No. 609,238. Patented Aug. 16, 1898.

E. E. MURPHY.

CARBONATING APPARATUS.

(Application filed Jan. 30, 1897. Renewed Nov. 26, 1897.)

(No Model.) 3 Sheets—Sheet 1.

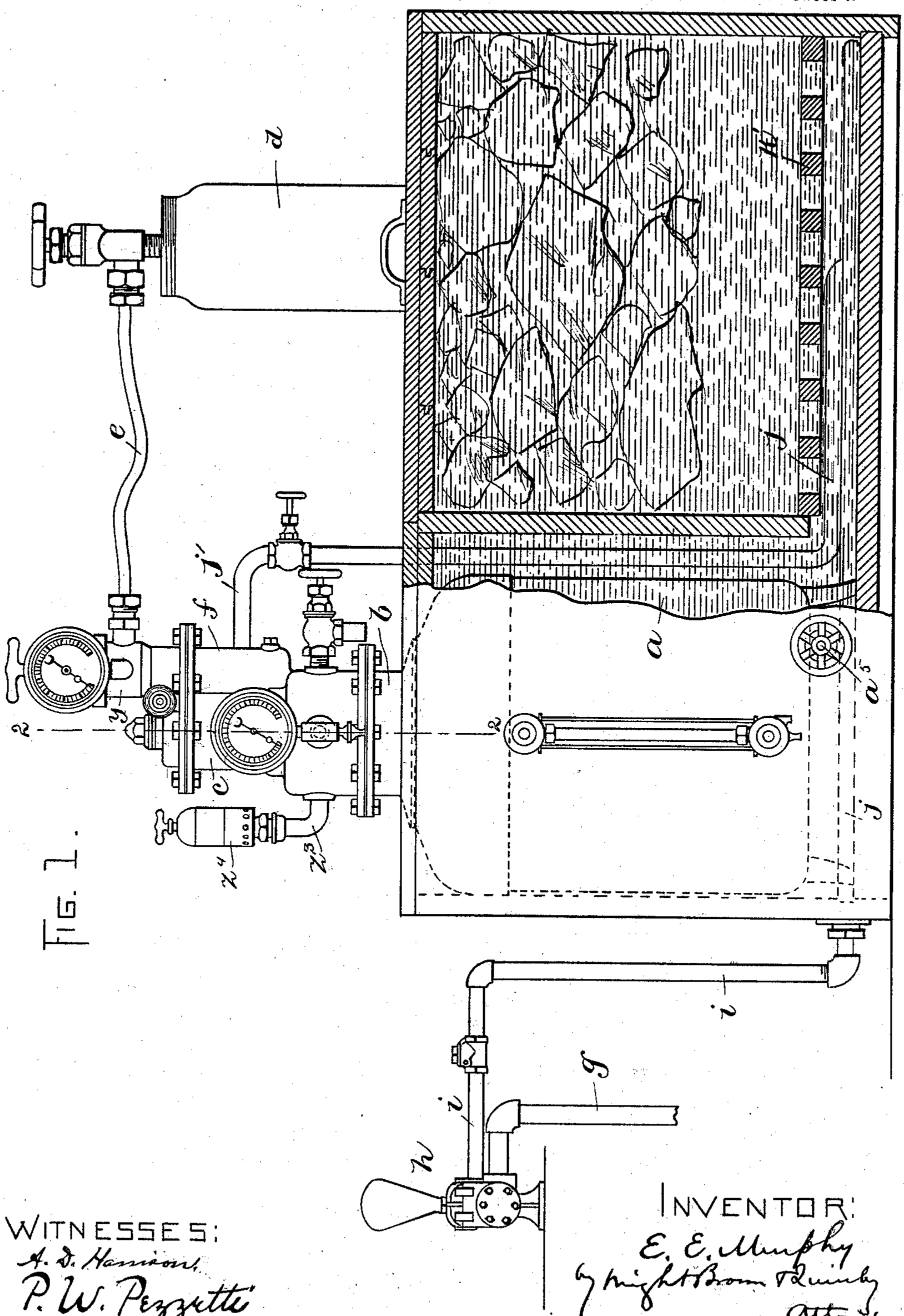


FIG. 1.

WITNESSES:
A. D. Harrison.
P. W. Pezzetti

INVENTOR:
E. E. Murphy
by Wright Brown & Quinby
Attys.

