No. 652,559. Patented June 26, 1900.

C. M. HOBBY.

AIR PUMP.

(Application filed Aug. 1, 1899.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

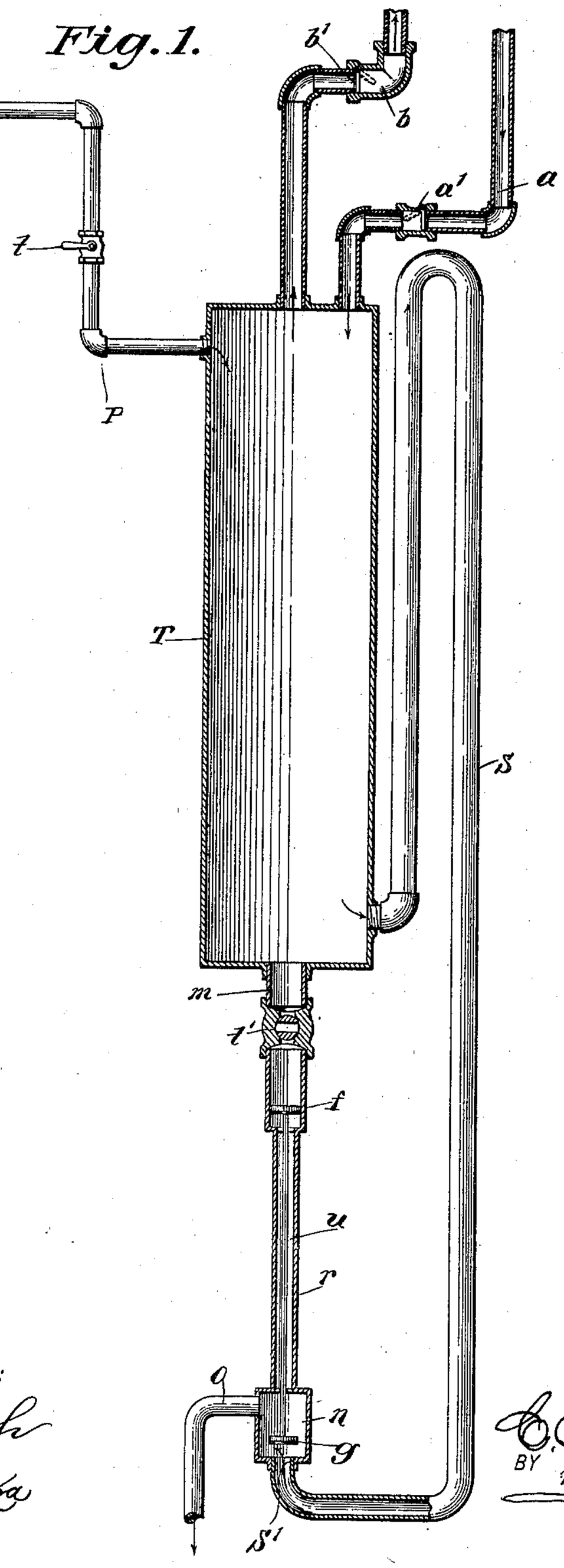

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Fig. 2.

