(No Model.) 2 Sheets—Sheet 1.

J. B. YEAGLEY.

APPARATUS FOR RAISING WATER FROM WELLS HAVING WATER-BEARING STRATA OF DIFFERENT HYDROSTATIC LEVELS.

No. 285,774. Patented Sept. 25, 1883.

Fig. 1.

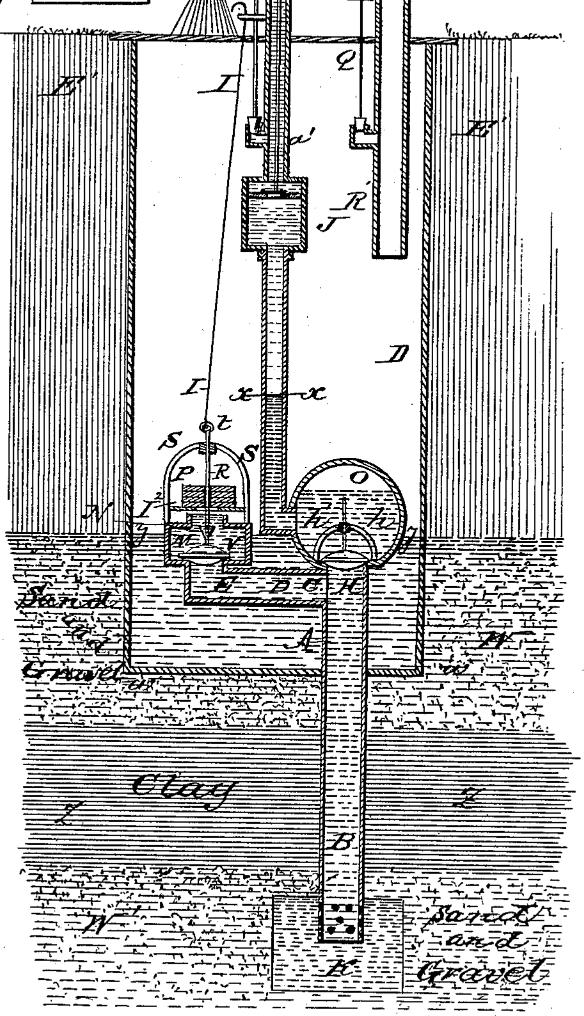


Fig. 7.

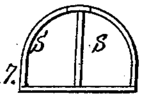


Fig. 4.

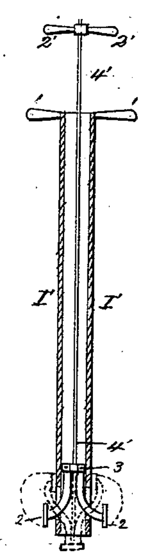


Fig. 5.

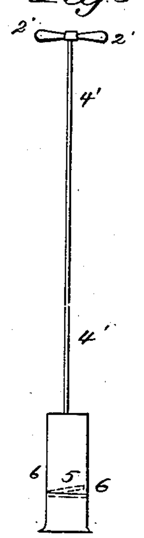
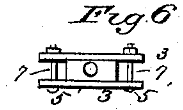


Fig. 6.



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(No Model.) 2 Sheets—Sheet 2.

