

F. J. McGUANE.
 LIQUID ELEVATING APPARATUS.
 APPLICATION FILED JULY 20, 1912.

1,221,069.

Patented Apr. 3, 1917.

3 SHEETS—SHEET 1.

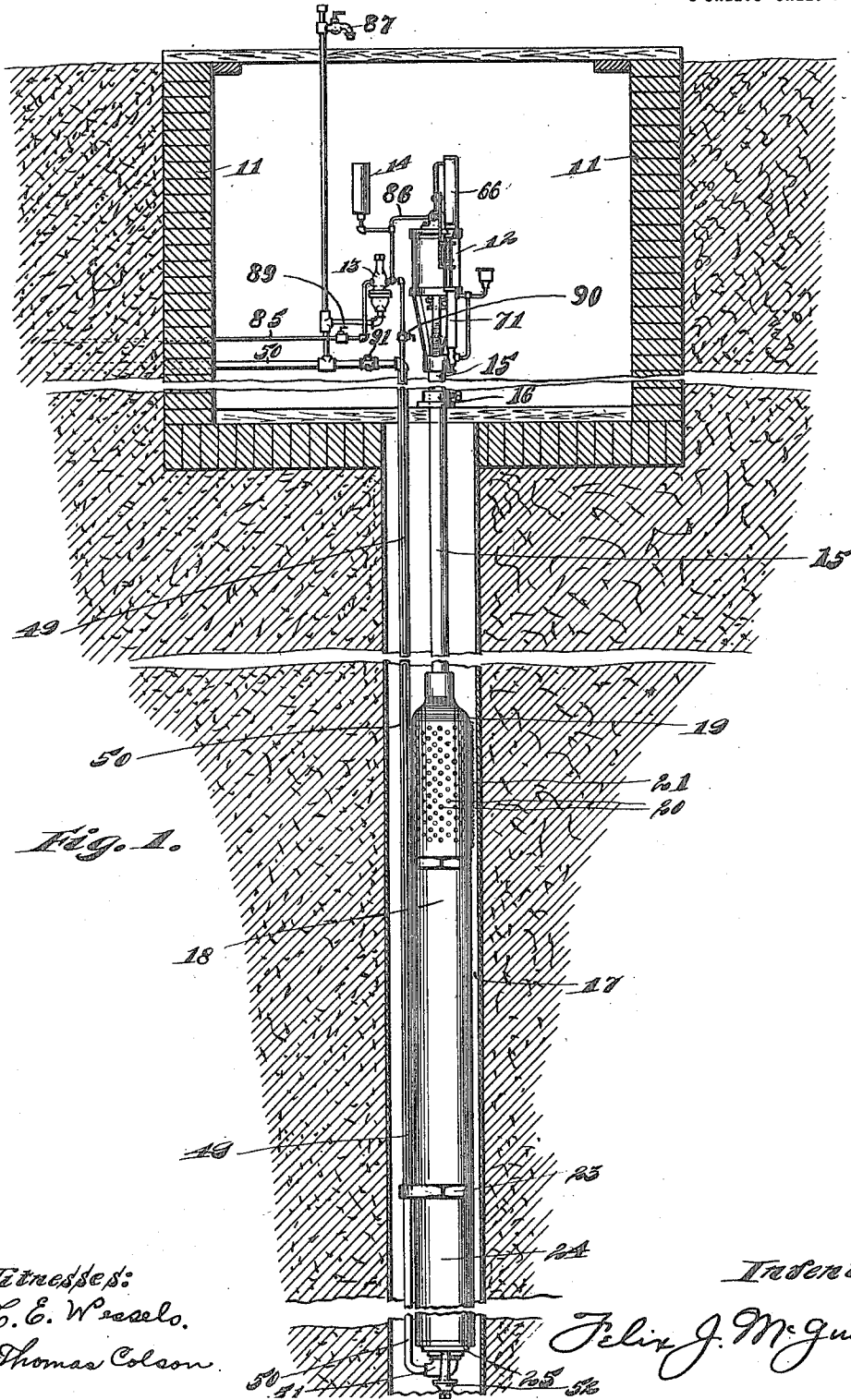


Fig. 1.

