No. 647,202. Patented Apr. 10, 1900.

A. I. SANDBO.

PUMP.

(Application filed Apr. 29, 1899.)

(No Model.) 2 Sheets—Sheet 1.

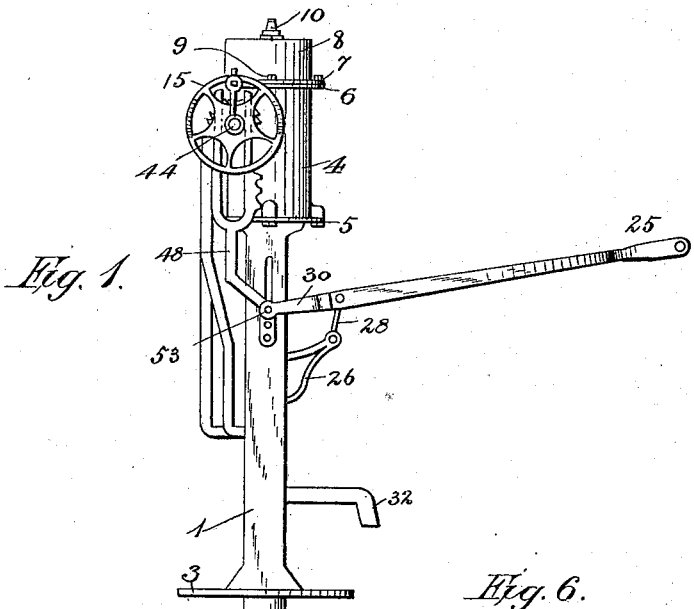


Fig. 1.

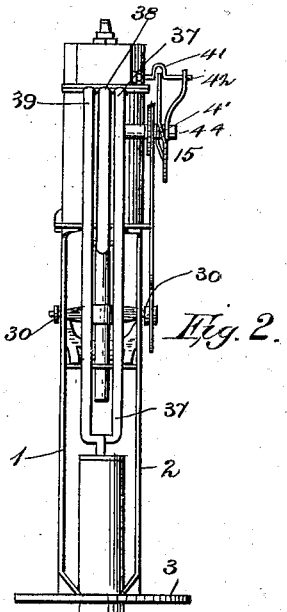


Fig. 2.

Fig. 6.

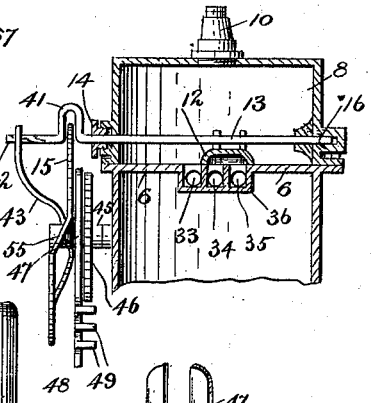
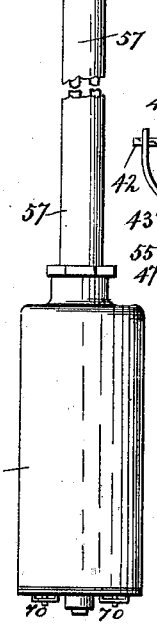
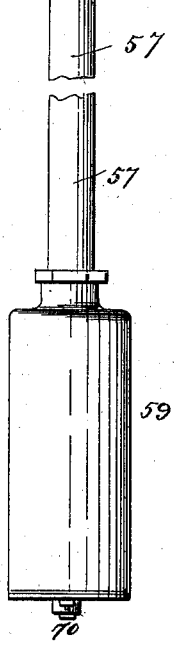


Fig. 9.





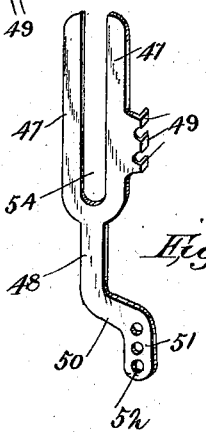


Fig. 7.

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(No Model.) 2 Sheets—Sheet 2.

Fig. 3.