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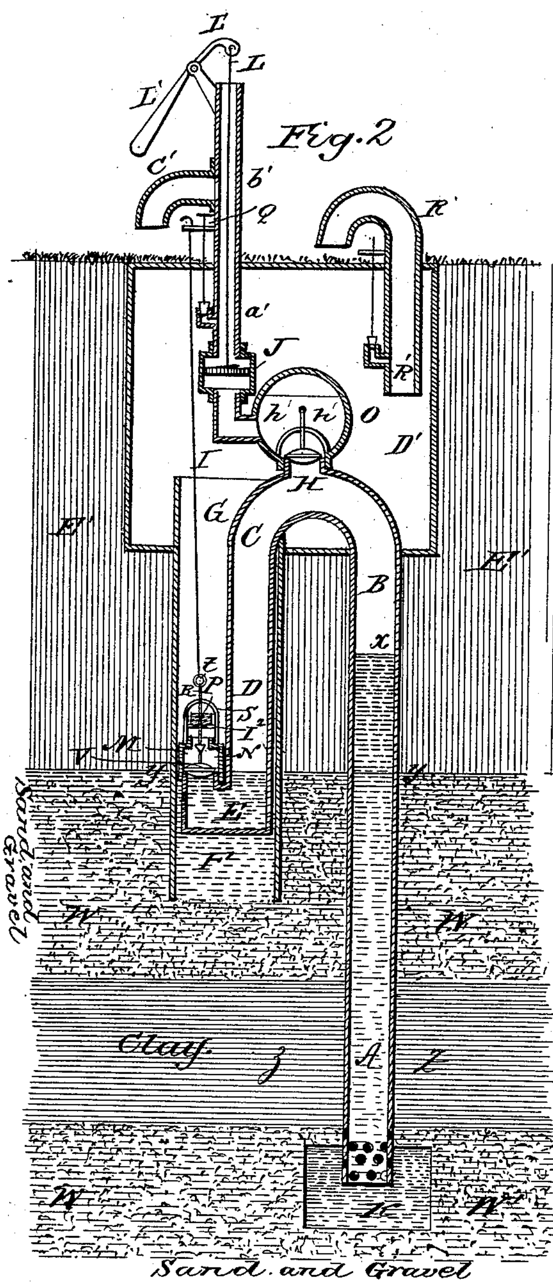

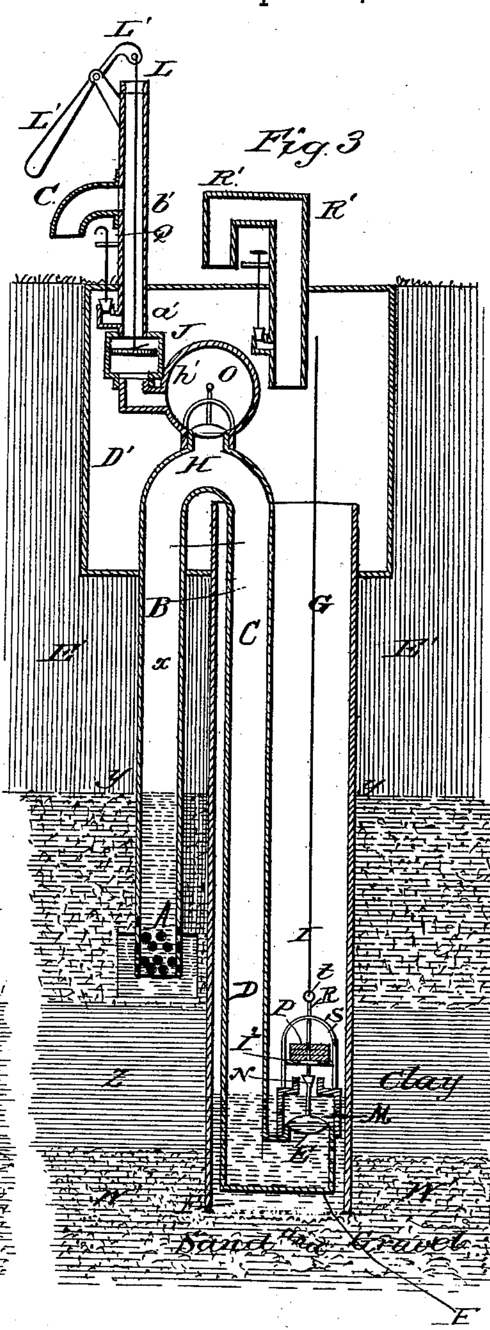

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UNITED STATES PATENT OFFICE.

JACOB B. YEAGLEY, OF INDIANAPOLIS, INDIANA.

APPARATUS FOR RAISING WATER FROM WELLS HAVING WATER-BEARING STRATA OF DIFFERENT HYDROSTATIC LEVELS.