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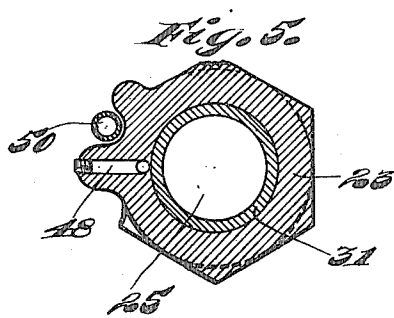
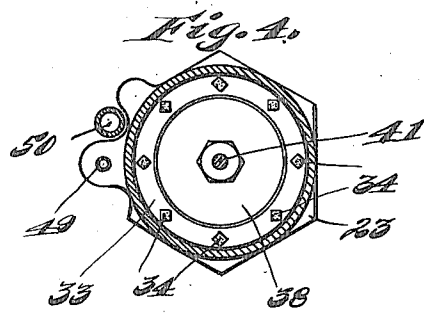
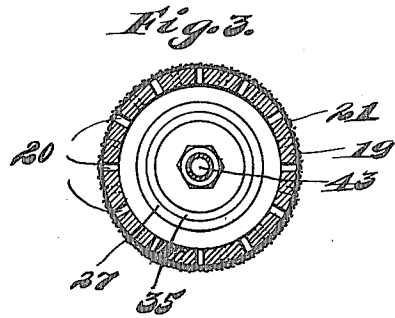
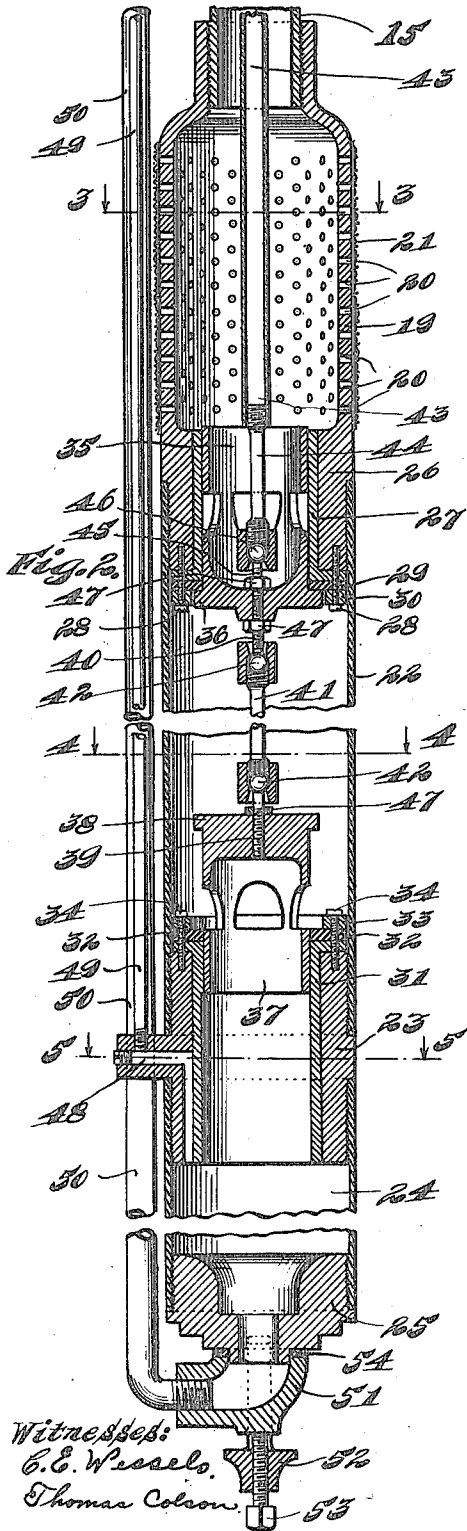
Felix J. McGuane

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3 SHEETS—SHEET 2.



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3 SHEETS—SHEET 3.

Fig. 6.