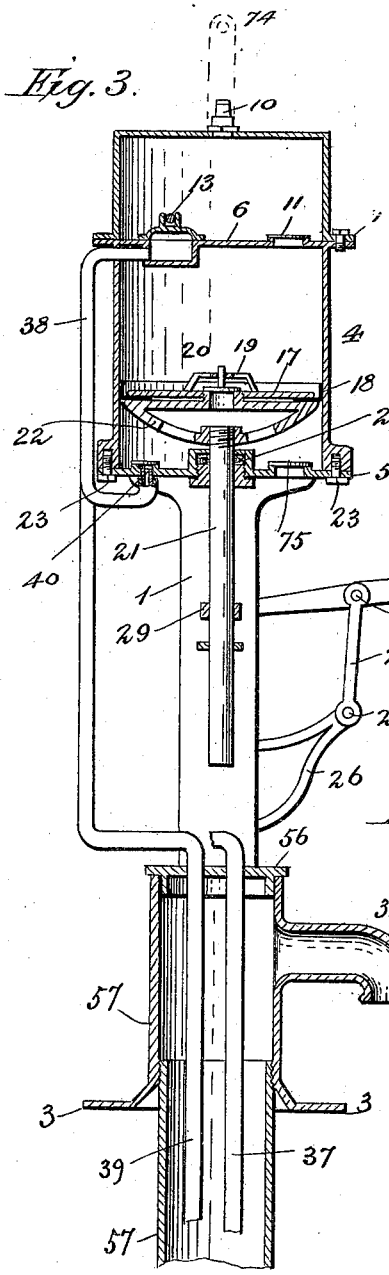


Fig. 4.

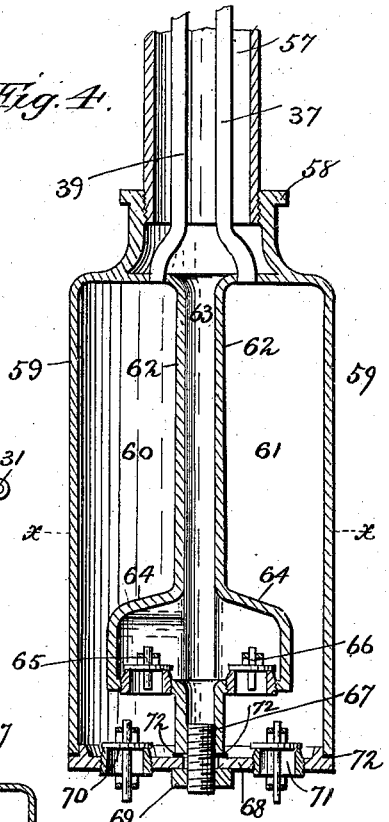
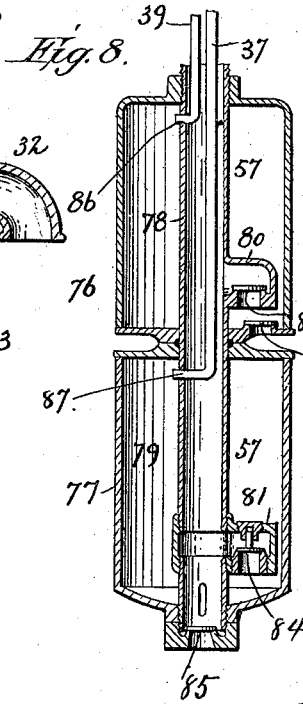


Fig. 8.



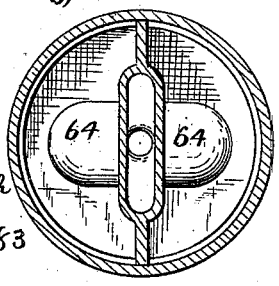


Fig. 5.

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SPECIFICATION forming part of Letters Patent No. 647,202, dated April 10, 1900.

Application filed April 29, 1899. Serial No. 715,036. (No model.)

To all whom it may concern:

Be it known that I, ANTON I. SANDBO, a citizen of the United States, residing at Waukon, in the county of Allamakee and State of Iowa, have invented certain new and useful Improvements in Pumps; 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.

My invention appertains to a pumping apparatus designed primarily for pumping water from deep wells or elsewhere, though it will be found equally reliable and efficient for pumping any kind of liquid, as oils or the like; and it consists in certain novel combination and construction of elements or parts, as will be hereinafter fully described, illustrated, and pointed out in the claims.