SPECIFICATION forming part of Letters Patent No. 285,774, dated September 25, 1883.

Application filed May 14, 1883. (No model.)

To all whom it may concern:

Be it known that I, JACOB B. YEAGLEY, a citizen of the United States, residing at Indianapolis, in the county of Marion and State of Indiana, have invented certain new and useful Improvements in Apparatus for Raising Water from Wells having Water-Bearing Strata of Different Hydrostatic Levels; 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.

The object of my invention is to automatically raise to the earth's surface, as a fountain, water from bored, driven, or dug wells, in which the fountain or water-vein struck rises only a part way, by employing two fountains of different hydrostatic levels. Now, it must be remembered that every bored, driven, or dug well of plentiful water has a fountain within itself, and is governed in its rise, when tubed, by the fountain-head water supplying it flowing through sand and gravel, crevices, or cracks, often for great distances. The geological stratification in numerous districts is such as to form alternate sand and gravel (water) strata and clay strata, frequently to very great depths, as, for instance, in this locality. These sand and gravel strata, at a depth of from twenty feet to one hundred feet, contain an inexhaustible supply of water. Several clay strata impervious to water must, however, be bored through to reach the deeper sand and gravel (water) strata. Now, it is found by experience, especially so in this locality, that often the second, third, or fourth sand and gravel (water) stratum furnishes a hydrostatic rise or level, when tubed above the first sand and gravel (water) stratum from five (5) to fifteen (15) feet, in inexhaustible quantities, while in wells in the first stratum, at a depth of twenty feet, water would stand only a few feet high from the bottom of the well, and would act as a drain for any quantity of water that may be thrown into it. The reason of this is plainly to be seen, as the two sand and gravel (water) strata in question are separated by an impervious clay stratum or strata (I mean impervious to water) having different fountain-heads of different hydrostatic levels. The lower water-bearing stratum, being tubed through the upper water-bearing stratum, will rise about as high as its fountain-head; but if simply a bore is made, and not tubed, the lower water-bearing stratum would rise through the clay stratum above it and into the first sand and gravel water-bearing stratum, and there be drained off, as the two waters, uniting, could not rise higher than the fountain of the upper water-bearing stratum without the two forming an independent or secondary fountain-head and draining off through the sand and gravel toward a lower level, possibly in every direction.

My invention therefore consists in novel features of construction and arrangement and combination of parts, all as will be hereinafter fully described, and set forth in the claims hereto annexed.

Referring to the accompanying drawings, Figure 1 represents a vertical section through my improved apparatus for raising water after it has been placed in the desired stratum; Figs. 2 and 3, similar views, to be hereinafter referred to. Figs. 4 and 5 are sectional views of tools or devices used for excavating and dredging the cavity or basin for the reception of the fountain-ejector; Figs. 6 and 7, detailed views, to be hereinafter referred to.

In the drawings, A B is the influx fountain-pipe. C D E is the efflux fountain-pipe, and F G in Figs. 2 and 3 is the drainage-pipe.

H is the air-chamber valve.

I I is the wire chain or cord to stop the working of the ejector at will.

J is the pump-cylinder, and K is the water-stratum cavity.

L L' L' are the pump-handle and piston-rod.

M is the efflux-cylinder, and N is a shoulder on the double-acting efflux valve-stem.

O is the air-chamber.

P P are metallic adjusting-rings or circular plates, with holes in center.

Q Q is an ordinary pump-stock or pipe-drainer, at will.

R is the efflux double-acting valve-stem.

S S are valve-stem guards and guides or keepers.

t is a ring or hook on valve-stem to attach a wire, chain, or cord, I I.

V is the double-acting efflux-valve playing in efflux-cylinder M.

W W W W is the first water-flow through sand and gravel strata.

W′ W′ W′ W′ is the second water-flow through sand and gravel strata.

X X represents a suppositional height to which the water rises from K.

Y Y Y Y represent the upper line of first water-flow through W W W W.