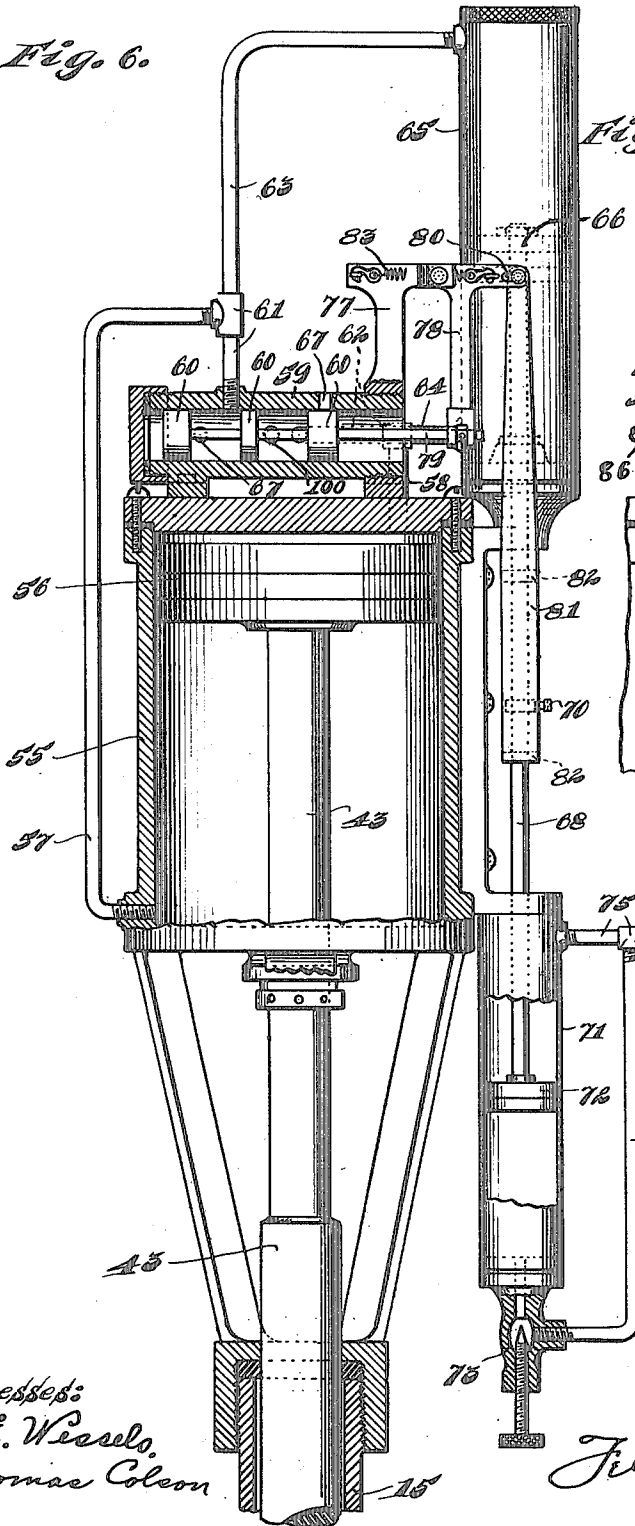


Fig. 7.

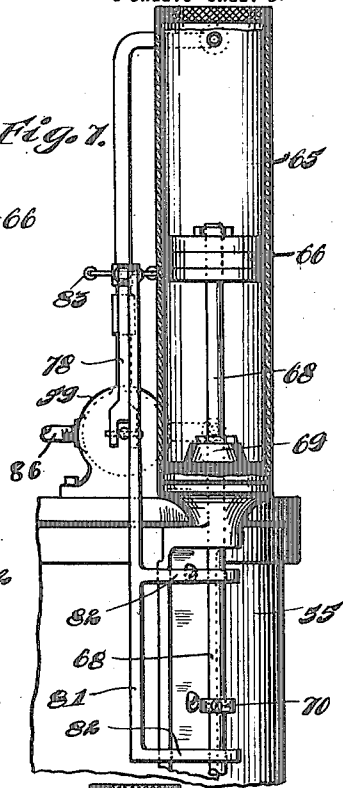
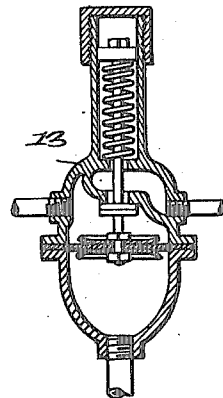


Fig. 8.



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UNITED STATES PATENT OFFICE.

FELIX J. MCGUANE, OF CHICAGO, ILLINOIS.

LIQUID-ELEVATING APPARATUS.

1,221,069.

Specification of Letters Patent.

Patented Apr. 3, 1917.

Application filed July 20, 1912. Serial No. 710,599.

To all whom it may concern:

Be it known that I, FELIX J. MCGUANE, a citizen of the United States, and a resident of the city of Chicago, in the county of Cook and State of Illinois, have invented a new, useful, and Improved Liquid-Elevating Apparatus, of which the following is a specification.

My invention relates to that class of liquid elevators in which compressed air is applied to a member within the well to raise the liquid, and has for its object to provide a device of the character mentioned which will be efficient in operation and of such simple and compact construction that it can readily be applied within the very narrow limitations of tubular wells.

