Sept. 20, 1927. 1,642,990

T. E. CROCKETT

WATER ELEVATING APPARATUS

Filed April 25, 1924 2 Sheets-Sheet 1

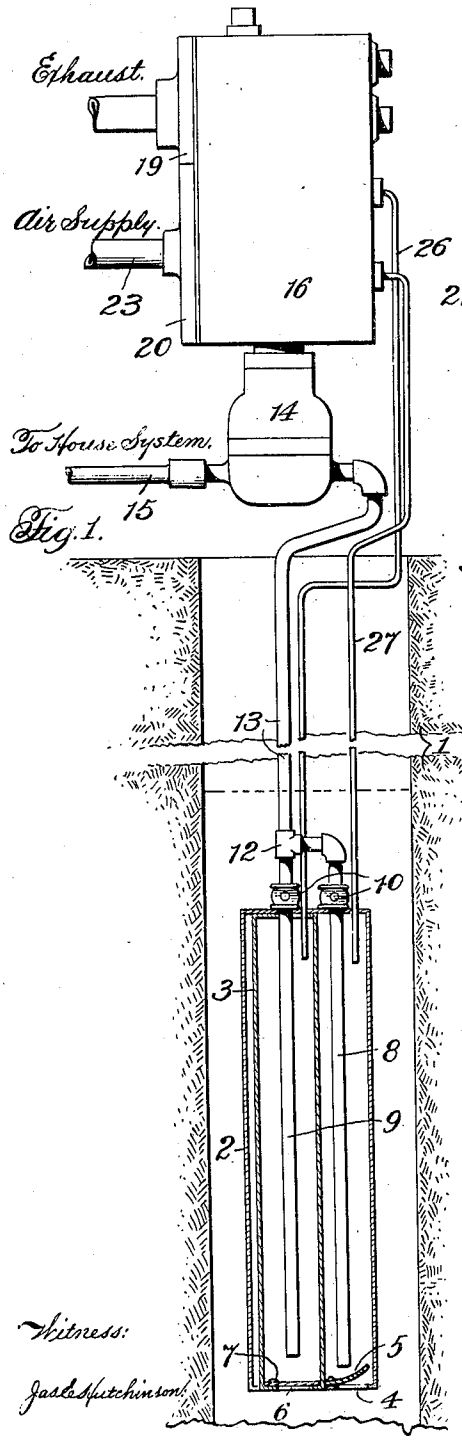


Fig. 1.

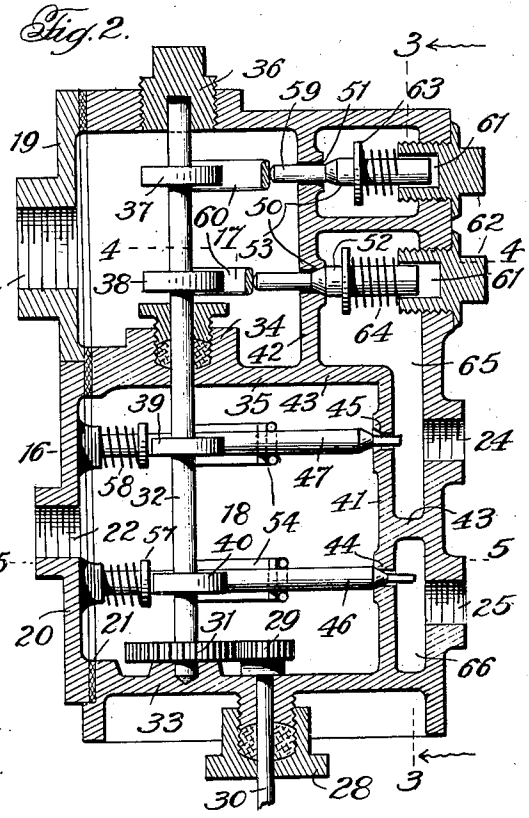


Fig. 2.