One object of my invention is to provide a pumping apparatus which in its initial action compresses a quantity of air into a receiving-reservoir and forces therefrom a quantity of water which has been previously admitted through the system of valves, thereby obviating the necessity of providing the usual suction rods and valves, the result being that I am enabled to lift a quantity of water from great depths at the expense of a minimum amount of power, inasmuch as the operation of the air-pump requires comparatively-little exertion or force.

A further advantage, among others, is to produce a pumping apparatus which may be operated by irregular, intermittent, or spasmodic force—as, for instance, that derived from a windmill.

A further object is to enable the operator to store a quantity of air under pressure within a reservoir which contains a supply of water, whereby the water may be withdrawn from said reservoir from time to time in desired quantities by simply turning a faucet.

A further object is to enable the water to be acted upon by the same quantity of air, which, being previously impregnated or treated with any desired antiseptic or vitalizing-gas, so acts upon the water that the latter will be greatly benefited by such contact, as will be readily understood.

A further object, among others, is to enable the water to be greatly elevated, and, if desired, the water may be discharged into water-mains without discharging but an infinitesimal quantity of air with the water.

My apparatus consists of but a comparatively-small number of parts, which may be cheaply constructed and expeditiously assembled in their respective operative positions and when thus assembled the entire pumping apparatus may be operated at a minimum expense of power, the operation being comparatively noiseless, a valuable desideratum, inasmuch as the same quantity of air is used over and over again and does not have to be exhausted, thereby producing a disagreeable hissing noise.

The preferred construction to be adopted in materializing the several features of my invention and the elements designed to cooperate therewith are illustrated in the accompanying drawings, in which—

Figure 1 is a side elevation showing my improved pumping apparatus ready for use and showing the middle portion of the water-tube broken away. Fig. 2 is a similar view taken from a point at right angles to the side illustrated in Fig. 1. Fig. 3 is a vertical central section of the upper portion of my pumping apparatus illustrated in Fig. 1. Fig. 4 is a vertical central section of the lower portion of the pumping apparatus illustrated in Fig. 1. Fig. 5 is a horizontal section of Fig. 4 on line $x\,x$. Fig. 6 is a vertical section of the upper portion of my pumping apparatus shown in Fig. 1, taken on a line at right angles to the line of division followed in Fig. 3. Fig. 7 is a detail perspective view of the air-valve actuator. Fig. 8 illustrates a modified construction which may be adopted in lieu of the construction illustrated in Fig. 4. Fig. 9 is a perspective view of the cam-wheel designed to operate the slide-valve.

In order to conveniently refer to the several features of my invention and their necessary coöperating accessories, designating-numerals will be employed, of which 1 and 2 indicate the supporting-standards for my improved pumping apparatus, said standards being permanently secured in any preferred way to the supporting base or collar 3, which is adapted to rest directly upon the top of a well or cistern and may be supported by any curbing or otherwise, as is usual.

Erected upon the standards 1 and 2 is the pumping-cylinder 4, having the lower and upper flanges or heads, respectively, 5 and 6, the latter extending outwardly sufficiently to be engaged by the flange 7, formed upon the air-chest 8, said flanges having interposed between them a washer of suitable packing, and are removably secured together by a series of bolts or set-screws 9 or otherwise, the air-chest being provided in its upper end with a safety-valve 10 of the usual or any preferred construction.

By reference to Figs. 3 and 6 it will be observed that the upper head 6 of the cylinder 4 serves the purpose of a diaphragm between the pumping-cylinder 4 and the air-chest, a suitable valve 11, opening into the air-chest, being provided in the head 6 in order to permit the free exit of the air from the cylinder 4 into said chest and prevent recession thereof, as will be hereinafter more clearly set forth.

The head 6, as will be seen by reference to Figs 5 and 6, is also provided with a slide-valve 12, which is controlled by the reciprocating plunger 13, properly secured to said valve and reaching outward through a suitable stuffing-box 14 into engagement with the cam-faced controlling-wheel 15, the inner end of said shaft being suitably mounted in the seat 16, formed in the side of the air-chest.