Another object of the invention is to provide a device of the character mentioned, which will have as few of its various working parts below the surface of the ground as possible so that the necessity of having to remove the entire pump from the well in order to make repairs will be reduced to a minimum.

Reference is to be had to the accompanying drawings which form a part of this specification and on which all parts corresponding to those mentioned in this specification are indicated by corresponding characters of reference.

Reference is hereby made to my co-pending application for Letters Patent on a liquid elevator, Serial No. 54,802 filed October 8, 1915.

Figure 1 is a vertical cross section of a tubular well with the device placed in position.

Fig. 2 is an enlarged vertical cross section through the center of the liquid elevating device, showing clearly the arrangement of the main valves, how the compressed air is admitted to the lower chamber, the water discharge outlet, etc.

Fig. 3 is a horizontal cross section at line 3—3.

Fig. 4 is a similar view taken on line 4—4.

Fig. 5 is a similar view taken on line 5—5.

Fig. 6 is a sectional view of the main working piston and cylinder which works the main valves of the pump.

Fig. 7 is a fragmental side elevation wherein a portion of the structure is viewed

at right angles to the showing of Fig. 6, one of the cylinders appearing in section; 55 and

Fig. 8 is a vertical sectional view showing one of the valves employed.

This view also shows in detail the timing mechanism which controls the admission of air to the main cylinder, as hereinafter explained.

The device comprises primarily, an upper chamber 22, a lower chamber 24, a throat coupling 23, connecting both chambers in vertical alinement, a liquid discharge outlet at the bottom of the lower chamber 24, to which discharge pipe 50 is connected, an air intake channel 48 within the wall of the throat coupling 23, discharging into the lower chamber 24, and connected at its opposite terminal with the air supply pipe 49, a cylindrical sliding valve 37 having lateral port holes as shown and controlling communication between the upper and lower chambers, a similar cylindrical valve 35, at top of chamber 22 and connected with aforesaid valve 37 by rod 41 and ball and socket joints 42, so that simultaneous movement of these two valves is effected, the length of the rod 41 being such that when one of the valves is entirely open the other is entirely closed, and the port holes in the valves being of such size and located in such positions vertically that when one of the valves just begins to open the other just begins to close with a little extra clearance so that both valves are never open at the same time at any point throughout their movement, a strainer head 19 of cylindrical construction with perforated wall and covered with fine strainer cloth 21, a throat extension at the lower end of said strainer head and cast integral therewith forming a head for upper chamber 22 and housing for valve 35, a supporting pipe 15 firmly screwed or otherwise secured to top of strainer head and adjustable supporting collar 16 embracing pipe 15 and adjustably secured thereto by set screws, a main valve operating piston and cylinder, 56 and 55, operating main valves 35 and 37 through connecting rod 43 which passes up through pipe 15, an auxiliary piston and cylinder 65 and 66, a churning piston and cylinder 71 and 72 connected in tandem with the aforesaid auxiliary piston and cylinder,

a by-pass 75 connecting top and bottom of churning cylinder, a needle regulating valve 73 controlling flow of liquid through by-pass 75, a collar 70 firmly secured to piston rod 68, a connecting rod 81 with lugs 82 embracing but not rigidly secured to piston rod 68 collar 70 being interposed between the lugs as shown, a standard 77 supporting the pivot for the bell crank 78, a connecting pin connecting rod 81 with bell crank 78, a piston valve controlling admission of air to cylinders 55 and 66, said piston valve being operated by movement of bell crank 78, an automatic air cutoff, diaphragm valve 13 which is connected to the water supply system at the under side of its diaphragm automatically cutting off the air supply from the apparatus while there is no water being drawn off, a small air reserve tank 14 connected to air pipe 86 as shown in Fig. 1 and a small liquid filling cup 76 connected to by-pass pipe 75, through which the cylinder 71 is filled with liquid.

Throat coupling 23 is lined with a renewable brass bushing 31. The throat extension of the strainer head 19 is lined with a similar brass bushing 27.

A leather gasket 32 is provided and held in place by ring 33 and screws 34, said screws 34 passing down through the ring, the gasket, the upper flange of the bushing 31 and into the throat coupling 23 into which the screws are firmly secured. This same arrangement is duplicated at the upper valve as shown in Fig. 2.

The cylindrical walls of the chambers 22 and 24 are constructed of ordinary metal tubing of proper weight and size to suit the requirements. The ends of these tubes are threaded internally to receive the threads of the throat coupling 23, the bottom plug 25 and the throat extension of the strainer head 19, as clearly illustrated in Fig. 2.