No. 609,238.

Patented Aug. 16, 1898.

E. E. MURPHY.

CARBONATING APPARATUS.

(Application filed Jan. 30, 1897. Renewed Nov. 26, 1897.)

(No Model.)

3 Sheets—Sheet 2.

FIG. 2.

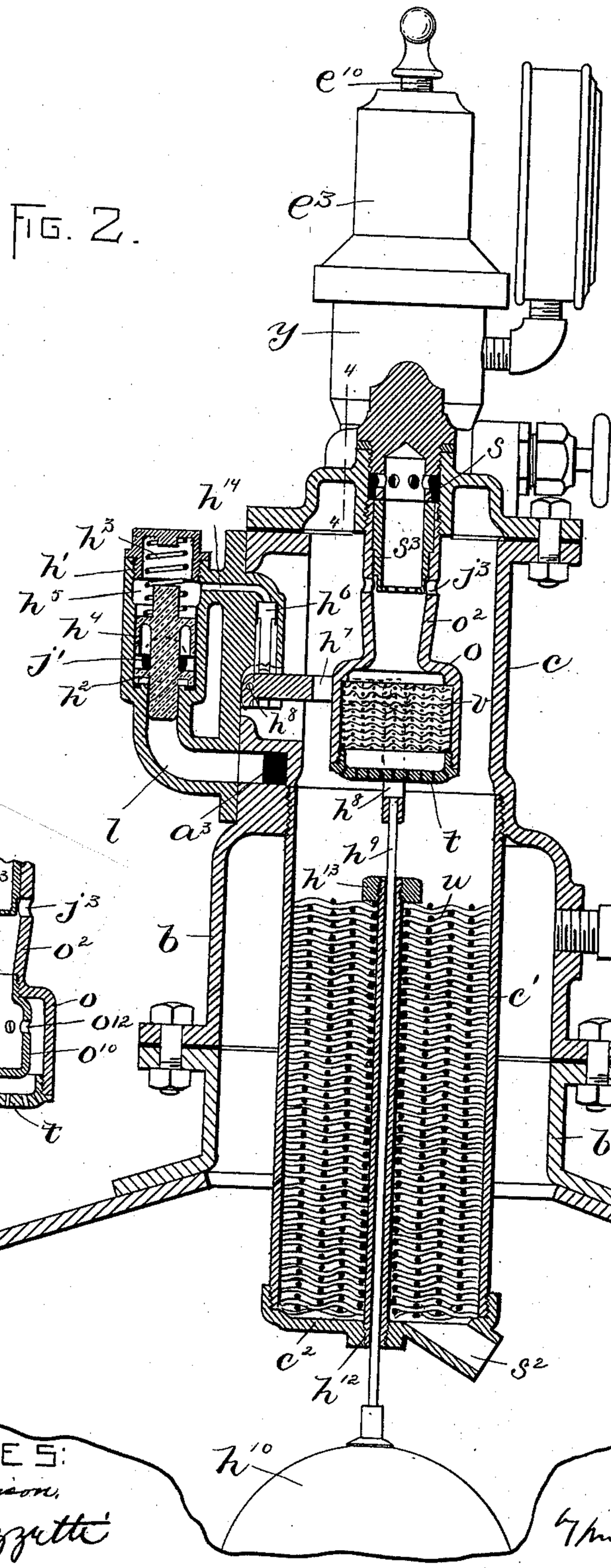


FIG. 2.a

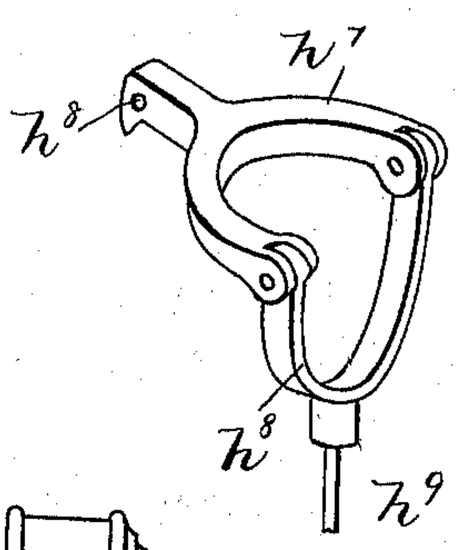
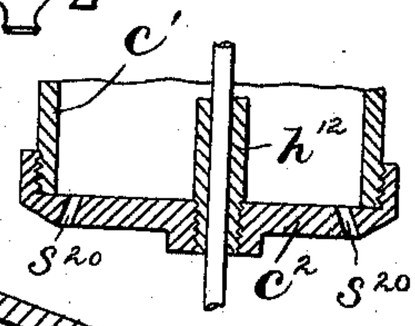


FIG. 5.