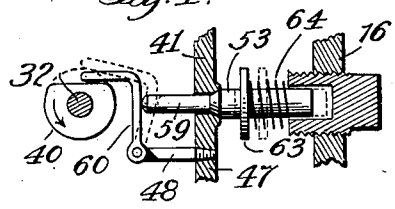


Fig. 4.

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Fig. 3.

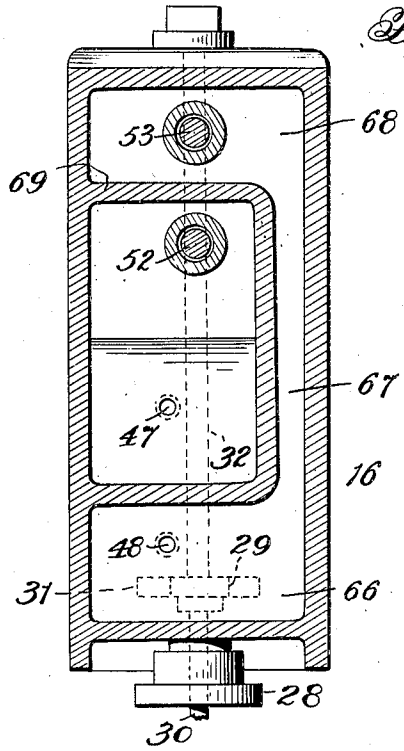
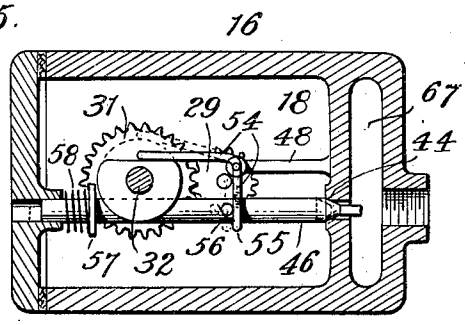


Fig. 5.



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UNITED STATES PATENT OFFICE.

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WATER-ELEVATING APPARATUS.

Application filed April 25, 1924. Serial No. 708,976.

This invention relates to water elevating apparatus.

One of the principal objects of the invention is the provision of a simple and inexpensively constructed device, which is designed to be automatically controlled by an ordinary water motor as the water is used in the system. This motor may be in the form of an ordinary water meter which will, in addition to controlling the operation of the valve, also measure the amount of water used in the system. Another object of the invention is the provision of conveniently installed apparatus for the continuous supply of water at the point of use and without the employment of any reciprocating or rotating pumping parts.

Another object of the invention is the provision of a simple and efficient control mechanism operated in the actuation of the water motor for controlling the supply of fluid pressure to the pumping apparatus in such manner that a continuous supply may be forced through the motor without the employment of reciprocating or rotating parts.

Still another object of the invention is the provision of novel water elevating mechanism employing compressed air for the continuous delivery of water to the point of use.

Further objects of the invention will appear as the following specific description is read in connection with the accompanying drawings, which form a part of this application, and in which:

Figure 1 is a general assembly view showing the parts in elevation mounted in a well and with portions broken away to more clearly illustrate the arrangement;

Figure 2 is a detail vertical sectional view through the control box;

Figure 3 is a vertical sectional view taken on the line 3—3 of Figure 2, looking in the direction of the arrows;

Figure 4 is a horizontal section showing one of the exhaust valves and taken approximately on the line 4—4 of Figure 2.

Figure 5 is a horizontal section on the line 5—5 of Fig. 2.

In order that the construction and operation of the device may be fully understood I have illustrated the same mounted in a well generally indicated at 1 and which, as will be readily understood, may be either a driven or a dug well, or in fact may constitute any source of supply in which the pumping apparatus can be submerged.

In the preferred embodiment of the invention, which of course may be modified, in accordance with the terms of the appended claims, I provide a relatively large closed cylinder 2, in which is mounted a cylinder 3. The cylinder 2 is provided with an opening 4 at its lower end which is closed by an inwardly opening flap valve or other suitable check valve 5. The cylinder 3 extends down through the bottom of the cylinder 2 and is also provided with an opening 6 closed by an inwardly opening check valve 7.