The strainer cloth 21 is preferably composed of wire fabric.

The valve 37 is provided with a stud 39, fitted in its top portion and the valve 35 is provided with a stud 40 fitted in its lower end. Each of said studs 39 and 40 are connected together by means of the connecting rod 41 and the ball and socket joints 42. A connecting rod 43 is provided with a stud 44 and such stud 44 is connected with a stud 45 by means of a ball and socket joint 46, and such stud 45 is screw threaded into the bottom portion of the valve 35 to effect movement of valves 35 and 37 by force exerted through the connecting rod 43. The studs 45, 40 and 39 are each provided with lock nuts 47 to lock such studs in their positions.

The valve operating mechanism 12 is supported on pipe 15 which extends through the lower portion of the cellar 11 and into the well 17.

The liquid elevator within the well and the valve actuating mechanism 12 can be adjusted vertically by adjusting the position of the collar 16 fastened by set screws as before explained.

Valves 35 and 37 each have a projecting shoulder as shown at 36 and 38 which shoulders engage the gaskets 29 and 32 respectively when the valves are fully closed tending to reduce air leakage as much as possible.

Also valves 35 and 37 have very carefully ground sliding fits within the linings 27 and 31 so that a practically air tight fit is secured as soon as the port holes have fully receded within the linings or bushings 27 and 31.

Owing to the fact that these valves must be so very accurately fitted it is evident that in case they were rigidly connected, instead of with ball and socket joints as provided for in this invention, that any slight inaccuracy which might exist in the vertical alignment of the housings 27 and 31 would cause these valves to bind or work with great friction which would cause uneven wear, etc., and it is to avoid this that these ball and socket joints are provided.

Ball and socket joint 46 is also provided for a similar reason with reference to connecting rod 43.

The water discharge pipe 50 is bent at right angle at its lower end as shown and connects with elbow 51 which is secured to the bottom of the plug 25 by means of the yoke 52 and set screw 53.

A gasket 54 is preferably inserted between the bottom of plug 25 and the top face of elbow 51 to insure a liquid tight joint therebetween.

Piston valve 60, working in valve box 59, and actuated by bell crank 78 through rod 79, is of the ordinary type, admitting and exhausting air to and from the upper and lower sides of the cylinder 55 and the cylinder 65, in the ordinary manner causing the pistons 56 and 66 to reciprocate, the one valve answering for both cylinders, as will be understood by noting the branch pipes 57 and 63 taken from the main pipe 61 leading from the valve box. Similar branch pipes 58 and 64 leading from main pipe 62, which pipe 62 connects with a reverse valve port, lead to the bottom of the cylinder 66 and to the top of the cylinder 55.

The exhaust ports of the valve box 59 are shown at 67, and the numeral 100 indicates the inlet end of the air supply pipe 86.

Cylinder 71 is kept filled with liquid at all times which is applied through the small filling cup 76, the latter being furnished with a screw cap, which is screwed down tight after the liquid has been applied.

Helical tension springs 83 are connected with the one arm of the bell crank lever 78 and the standard 77 to accelerate move-

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ment of the piston valve 60 when once started by the piston rod 68 as clearly illustrated in Fig. 6.

In operation a source of air supply is connected by means of pipe 85, as will be noted by reference to Fig. 1, the air is conveyed first to the automatic cut off valve 13, and after passing through this valve a branch connection is made to the main valve operating mechanism 12 and a separate branch connection is brought down into the well and connected to the air passage 48 which leads into the lower chamber 24. Valve 13 has nothing whatever to do with the working of the apparatus and its only purpose is to shut off the air entirely while there is no water being drawn off, thereby preventing the loss of air which might take place through slow leakage due to any slight imperfection which might exist in the valves, etc., of the apparatus and which loss of air, while not being of much importance during the short period of time that the liquid is being drawn off, would amount to considerable if allowed to continue throughout the long periods of time in which the apparatus is not in operation.

Assuming that pipe 85 is connected as explained to a source of air supply with all parts connected up and the liquid elevator placed in position within the well and adjusted to such a vertical position that the strainer head 19 comes about five or six feet below the level of the water in the well, before any liquid can be drawn off it is first necessary to prime the chambers 22 and 24 which is accomplished as follows. Air cock 90 is closed and air cock 89 is opened, the liquid faucet 87 is also opened which releases all pressure from the under side of the diaphragm in the diaphragm valve 13, thereby allowing free passage of air into the main valve operating mechanism 12. The cock 90 being closed no air can pass into chamber 24. The air passing up through the pipe 86 is delivered first to the valve box 59 where it is distributed to the upper and lower parts of the cylinders 55 and 65 alternately through the operation of this valve mechanism as before explained.