FIG. 6.



WITNESSES:
A. D. Harrison.
P. W. Pezzetti

INVENTOR:
E. E. Murphy
by Wright Brown & Quinby
Attys.

No. 609,238. Patented Aug. 16, 1898.

E. E. MURPHY.

CARBONATING APPARATUS.

(Application filed Jan. 30, 1897. Renewed Nov. 26, 1897.)

(No Model.) 3 Sheets—Sheet 3.

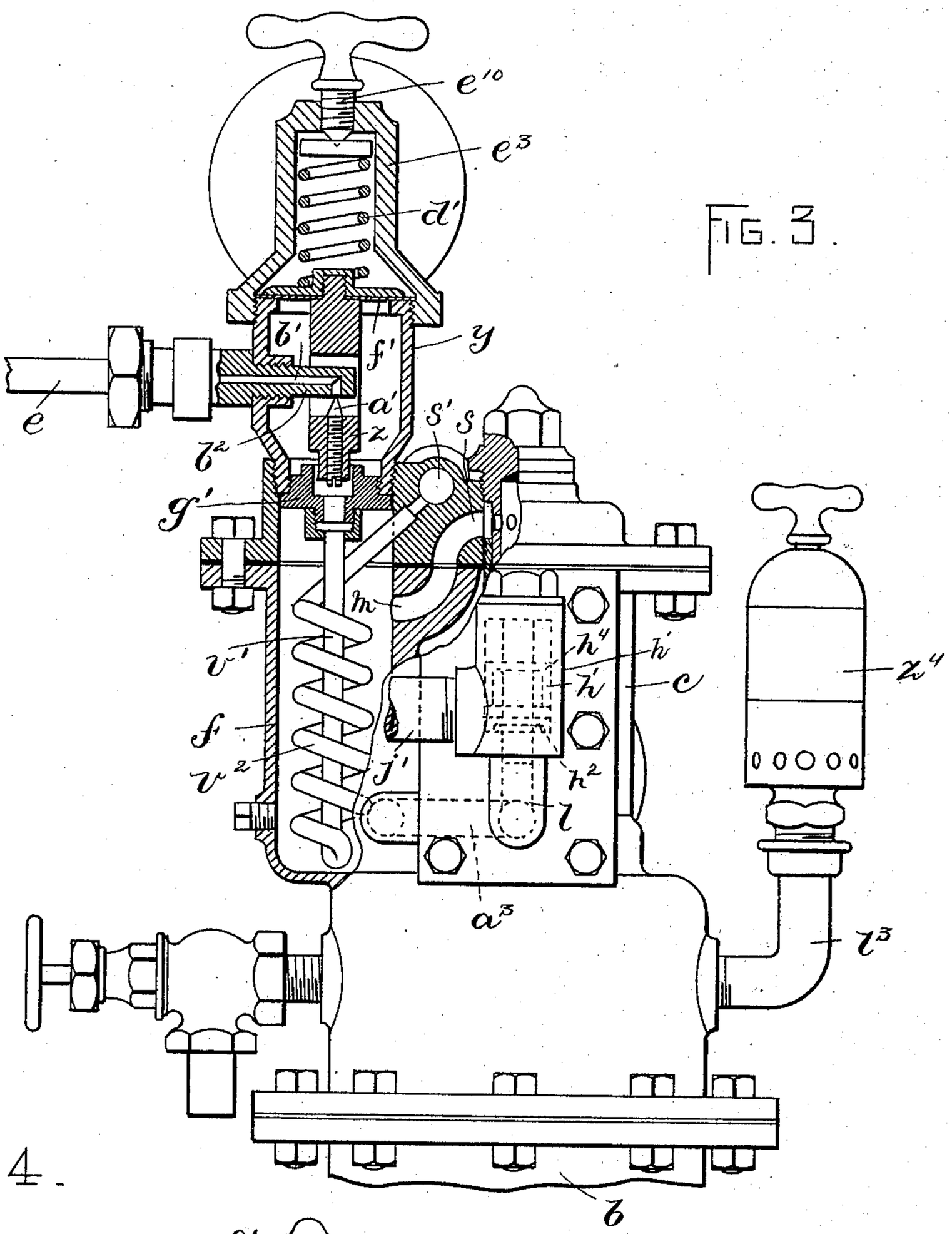
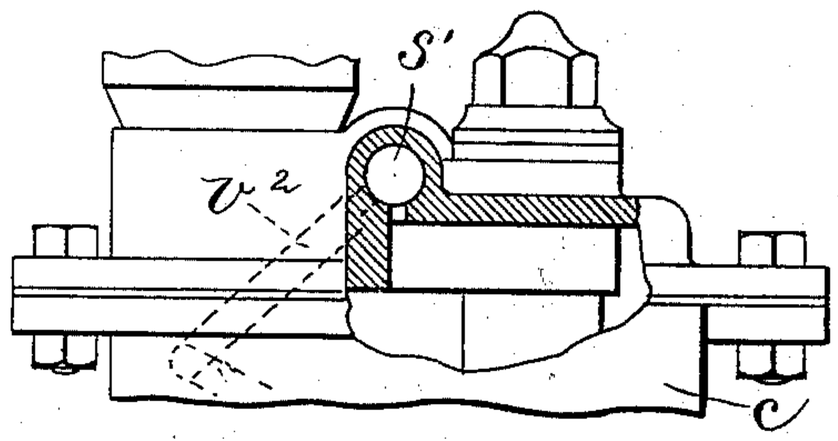


