(No Model.)

A. L. REYNOLDS.

SOLAR WATER LIFTING APPARATUS.

No. 408,929. Patented Aug. 13, 1889.

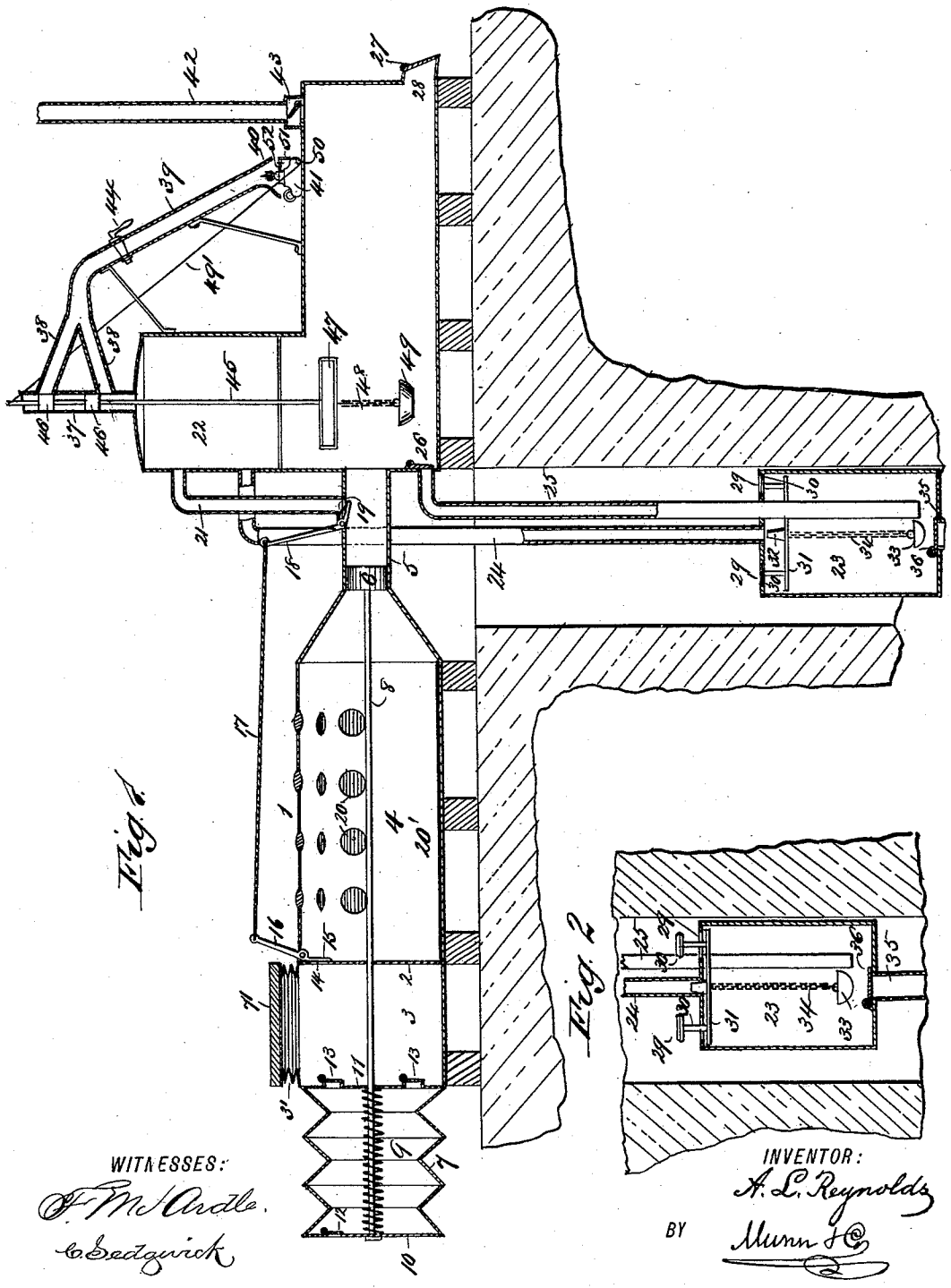


Fig. 1.