Within the cylinder 4 I mount the piston-head, designed as an air-compressor, said head consisting of the diaphragm or plate 17, provided with the usual packing 18 and with a preferably centrally-disposed valve-seat 19 and valve 20 therefor, the same being designed to permit the free upward movement of the air during the downstroke of the piston, said diaphragm 17 being operatively held in position and connected to the piston-rod 21 by the yoke or head proper, 22, which may be constructed as shown in Fig. 3 or in any preferred way which will reinforce and hold the diaphragm-plate 17 to its work. The lower head 5 is secured to the cylinder-body by any suitable means, as by the threaded bolts 23, it being understood that a suitable gasket of packing is to be interposed between said head and the cylinder-body.

In the central portion of the head 5 I provide the stuffing-box 24, through which the piston 21 may be freely reciprocated by any suitable power, as by the lever 25, properly fulcrumed and supported in position by the brackets 26, secured to the standards 1, a link 27 being preferably disposed between said brackets and lever in order to compensate for the changing position of the fulcrum-point when said lever is raised and lowered, as will be clearly necessary, said parts being pivotally held in coöperative relationship, as by the bolts or shafts 28. The inner ends of the lever 25, which is preferably bifurcated or double for a portion of its length, are pivotally attached to the yoke 29, which latter is provided with an aperture in its middle portion adapted to receive said piston, the parts being permanently held into rigid union with each other by any suitable means, as by keying the same upon said piston or otherwise uniting said parts.

By reference to Fig. 2 it will be observed that the bifurcated ends 30 of the lever 25 extend upon either side of the pumping apparatus and are of sufficient width to reach upward on either side of the cylinder 4 and its coöperating accessories, so as to be entirely in clearance with said parts, when the extreme upper end of said lever may be connected to the reciprocating shaft of a windmill by means of the aperture 31 and the pump driven by such power, though it is obvious that when the said lever is disposed in a substantially-horizontal position and supported by the brackets 26 and links 27 it will be in position to be operated by hand-power, inasmuch as little force is required to operate the air-pump and incidentally force the water in connection therewith to any point desired or so that such water will pour out of the nozzle or spout 32.

It will be noted that by making the controlling-lever bifurcated with a branch of the bifurcation on each side of the pump-body I attain a smoother and more even action of the parts operated by the lever, and there is consequently less friction and wear of the parts. This feature is of especial advantage where the pump is actuated by a windmill or other engine-like motor.

I locate in the diaphragm or head 6 the three ports 33, 34, and 35, which are controlled by the slide-valve 12, said ports being housed or arranged to terminate in the pocket 36, formed in the head 6, and are arranged to extend outward through the wall of the cylinder 4, and each port is properly connected to suitable pipes, the port 33 being connected with the pipe 37, the port 34 having connection with the pipe 38, while port 35 is connected to the pipe 39, as indicated in Fig. 2.

By reference to Fig. 3 it will be observed that pipe 38 extends downward and is bent under the cylinder 4 and communicates with said cylinder by means of the inwardly-movable valve 40, the object being to exhaust the air from one of the pipes 37 or 39 back into said cylinder to be repeatedly used, as will be hereinafter pointed out.

In order to provide means for effecting the reciprocation of the plunger 13, I form upon the outer end thereof after it leaves the stuffing-box 14 the loop or guide 41, adapted to receive the outer edge and peripheral face of the cam guide-wheel 15, the outer free end 42 of the plunger 13 being sustained and held in its operative position by the bracket 43, which is secured upon the end of the shaft 44, upon which the cam-wheel 15 is rotatably mounted by means of the sleeve 45, which is firmly secured to said wheel or forms an in-

tegral part thereof and is designed to also carry the ratchet-wheel 46, by means of which said cam-wheel 15 is actuated.

By reference to Fig. 6 it will be observed that a space or opening is left between the cam-wheel 15 and the ratchet-wheel 46, and within this space or opening thus provided I dispose the branches 47 of the bifurcated actuating toothed bar 48, one of said branches being provided with the ratchets or teeth 49, designed to engage the teeth upon the ratchet-wheel 46, said teeth being preferably three in quantity, though a greater number may be employed, if deemed desirable.