The purpose of the auxiliary piston and cylinder 65 and 66 is to operate this valve mechanism. By referring to Fig. 6 it will be noted that the collar 70 is firmly secured to the piston rod 68 in such a position that it will intercept the projecting lugs 82 of the connecting rod 81 at a point in its travel a short distance previous to the termination of the upward and downward stroke of the piston 66. The valve 60 is therefore shifted back and forth each time the piston 66 reaches a point very near the termination of its upward and downward stroke and while the collar 70 is traveling between these two points the valve 60 remains stationary.

As the piston 72 is connected on the same rod with piston 66, it is evident that both of these pistons will move simultaneously, and any retarding influence which might be placed in the way of the piston 72 will act likewise on piston 66. The cylinder 71 being filled with liquid, it is evident that as the piston 72 reciprocates, the liquid within the cylinder will also reciprocate through the bypass 75 and as the rapidity of flow of the liquid through this bypass can be controlled by the needle valve 73 it follows that by adjusting the needle valve 75 the speed of travel of pistons 72 and 66 can be controlled accordingly.

The air on entering the valve chest 59 will be delivered to the cylinders 55 and 65 simultaneously and as there is no resistance in the path of the piston 56 with the exception of that produced by the friction of the main valves of the pump the movement of this piston will be comparatively rapid. In the case of the piston 66, however, the needle valve 73 being set at a point where the liquid can flow through only very slowly, it will take some time before this piston 66 reaches the end of its stroke and when it does reach the end of its stroke shifting the valve 60 it will meet with the same resistance on its upward stroke. It will be clear therefore that the valve 60 is shifted only at intervals and the period of time between these intervals can be regulated by the adjustment of the needle valve 73. At each shifting of the valves however the main piston 56 moves very rapidly so that the main valves of the device are shifted as quickly as possible, a certain period of time intervening after each movement.

The main valves 35 and 37 therefore do not reciprocate continuously but intermittently and the period of time intervening between each movement of these valves is regulated by the needle valve 75 so as to be just sufficiently long to allow the chamber 22 to completely fill with liquid when the upper valve 35 is opened.

These working parts having been fully explained as above, it will now be easily understood that as long as the compressed air is supplied to the valve operating mechanism 12 the main valves 35 and 36 will continue to shift at intervals as explained. The liquid elevator being immersed in the water in the well in such position that the strainer head 19 is well below the surface of the water, it is evident that as soon as the valve 35 is opened by the downward movement of the piston 56, the water or liquid in the well will immediately rush into the upper chamber 22 and displace the air therein which will be forced out against the current of incoming water or other liquid and this air will rise to the top of the well where it will be liberated.

As before stated the valve operating mechanism 12 is set so that the valves 35 and 37 will move again at the same time that the chamber 22 has just completely filled, now as soon, therefore, as this upper chamber 22 has completely filled the piston 56 will move upward closing valve 35 and opening valve 37. This will allow the liquid in chamber 22 to drop down into the chamber 24 displacing the air in said chamber 24, which air will rise into chamber 22. Just about at the time the liquid in chamber 22 has completely dropped into the lower chamber 24 the main valves 35 and 37 will again be shifted and the chamber 22 will again be filled in the same manner as before. After both chambers have been filled with liquid in this manner the apparatus is then ready for service and the air cock 90 is now opened and the compressed air admitted to the lower chamber 24 through the pipe 49 which connects with channel 48.

This will cause the water to rise in the pipe 50 and faucet 87 being open water or liquid will be discharged therefrom. As chamber 24 is always in wide open communication with the source of air pressure supply, as long as there is water being drawn off and the automatic valve 13 open it is evident that a constant exerting force or pressure will be steadily maintained on the top of the liquid in the lower chamber 24 when the valve 37 is closed and when the valve 37 is open the air rising into the upper chamber 22, the pressure will be exerted in the said upper chamber 22. In either case the tendency will be to force the water out of the chambers and up into the pipe 50 and as the liquid enters the chambers through the shifting of the valves 35 and 37, as has already been explained, and as the port holes in these valves are of sufficient size to admit the liquid just as fast as the capacity of the pipe 50 will allow it to escape, it is evident that a constant flowing stream of liquid will be continuously discharged at the faucet 87 as long as it is kept open, and as the liquid is supplied to the chambers just as fast as it flows out through the pipe 50 it will be clear that it will be impossible for the pump to empty itself after it has once been primed, which is done before the apparatus is brought into operation as explained, by opening the air cock 89 with air cock 90 closed bringing the main valve operating mechanism into operation and shifting the valves 35 and 37 a few times before any liquid is drawn off from the apparatus, thereby completely filling the chambers 22 and 24.

