(No Model.) 3 Sheets—Sheet 1.

E. H. WEATHERHEAD.

HYDRAULIC AIR PUMP.

No. 383,028. Patented May 15, 1888.

Fig. 4.

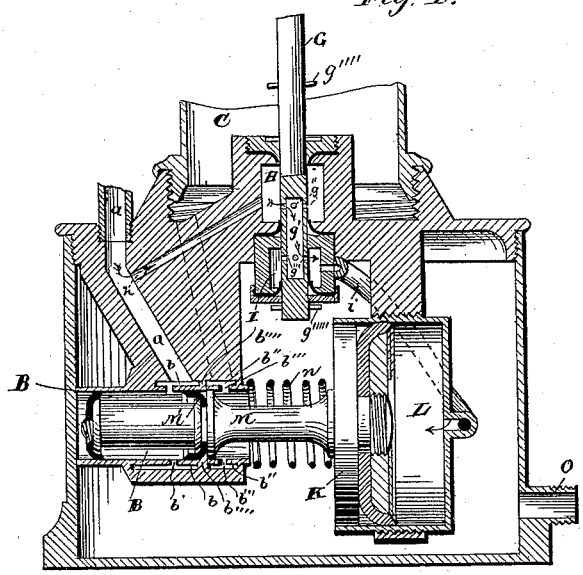

Fig. 1.

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Fig. 3.

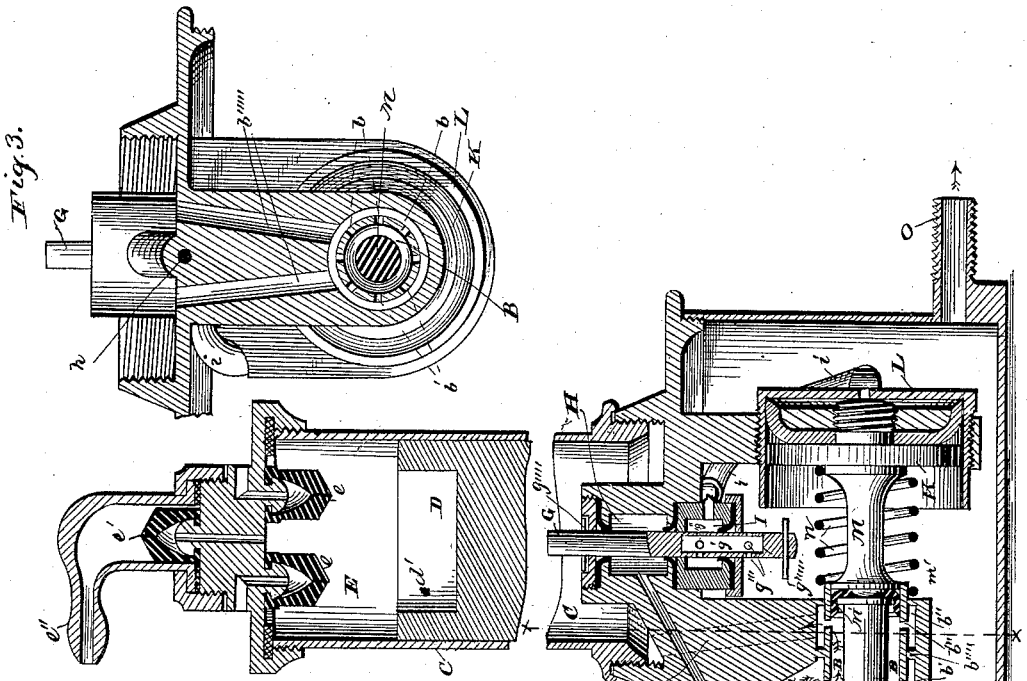
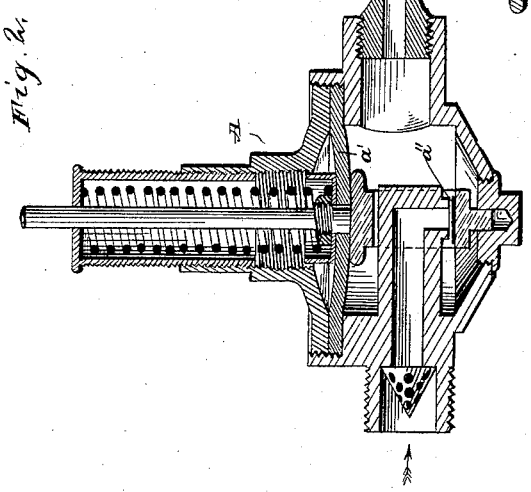


Fig. 2.