The actuating toothed bar 48 is illustrated in complete form in Fig. 7, and it will be seen that in order to accommodate it for coöperation with one of the branches 30 of the lever 25 I provide the laterally-extending branch 50 and the depending section 51, the latter having a series of perforations 52, preferably three in number, by means of which it may be adjustably secured in position by passing the outer ends 53 of the yoke 29 through one of the apertures 52, thus regulating or controlling the reach of the bifurcated ends 47 as the toothed bar 48 is reciprocated by the action of the lever 25, it being understood that the space indicated by the numeral 54 in Fig. 7 is designed for the reception of the sleeve 45 or that portion thereof between the wheels 15 and 46, thereby permitting said bifurcated ends to play loosely between said wheels.

By reference to Figs. 6 and 9 it will be seen that the cam guide-wheel 15 is provided, preferably at opposite points, with the cam-faces 55, it being understood that a greater or less number of said bends or cam-sections may be provided, as desired, according to the diameter of the wheel upon which they are formed, the object of said inclined sections being to throw part of the peripheral face or rim of the wheel in a different plane from that occupied by the remaining portion of the wheel in order that the plunger 13 may be held at one point—as, for instance, in an inwardly-disposed position—until the wheel 15 is rotated sufficiently to bring the next bend or cam-section into engagement with the loop 41, when, as will be seen by reference to Fig. 6, the plunger will be drawn outward, inasmuch as the loop-section 41 will ride outward upon the inclined or cam face 55 until the end of said section is reached, when said plunger will be again held in a stationary position until the wheel is sufficiently rotated to again bring the next cam-section in contact with the loop-section 41, when the plunger will be again thrust inward and the operation repeated, and since the slide-valve 12 is attached to the plunger 13 it will be correspondingly moved, and thereby leave one of the ports open or in communication with the air-chest, while the other two ports will be covered by the sliding portion 12, and thereby entirely cut off from communication with said air-chest, though in direct communication with each other, the object being to place that portion of the air-chest 8 below the piston-head in direct communication by means of the pipe 38 with one or the other of the pipes 37 or 39 and the reservoirs to which they extend. The pipes 37 and 39 extend downward, as indicated in Fig. 3, and pass through tightly-fitting apertures provided in the cap 56, which forms a closure or head for the upper end of the tube 57, which is of sufficient length to extend downward into the bottom of the well and is threaded into the collar or flange 58, integrally formed or otherwise provided upon the upper end of the reservoir or casing 59, which may be cylindrical or other preferred shape and is divided into two separate and distinct chambers or compartments 60 and 61 by the hollow or double partition 62, thereby leaving between the walls of said partition the chamber or throat 63, which at its lower end is provided with the lateral branches or enlargement 64, as more clearly shown in Fig. 5, the object of said lateral extensions being to provide seats for the inwardly-movable valves 65 and 66, the purpose of which will be hereinafter made plain. The lower end of the partition is provided with a threaded seat designed to receive the threaded end of the anchoring-stem 67, by means of which the removable bottom 68 is secured upon the end of the reservoir 59 and held in position by the nut 69. The removable bottom section 68 is provided with the inwardly-movable valves 70 and 71, which in common with the valves 65 and 66 are designed to permit the free upward or inflow of water when the reservoir 59 is immersed, except at certain times and under certain conditions, as will be hereinafter explained.

Instead of forming the threaded stem of a separate piece of material the double partition 62 may be so cast or otherwise formed that it will have a depending stem, which may be threaded to receive the nut 69, by means of which the bottom 68 may be securely held in place after a ring of packing 72 is placed in the seat formed by the flange 73 and between the lower edge of the partition and said bottom, thereby forming two separate and distinct air-tight chambers 60 and 61 upon the opposite sides of the partition 62.

After the parts have been constructed substantially in the manner specified and assembled in their respective operative positions the piston 21 may be reciprocated by operating the handle 25 manually, or said piston may be reciprocated by removing the bolt 28 and raising the lever 25, so that it will occupy a vertical position immediately above the air-chest, as indicated by the dotted lines designated by the numeral 74, when said lever may be connected directly to the plunger-rod of a windmill or other source of power, it being understood that the branches 30 are disposed upon either side of the cylinder 4 and coöp-

