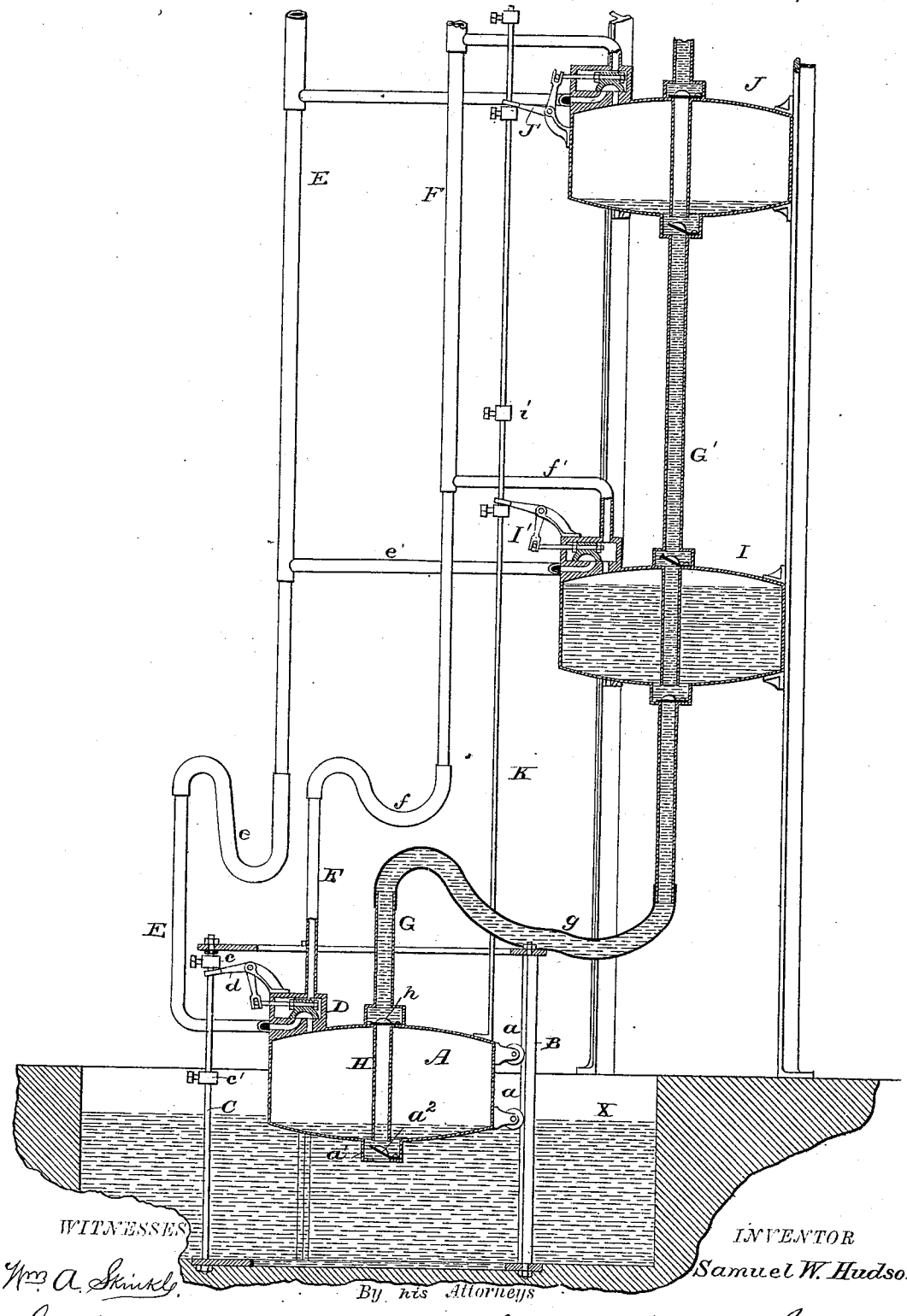
(No Model.)

S. W. HUDSON.

PNEUMATIC WATER ELEVATOR.

No. 248,749. Patented Oct. 25, 1881.



N. PETERS. Photo-Lithographer. Washington, D. C.

UNITED STATES PATENT OFFICE.

SAMUEL W. HUDSON, OF HUDSONDALE, PENNSYLVANIA.

PNEUMATIC WATER-ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 248,749, dated October 25, 1881.

Application filed August 12, 1881. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL W. HUDSON, of Hudsondale, in the county of Carbon and State of Pennsylvania, have invented an Improved Pneumatic Water-Elevator, of which the following is a specification.