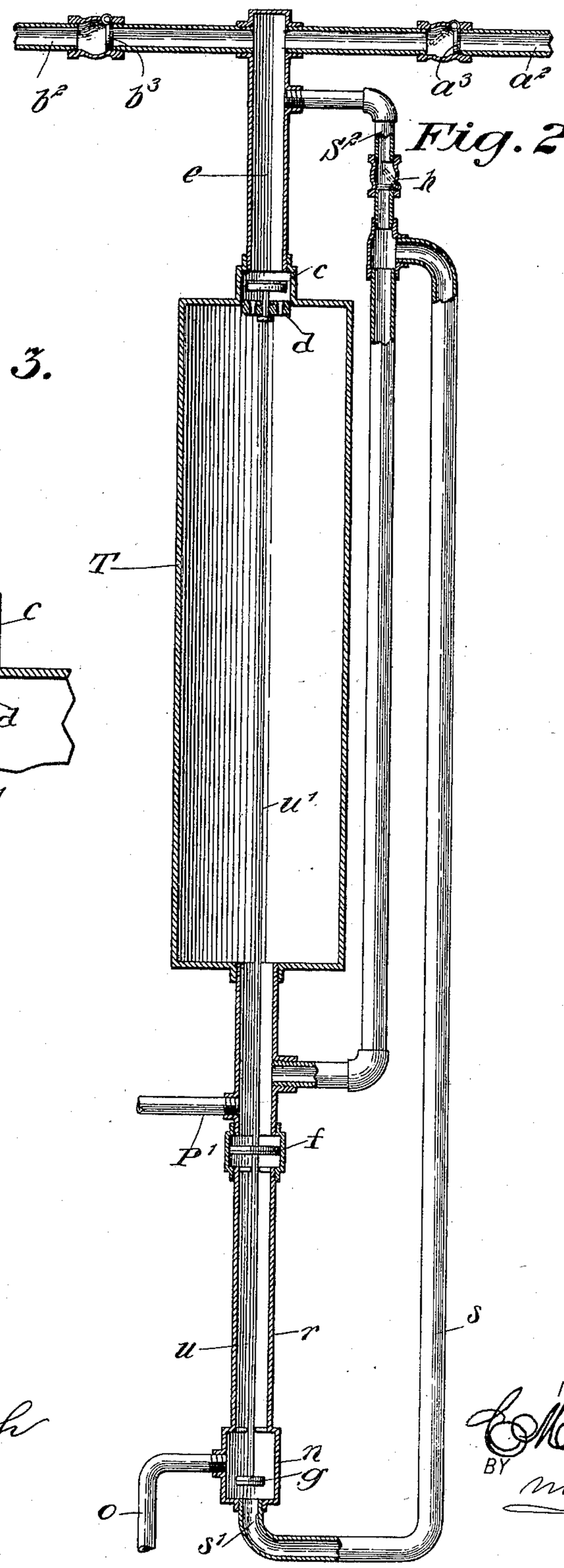
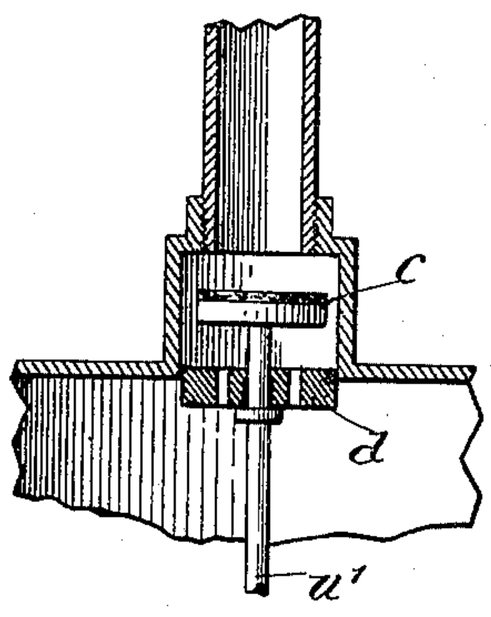


Fig. 3.



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UNITED STATES PATENT OFFICE.

CICERO M. HOBBY, OF SAN DIEGO, CALIFORNIA.

AIR-PUMP.

SPECIFICATION forming part of Letters Patent No. 652,559, dated June 26, 1900.

Application filed August 1, 1899. Serial No. 725,746. (No model.)

To all whom it may concern:

Be it known that I, CICERO M. HOBBY, of San Diego, in the county of San Diego and State of California, have invented a new and Improved Air-Pump, of which the following is a full, clear, and exact description.

My invention relates to air-pumps, and has for its object to provide a construction which may be used as well for exhausting purposes as for compressing purposes and which will operate automatically without any manipulations on the part of the operator.

The invention will be fully described hereinafter, and the features of novelty will be pointed out in the appended claims.

Reference is to be had to the accompanying drawings, in which—

Figures 1 and 2 are sectional elevations of two different air-pumps constructed according to my invention, and Fig. 3 is an enlarged detail of the pump shown in Fig. 2.

As illustrated in Fig. 1, the pump consists of a body or receptacle T, provided at any suitable point with a water-supply pipe P, controlled by a valve *t*. At the top the receptacle is provided with an air-inlet pipe *a*, containing an inwardly-opening valve *a'*, and with an air-outlet pipe *b*, containing an outwardly-opening outlet-valve *b'*. At the bottom the receptacle T is connected with a siphon S, which rises above the top of the receptacle, but preferably not above the air-valves *a' b'*. The bottom of the receptacle is also provided with a downwardly-extending pipe *m*, having a valve *t'*, and in said pipe is located a piston *f*, connected by a rod *u*, extending through the tube *r*, connected to the pipe *m*, with a valve *g*, located in a chamber *n* at the lower end of the tube *r*, said valve being adapted to close the opening S', by which the siphon S discharges into said chamber *n*. From the said chamber an outlet-pipe O leads to a point at a suitable distance below the level of the receptacle T.

The apparatus may be used in several different ways—for instance, as follows: To exhaust air from any receptacle connected with the pipe *a* the valve *t'* in the pipe *m* may be closed and the cock *t* in the supply-pipe P opened. Water will then rush into the receptacle T and gradually fill the same, causing the air originally contained in said receptacle to escape into the atmosphere through the pipe *b*. This will continue until the water reaches the level of the bend or arch of the siphon S. The siphon will then be started and will withdraw the contents of the receptacle T through the chamber *n* and the outlet-pipe O, it being understood that the valve *g* remains inactive.