Z Z Z Z represent a clay stratum impervious to water.

D′ D′ represent in Figs. 2 and 3 walled holes or openings or cavities dug out, and in Fig. 1 a dug well into the first water-bearing stratum. E′ E′ is soil and mixed earth overlying the first water stratum.

h′ h′ are the air-chamber valve-stem guards, guides, or keepers for valve.

I² I² is the cross-bar rest or stop for adjusting-rings P P to rest on.

a′ b′ is the efflux supply-pipe leading water to surface. C′ is a spout to efflux supply-pipe.

A B and C D form in Figs. 2 and 3 siphons, in which A B is the short and C D the long leg, the water rising to *x*, Fig. 2, by hydrostatic pressure, at which point the siphon begins.

Figs. 2 and 3 simply show instances where in different locatities the water in the stratum or strata found in W W and W′ W′ may have different hydrostatic levels or fountain-heads.

The pump part of my improved apparatus may be dispensed with and pipe R′ R′ screwed on pipe *a′* instead of the pump. Then in Figs. 2 and 3 the ejector requires a small hand-pump or exhausting-syringe to start water-flow through siphon A B C D. Where pump is dispensed with, the pump-stock or pipe-drainer Q Q is attached to pipe R′ R′.

Figs. 4 and 5 show the tools or devices used for excavating and dredging the cavity or basin K in Figs. 1, 2, and 3 through the fountain-tubes A B, after they have been placed in the desired stratum. I′ I′ in Fig. 4 is a tube or tubes screwed together, of required length necessary. This tube I′ I′ has two longitudinal slots on opposite sides, near its bottom. Through these slots pass the excavators or cutters 2 2, which are adjusted to cross-bar 3 3 in a mortise or slot, and held by small bolts or pins, on which said excavators may turn as the rod 4′ 4′ is forced up and down, the cross-bar 3 3 being securely fastened by screwing rod 4′ 4′ into it, or it may be fastened with a nut. Now, if the rod 4′ 4′ is forced up and down within the tube I′ I′, the excavators will slide through the longitudinal slots in the direction shown by the dotted lines in Fig. 4, while at the same time the whole device may be turned by tube-handles 1 1, giving the excavators a double motion, one, as shown by dotted lines, and the other circular, thus cutting and boring light or strong at will, as the excavators are thrust in or out of tube I′ I′. Now, this excavator, as a whole, is of such size as to freely pass through the bore or tube A B before the top part of the apparatus is screwed on. The excavator may be made to operate as soon as the slots in tube I′ I′ pass below the lower end of fountain-tube A B, excavating even above and around the lower end of the tube A B, causing, by dredging or pumping out from time to time the quicksand, sand, and fine gravel, an excavation or basin, as shown at K, Figs. 1, 2, and 3.

Fig. 5 shows the dredging-tool used in connection with the excavator, both to be used alternately, the dredging-tool first, then the excavator. The dredging-tool is simply a short tube with a valve opening upward a few inches above and within the short tube 6 6, Fig. 5. The same rod, 4′ 4′, is used for both excavator and dredging-tool alternately.

Fig. 6 shows more plainly the upper side of cross-bar 3 3 in Fig. 4, 7 7 being the mortises or slots with pins, in which the excavators or cutters are adjusted.

The devices in Figs. 4, 5, and 6 are shown and described with the apparatus, in order that such an excavation as shown at K is easily made through a tube or bore where water is found in quicksand, sand and gravel, or other water-pervious strata, as such excavation, either natural or artificial, is necessary to give free flow and full force in ejector.

