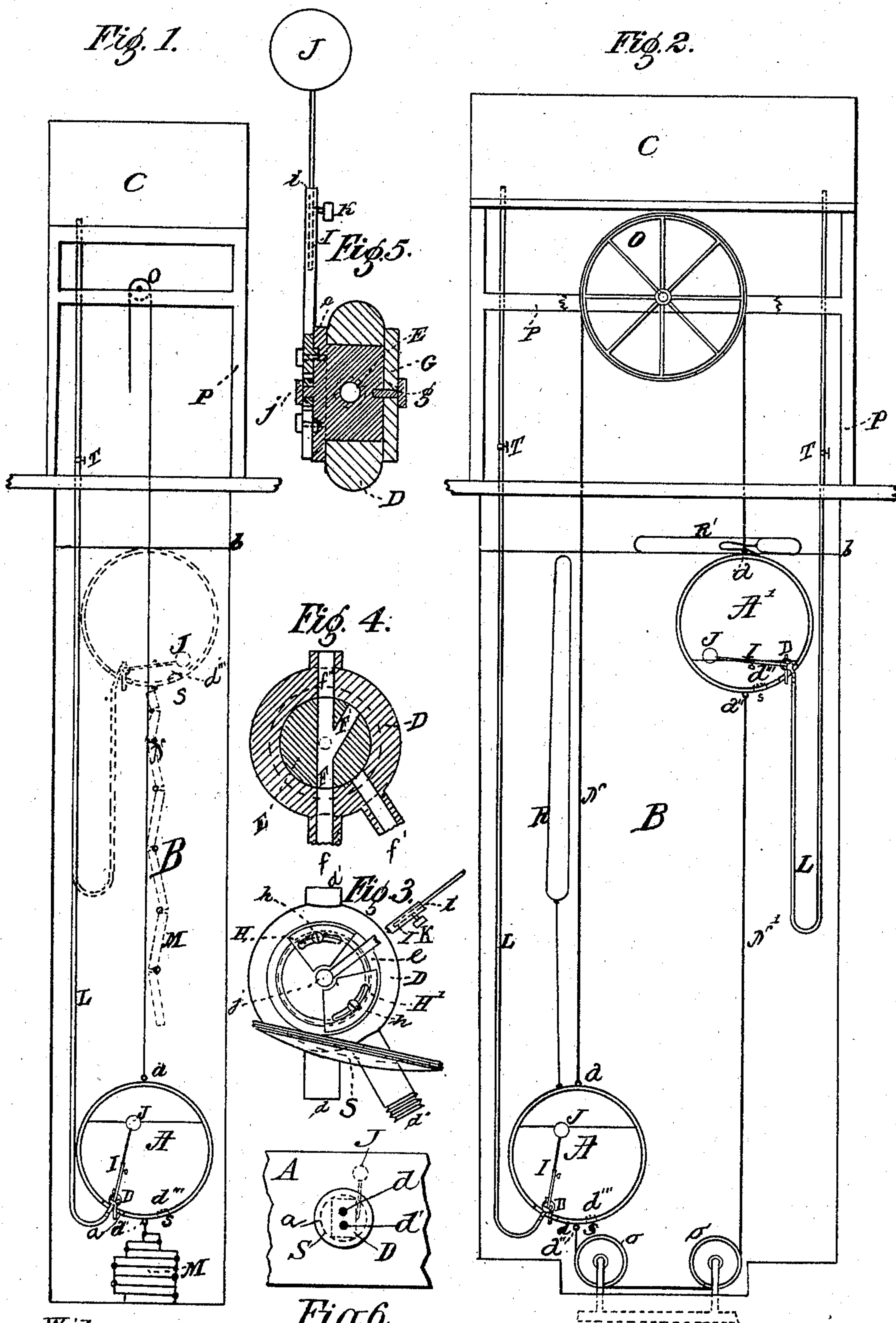


(No Model.)

P. S. A. BICKEL.
COMPRESSED AIR WATER ELEVATOR.

No. 591,029.

Patented Oct. 5, 1897.



Witnesses
Robert Coombe.
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per:
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UNITED STATES PATENT OFFICE.

PAUL S. A. BICKEL, OF HELENA, MONTANA.

COMPRESSED-AIR WATER-ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 591,029, dated October 5, 1897.

Application filed January 22, 1896. Serial No. 576,473. (No model.)

To all whom it may concern:

Be it known that I, PAUL S. A. BICKEL, a citizen of the United States, and a resident of the city of Helena, county of Lewis and Clarke, State of Montana, have invented new and useful Improvements in Compressed-Air Water-Elevators, of which the following is a specification.

There have been many inventions for raising water from wells, mines, irrigating-streams, and like places by pumping and otherwise, all requiring more or less power, either from the use of the water or from outside sources.

My invention supplies a simple inexpensive method of elevating water or other liquids at a very small expenditure of outside power, the principal motive force being compressed air, compressed simply by the pressure of the water itself in the well or other chamber.

Figure I shows a side elevation of the apparatus. Fig. II shows the same apparatus in duplicate with slight variations. Fig. III shows a side elevation of the valve used. Fig. IV shows a vertical section of the valve. Fig. V shows a vertical section of the valve at right angles to Fig. IV. Fig. VI shows a side view of the tank, showing manhole.

A is an air-tight vessel having a manhole *a* in the bottom and the rings *a'* and *a''* fastened to the top and bottom, respectively.

B is any vessel or chamber holding a liquid.

C is a receiving-tank, to which the liquid is to be raised.