It will be observed that the chamber 24 is never at any time in open communication with any point beyond chamber 22, except through the pipe 50 through which the liquid leaves the apparatus, and pipe 49 through which the compressed air enters.

Having thus explained the operation of the apparatus it will be easily understood that as long as the faucet 87 is kept open there will flow a constant stream of liquid therefrom. Now as soon as this faucet 87 is closed, this will cause a sudden rise of pressure in the pipe 50, a branch connection from which leads to the diaphragm valve 13, and acting on the diaphragm of this valve this pressure will automatically cut off the air supply from the pump. The movement of the diaphragm of this valve controls the opening and closing of an air valve in the main air supply pipe 85 where it passes through the upper part of the valve 13 in such a way that when the pressure rises to a certain point the valve will completely close and when the pressure drops in the pipe 50 the relaxation of the diaphragm will cause the valve to open. Now when the faucet 87 is closed and the air pressure cut off from the apparatus, the reserve air tank 14 will contain sufficient air to operate the valves 35 and 37 a few times to reprime the pump and leave it ready for action again when it is desired to draw more water. The check valve 91 preventing the air contained in this reserve air tank from passing into the pipe 49 and into the pump chambers so that the only avenue of escape for this air contained in this reserve tank 14 after the air is cut off from the apparatus is through the pipe 86 which leads to the main valve operating mechanism. Air tank 14 is of sufficient capacity to contain enough air to operate the main valves a few times after the air supply has been cut off.

While I have illustrated and described the preferred form of construction for carrying my invention into effect, this is capable of variation and modification without departing from the spirit of the invention. I, therefore, do not wish to be limited to the precise details of construction set forth, but desire to avail myself of such variations and modifications as come within the scope of the appended claims.

Reference is hereby made to my copending application Number 54,802, for Letters Patent on a liquid elevator, filed October 8, 1915, and disclosing a structure similar to that shown in this application, the claims in the said application Number 54,802 being restricted to improvements not shown in this present application No. 710,599.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A liquid elevator comprising an upper chamber and a lower chamber, a valve in the top of said upper chamber, a second valve in the bottom of said upper chamber controlling communication between said upper and said lower chambers, means whereby said valves are caused to open and close alter-

nately, means for admitting liquid on top of the first valve, and means for admitting air to the lower chamber.

2. A liquid elevator comprising an upper chamber and a lower chamber, a valve in the top of said upper chamber for receiving liquid and discharging air, a second valve in the bottom of said upper chamber controlling communication between said upper and said lower chambers, means whereby said valves are caused to open and close alternately, means whereby air under pressure is supplied to said lower chamber and means for drawing liquid from bottom of said lower chamber.

3. A liquid elevator comprising an upper chamber and a lower chamber, a valve in the top of said upper chamber for receiving liquid and discharging air, a throat coupling connecting said upper and said lower chambers, an air intake channel within the wall body of said throat coupling, discharging into said lower chamber, a second valve controlling communication between said upper and said lower chambers through said channel, means whereby said valves are caused to open and close alternately, and means for drawing off liquid from the bottom of said lower chamber.

4. A liquid elevator comprising an upper chamber and a lower chamber, a valve in the top of said upper chamber for receiving liquid and discharging air, a throat coupling connecting said upper and said lower chambers, an air intake channel within the wall body of said throat coupling, discharging into said lower chamber, a second valve controlling communication between said upper and said lower chambers through said channel, means whereby said valves are caused to open and close alternately, a liquid outlet in the bottom of said lower chamber, a liquid discharge pipe; an elbow coupling connected to said liquid discharge pipe, a ring gasket encircling said liquid outlet, the upper mouth of said elbow embracing said gasket, a yoke rigidly secured to bottom of said lower chamber and embracing said elbow coupling, a set screw in said yoke pressing against said elbow coupling whereby said elbow coupling is held firmly against the gasket.

5. A liquid elevator comprising an upper chamber and a lower chamber, a valve at the top of said upper chamber for receiving liquid and discharging air, a second valve at the bottom of said upper chamber controlling communication between said upper and said lower chambers, and a connecting rod uniting said valves for simultaneous movement.