In practice the cylinders 2 and 3 are so proportioned that their internal area or capacity is substantially the same, that is the internal capacity of the cylinder 2 should be approximately twice as great as the internal capacity of the cylinder 3, but when the cylinder 3 is positioned as shown within the cylinder 2, the capacity of the cylinder 2 is cut in half, thereby making the capacity of the cylinder 2 substantially the same as the cylinder 3. The ratio here described may be, of course, altered to some extent, but it is preferable to have the capacities of the cylinders 2 and 3 substantially equal, so that one can fill, while the other is discharging, as will be better understood from what follows.

Extending into the cylinders 2 and 3 are pipes 8 and 9, both of which have their open lower ends terminating closely adjacent the bottom of their respective cylinders, the pipe 8 being positioned within the cylinder 2, while the pipe 9 is positioned within the cylinder 3. Each pipe is provided with a check valve 10 and the pipe 8 is joined to the pipe 9 by an ordinary elbow 11 and T-coupling 12.

Leading from this point of connection is a common discharge pipe 13 connected to one side of an ordinary water motor 14, the opposite side of which is connected as is usual to the house-system or point of use by a pipe 15.

As shown in Figure 1, I mount directly upon the motor 14 the control apparatus which in the present embodiment comprises a substantially rectangular casing 16 which is divided into upper and lower compartments 17 and 18, the former having its open side closed by a plate 19 and the latter having its open side closed by a plate 20. Both

of these plates are secured in position on the casing against suitable gaskets, in any preferred manner, and the plate 19 is provided with an exhaust port 21 which may open to the atmosphere or be connected by a pipe to a muffler or some similar apparatus if found desirable. The plate 20 is provided with a port 22 which leads to an air supply pipe 23 connected to a storage tank or direct to an air compressor as is found desired.

At the opposite side of the casing from the plates 19 and 20 are outlet ports 24 and 25 connected respectively to delivery pipes 26 and 27 which in turn lead to the upper ends of the cylinders 3 and 2, respectively. These pipes deliver air direct from the source of air supply to the upper portion of the closed cylinders 2 and 3 at alternate times and also serve as exhaust pipes when the cylinders are filling with water as will be hereinafter described.

In practice the center shaft of the water motor 14 is removed and a somewhat longer shaft substituted therefor, which extends up through a suitable packing gland 28 in the lower wall of the casing 16 and carries upon its upper end a pinion 29. This shaft which is indicated at 30 may form a continuation of the motor shaft or may be an independent shaft coupled to the motor shaft, if found desirable. As it merely drives the control valve mechanism, I shall refer to the same as a drive shaft.

Meshing with the pinion 19 is a gear 31 carried by the lower end of the cam shaft 32, stepped in a bearing 33 in the lower wall of the casing 16 and passing through a packing gland 34 in the partition 35 which divides the casing into the compartments 17 and 18.

The upper end of the shaft is journaled in a removable nut 36 threaded into the upper wall of the casing and provided to permit ready insertion of the shaft into its proper position within the casing, as just described.

The shaft 32, as shown in Figure 2, carries the exhaust controlling cams 37 and 38 which are positioned within the compartment 17 and also carries the supply controlling cams 39 and 40 positioned within the compartment 18.

As shown in Figures 2 and 3, the casing is provided with longitudinally or vertically extending partitions 41 and 42 and with a horizontal dividing web 43. The partition 41 is provided with valve seats 44 and 45 into which are fitted valves 46 and 47 controlled respectively by the cams 40 and 39 and the partition 42 is provided with valve seats 50 and 51 into which are fitted valves 52 and 53 controlled respectively by the cams 38 and 37.

The mechanism for controlling the operation of the valves 46 and 47 will now be described.