erating parts carried thereby. As the piston 31 is reciprocated the first effect will be to cause an inflow of air into the cylinder 4 through the inwardly-movable valve 75, formed in the head 5 of said cylinder, and that upon the downward stroke of the piston-head said valve will be closed, while the valve 20 will open, thus leaving the air above the piston-head, from whence it will be forced into the air-chest through the upwardly-movable valve 11, it being understood, as will be seen by reference to Fig. 6, that the slide-valve 12 has been thrown in such position by the cam-wheel 15 and that said valve will cover two of the ports, as 34 and 35, leaving the port 33 open, which, being in communication with the pipe 37, will permit the air to flow out of the chest 8 downward into the chamber 61, as will be seen by reference to Fig. 4. Since the water is free to rise through the valves 65 and 66 and 70 and 72, it will of course extend upward in the reservoir 59 and into the pipe 57 to a height coincident with the level of the water outside of said pipe, which will of course leave the compartments or chambers 60, 61, and 63 normally filled with water. The initial action or effect of the air will therefore take place or be manifested when coming through pipe 37 and entering the upper end of the chamber 61, the result being that the water in said chamber will be forced downward, causing the valves 65 and 71 to tightly close, while valve 66 will be opened, thereby permitting the water to flow from the chamber 61 upward through the throat or chamber 63 and thence through the pipe 57 and out at the nozzle or spout 32 or elsewhere, as may be provided by proper pipe connections. The act of compressing the air within the upper portion of the chamber 61 will continue until the cam-wheel 15 has rotated sufficiently to bring one of the cam-faces 55 into engagement with the loop or guiding section 41, when the plunger 13 will be drawn outward and incidentally bring the slide-valve 12 in proper position to cover the ports 33 and 34, thereby leaving the port 35 open or in communication with the air-chest 8, the movement of the valve 12 being so timed by means of the cam-face or bend 55, formed upon the wheel 15, that it will occur when the reservoir 61 has been almost completely emptied of water and consequently filled with compressed air. The act of moving the valve 12 over the ports 33 and 34 establishes communication between the pipes 37 and 38, thereby rendering it unnecessary for the valve 75 to again open, inasmuch as the air, which is now in a compressed condition, in the chamber 61 may be withdrawn therefrom through the pipes 37 and 38 and repeatedly utilized. As the piston is continuously reciprocated the bifurcated lever 48 will be moved upward and downward, bringing the teeth 49 into engagement with the ratchet-wheel 46, and thereby intermittently rotate the wheel 15, finally bringing the next succeeding bend or cam-section 55 into engagement with the loop 41, and thereby controlling the valve 12, so moving it that when one of the chambers 60 or 61 is exhausted of water the other chamber, which has become filled with water, will be acted upon by directing the air in the upper portion thereof, and consequently forcing the water downward until the compartment is emptied, the operation being continuously repeated, it being understood that as soon as the pressure of air is removed from the empty reservoir the water will rush in through the proper valves and again fill the same by the time the opposite reservoir is empty.

By charging the air within the air-chest or otherwise with some suitable antiseptic the water may be completely aerated and purified, and since the same air is used over and over again the aeration of the water may be accomplished at a minimum cost.

To completely follow the operation of my pump after the slide-valve 12 has been moved over the ports 33 and 34, it may be stated that upon the reciprocation of the piston-head the backflow of the compressed air within the chamber 61, induced not only by its own compression, but also by the rising water within the chamber 61, is utilized, inasmuch as it is drawn upward through the pipe 37 and thence through the port 33 and then out at the port 34 and downward through the pipe 38 and from thence through the valve 40 into the cylinder 4, it being clear that when the valve is again moved over the ports 34 and 35 the air will be drawn upward through the pipe 39 and thence inward through the port 35 and then outward through the port 34 and downward through the pipe 38 and valve 40, as before stated, the operation being repeated *ad infinitum*.

It is clear that by properly regulating the actuating-lever 48 by means of the apertures 52 the ratchet-wheel 46 may be rotated one or more cogs at each upward movement of the ratchets or teeth 49.

In Fig. 8 I have shown a slightly-modified construction, which may be adopted when materializing the reservoir 59, since it will be seen that I have provided an upper and lower reservoir 76 and 77, respectively, properly secured together, one above the other, by means of an extension or continuation of the tube 57, as by this arrangement two annular chambers 78 and 79 are formed around said continuation of the tube 57. At a point upon the tube 57, within each of said annular chambers, I provide a lateral extension, the extension 80 being provided for the annular chamber 78, while the extension 81 is located in the annular chamber 79. The lateral extension 80 of the pipe 57 is provided upon its under side with the inwardly-movable valve 82, which is located, preferably, near or over the inwardly-movable valve 83, formed in the bottom of the reservoir 76, while the lateral extension 81 is provided with a slightly-different form of valve, as indicated by the numeral 84, which obviates the necessity of a

valve for the bottom of the reservoir 79, inasmuch as an upwardly-movable valve 85 may be located directly in the end of the tube 57.