6. A liquid elevator comprising an upper chamber and a lower chamber, a valve at the top of said upper chamber for receiving liquid and discharging air, a second valve at

the bottom of said upper chamber controlling communication between said upper and said lower chambers, a connecting rod; ball and socket joints uniting said connecting rod with said valves; a second connecting rod for imparting movement to said valves, and a ball and socket joint connecting said second connecting rod to the uppermost of said valves.

7. In a device of the character described, a valve shifting means comprising a cylinder, a reciprocating piston therein, a controlling valve connected with said cylinder; a second cylinder connected with said controlling valve, a second reciprocatory piston in said second cylinder and operatively connected with said controlling valve, and adjustable means for retarding the movement of said second reciprocatory piston.

8. In a device of the character described, a valve shifting means comprising a cylinder, a reciprocating piston therein, a controlling valve connected with said cylinder; a second cylinder connected with said controlling valve, a second reciprocatory piston in said second cylinder and operatively connected with said controlling valve, a third liquid filled cylinder; a third reciprocatory piston in said third cylinder and connected to said second reciprocatory piston for simultaneous movement therewith, a bypass connecting the top and bottom of said third cylinder, and a needle valve in said bypass whereby flow of liquid through said bypass may be regulated.

9. In a device of the character described, a valve shifting means comprising a cylinder, a reciprocating piston therein, a controlling valve connected with said cylinder; a second cylinder connected with said controlling valve, a second reciprocatory piston in said second cylinder, a bell crank connected to said controlling valve, a piston rod attached to said second piston, a rod connected to said bell crank and provided with a pair of projecting lugs embracing said piston rod, a collar attached rigidly to said piston rod between said lugs and constituting means for imparting intermittent movement to the lug-carrying rod and the bell crank and springs attached to said bell crank to accelerate its movement.

10. In a device of the character described an air supply pipe, an air cut off valve in said supply pipe, an air operated valve shifting means, a branch pipe leading to said valve shifting means, a check valve in said branch pipe, and a reserve air tank connected to said branch pipe whereby sufficient air will be stored to operate said valve shifting means for a limited period after air has been cut off in main air supply pipe by said cut off valve.

11. In a device of the class described, a main cylinder; a main piston working there-

- in; an auxiliary cylinder; an auxiliary piston working in the auxiliary cylinder; a source of fluid pressure supply communicating with both ends of both cylinders; a valve interposed in said source and constituting means for directing fluid pressure selectively into the ends of the respective cylinders; and means under the control of the auxiliary piston for operating the valve. 5
12. In a device of the class described, a main cylinder; a main piston working therein; an auxiliary cylinder; an auxiliary piston working in the auxiliary cylinder; a source of fluid pressure supply communicating with both ends of both cylinders; a valve interposed in said source and constituting means for directing fluid pressure selectively into the ends of the respective cylinders; means under the control of the auxiliary piston for operating the valve; and a retarding means operatively connected with the piston. 10
13. In a device of the class described, a main cylinder; a main piston working therein; an auxiliary cylinder; an auxiliary piston working in the auxiliary cylinder; a source of fluid pressure supply communicating with both ends of both cylinders; a valve interposed in said source and constituting means for directing fluid pressure selectively into the ends of the respective cylinders; means under the control of the auxiliary piston for operating the valve; a retarding means operatively connected with the auxiliary piston; and a regulating device operatively connected with the retarding means. 15
14. In a device of the class described, a main cylinder; a main piston working therein; an auxiliary cylinder; an auxiliary piston working in the auxiliary cylinder; a source of fluid pressure supply communicating with both ends of both cylinders; a valve interposed in said source and constituting means for directing fluid pressure selectively into the ends of the respective cylinders; means under the control of the auxiliary piston for operating the valve; and a dash pot connected with the auxiliary piston. 20
15. In a device of the class described, a main cylinder; a main piston working therein; an auxiliary cylinder; a dash pot cylinder; a piston working in the auxiliary cylinder and in the dash pot cylinder; a source of fluid pressure supply communicating with both ends of the main cylinder and the auxiliary cylinder; a valve interposed in said source and constituting means for directing fluid pressure selectively to the ends of the main cylinder and the auxiliary cylinder; means under the control of the last specified piston for operating the valve; a by-pass forming a connection between spaced portions of the dash pot cylinder; and means under the control of an operator for adjusting the cross sectional area of the by-pass. 25
- In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses. 30
- FELIX J. MCGUANE. 35
- Witnesses:
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- 45
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