Secured to the partition 41, in any suitable manner, are the studs 48, each of which has pivoted thereto a bell-crank 54 whose free end lies in the path of one of the cams 39 or 40. The opposite end of the bell crank is forked or bifurcated as shown at 55, so as to straddle the stem of the valve and bear against the collar 56 secured to said stem. At the opposite end of each valve stem 46 or 47 there is secured another collar 57 between which and the plate 20 is positioned a spiral spring 58 surrounding the valve stem and normally acting to press the same toward the right to seat the valve. As the shaft 32 is rotated the cams 39 and 40, which are arranged with their high spots at diametrically opposite points, engage the bell cranks 54, the valves 46 and 47 will be open. When the low spots on the cam are reached the bell cranks will be pushed against the flats of the cam by the action of the springs 58 in seating the valves. It will be noticed that the cams are substantially in the form of half-moons, so that when the bell crank drops off the high spot on the cam, the spring 58 will immediately close the valves and as these valves are operated alternately, as will be more clearly hereinafter understood, when one is closed with a rapid motion, the other is opened with an equally rapid motion, so as to prevent any loss of time in discharging air to the respective cylinders 2 or 3.

The valves 52 and 53 are each provided with elongated stems 59, which slide through the seat openings 50 and 51, so as to engage one of the bell crank levers 60, which are operated in a manner similar to the bell cranks 54 by the cams 37 and 38. The bell cranks 60 do not have, however, the fork or bifurcated ends 55, as they push the valves 52 and 53 away from their seats instead of pulling the valves away as the bell cranks 54 do.

Each of the valves 52 and 53 has the end opposite the elongated stem 59 slidably mounted in sockets 61 in nuts 62 threaded into the box as shown in Figure 2. Also each of the valve stems is provided with a collar 63 between which and the associated nut 62 is a spiral spring 64, normally acting to force the valve to its seat.

As shown in Figure 2 the valve 46 is in closed position as is also the valve 52. This permits the air entering the chamber 18 to exhaust around the valve 47, which is then open, and through the port 24 into the pipe 26. This places a pressure upon the water in the cylinder 3, which acts to close the valve 7 and drive the water in said cylinder up through the pipe 9, past the check valve 10 therein and to the water motor through the pipe 13. If a spigot is open in the house system, water passes through the motor and rotating the shaft 30, drives the cam shaft 32. After all of the water has

been exhausted from the cylinder 3, the cams and the shaft 32 will then reverse the parts closing the valve 47 and opening the valve 46 and the valve 52. The air in cylinder 3 will be exhausted back through the pipe 26, into the valve chamber 65 and into the chamber 17, where it finds escape through the port 21.

As shown in Figure 3 the port 25 and valve opening 44 are connected to a chamber 66 which is in turn connected by a by-pass 67 to a valve chamber 68 containing the valve 53. This chamber 68 is separated from the chamber 65 by a transverse partition 69, as shown in Figure 2.

When the parts are reversed from the position shown in Figure 2 and the valve 46 opened through the rotation of the shaft 32 and the action of the cams 39 and 40, air from the source of supply entering the chamber 18 will pass through the open valve port 44 and to the cylinder 2, by way of the chamber 66, port 25, pipe 27, where it acts upon the water in said cylinder and expels the same through the pipe 8 and check valve 10 to the pipe 13 and to the meter as before described. The air entering chamber 66 is of course also in the by-pass 67 and chamber 68, but the cams being so arranged that when the valve 46 is open, the valve 53 is of course closed and the air in chamber 68 cannot move except through the port 25 to the pipe 27. When the valve 46 is again closed, the valve 53 will be opened and the air in cylinder 2 will exhaust as follows: pipe 27, port 25, chamber 66, by-pass 67, chamber 68, and valve 53 to chamber 17.

As will be readily understood the cylinder which is not being acted upon by compressed air, will have its check valve subjected to the pressure of the water in the well, which will lift said valve and fill the compartment to a predetermined height, at which time if water is being used in the system the parts will be reversed and pressure will be applied to that cylinder which has just been filled with water and the air previously forced into the other cylinder will be exhausted. If a cylinder has been partially filled with water, or the water therein has been partially discharged, and the faucet in the house system closed, the parts will remain in this position until the motor shaft is again rotated, by reason of using water from the system and the parts will continue to operate as before.

