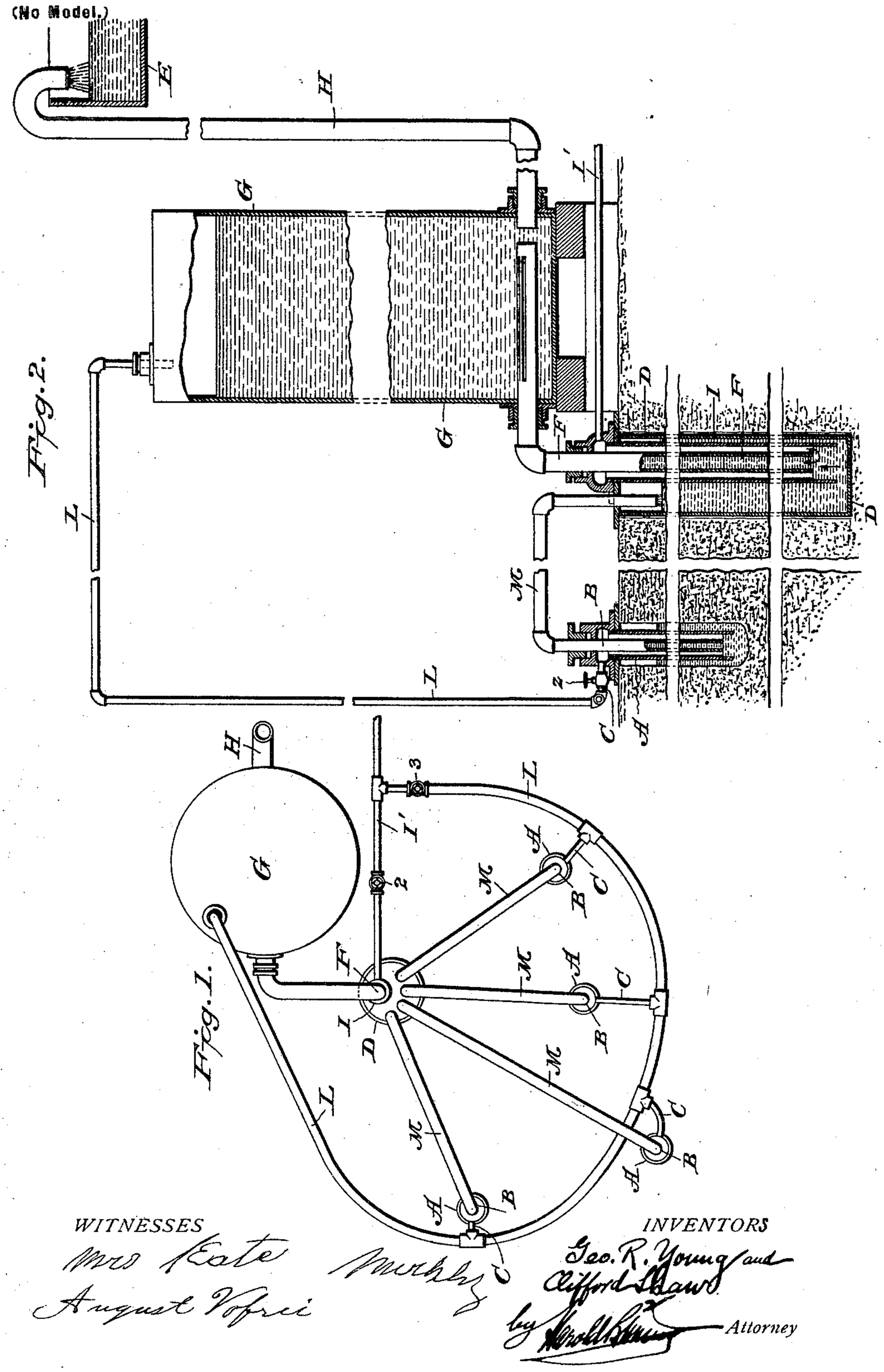
No. 704,608. Patented July 15, 1902.

G. R. YOUNG & C. SHAW.

APPARATUS FOR RAISING WATER.

(Application filed Nov. 23, 1898.)

(No Model.)



WITNESSES

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UNITED STATES PATENT OFFICE.

GEORGE R. YOUNG, OF RIDGEWOOD, NEW JERSEY, AND CLIFFORD SHAW, OF NEW YORK, N. Y., ASSIGNORS TO THE BACON AIR LIFT COMPANY, A CORPORATION OF NEW JERSEY.

APPARATUS FOR RAISING WATER.

SPECIFICATION forming part of Letters Patent No. 704,608, dated July 15, 1902.

Application filed November 23, 1898. Serial No. 697,263. (No model.)

To all whom it may concern:

Be it known that we, GEORGE R. YOUNG, residing at Ridgewood, in the State of New Jersey, and CLIFFORD SHAW, residing at New York, in the State of New York, have invented certain new and useful Improvements in Apparatus for Raising Water, of which the following is a description, referring to the accompanying drawings, which form a part of this specification.