D is a valve having the inlet-tube *d* and the exit-tubes *d'* and *d''*. The tubes *d'* and *d''* are firmly soldered into the lid S of the manhole *a*.

E is the valve proper, being a cylinder, having the flange *e* and being perforated at right angles to the axis by the straight port F and its branch F'. The cylinder E is held in place by the cap G, secured to it by the screw *g*. The adjustable segments H and H' are slotted, and are secured to the cylinder E by the set-screw *h*.

The stem I of the air-bulb J is loosely pivoted on the screw *j* and is adjustable lengthwise by means of a telescope joint *i* and the set-screw *k*.

The valve D has three ports *f*, *f'*, and *f''*.

L is a hose which couples on the tube *d''*

and is connected at the other end with the tank C.

M is a string of weights connected by hinged joints and secured to the bottom of the vessel A by the ring *a''*. 55

N is a rope fastened to the top of the vessel A by the ring *a'* and passing up over the pulley O.

P is any support for the pulley O or tank C. 60

In the duplicate construction the weights M are not used, but the inflated tubes R and R' are attached to the top of the vessels A and A', respectively. The rope N connects the two vessels at their tops, and the rope N', 65 passing under the pulleys O and O', fixed in the bottom of the chamber B, connects them at their bottoms. The surface of the liquid is indicated by *b*.

Instead of the automatic valve shown in Figs. III and IV, the vessel A may have as an exit a simple opening furnished with a nipple *d''* for the attachment of the hose L and an inlet *s*, covered with a simple clack-valve *d'''*, and in connection therewith a faucet-valve T in the hose L. In the duplicate construction these parts are simply duplicated. 75

Having thus described my invention, its method of operation is readily seen and is as follows: In the simple construction the vessel A is held suspended by the rope N and the weights M so adjusted that the vessel, thus weighted, will just sink to the bottom. The vessel being practically full of air when first submerged, the air-bulb J and stem I will occupy a horizontal position and the parts of the valve D will be open, as shown in Fig. IV, permitting the free ingress of the liquid into the vessel. As the vessel is permitted to sink the pressure of water in the chamber B gradually compresses the air in the vessel A and partly fills it and the air-bulb J rises. This air-bulb is so adjusted by means of its telescope joint that when the vessel has reached the bottom or the depth selected by pressure on the segment H it has closed the port *f* and opened the port *f'*. As the vessel is lowered the hinged segments of the weights are piled upon the bottom, thus offsetting the replacing of part of the air in the vessel A with the liquid and preserving 80 85 90 95 100

the same relative weight to the liquid at the varying depths as at the surface. The vessel is now raised with very little power by the rope N, and as it rises the compressed air expels through the hose L the liquid in the vessel until the pressure is reduced to that of the column from the surface in the vessel A to the surface in the receiving-tank C.

If the clack-valve d''' and faucet-valve T in the hose are used in place of the automatic valve, the method is simpler. Before allowing the vessel to sink the valve T is closed. As the vessel sinks the water flows into the vessel through the clack-valve until the desired depth is reached. The vessel is then raised and the pressure within keeps the clack-valve closed. When the vessel reaches the surface, the valve T is opened and the compressed air in the vessel expels the liquid, as above described.

In the duplicate construction the action is the same in duplicate under either arrangement, except that instead of the weights M each vessel A and A' has secured to its top an inflated tube R and R', adjusted to equalize their weights as far as possible.

It is to be noted that the liquid raised in the vessel may be held in there by the faucet in the hose and released at will at such times and altitudes (within its limitations) as desired until the pressure is expended. The wide and varied uses to which the invention can be put by reason of the little power necessary to raise the vessel, the simplicity and inexpensiveness of the apparatus, and the convenience of holding this volume of water or other liquid under controlled pressure is easily seen. The size of the vessel is only limited by the size of the main chamber and by considerations of convenience.

I do not confine myself to the valves shown, as many others may be used to secure the same results.

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

1. In a liquid-elevator, the combination of

an air-tight vessel having an inlet and an outlet for the liquid only, with means for raising and lowering said vessel in the liquid, means for closing said inlet at the lowest point reached, thereby securing the liquid and air therein, at the surrounding pressure, means for releasing the liquid therein under the force of the said compressed air, as the vessel is raised, and a discharge-pipe.

2. A liquid-elevator composed of an air-tight vessel, having an inlet for the liquid only, controlled by a valve which permits the inflow of the liquid as the vessel is lowered therein, and closes as the vessel is raised, and having an outlet for the liquid only, controlled by a valve which is closed when the vessel is lowered and is opened when the vessel is raised, and of means for raising and lowering said vessel.

3. A liquid-elevator composed of an air-tight vessel, having an inlet for the liquid only, controlled by a valve which opens as the vessel is lowered in the liquid, and closes as it is raised therein, and an outlet for the liquid only controlled by a valve with the reverse action, a discharge-pipe, means for raising and lowering the vessel in the liquid, and adjustable means for minimizing its weight in the liquid.

4. In a liquid-elevator, two similar air-tight vessels, each having an inlet, for the liquid only, controlled by a valve, which opens as the vessel is lowered in the liquid, and closes as it is raised therein, and an outlet, for the liquid only, controlled by a valve with the reverse action, and discharge-pipes; means for raising and lowering the vessels in the liquid; and adjustable means for minimizing the weight of said vessels in the liquid.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 21st day of December, 1895.

PAUL S. A. BICKEL.

Witnesses:

EDWARD C. RUSSEL,
ROBERT COOMBE.