occupies the interior of the vessel 2 is compelled to go elsewhere and as the pressure increases owing to the inflow of water into said vessel, such air is forcibly expelled into the discharge pipe 3 and its return prevented by means of the check valve 4.

In connection with the supply pipe 5 I have provided a pressure regulator shown in Fig. 2 whereby the operation of the apparatus is entirely automatic and it is designed to maintain a constant predetermined pressure and to work only at such intervals as is requisite to insure such pressure as a constant quantity.

What I claim is—

1. In air-forcing apparatus a closed vessel provided with supply and discharge water valves, a float-equipped lever to operate said valves, and mechanism adapted to hold said lever against flotation as likewise against the effects of gravity, combined with a float-equipped tripping-lever free to rise and fall upon the water entering and discharging, an air-valve operated by said tripping-lever, together with means for locking and releasing the valve-lever through the agency of the tripping-lever, substantially as specified.

2. In combination a closed vessel, two float-equipped levers, to wit: a tripping-lever and a valve-lever the tripping-lever adapted for free rise and fall upon the water in said vessel, the valve lever to be held locked against rising by flotation or falling by gravity, two gravity latches loosely mounted upon a common shaft, and a pronged hub carried by said tripping-lever and adapted to operate the latches to allow movement of the valve-lever at predetermined times, substantially as set forth.

3. In air-forcing apparatus a closed vessel, supply and discharge water valves, likewise an air valve, a float-equipped lever adapted to operate the said water valves, combined with a float-equipped tripping-lever adapted to open the air valve, and mechanism interconnecting the two levers, whereby the valve lever is released to rise or fall at certain intervals of time, substantially as specified.

4. In combination with a closed vessel having water supply and discharge, as likewise air supply and discharge passages, a float-equipped valve lever adapted to be held locked in two extremes of position, a float-equipped tripping-lever adapted to rise and fall with the varying level of the water, and release the valve lever when in either extreme of position, two gravity-closed water valves—supply and discharge—adapted to be alternately opened by the valve-lever, pivotal arms attached to the valve-rods, and means for releasing the valve-lever by aid of the tripping lever, substantially as set forth.

5. In combination, a closed vessel, two float-equipped levers, comprising a tripping lever and a valve lever, the tripping-lever adapted for free rise and fall upon the water in the vessel, the valve-lever to be held locked against rising by flotation or falling by gravity, two gravity latches loosely mounted upon a common shaft, a pronged hub carried by said tripping lever to operate the latches and allow movement of the valve-lever at predetermined times, two valves to control the fluid supply and discharge, the discharge valve to be opened at the rise of the float 14′, the supply valve to be opened upon the fall of said float, and an air-valve operated by the tripping lever to open at stated times, substantially as described.

6. In air-forcing apparatus, a closed vessel having water supply and discharge valves, a float-equipped valve-lever adapted to be held locked in two extremes of position, a float-equipped tripping lever adapted to rise and fall with the varying level of the water and release the valve-lever when in either extreme of position, combined with an air-valve which admits air within the closed vessel, a rod 38 to operate said valve and pivotally united to a finger-bar, a rocker sleeve 25 suitably supported, and a finger-bar 39 loosely mounted on said sleeve, the finger bar operating to release and close said air-valve upon the fall of the valve-lever, substantially as set forth.

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

HERMAN STRATER.

Witnesses:

H. E. LODGE,

FRANCIS C. STANWOOD.