The accompanying drawing shows my invention organized in the way now best known to me; but obviously the various details of construction may be changed without departing from the spirit of my invention.

In the drawing, which is an elevation, partly in section, A is a tank or vessel, which is caused to rise and sink in the water-reservoir X by alternately forcing compressed air into it and exhausting the air from it. In rising and falling the tank, which is preferably circular, is guided by guide-wheels *a a*, which run on vertical rails B, of which there should be three.

A valve-chest, D, in which an ordinary slide-valve works, is secured upon the tank, with the interior of which it communicates. The exhaust and air-compressing pipes E and F are connected with the valve-chest, and the slide-valve, which is operated by the elbow-lever *d*, alternately puts the exhaust and compressed-air pipes into communication with the interior of the tank, as will be well understood. Suitable exhaust and compressing apparatus are to be connected with the pipes E and F. The opening in the enlargement or cup *a'* in the bottom of the tank A is closed by an inlet-valve, a^2. The water-elevator pipe G is connected centrally to the top of the tank, and this upper opening in the tank is closed by the outlet-valve *h*. A pipe, H, extends from the valve *h* to the enlargement *a'* in the bottom of the tank A. To permit of the rising and falling of the tank the pipes E F G are made flexible at *e*, *f*, and *g*.

At a suitable height a stationary tank, I, with which the water-elevator pipe G communicates, is arranged. This tank is exactly similar in construction to the rising and falling tank A, and is provided with a similar valve-chest, with which the exhaust and compressed air pipes are connected by cross-pipes *e' f'*. From the tank I an elevator-pipe, G', extends up to another tank, J, exactly similar to I, and similarly connected with the exhaust and compressed-air pipes.

It will be observed that the inlet and outlet valves of each tank permit the water to rise, but prevent it from descending.

I have shown but two stationary tanks, I J; but of course any number are to be used, according to the height to which the water is to be elevated.

The elbow-lever *d* of the tank A is rocked to operate the slide-valve by striking against adjustable stops *c c'* on the rod C as the tank rises and falls, while the levers I' J' are operated by stops on a vertical rod, K, which is mounted on the rising and falling tank. This rod should have guide-bearings at suitable intervals.

It will be observed that the elbow-lever I' is pivoted above the slide-valve, while the lever J' is pivoted below its valve, and as a consequence the movement of each valve is the reverse of the other. Thus when the compressed-air port is open to the tank I the exhaust-port will be open to the tank J. In every case the exhaust-pipe will be in communication with the tank when the slide-valve is thrust in, and the compressed-air pipe in communication with the valve is drawn out. Whatever may be the number of stationary tanks employed, each valve will be controlled as just mentioned, so that while the compressed air is admitted into one tank the air will be exhausted from the one next above it.

The operation of the apparatus is as follows: Supposing there is no water in the elevator-pipe and stationary tanks, that the tank A is sunk and full of water, that the stop *c'* has thrown the elbow-lever *d* up and placed the compressed-air pipe F in communication with the interior of the tank, and that the stop *i* on the rod K has thrown the lever at I down and placed the exhaust-pipe E in communication with the tank I. The pressure of the air in A and the power of the exhaust in I will jointly act to force and raise the water from the tank A into the pipe G and tank I. The tank A, becoming buoyant, will rise until the elbow-lever *d* strikes the stop *c*, when the compressed-air port at A will be closed and the exhaust opened, as shown in the drawing, and the tank will commence to sink. At the same moment the stops on the vertical rod K operate the slide-valves at the stationary tanks I and J.

At I the compressed-air pipe is put into communication with the tank, while at J the exhaust-pipe is opened to the tank. The water in the tank is thus raised to the tank J by the joint action of the pressure in the tank I and the power of the exhaust in the tank J. As the tank A rises again the water in it will be elevated to the tank I, as before described, while the water in the tank J will be elevated to the tank next above by the combined action of the pressure in J and the exhaust in the tank above. The last lift or discharge of the water will be done by pressure only. The operation, as will be readily understood, continues in this way, whatever may be the number of stationary tanks, the water being raised from one tank to the one next above by the combined action of the pressure and the vacuum, so that if the machine is working at a pressure of fifty pounds and a vacuum of ten pounds it will have a lift of one hundred and twenty feet.