Fig. 2.

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SOLAR WATER-LIFTING APPARATUS.

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To all whom it may concern:

Be it known that I, ALVA L. REYNOLDS, of Elsinore, in the county of San Diego and State of California, have invented a new and Improved Solar Water-Lifting Apparatus, of which the following is a full, clear, and exact description.

This invention relates to an apparatus in which the expansion and contraction of air is utilized to raise water from one level to another, and has for its object to provide an apparatus operated as above referred to, whereby water may be drawn up automatically from deep wells.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar letters of reference indicate corresponding parts in both the figures.

Figure 1 illustrates in vertical section and partly broken away an apparatus constructed in accordance with this invention. Fig. 2 is a detail view thereof with parts broken away, showing float in raised position.

In carrying out this invention a cylinder 1 is provided, mounted in any suitable manner, and formed by means of partition 2 into the compartments 3 4, with a cylinder 5 at one end containing a piston 6, the bellows 7 at its other end, and the bellows 3′, with weight 7′, on the top of compartment 3. The piston 6 is connected by a rod 8 with the rear of bellows 7, which is held in extended position by means of a spring 9, extending between the end 10 of the bellows 7 and the rear wall 11 of cylinder 1. Air is admitted to bellows 7 by means of an inwardly-opening valve 12, and from bellows 7 into chamber 3 by means of valves 13.

The partition 2 has an opening 14, normally covered by a valve 15, opening into chamber 4, and provided with a lever 16, connecting by cord 17 with a lever 18, having a spring-catch 19, with which the piston 6 is brought into engagement. The upper portion of the compartment 4 is provided with lenses 20, through which the rays of the sun pass to a reflecting-lining 20′ on its bottom, thereby generating great heat in compartment 4 and expanding the air therein. The cylinder 5 connects by means of a tube 21 with a condensing-chamber 22, which is connected with a receptacle or chamber 23 by means of suction-pipes 24 25, the pipe 25 being provided with a valve 26, opening into chamber 22. The latter is provided with an outwardly-opening valve 27, covering discharge-outlet 28. Outwardly-opening valves 29 cover openings 30 in the top of chamber 23, and are secured to a float 31, having a valve 32, adapted to close pipe 24. The valves 29 are held in closed position by means of a weight 33 and chain 34, attached to float 31. From chamber 23 extends a pipe 35, of a sufficient length to reach the bottom of the well to be pumped out. The mouth of pipe 35 is covered by an inwardly-opening valve 36.

If desired, this machine may be operated when the sun does not shine by applying artificial heat. When the sun goes down, the heater or compartment 4 fails to discharge its usual supply of hot air, which naturally leaves the vacuum-pan full of water. In order to operate the machine by artificial heat, the apparatus hereinafter described is employed.

At the top of the condensing-chamber 22 is mounted a vertical tube 37, having laterally-extending branch tubes 38, which unite to form a downwardly-inclined tube 39, having its open lower flaring end 40 depending above a lamp 41, mounted on the top of the condensing-chamber 22. Adjacent to the lamp 41 is mounted on top of the condensing-chamber 22 a vertical pipe 42 for the escape of hot air, having at its lower end an automatic lifting-valve 43. The downwardly-inclined tube or pipe 39 may be closed by means of a stop-cock 44. Within the vertical tube 37 is mounted a vertically-movable piston-rod 45, having valves 46, which are adapted to open and close the connection of the branch tubes 38 with the vertical tube 37, and at its lower end, in the condensing-chamber 22, a float 47, having suspended therefrom by a chain 48 a weight 49. A cord 49′ may be attached to the top of the piston-rod 45 and passed over a pulley 50 on the top of the chamber 22 to a lever 51, connected to a shaft 52 on the lamp, controlling its wick, whereby the vertical movement of the piston-rod 45 will automatically regulate the flame of the lamp.