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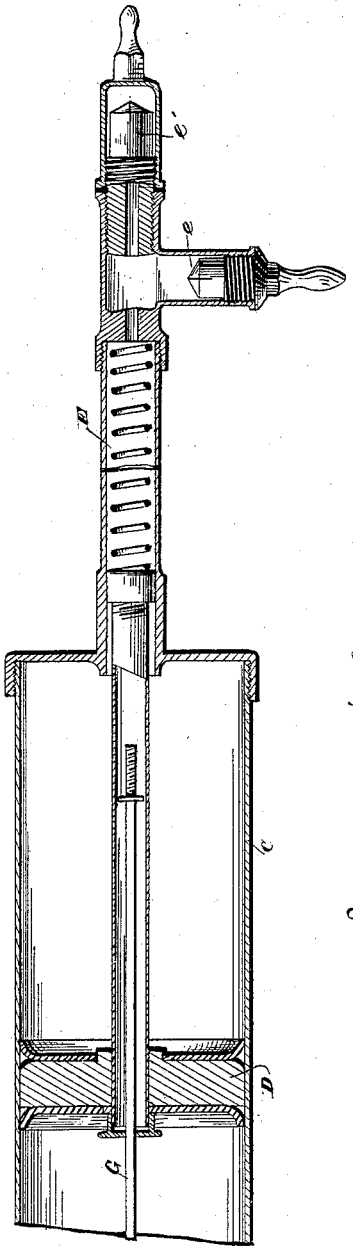

Fig. 5.

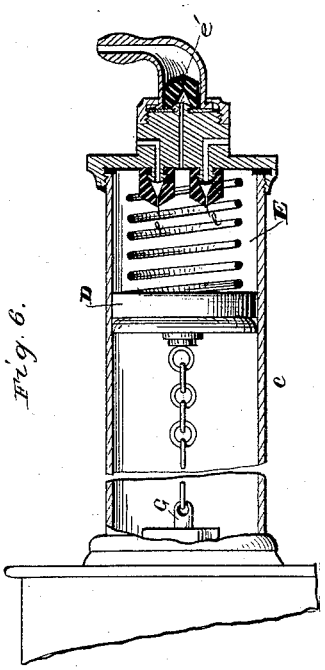

Fig. 6.

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UNITED STATES PATENT OFFICE.

EDWARD H. WEATHERHEAD, OF CLEVELAND, OHIO.

HYDRAULIC AIR-PUMP.

SPECIFICATION forming part of Letters Patent No. 383,028, dated May 15, 1888.

Application filed April 7, 1887. Serial No. 234,070. (No model.)

To all whom it may concern:

Be it known that I, EDWARD H. WEATHERHEAD, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Hydraulic Air-Pumps; and I do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

The invention relates to hydraulic air-pumps; and it consists in the construction and combination of parts as hereinafter described, and more particularly pointed out in the claims.

In the accompanying drawings, Figure 1 is a vertical sectional elevation of the pump with a part broken out in the cylinder and weighted piston, and the fluid-pressure regulator shown in full lines on the left. Fig. 2 is a vertical central section of the complete apparatus with a piece broken out, as before. Fig. 3 is a transverse section on line *x x*, Fig. 2. Fig. 4 is a view showing the parts in the pump proper in the opposite position to that shown in Fig. 2. Figs. 5 and 6 show modifications with springs for returning the piston; and Fig. 6 shows a chain to operate the valve below.

The object of the invention is to provide an automatic hydraulic pump for supplying and maintaining uniform atmospheric pressure in a cask of beer or other beverage, or in any other receptacle or chamber where such pressure is required. This is accomplished by a system of valves, pistons, pressure-regulators, and the like, by which the action of the valve in producing the desired atmospheric pressure is automatically controlled, as will now be described.