It will be noted that under all conditions the lowermost valves in each chamber 17 and 18 operate together, either to close or to open while the uppermost valve in each chamber operates in a like manner and always in unison, that is, when the valve 47 is open the valve 53 is open, and when the valve 47 is closed the valve 53 is in a like position. It will also be noticed that the valves in each chamber, that is the inlet and exhaust valves, 46, 47, and 52, 53, respectively, are alternately opened and closed, so that air is passing through one to accomplish a water expelling action in one of the cylinders, while the air in the other cylinder is being exhausted and the cylinder filling with water. As the apparatus works only in accordance with the amount of water used, and as one cylinder is filling while the other cylinder is exhausting, or having its water driven off to the motor, and as both are connected to a common controlled apparatus, it will be seen that when a faucet in a house system is opened there will be a continuous supply of water flowing through the pipe 13 and motor 14, which driving the shaft 32 insures a constant supply of air to the alternately operative cylinders.

The present construction is especially designed for drilled wells when a compact arrangement of parts must be employed, but it will be of course understood that the present apparatus may be utilized with the tanks or containers submerged in any source of liquid supply such as water, oil or any other liquid.

What I claim is:

1. In a liquid pumping apparatus, a pair of gravity filled containers, one of which surrounds the other, a discharge pipe, independent connections from said containers to said discharge pipe, a motor driven by fluid discharged from said containers, and means controlled by said motor for causing alternate discharge from said containers through said motor.

2. In a liquid pumping apparatus, a pair of gravity filled containers, one of which surrounds the other, a discharge pipe, independent connections from said containers to said discharge pipe, a motor driven by fluid discharged from said containers, a source of fluid pressure, and means controlled by said motor for alternately admitting pressure to and discharging pressure from said containers to discharge the liquid therefrom.

3. In a liquid pumping apparatus, a pair of gravity filled containers, one of which surrounds the other, a discharge pipe, independent connections from said containers to said discharge pipe, a motor driven by fluid discharged from said containers, a source of fluid pressure, valved connections between said source of pressure and said containers, and means actuated by said motor for controlling the valve connections whereby pressure is admitted and exhausted from said containers alternately.

4. In a liquid pumping apparatus, a pair of gravity filled containers, one of which surrounds the other, a discharge pipe, independent connections from said containers to said discharge pipe, a source of fluid pressure connected to each container, a series of

inlet and exhaust valves alternately opened and closed to admit pressure to and discharge the same from said containers and a motor for operating said valves controlled by the liquid discharged from the containers.

5. In a liquid pumping apparatus, a pair of gravity filled containers, one of which surrounds the other, a discharge pipe, independent connections from said containers to said discharge pipe, a source of fluid pressure, means for controlling the admission of fluid pressure to and the exhaust from said containers whereby pressure is admitted to one container simultaneously with the exhaust from the other, and means driven by the fluid discharged from said containers for actuating said controlling means.

6. In a liquid pumping apparatus, a pair of gravity filled containers, one of which surrounds the other, and into which liquid is alternately admitted and discharged, a discharge pipe, independent connections from said containers to said discharge pipe, a cam shaft carrying a plurality of cams, a source of fluid pressure, valves actuated by the cams for controlling the admission of pressure alternately to said containers, and a motor actuated when and by discharge of liquid from said containers for rotating said cam shaft.

7. In a liquid pumping apparatus, a pair of gravity filled containers, one of which surrounds the other, and into which liquid is alternately admitted and discharged, a discharge pipe, independent connections from said containers to said discharge pipe, a casing, connections therefrom to said containers, said casing divided into upper and lower compartments, a cam shaft journalled in said casing and passing through said compartments, cams on said shaft, separate passages connecting the upper and lower compartment, valves controlling said passages and the connections from the casing to the containers, a source of fluid pressure connected to the casing, means actuated by the cams for operating the valves to alternately release the pressure in the casing to alternate containers whereby pressure is admitted to one and simultaneously exhausted from the other through said passages, and a motor connected to the discharge pipe and actuated by the fluid discharge from either container for driving the cam shaft.

In testimony whereof I affix my signature.

THOMAS E. CROCKETT.