There is but little friction of machinery to be overcome in the operation of my apparatus, and, as a consequence, less power is required to elevate a given amount of water. Again, the water, being elevated by pressure at one end and a vacuum at the other, rises with greater facility than if pressure alone were employed. Further than this, the vacuum and pressure may be created by the same machine, and less power and less heavy machinery would be required to create a given vacuum and pressure than to create a pressure alone equal to them in power.

The operation of my improved machine is entirely automatic, and the column of water, being practically continuously elevated, acquires something of a momentum, which facilitates its elevation.

As before remarked, any required number of stationary tanks can be employed and the water elevated to a very great height.

A machine specially adapted for use in connection with this apparatus is shown in Letters Patent No. 244,243, granted to me July 12, 1881, in which an endless chain carrying piston-heads runs over sprockets, creating an exhaust on one side of the machine and a pressure on the other.

The adjustable stop *c c'* should be so adjusted to limit the rise and fall of the tank A as not to allow it to sink deep enough to bring the water on a level with the opening into the valve-chest, as otherwise the apparatus in exhausting would draw the water up into the exhaust-pipe. The adjustable stops on the vertical rod K should also be adjusted to operate the valves, so that the water in the stationary tanks shall not rise to the valve-opening.

I have shown my apparatus organized to elevate the water vertically; but obviously it could be constructed to operate at any angle, and it seems unnecessary to describe or show such a construction.

Of course water may be elevated by my improved apparatus by pressure alone or by vacuum alone; but where the vacuum only is employed the distance between the tanks, or height of lift, will be limited. When the apparatus is working with pressure, when the pressure is in the tank A there will be no pressure in the tank I above, and when the tank A is sinking there will be no pressure in it, but there will be in the tank I, and so on for the whole series, each alternate tank being thrown into communication with the compressed-air pipe and the remaining or intermediate tanks out of communication with it at one movement of the tank A, and vice versa, exactly as above described, when pressure and vacuum are both employed. When the apparatus is working with pressure alone the compressed air escapes through the pipes E and *e*.

This apparatus is especially adapted for raising water from mines, in which case, when compressed air is used either alone or with a vacuum, it can be conveyed in pipes to any desired point and used for ventilation. In working the apparatus by vacuum only the alternate series of tanks will be thrown into and out of communication with the exhaust-pipe in the same manner as before described, and when any tank is cut out of connection with the exhaust it should be thrown open to the atmosphere through the pipe F—that is, if there is a vacuum in I operating to raise water from A, A should be open to the atmosphere, in order to obtain the atmospheric pressure and allow the water to rise, and so on throughout the series of tanks. No change in the valve mechanism is required to operate with pressure or vacuum alone or with both combined.

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

1. The combination of a series of water-tanks having inlet and outlet valves, water-elevating pipes connecting them, exhaust and compressed-air pipes connected with each tank, and automatic valve mechanism which intermittently operates to place each alternate tank in communication with the compressed-air pipe and the remaining or intermediate tanks into communication with the exhaust-pipe, and vice versa.

2. The combination, substantially as herein set forth, of the rising and falling tank, its inlet and outlet valves, a series of stationary tanks, their inlet and outlet valves, connecting water-elevating pipes, exhaust and compressed air pipes connected with each tank, and automatic valve mechanism operated by the rising and falling of the tank, which intermittently operates to put the compressed-air pipe into communication with each alternate tank and the exhaust-pipe into communication with the intermediate or remaining tanks, and vice versa.

3. The combination, substantially as herein set forth, of the rising and falling tank, its inlet and outlet valves, the exhaust and compressed-air pipes connected with the tank, the

slide-valve, its elbow-lever, and the adjustable stops for operating the lever.

4. The combination, substantially as herein set forth, of the rising and falling tank, its inlet and outlet valves, the stationary tanks, their inlet and outlet valves, exhaust and compressed-air pipes connected with each tank, the slide-valve of the rising and falling tank, its lever, the adjustable stops for operating it, the vertical rod K, the slide-valves of the stationary tanks, their levers, and the adjustable stops for operating them.

5. The combination, substantially as herein set forth, of the rising and falling tank, its inlet and outlet valves, a series of stationary tanks, their inlet and outlet valves, connecting water-elevating pipes, an exhaust or compressed-air pipe connected with each tank, and automatic valve mechanism operated by the rising and falling of the tank, which intermittently operates to put said exhaust or compressed-air pipe into communication with each alternate tank and open the remaining or intermediate tank to the atmosphere, and vice versa.

In testimony whereof I have hereunto subscribed my name.

SAMUEL W. HUDSON.

Witnesses:
WM. G. FRYMAN,
JOSEPH KALBFUS.