A represents a water-pressure regulator preferably constructed as shown. The fluid entering under suitable pressure, as from a hydrant or a street-main, flows through the regulator when open to the chamber B, the channel *a* serving to make the connection. This chamber is provided with one water-belt, *b*, into which the channel *a* discharges, and perforations *b'*, through which the water enters the chamber, and a second water-belt, *b''*, and a series of perforations, *b'''*, entering thereto, as seen in Fig. 3. The two water-belts are separated by a wall, *b''''*, and in communication with the belt *b''* are two ducts, *b''''*, Fig. 3, which lead to the pipe or cylinder C. The course of the fluid into the cylinder may thus be easily traced, and is shown by the arrows in Fig. 2.

In the cylinder C, Fig. 1, is what may be termed a "weighted cylindrical piston," D, provided with packing at *d*, to prevent the fluid from entering between it and the wall of the cylinder, and above the piston or weight is the air-chamber E. This chamber has valved air-inlets *e e* and valved air-outlet *e'*, with a nozzle, *e''*, for attaching the rubber tube leading to the beer-barrel.

The gravitating piston D has a recess, *d'*, in its top to protect the valves *e e*, and a bore, *d''*, extending through its center from the bottom to near the top of the piston, the length whereof corresponds to the distance the piston is designed to travel in performing its functions. The bore may therefore be only half the length of the piston, or may vary either way as greater or less movement is desired. Ordinarily it will be extended so as to have the piston traverse the length of the inclosing tube or cylinder. It will therefore be observed that if the water is admitted under sufficient pressure through the passage above described to lift the piston in the cylinder C the piston will rise therein and compress the air in the air-chamber E, subject to two conditions: first, the extent of the hydraulic pressure beneath the piston, and, second, the resistance of the pressure upon the back of the outlet-valve *e'*.

The conditions under which beer is drawn vary considerably. Sometimes it is on the same floor where it is drawn and sometimes it is in the cellar. When the barrel is on the same floor with the draft, much less pressure will be required on the top of the beer to get the desired flow than when the barrel is in the cellar, one or more floors below. This will have to be taken into account in adjusting the pressure regulator A. Thus, supposing the normal pressure of the gas in the barrel to be twenty pounds to the square inch, the pressure-regulator will be set, say, at twenty-five pounds, which will lift the weighted piston and maintain such pressure in the air-chamber as will hold the pressure in the barrel uniformly at twenty pounds; but if the beer has to be

carried one or more stories high a correspondingly greater pressure will be needed, and the pressure-regulator should be adjusted accordingly. Now let us further suppose that the piston D has been carried to the extremity of the cylinder in its upward movement and expelled all the air from the air-chamber. The pump would stop and there could be no further action if there were no other appliances; hence the mechanism for relieving the cylinder behind the piston and for re-establishing the conditions under which the piston originally started on its mission. First, then, we have what may be termed the "piston-rod G," provided at one end with a head, *g*, confined and working in the bore of the piston and at the other end with an interior chamber, *g'*, having two sets of openings, *g''* and *g'''*, entering the chamber from the outside. This end of the rod passes through two fluid-chambers, H and I, one above the other and separated by a water-tight wall. The chamber H has a small passage, *h*, in constant communication with the inlet-channel *a*, and the chamber I has a pipe or tube, *i*, leading to the front of the piston K, as most clearly seen in Fig. 4. The piston K works in a short cylinder, L, closed in front, except where it is entered by the tube *i*, and open at its rear. This piston has a rod, M, with a packed valve, M', working in the chamber B, through which the water enters the pump, and encircling the said rod and bearing against the back of the piston and the casing of the chamber B, respectively, is a spiral spring, *n*, designed to return the piston after each action to the position shown in Fig. 2.