The pipe 39 instead of ending directly in the upper end of the reservoir 62, as shown in Fig. 4, extends into the annular chamber 78 by means of the lateral branch 86, which reaches through the wall of the tube 57, and it is clear that when the air is forced downward through the pipe 39 the water which is stored in the annular chamber 78 is forced downward, thereby closing the valve 83 and opening the valve 82 and permitting the water to pass upward through the tube 57 to the point of exit. The tube 37 extends downward within the pipe 57 to a point near the top of the annular chamber 79, when, by means of the lateral branch or extension 87, it extends directly through the wall of said tube into the upper part of said annular chamber, and it is clear that when the air is forced through said tube the water in the annular chamber will be forced downward, thereby causing the valve 85 to become closed and the valve 84 to open, which will permit the upward rise of the water in the tube 57 and thence outward through the nozzle 32, as in the construction illustrated in Fig. 4.

While I have illustrated the preferred construction to be adopted in the materialization of my improved pumping apparatus, it will be understood that all substantial equivalents thereof and any modification naturally falling within the purview of my invention is comprehended by me in this application, and I therefore do not wish to be confined strictly to the exact showing herein presented.

Believing that the construction, advantages, and operation of my improved pumping apparatus have been made fully apparent by the foregoing specification, considered in connection with the accompanying drawings, I will dispense with further reference to the details thereof.

What I claim as new, and desire to secure by Letters Patent, is—

1. In a pumping apparatus, an air-compressor having two chambers, a water-reservoir having three compartments and valve connections between the same and the water in which said reservoir is immersed; pipes making an independent connection between one of the air-chambers and one of said compartments, a countersink or pocket formed in the partition separating the air-chambers and provided with ports, two of which are adapted to connect with said pipes leading to the reservoir, while the third is connected to the lower air-chamber by proper valve and pipe connections, and a piston fitting said lower air-chamber and means to reciprocate the same and additional means for connecting two of said pipes with each other, whereby the air previously delivered into one of said compartments is again withdrawn therefrom and sent into the other compartment, in the manner specified and for the purpose set forth.

2. In pumping apparatus, supporting-standards having slots therein, a bifurcated lever having a branch of the bifurcation working in each of the slots, a bar pivoted to the lever and having two branches, a toothed member being connected with one of the branches and valve mechanism coöperating with said bar, all combined as set forth.

3. In a pumping apparatus, a cylinder having two distinct chambers separated by a horizontal partition, three-way ports located in said partition, a slide-valve provided with a plunger, a cam-wheel operatively connected with said plunger, a ratchet-wheel and a bifurcated actuating-lever one bifurcation having a toothed member connected therewith, said lever being located between said cam and ratchet wheels and a pumping-lever connected to the actuating-lever, all combined as set forth.

4. In a pumping apparatus, an air-compressor having two separate and distinct chambers formed by a dividing-partition, a three-way port located in said partition, a slide-valve controlling two of said ports, a valve in said partition opening upward, a piston operating in the lower chamber and means to operate the foregoing parts, all arranged and combined as set forth.

5. In pumping apparatus, an air-compressor having two distinct chambers separated by a partition, a three-way port formed in said partition, a slide-valve having a plunger provided with a loop controlling two of said ports, a cam-wheel extending into said loop whereby the valve will intermittently reciprocate, all combined as set forth.

6. In pumping apparatus, a cylinder having two distinct chambers separated by a partition, three-way ports located in said partition, a slide-valve provided with a plunger, a cam-wheel operatively connected with said plunger, a ratchet-wheel and a bifurcated actuating toothed bar having teeth and located between said cam and ratchet wheels and a pumping-lever connected to the actuating-lever, all combined as set forth.

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

ANTON I. SANDBO.

Witnesses:
OTTO HAGEN,
EMIL SCHUKER.