The object of the invention is to facilitate the raising of water from wells in a highly efficient manner by means of the air-lift or aerated column.

Water has heretofore been raised by introducing air into the column of water within a submerged uptake-pipe, whereby the hydrostatic balance is disturbed and the surrounding water forces the aerated column upward in the uptake, the possible elevation depending on the amount of air introduced and on other hydrostatic principles well known to those skilled in this art. The invention to be set forth in this application relates to such system, and this application constitutes a continuation of our applications, No. 636,130, filed May 12, 1897, and No. 660,073, filed November 29, 1897, for the purpose of including in a single patent the claims of both applications and of remedying inadvertent defects in such claims which might otherwise have necessitated a reissue.

The nature of the invention will readily be understood from the illustration of a preferred form of it as given in the accompanying drawings.

Figure 1 is a diagrammatic plan view, and Fig. 2 an illustrative section.

In both the figures the same characters of reference refer to the same or to similar parts.

In many instances a number or gang of supply-wells are necessary to collect the desired amount of water, and it is frequently inexpedient, as well as expensive, to sink such wells to any great depth. Furthermore, it is frequently necessary to raise the water to a considerable height above the level of the source of supply, and to do this by the air-lift requires a correspondingly great depth for the aerated column below the water-level. The present invention is particularly well adapted to both these requirements, especially so if the water has also to be carried some distance horizontally from the wells before its final delivery. Where all these requirements are to be met by the present invention, the supply-wells are to be sunk to such depth only as may serve to allow the raising of the water above ground, and the water from all the supply-wells is delivered to a deep well or pit D, which, with its uptake F and air-pipe I and other connections, forms our means for delivering the water to the intended elevation and locality. The air-supply pipe I′ supplies the air from the compressor or other source to the bottom of the column of water in the uptake-pipe F. Preferably above ground and near the reservoir-well is located a separating-tank G, into which the uptake F delivers the air and water and within which the air separates from the water. By the apparatus so far described, therefore, the water may be raised to the separating-tank, and if this tank is at or above the level of final delivery no further raising of the water is of course necessary. If it be required, however, to raise the water to a higher level and at some horizontal distance, instead of employing the system set forth in Patent No. 592,037, granted to us October 19, 1897, which system aerates water for the second time, we with advantage send the water without aerating it directly from the separator G to and up to the final place of delivery, as E, through suitable piping H, preserving within the separator G enough air-pressure to force the water up to the point of delivery. Instead of wasting the compressed air in the tank G by allowing it to escape through such an escape-valve as is set forth in our said patent we utilize the whole, or as much as may be desired, to effect the raising and delivery of water from the supply-wells A to the reservoir-well D, employing, if needed, regulating-valves Z for each supply-well. The pipe L delivers the air from the separator to the gang of wells A through the branch connections C. The uptakes B deliver into the runners or

horizontal pipes M, which in turn deliver to the reservoir-well D. The air-pipe L may also be connected, so that air may be delivered to it from the pressure-pipe I' through valve 3 to operate the supply-wells in order to fill the reservoir-well, if necessary, before starting the reservoir-well. The valve 2, Fig. 1, serves in such case to shut off the air from the reservoir-well D until the latter is filled sufficiently.

As there is a tendency under certain conditions to very considerable irregularities or fluctuations in the separator (if it be small or shallow and if no automatic regulating-valve is employed) we construct the separator G of such height that the column of water within it may vary considerably to exert a regulating influence on the whole system by increasing or decreasing the hydrostatic pressure due to the difference of levels between the water-level in the separator and the point of final delivery. If the separator is one-fifth or even one-tenth of this height, its regulating action is very effective. The utility of this regulating-separator will be apparent from the following considerations: Supposing the difference in levels between the normal water-level in the separator G and the final point of delivery is one hundred feet, then if the separator G is closed so as to maintain an air-pressure within it, as illustrated, and if the water in the separator-tank should fall four feet, owing, for example, to the pipe F delivering more air and less water, the pressure exerted on the pipe H will be diminished very little, if at all, and therefore the air-pressure within the tank will have increased approximately two pounds. Consequently the air will discharge more rapidly through the pipe L and tend to restore the normal level within the separator-tank G. The separator-tank will act as a regulator even if the valves 2 discharge into the atmosphere for the reasons just explained. If the air above the water in the tank G has entirely free communication with the atmosphere, as would be the case if the tank had no top, the regulating effect would still occur, though obviously the point of delivery of the pipe H would have to be lower than the normal level in the separator-tank G, as the column in the tank G would have to act against the column of water in the pipe H and against the frictional resistance of water passing through the pipe H. Where water is delivered at considerable distance through a horizontal pipe, the frictional resistance is very considerable. Obviously, when the height of water in the tank G rises more water will flow through the pipe H, tending to restore the normal level, and when the level in the tank G falls the rate of discharge will decrease.