Going back to the piston-rod G, we find it provided with two pins or collars, *g''''* and *g'''''*, which form stops for the said rod in its longitudinal movements, according as the piston is at one end or the other of its cylinder. Thus, for example, when the piston descends to the bottom of the cylinder it strikes the pin *g''''* and carries the rod into the position seen in Fig. 2, and when it rises to the top of the cylinder it carries the rod to the position seen in Fig. 4. The position of the parts, as shown in Figs. 1 and 2, indicates that the piston is under pressure from below and everything is adjusted to this movement. So it will be seen that the piston K is forced by its spring to its normal position and no fluid-channels are open except those leading into the cylinder C. Now suppose, further, that the piston moves to the top of its stroke. This done, it lifts the piston-rod G to the position shown in Fig. 4, and the fluid at once begins to flow through the passage *h* to the chamber H, and thence through the chamber *g'* by means of the openings *g'' g'''* to the tube *i* into the chamber L. The piston K being forced back by the action of the water, the spring *n* is compressed, and the valve M', passing to the left of the series of openings or perforations *b'''*, brings the passages *b'''''*, now become discharge-passages, to the outside of the valve, as seen in Fig. 4, and permits the water in the cylinder C to escape into the outer casing and through the general outlet O. The parts then remain in the position as seen in Fig. 4 until the weighted piston D, by the force of its weight, has expelled the water from the cylinder C through the said channel, and the piston-rod G is again carried down to the position seen in Fig. 2. This change in the position of the rod closes the flow of water through chamber H and opens a line of discharge for the water in cylinder L back through tube *i* and out through chamber I and the chamber and openings in the end of the piston-rod G, the spring on said rod being sufficient to expel the water from cylinder L, which again returns all the parts to their original position, and the water is free to flow into cylinder C and return the piston to work.

When the air in the chamber E has been compressed to the density corresponding to the pressure fixed in the fluid-regulator, the diaphragm *a'* therein is raised, the valve *a''* thereby closed, and no more water can enter the apparatus until a quantity of compressed air has been given off, when the pressure from the hydrant or source of supply will immediately assert itself and re-establish the conditions before existing.

It is obvious that when the piston D descends the air-chamber will fill with fresh air through the valves *e e*. The piston descends by its own gravity, and its weight is designed to be sufficient to expel the water from the cylinder C through the channel before described with rapidity, and thus quickly readjust the parts for a return-stroke and renewed work.

If preferred, a single passage, *b'''''*, may be employed, and so may also a single air-inlet, *e'*.

In Figs. 5 and 6 I show modifications of the pressure mechanism for the main piston, consisting of springs instead of weights. When springs are used, the main cylinder may occupy a horizontal position, if preferred, and these springs may be arranged in any manner that will give quick action in expelling the water and drawing in the air. In Fig. 6 is also shown a chain connected with the main piston and the valve G in the chambers H and I, instead of the piston-rod. The chain serves to raise the said valve when the piston rises, and the piston depresses it in its return movement. The form and manner of operating the valve G may be varied and still be within the scope of my invention, the purpose being to control the flow of fluid through the channel *h* and *i* to the piston K by means of the piston D, and this can be done in several ways.

One great advantage in the mechanism herein provided for changing the position of the main valve is its quickness, combined with noiselessness of movement. The action of the valve-piston is almost instantaneous when the pressure is turned on, yet it moves so quietly that the operation is scarcely audible a few feet away.

It will be observed that with my construction of valve for governing the flow of water to and from the main cylinder the valve is so formed that the inlet of water to said cylinder is closed before the outlet is opened, so that there is a point in the movement of the valve at which the flow of the fluid is entirely stopped.

A diaphragm-piston might be used instead of the form shown, and fluid-pressure might be employed on both sides instead of only one, in which case the spring would be dispensed with. Only enough back-pressure is required to expel the water from the cylinder L and change the position of the valve M'.

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

1. In a hydraulic air-pump, a main cylinder closed throughout its length and having air inlets and outlets at one end and water inlets and outlets at the other end, a piston in said cylinder by which the air and water are separated, and a counter pressing device, as a spring or weight, within the cylinder to bear the piston down and expel the water from the cylinder, in combination with a valve located in the water-inlet channel leading to said cylinder, and a separate piston to operate said valve having a water-channel communicating with the source of water-supply and operated by the pressure of the same, substantially as set forth.

2. In a hydraulic air-pump, a main cylinder provided with a piston and a pressure device, as a spring or weight, bearing upon said piston and confined within the cylinder, to force the piston back toward the starting-point and expel the water from the cylinder, in combination with a main valve in the water-supply channel, and a separate piston to actuate said valve, having a channel connecting with the source of water-supply behind the main valve therein, by which said piston and valve are operated when the main valve is closed, substantially as set forth.

3. In a hydraulic air-pump, a main cylinder having air and water passages at its respective ends, a close-fitting piston separating the cylinder into chambers, and a weight upon said piston, a valve at the end of the cylinder, and a connecting-piece between the valve and the piston, in combination with a valve in the water-supply channel, and a separate piston provided with water-pressure for controlling the said valve, substantially as set forth.

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