The operation is as follows: The action of the sun shining on the lenses 20 heats the air in compartment 4, which thereupon expands and forces the piston 6 forward against the

tension of spring 9. The forward movement of piston 6 compresses the bellows 7, causing cold air to be carried through valves 13 into compartment 3. As the air is thus compressed the bellows 3′ are extended and the weight 7′ lifted up, and when piston 6 is brought into engagement with spring 19 it is held by the same, while the heated air passes through tube 21 into condensing or cooling chamber 22. As the heated air leaves the compartment 4, the air in compartment 3, which has been somewhat compressed by the action of bellows 7, overbalances the pressure in compartment 4 and rushes through opening 14 into compartment 4, thereby opening valve 15, and by means of its connections releasing catch 19 from piston 6. The compressed spring 9 thereby throws the bellows 7 back to original position, and with it the piston 6. The weight 7′ then compresses the bellows 3′ and immediately supplies the compartment 4 with cold air. While hot air is being generated again in compartment 4 the air in condensing-chamber 22 is cooling and contracting, forming a partial vacuum, which produces a suction, drawing the water through pipe 35 into chamber 23. The water, rising in chamber 23 and filling it, lifts the weighted float 31, opening the valves 29 and closing the pipe 24 by means of valve 32. The admission of air through openings 30 causes the valve 36 to close, and the water in the chamber 23 is then drawn up through pipe 25 into chamber 22 by means of the vacuum therein, aided by the return or backward stroke of piston 6, as before set forth, and is discharged through outlet 28. It will be understood that if the float 31 were raised just as fast as the water there would be a point where the valves 29 and 32 would both be open; but the suction within chamber 23 causes a resistance to the float 31 in addition to its weight, and therefore the water must rise on the float until this resistance is overcome, and when this takes place the natural tendency of the float will be to suddenly rise, and thus the space of time in which the valves 29 and 32 are open at the same time will be but instantaneous. As the water in chamber 23 falls below the weight 33, the latter draws the valve 32 open and closes the valves 29, and the chamber 23 is again filled with water, as before.

The chamber 23 is assumed to be located at the twenty-five-foot level. A number of chambers similar to chamber 23 may be employed, according to the depth of the well to be pumped out, and in this way the water can be raised from one level to another by successively breaking the pressure.

The cold water drawn up through pipe 25 into vacuum-chamber 22, as above described, aids in the cooling until the next supply of hot air is discharged from compartment 4 into chamber 22, when the valve 26 closes and the valve 27 opens, permitting the water to escape through outlet 28.

After the sun goes down the apparatus may be operated as follows: The vacuum-chamber 22 being left full of water the float 47, elevated by the water, holds the lower valve 46 up out of engagement with lower tube 38 and the upper valve 46 in closed position with upper tube 38, as shown in Fig. 1. The lamp 41 is lighted and the stop-cock 44 turned on, thereby admitting the outside air past the flame of lamp 41, through tube 39, to the vacuum-chamber 22. Expansion of the air in vacuum-chamber 22 taking place, the water therein is discharged through outlet 28. The draft caused by the water leaving the vacuum-pan draws the hot air from the blaze of the lamp 41 up through tube 39, its lower branch tube 38, and tube 37 to the chamber 22, and any surplus of heat admitted may escape through tube 42, the valve 43 being automatically lifted. By this means the current is kept up until the water falls below the weight 49, when the latter acts to draw down the rod 45 and close the lower valve 46 and open the upper valve 46, thereby leaving a draft for the flame of the lamp 41. Contraction now takes place in the vacuum-chamber 22, and the valves 43 and 27 are closed by suction. Water now rises in the vacuum-chamber 22, and upon reaching the float 47 raises it, and thereby, through rod 45, opens lower valve 46 and closes upper valve 46, thus permitting the vacuum-chamber 22 to be emptied and reheated. When the rod 45 is raised, as just described, it acts on the cord 49′ to raise the wick of lamp 41 and provide a large flame when the heat therefrom is required, and when the rod 45 is lowered it acts on cord 49′ to lower the wick of the lamp 41 and diminish the flame, thereby economizing fuel.