Construction and operation of my improved apparatus: In Fig. 1 is shown a dug well into the first sand and gravel water bearing stratum, the water rising in well to Y Y. Now, the tube A B is driven or sunk by boring through the clay stratum Z Z into the second (2) sand and gravel water-bearing stratum, W′ W′. If it is found that the water from the latter stratum rises when tubed four or more feet above Y Y to X X, then the excavation K may be made. After pumping out the finer sand, &c., about the lower end of the pipe A B, then the dredging-tool, Fig. 5, and excavator, Fig. 4, are used to complete the excavation, as shown at K. The lower end of pipe A B, resting in cavity or basin K, should be perforated to admit the water more freely. Then the other parts are screwed on pipe A B. Then the water from A B will flow through C D E, lifting the valve V, (which is made as light as possible,) and the water will rush out of the efflux-cylinder. Now, the adjusting-rings are slipped on the valve-stem (see Fig. 1) to give just sufficient weight to the valve, so that the shoulder N on valve-stem will lift the adjusting-rings, and when the water through the pipe A B C D E has attained its greatest velocity, then the valve V will close the efflux instantly, and by the sudden stoppage of flow water will be forced into the air-chamber O, forcing up the valve H. The current having thus spent its force, the valve V is immediately made to fall, the adjusting rings or weights being arrested in their fall by the cross-bar rests or stops I′, leaving the valve free to obey the pressure, thereby again permitting the water to flow through the aperture, raising the valve V again until the shoulder N will again lift the adjusting-weights P P. When the current has again attained its greatest velocity, the aperture will again be closed, thus suddenly arresting the current, as before, and causing, by its reaction or momentum, a pressure throughout the whole pipe, causing again a portion of the water to enter the chamber O, and so on at intervals of but little variation. The water by these successive impulses is forced into the air-chamber O, there condensing the air in the upper part, causing a steady stream to flow from the pipe and spout a' b' c'; otherwise without the air-chamber the flow would be spasmodically governed by the impulses of flow and arrest above described. The principle of this operation is well known in the action of the "hydraulic ram." Now, where the flow through the pipe and spout a' b' c' is slow and water for a few moments is required in greater quantity, the pump can be used, when the valve V will instantly close the aperture to the efflux-cylinder M, thus making a perfect pump through the pipe A B and O and a' b' c', the valve H serving for the usual lower pump-valve. Again, should there be a heavy flood, raising the surface-water in stratum W W up to or even above X X, such surface-water could not enter C D E, Fig. 1, thereby leaving the pump in good condition for obtaining clear fresh water from the stratum W′ W′, until the flood subsides, when the apparatus will again automatically operate. Now, should it be desired to stop the operation of the ejector, then close the efflux-aperture with the valve V by means of the wire chain or cord I I and open the drainer Q Q, thus preventing the possibility of freezing. The reverse will again set the apparatus in operation. The other forms, as shown in Figs. 2 and 3, operate on virtually the same principle, except that an additional pneumatic principle is employed by the use of the siphons A B C D. The weights P P are employed to regulate the valve V in proportion as the fall of water from Y Y to X X varies, because the greater the fall the greater the weights must be to regulate the valve V to always close the efflux-aperture at the time the current attains its greatest flow or most rapid velocity, in order to obtain its greatest reaction and consequent greatest pressure throughout the pipe and valve H, which opens upward to admit water into chamber O.

Now, it must be borne in mind that the shortness of the pipe A B from the cavity or basin K to the efflux-aperture does not affect the apparatus like a short pipe from a reservoir to a hydraulic ram, because the reservoir of the ejector is curved, while that of the hydraulic ram is not, and the reaction of water in the ejector cannot throw itself back upon its reservoir, (cavity or basin K,) because it is full and forced upward, not by the rapidity of the flow-water in the stratum, but by hydrostatic pressure from the fountain-head, which is really the main reservoir of the apparatus, which main reservoir or fountain-head may be at a great distance, the pervious water stratum (supplying the cavity or basin K) representing an indefinitely large and curved aqueduct.

In Fig. 3, where it happens that an upper stratum furnishes the required fall to a lower stratum, then the pipe F G must be made as a tight-fitting curbing-pipe through the different strata into the drainage stratum W′ W′, otherwise the two waters of the two strata would unite, the water in K W W would to quite an extent drain through the opening made through the stratum Z Z and be drained off by stratum W′ W′.