The operation of the invention in its most complete form, as described, is as follows: Supposing the levels in the supply-wells and in the reservoir-wells to be whatever the wells are designed for, compressed air is introduced into the air-pipe I of well D under enough pressure to force it below the foot of the uptake-pipe F. The amount of air supplied can then be controlled by the valve 2, Fig. 1, and the rate at which the water is delivered up the uptake will vary accordingly when the full operation has once been established. Air will escape through supply-wells A when the air-pressure in the separator G is sufficient to force the air down to the bottom of the respective uptakes B. The system balances itself when the level in the separator G is such that the water is forced freely up the pipe H, overcoming friction, while the air passes off through pipe L, overcoming friction in pipes C and the depth of water in the supply-wells A, and finally escaping up the uptakes B with the water. The valves Z may regulate the several wells to keep them running evenly, notwithstanding very considerable differences in the amount of water flowing and in the water-levels in them. The depth to which the well D should be sunk may vary considerably for any given requirements, but in general the depth of the foot of the uptake F below the water-level in the well D should be about double the height of final delivery above the separator plus the height of the separator above the level in the well D. The most advantageous depth for the supply-wells, as measured from water-level to the bottom of the uptakes B, will be equal to the normal difference between the water-level in the separator G and the final point of delivery. Under such circumstances the need of restraining the flow of air from the separator by a regulating-valve is largely obviated. As the column of water within the separator acts (when the separator is sufficiently tall, as described) to regulate and to prevent fluctuations the separator so constructed constitutes a compensator as well as a separator.

Having now fully set forth our improvement in one of its most complete and preferred forms, we claim as the novel and characteristic features of the invention the following points and combinations:

1. In combination in a water-raising system, an air-lift well, an uptake therefor, means for aerating the column of water in the uptake to raise it, a separating vessel or tank to which the uptake delivers, a pipe for delivering water from the separating vessel or tank to a higher level without aeration, and means for discharging the air from the separating vessel or tank while maintaining the requisite pressure within the tank, the said separating vessel or tank being of such considerable height vertically as to act as a regulator or compensator as distinguished from a mere separating vessel or tank of height incapable of effecting such regulation or compensation, substantially as set forth.

2. In combination in a water-raising system, an air-lift reservoir-well, an uptake

therefor, means for aerating the column of water in the uptake to raise it, a separating vessel or tank to which the uptake delivers, a pipe for delivering water from the separating vessel or tank to a higher level without aeration, an air-pipe delivering air from the said separating vessel or tank, one or more supply well or wells, an uptake for each, means for carrying water from such uptake or uptakes to the said reservoir-well, and connections from the said air-pipe for delivering air to the said uptake or uptakes of the supply well or wells to aerate and raise the water therein, substantially as set forth.

3. In combination in a water-raising system, an air-lift reservoir-well, an uptake therefor, means for aerating the column of water in the uptake to raise it, a separating vessel or tank to which the uptake delivers, a pipe for delivering water from the separating vessel or tank to a higher level without aeration, an air-pipe delivering air from the said separating vessel or tank, one or more supply well or wells, an uptake for each, means for carrying water from such uptake or uptakes to the said reservoir-well, and connections from the said air-pipe for delivering air to the said uptake or uptakes of the supply well or wells to aerate and raise the water therein, the said separating vessel or tank being of considerable height to act as a regulator or compensator, for the system, substantially as set forth.

4. In combination in a water-raising system, a deeper air-lift well and a shallower air-lift well, an uptake in each, means for delivering compressed air to the uptake of the deeper well, means for separating the air from the water under pressure greater than the atmosphere, and means for delivering a portion at least of such air under pressure to the uptake of the shallower well, substantially as set forth.

5. In combination with a plurality of supply-wells, a relatively deeper reservoir-well, to which the said supply-wells deliver, an uptake for the reservoir-well and an air-pipe and connections delivering air under pressure to the uptake, a separating vessel or tank for separating under pressure the water and air delivered from such uptake, an uptake in each supply-well and air connections from the separating vessel or tank to such uptakes to aerate and raise the water therein, substantially as set forth.

6. In combination with a plurality of supply-wells, a relatively deeper reservoir-well, to which the said supply-wells deliver, an uptake for the reservoir-well, and an air-pipe and connections delivering air under pressure to the uptake, a separating vessel or tank for separating under pressure the water and air delivered from such uptake, an uptake in each supply-well, and air connections from the separating vessel or tank to such uptakes to aerate and raise the water therein, a connection from the first said air-pipe to the supply-wells, and regulating-valves for the several pipes and connections, substantially as set forth.

7. In combination with a plurality of supply-wells, a relatively deeper reservoir-well, to which the said supply-wells deliver, an uptake for the reservoir-well, and an air-pipe and connections delivering air under pressure to the uptake, a separating vessel or tank for separating under pressure the water and air delivered from such uptake, an uptake in each supply-well and air connections from the separating vessel or tank to such uptakes to aerate and raise the water therein, and regulating-valves for adjusting the supply-wells severally, substantially as set forth.

Signed this 22d day of November, 1898, at New York city.

GEORGE R. YOUNG.
CLIFFORD SHAW.

Witnesses:
JOHN C. WALL,
HAROLD BINNEY.