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

1. A solar water-lifting apparatus consisting of a cylinder having a heating-chamber provided with lenses, a piston-cylinder, a chamber behind the heating-chamber with weighted bellows on its top, spring-actuated bellows behind said second chamber with valves opening therein, a piston connected to the spring-actuated bellows, a catch arranged in piston-cylinder to engage the piston and connected with a valve opening from the second chamber into heating-chamber, a condensing-chamber, a tube leading from piston-cylinder to condensing-chamber having a discharge-outlet and valve, a pressure-breaking receptacle or receptacles having air-valves opening outwardly and connected with a weighted float, suction-tubes connecting the condensing-chamber with the pressure-breaking receptacle, one of which is closed at its upper end by an upwardly-lifting valve and the other at its lower end by a valve on the float, and a suction-pipe extending downward from pressure-breaking chamber and having an upwardly-lifting valve at its mouth in said chamber, substantially as described.

2. In a solar water-lifting apparatus, substantially as described, a pressure-breaking receptacle consisting of a chamber provided with suction-tubes leading to a condensing or vacuum chamber, a weighted float with a valve for closing one of the suction-tubes, and an outwardly-opening valve at the upper end of the other suction-tube, outwardly-opening valves closing air-openings in the receptacle, and a suction-tube extending downward from the receptacle having an inlet stop-valve at its mouth, substantially as described.

3. In a solar water-lifting apparatus, a cylinder having a heating-chamber provided with lenses, a piston-cylinder, a chamber behind the heating-chamber with weighted bellows on its top opening into the second chamber, spring-actuated bellows behind said second chamber with valves opening into the latter, a piston connected to the spring-actuated bellows, a catch arranged in piston-cylinder to engage the piston and connected with a valve opening from the second chamber into the heating-chamber, a condensing-chamber, a tube leading from piston-cylinder to condensing-chamber, having a discharge-outlet and outwardly-opening valve, and a tube leading downwardly from the condensing-chamber and having a valve at its upper end opening inwardly into the condensing-chamber, substantially as described.

4. In a solar water-lifting apparatus, a condensing-chamber having in its lower portion a water-discharge outlet and outwardly-opening valve, a water-inlet pipe extending downward and with a valve at its upper end opening inwardly into the condensing-chamber, a vertical tube on the top of the condensing-chamber opening into the latter and containing a vertical rod, with valves and a weighted float on the lower end of the vertical rod, an air-tube with a stop-cock and a flaring open mouth at its lower end located above a lamp on the top of the condensing-chamber, and branch tubes at its upper end connecting with the vertical tube and alternately opened and closed by the valves therein, a connection between the vertical rod and wick of the lamp for raising and lowering the wick, and a second vertical tube with upwardly-opening valve located on the top of the condensing-chamber for the escape of air, substantially as shown and described.

5. A solar water-lifting apparatus consisting of a heating-chamber provided with lenses and a reflecting-lining, a piston-cylinder, a chamber behind the heating-chamber with weighted bellows on its top opening into the second chamber, spring-actuated bellows behind said second chamber with valves opening therein, a piston connected to the spring-actuated bellows, a catch arranged in piston-cylinder to engage the piston and connected with a valve opening from the second chamber into heating-chamber, a condensing-chamber, a tube leading from piston-cylinder to condensing-chamber having discharge outlet and valve, a vertical tube on the top of condensing-chamber opening into the same and containing valves, and a piston-rod with a weighted float at its lower end located in the condensing-chamber, a burner on the top of condensing-chamber having a connection between it and the vertical piston-rod for controlling the flame of the burner, a tube with a flaring mouth at its lower end located over the burner and connected by branch tubes at its upper end with the vertical tube containing piston rod and valves, the latter alternately opening and closing the branch tubes, a second vertical tube on the top of condensing-chamber with an upwardly-opening air-valve, and pressure-breaking receptacle consisting of a chamber provided with suction-tubes leading to the condensing-chamber and containing a weighted float with a valve for closing one of the suction-tubes, and a valve at the upper end of the other suction-tube opening into the condensing-chamber, outwardly-opening valves closing air-inlet openings in the receptacle, and a suction-tube extending downward from the receptacle and having a stop-valve at its upper end opening into the receptacle, substantially as shown and described.

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Witnesses:
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