The outlet-pipe O and the siphon should have a greater capacity for discharge than the supply admitted through the pipe, (which effect may be readily obtained by an appropriate adjustment of the valve *t*.) It follows that the level of the water in the receptacle T will fall notwithstanding the continuance of the supply of water through the pipe P, and the preponderance of atmospheric pressure will close the valve *b'*, and at the same time the valve *a'* will open automatically, allowing the air to exhaust from the body connected with the pipe *a*. This will continue until the siphon is broken, when the valve *a'* will close again, and the water from the supply-pipe P will gradually refill the receptacle until the siphon is started again, thus repeating the operation indefinitely. If desired, the same operation may be performed, but with the valve *t'* open. In this case the siphon will not be started until the liquid has risen to a sufficient height to cause the liquid in the siphon to unseat the valve *g*, which is in this case held down by the weight of the column of water resting upon the piston *f*. In this case the siphon therefore will not be started until the most favorable time and a very accurate and efficient action may thus be obtained.

It will be understood that the amount of excess pressure to start the siphon will depend on the relative areas of the piston *f* and the valve *g*, as well as on the distance between the said parts and on the amount of rise the siphon has at its arch. It will also be understood that when the pump is used for exhausting air the outlet-pipe O should have its lower end arranged under the surface of a body of water, so as to prevent any inrush of air into the receptacle T when the siphon is broken.

When operating the apparatus as a compressor, the pipe *a* is left open to the atmosphere and the pipe *b* is connected with the

body of the receptacle within which the air is to be compressed. Supposing the valve t' to be open, the water admitted through the supply-pipe P will in rising force air into the pipe b and into the pressure-chamber connected therewith, the valve a' remaining closed. This will continue until the pressure in the siphon s becomes sufficient to overcome the pressure bearing upon the piston f to unseat the valve g. This will start the siphon, closing the valve b' and opening the valve a', and after some time cause the pressure of the water in the receptacle T to close the valve g. The siphon is thus positively interrupted and the operation will be repeated, as will be readily understood. Of course the apparatus could also be used as a compressor without taking advantage of the action of the valve g—that is, the valve t' may be closed during compression, in which case the periodical starting and breaking of the siphon would be due only to the rising and falling of the water in the receptacle T. It will be obvious that by the use of the valve g and its operating-piston f I may be enabled not only to time the action of the siphon so as to secure the best results, but also to secure a greater amount of pressure, since more pressure will be required to start the siphon against the resistance opposed by the valve g than if said valve is inactive.

In the construction illustrated by Figs. 2 and 3 the system of balanced valves f and g is the same as in Fig. 1, the entrance of water under pressure being at any point in the system, either below or above—for instance, at P'. The main difference lies in the upward extension u' of the rod u, connecting the balanced valves to terminate in the pipe e, by which air has entrance and exit in a head at c, with a float d below moving freely on the rod and perforated so that air or water may readily pass through, but so adjusted that when the float rises against the head of the rod the head covers the perforations in the float and allows the pressure of water in the cylinder to act in lifting the rod. The balance secured by the downward pressure at f and the upward pressure at g is assisted by the pressure at c in addition to the excess weight of the column of water in the siphon between f and c to cause the valve g to open and the siphon to come into operation. The details of the float and head are shown in Fig. 3. The general effect is the same as before described. Water entering under pressure at P' closes the valves f and g and, filling the chamber T, expels the air through the air-valve b^3, which permits exit and not entrance. The water rising in the short leg of the siphon equally expels air through the valve h into the normal exit-pipe b^2. (This valve h and small pipe S^2 are not essential, but are used for the purpose of making the water rise to the same level in the siphon as in the barrel when there is back pressure from condensation of air, the valve h opening upward only.) When the water fills the tank and rises to the arch of the siphon, (which should be at or about the same altitude as the valve or float c,) the water passes over the arch, the valve g opens by the lifting of the rod, and the water escapes through the continuation of the siphon o. As the water escapes air comes in through the valve a^3 until chamber and siphon are again filled with air, when the column of water resting on valve f closes the siphon by the valve g, and thus, however great may be the pressure of air in the receiving-chamber, the siphon is unable to carry off the water until the chamber is filled and the water passes over the arch and the weight of the column of water in the siphon is added to the back pressure of air. In other respects the principle upon which its use as an air-compressor rests is the same as in the construction shown in Fig. 1.

I have found that the addition of the float d to aid in tripping the valve and of the small pipe S^2 and valve h to allow the air to pass out of the siphon is of particular advantage when working under high pressure, as with these additions the operation is more certainly controllable.