The drainage-pipe F G may be perforated or open, as shown in Figs. 2 and 3, to allow the water to pass out and on with the water in the stratum, and the sand and gravel taken out to the bottom of the drain-pipe. Where the fountain is found in a crack, crevice, or fissure, no excavation, as shown at K, is necessary; likewise in the drainage.

Where the pump is not used, and the pipe R′ R′ screwed on pipe a' instead, the apparatus can be started in Figs. 2 and 3 with a small hand-pump or exhausting-syringe by attaching it to the spout of the pipe.

The valve V is of double-convex form, so it can close both apertures, the one above and the other below it.

The valve-stem guards, &c., are more plainly shown in detail or detached view, Fig. 7. The cross-bars (for the adjusting-weights P P to rest on) form a cross joining the guards. These cross-bars have a round opening large enough for the shoulder N on valve-stem R to pass through. Now, as the force of the water carries the valve upward it will lift the adjusting-weights when the water has its greatest efflux and close the aperture. Then as soon as the reactionary force has been expended, the water coming to a rest, the weighted valve will drop, leaving the adjusting-weights resting upon cross-bar rests, thus relieving the valve of the weights and allow an easy flow again to commence through the efflux-aperture till the most rapid efflux has again been attained, as before, and so on.

It will be seen that the secret of success of my improved apparatus lies in the employment of two (2) sand and gravel (water) strata of different fountain-heads or levels separated by clay or other water-impervious strata, and the one rising the highest, whether the second, third, fourth, or any other, is tubed through those lying above, and the lowest water-raising stratum is used as a drain. Should this latter be the second (2) water stratum, and, say, the third or fourth the higher, then the second must also be tubed to prevent the first water from joining, by means of a large tube to admit the long leg of the siphon, with its efflux devices, (see illustrations in Figs. 2 and 3;) but where the first water-bearing stratum raises the water higher than the second, then it is arranged as shown in Fig. 3.

Where wells dug to the first water-vein, as shown in Fig. 1, are not desired, then the siphon form of the apparatus may be employed, as shown in Fig. 2, and the drainage-pipe F G set into the drainage stratum, as shown in Fig. 2. Where an upper water-vein gives a higher rise than a lower one, then the form shown in the third figure is employed.

In Fig. 3 the pump should be placed on other side of the air-chamber, where pipe R′ R′ stands, so as to stand perpendicularly and over pipes A B and F G. For ordinary purposes the pipes A B and C D E are from one and one-fourth to one and one-half inch in diameter inside, while the pipes a' a' and R′ R′ are much smaller, while the drainage-pipe F G need only be, for ordinary purposes, from four to six inches in diameter—just large enough to freely admit pipe C D E with its efflux-cylinder. The valve H must be made to fit accurately, especially when forms are used, as shown in Figs. 2 and 3; otherwise the water would run back and allow the air to enter the siphon A B C D, and then the water in A B would drop to x, which represents the suppositional height to which the water will rise from stratum W′ W′ in Fig. 2, while the water in C D will drop into the drainage stratum W W, same figure. The line X X X X represents the suppositional height to which the water will rise in A B, Figs. 1, 2, and 3, while Y Y Y Y represents the rise in Figs. 1 and 2 from stratum W W W. In Fig. 3 different strata are supposed to be employed from those in Figs. 1 and 2, being a suppositional reversion from veins found in Figs. 1 and 2, being simply to illustrate how such a reversion can be successfully overcome and employed.