FIG. 3.

FIG. 4.



WITNESSES:
A. D. Harrison
P. W. Pezzetti

INVENTOR:
E. E. Murphy
by Wright Brown & Quinby
attys.

UNITED STATES PATENT OFFICE.

EDWARD E. MURPHY, OF BOSTON, MASSACHUSETTS, ASSIGNOR TO THE NEW ERA PROCESS COMPANY, OF WEST VIRGINIA.

CARBONATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 609,238, dated August 16, 1898.

Application filed January 30, 1897. Renewed November 26, 1897. Serial No. 659,850. (No model.)

To all whom it may concern:

Be it known that I, EDWARD E. MURPHY, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Carbonating Apparatus, of which the following is a specification.

This invention relates to apparatus for carbonating water and other liquids, and has for its object to provide a simple and efficient automatic apparatus which shall insure a thorough mechanical combination between the liquid and the carbonic-acid gas, the carbonating operation being controlled by the accumulation of carbonated liquid, ceasing when a predetermined quantity has accumulated, and going on when the accumulation is reduced, in which the condensation of the gas after it escapes from its tank or receptacle is prevented and in which the gas is utilized for the cooling of the water or other liquid prior to its being carbonated or commingled with the carbonic-acid gas.

The invention therefore consists in the improvements which I shall now proceed to describe in detail and then point out in the claims hereto appended.

Reference is to be had to the annexed drawings, and to the letters marked thereon, forming a part of this specification, the same letters designating the same parts or features, as the case may be, wherever they occur.

Of the drawings, Figure 1 represents in side elevation an apparatus embodying my improvements, parts of the cooling-tank being illustrated in section. Fig. 2 is a vertical sectional view of that part of the carbonating apparatus in which the liquid is commingled with the gas. Fig. 2^a is a detail perspective view. Fig. 3 is partial sectional view and partial side elevation taken from the side opposite that shown in Fig. 1. Fig. 4 is a section on line 4 4 of Fig. 2. Fig. 5 is a sectional view of a part of the apparatus hereinafter referred to. Fig. 6 represents a sectional view of the lower end of the carbonating-chamber.

The same letters of reference indicate the same parts in all the figures.

In the drawings, *a* represents a reservoir or receptacle for the carbonated liquid which is the product of the apparatus to be described. The receptacle *a*, which is provided with a suitable outlet a^5, through which the carbonated liquid may be drawn off for use, is surmounted by a dome *b*, which in turn is surmounted by a carbonating-chamber *c*, in which the gas and liquid are mechanically combined. The upper portion of the chamber *c* is formed on the dome *b*, while the lower portion is within the dome and is formed by screwing the upper end of a tube *c'* into a thread formed in the neck, which connects the dome with the upper portion of the chamber. The dome and chamber are thus telescoped and the height of the structure reduced to the minimum.