I desire to point out particularly that my siphon operates under conditions materially different from those obtaining with ordinary siphons. Where, as usual, the pressure of the atmosphere is exerted directly on the surface of the liquid as well as on the discharge end of the long leg of the siphon, (even if said end dips into a liquid contained in a vessel open to the atmosphere,) the force of the siphon action is measured by the weight of a column of liquid equal in height to the difference between the length of the long leg and the length of the short leg. With a closed chamber, however, under otherwise identical circumstances there will be no siphonage as long as the length of the outlet-leg does not exceed the height of a column of liquid capable of being sustained by atmospheric pressure, for the chamber being closed there will be no atmospheric pressure upon the surface of the liquid contained therein when said surface is level with the arch of the siphon and atmospheric pressure on the long leg would just counterbalance the weight of the liquid contained in said leg. Should the surface of the liquid within the closed chamber be below the top of the siphon's arch, the weight of the liquid contained in the portion of the siphon extending from the vessel to the arch—that is, the short leg of the siphon—will act on the liquid in the vessel and increase the pressure in the said vessel until equilibrium is restored—that is, no flow would result. If, however, the liquid within the vessel rises above the level of the siphon's arch, there would be an excess of pressure toward the outlet measured by the weight of a column of liquid of a height equal to the distance of the surface of the liquid within the vessel above the arch, and the liquid will flow out until the liquid

within the vessel sinks to the level of the siphon's arch. If, now, by the continuous admission of liquid into the closed vessel the level of the liquid is kept above the arch, a continuous flow will obviously result; but there will be no siphonage, properly speaking, since the liquid at no point rises higher than the level within the vessel. Should the upper portion or air-space of the vessel be connected with a closed air-chamber, as in the drawings, it would seem that air could be exhausted from the vessel by admitting less liquid per unit of time than is discharged through the outlet-leg of the siphon. In this case, however, the fall of the surface of the liquid within the vessel will soon be checked, owing to the diminution of the air-pressure within the vessel, which causes the inflow and outflow to become equal, so that no further exhaustion will take place. Similarly, if it be attempted to utilize the siphon action for the compression of air a slight amount of compression will bring about an equalization of the inflow and outflow, and then there will result a continuous flow, leaving the level of the liquid in the vessel unchanged. It will therefore be seen that if a device of the class described (with a closed vessel) is to be used effectively for the compression or exhaustion of air it is necessary to retard the action of the siphon and to secure such an action that the vessel will first become entirely filled and then entirely emptied. For this purpose I have utilized the pressure of the liquid within the vessel T to close the valve *g*, which controls the outlet-leg of the siphon until the liquid flows over the arch of the siphon and opens the valve. To render the operation certain even when variations of pressure in the supply-pipe might temporarily increase the resistance to the opening of the valve *g*, I may provide the float *d*, Fig. 2, which, as described, rises with the liquid, and when in contact with the head *c* becomes a piston working upwardly to assist the opening of the valve *g*.

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

1. The combination of a receptacle closed to the atmosphere and having a liquid-inlet, a valved air-inlet, a valved air-outlet, a siphon connected with the receptacle and having its arch rising above the top of the receptacle, a pressure-cylinder at the bottom of the receptacle, an operating-piston in said pressure-cylinder, a valve-chamber interposed in the outlet-leg of the siphon, a valve arranged to control the connection of said chamber with the siphon and connected with said operating-piston, another valve or head likewise connected with said piston and arranged in the upper part of the receptacle, and a float arranged to engage said head.

2. The combination of a receptacle closed to the atmosphere and having a liquid-inlet, a valved air-inlet and a valved air-outlet, a siphon connected with the receptacle, and a valved connection between the arch of the siphon and the air-outlet.

3. The combination of a receptacle closed to the atmosphere and having a liquid-inlet, a valved air-inlet, a valved air-outlet, a siphon connected with said receptacle, a valve-chamber interposed in the discharge-leg of the siphon, a valve in said chamber, adapted to close the outlet from the siphon to said chamber, a pipe or cylinder connected with the receptacle, and a piston movable in said cylinder below the bottom of the receptacle and connected with said valve.

4. The combination of a receptacle closed to the atmosphere and having a liquid-inlet, a valved air-inlet, a valved air-outlet, a siphon connected with the receptacle and having its arch rising above the top of the receptacle, a pressure-cylinder at the bottom of the receptacle, an operating-piston in said pressure-cylinder, a valve-chamber interposed in the outlet-leg of the siphon, and a valve arranged to control the connection of said chamber with the siphon and connected with said operating-piston.

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Witnesses:
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EDWIN E. HOBBY.