In Figs. 2 and 3, A B C D, with air-chambers O, could be run up to surface, dispensing with excavations D D; but I prefer it in form shown to prevent liability of water freezing in and about top part of B, C, H, and O, &c. Now, in many other localities the geological stratification of alternate pervious and impervious water strata, of sand and gravel or chalk on the one hand, and clay or stone on the other, do not exist; but after digging down but short distances stratified limestone in the form of layers with seams between them are found, and no wells can there be dug, (except to great depths frequently,) as the water passes off rapidly through these seams, leaving the well dry, because these strata at intervals—sometimes at short or long distances—have cracks or crevices or fissures downward, through which the surface-water flows until some impervious stratum is reached, upon which it will flow, seeking a lower level, combining in its course with other similar streamlets, and often reaching larger streamlets having as their fountain-heads, probably, a river, lake, or reservoir. These then run along upon the impervious stratum, and may sooner or farther on in their course be found between two impervious water strata which are elevated, where a large basin or reservoir is formed, often extending for many miles. Now, if a bore is made through the upper impervious stratum, a fountain is struck, and where tubed will rise nearly as high as its fountain-head waters. This rise can then be drained to a lower water-rise level, where the surplus-water from the ejector may be drained off, as shown in drawings. Thus it will be seen that almost under any condition of the geological stratification of the earth's crust fountains may be obtained, sometimes rising to the earth's surface when tubed, and are then called "Artesian" wells or fountains; but in many cases Artesian-fountain seekers have bored and drilled to great depths, succeeding only in finding an abundance of water to rise within from ten to fifteen or twenty feet of the earth's surface, after expending a large sum of money and labor. Now, with my improved apparatus, Artesian fountains may, almost to a certainty, be secured at small expense, for if the fountain is found to rise, say, from five (5) or more feet above the water in another stratum, either sand and gravel, or limestone, as before explained, this latter can be used as the draining stratum of the waste water from the apparatus. There are many attempted Artesian wells or fountains all over the country on which there have been large sums of money expended that now stand abandoned because the water could only be brought within from ten (10) to twenty feet of the earth's surface. All such cases can be made a success by applying my improved apparatus.

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

1. The combination, with a pump or exhausting device, of an influx fountain-pipe, an efflux fountain-pipe, and an intermediate connecting valved air-chamber, O, substantially as and for the purpose herein shown and described.

2. The combination, with a pump or exhausting device, of an influx fountain-pipe, A B, an efflux fountain-pipe, C D E, an efflux-cylinder, M, having a double-acting valve, V, and an intermediate connecting valved air-chamber, O, substantially as and for the purpose herein shown and described.

3. The combination, with a pump or exhausting device, of an influx fountain-pipe, A B, an efflux fountain-pipe, C D E, an efflux-cylinder, M, having an adjustable weighted valve, V, and operating mechanism, and the intermediate connecting valved air-chamber, O, substantially as and for the purpose herein shown and described.

4. The combination of the pipes a' b', influx fountain-pipe A B, an efflux fountain-pipe, C

D E, efflux-cylinder M, having valve V, and intermediate connecting valved chamber, O, substantially as herein shown and described.

5. The combination, with a pump or exhausting device, of an influx fountain-pipe, an efflux fountain-pipe, an intermediate connecting valved air-chamber, O, an efflux-cylinder, M, having valve V, and mechanism for operating said valve, substantially as and for the purpose herein shown and described.

6. The combination, with a pump or exhausting device, of an influx fountain-pipe, A B, an efflux fountain-pipe, C D E, the two pipes forming a siphon adapted to connect two water-bearing strata of different hydrostatic levels or fountain-heads, the intermediate connecting valved air-chamber, O, the efflux-cylinder M, drainage-pipe F G, valve V, and operating mechanism, substantially as and for the purposes herein shown and described.

7. The combination, with a pump or exhausting device, of an influx fountain-pipe, A B, an efflux fountain-pipe, C D E, said two pipes adapted to connect two water-bearing strata of different hydrostatic levels or fountain-heads, the intermediate valved air-chamber, O, the efflux-cylinder M, valve V, and operating mechanism, substantially as and for the purposes herein shown and described.

8. The combination of an influx fountain-pipe, an efflux fountain-pipe having an efflux valved cylinder, and an intermediate valved air-chamber connecting the influx and efflux fountain-pipes, substantially as and for the purpose herein shown and described.

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

JACOB BLOOM YEAGLEY.

Witnesses:

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R. S. PENNY.