The chamber *c* is provided at its upper portion with a liquid-inlet *s*, Fig. 3, and a gas-inlet *s'*, Fig. 4, and at its lower end with an outlet s^2 for the carbonated liquid, said outlet being in the portion of the chamber which projects into the liquid-reservoir *a*, so that a space or air-trap of considerable area exists in the dome above the outlet of the carbonating-chamber, the object of this air-trap being explained hereinafter. The chamber *c* is provided internally with means for effecting a thorough mechanical combination of liquid and gas admitted through the inlets *s* and *s'*, said means as here shown comprising a nozzle s^3, which communicates with the liquid-inlet *s* and projects downwardly into the chamber *c*, its lower end being provided with numerous small perforations, which deliver the liquid in fine streams, and a chamber or casing *o*, which has a contracted neck o^2 at its upper end, receiving the nozzle s^3 and separated from the latter by an annular space, said neck o^2 having orifices j^3 communicating with the chamber *c* and receiving gas that enters said chamber through the gas-inlet *s'*. The lower end of the nozzle s^3 is preferably located below the gas-admitting orifices j^3, so that said nozzle to a certain extent acts as an injector, facilitating the passage of gas into the casing *o*. The casing is provided with a metallic sponge composed of a series of layers *v* of wire-cloth, through which the gas and liquid pass downwardly and by which the liquid is minutely subdivided to faciliate the mechanical combination of the gas and liquid.

The mixture of gas and liquid may be discharged directly from the casing *o* through a perforated bottom *t* upon another metallic sponge composed of a series of layers of wire-cloth disks *u*, placed in the lower portion of the chamber *c*. The perforations in the bottom of the casing *o* discharge streams of gas and water downwardly upon the wire disks *u*. The depth of the accumulation of wire disks *u* (constituting a wire sponge) is such that the water is sufficiently churned and agitated to cause it to give up the excess of gas before reaching the outlet s^2. The gas thus liberated is prevented by the pressure in the reservoir *a* from passing downwardly through the outlet s^2 and therefore remains in the carbonating-chamber. Thus in the event of the downward flow of the water being so rapid as to carry with it more gas than can be taken up while being mechanically mixed by the upper series of screens the agitation produced by the lower disks *u* is such as to insure the separation of the excess of gas.

In Fig. 5 I show a different construction of the mixing-casing *o*, in which said casing instead of having wire-cloth disks, as shown in Fig. 2, is provided with a cup o^{10}, arranged to receive the liquid from the nozzle s^3 and the accompanying gas. Said cup has its upper end screw-threaded and engaged with an internal thread in the casing *o*, its lower end being closed. The outlet of the cup is a series of orifices o^{12} in its upper portion. The liquid discharged by the nozzle is received by the cup and agitated by its forcible impact against the bottom of the cup, so that it is broken up and mechanically mixed with the gas nearly or quite as effectively as by the disks, the cup being a more substantial, durable, and easily installed and maintained agitating device than said disks.

The carbonated liquid escaping through the outlet s^2 accumulates in the receptacle *a*, and thus has a tendency to expel from the liquid the air that may be contained therein in consequence of the greater affinity of the liquid for gas than for air. The air thus expelled accumulates in the upper portion of the dome *b*, which, as already stated, is caused by the downwardly-projecting portion *c'* of the carbonating-chamber to act as an air-trap, preventing the air from passing upwardly into the carbonating-chamber. The air thus entrapped escapes through an air-blow-off valve z^4, which is connected by a pipe z^3 with the upper portion of the dome *b*, said valve being adjustable, so that it will yield and permit the escape of air at any desired pressure.

Liquid is supplied to the liquid-inlet *s* from a source of supply by a steam-pump *h*, which is connected by a pipe *g* with a source of liquid-supply and by a suitable conduit with the inlet *s*, said conduit as here shown comprising, first, a pipe *i*, connected with the pump and receiving liquid therefrom; secondly, a coil *j*, connected with the pipe *i* and having its convolutions arranged on the bottom of a tank or receptacle, a part of which contains the liquid-receptacle *a*, while another part is adapted to receive a filling of ice, and has a grating *k'*, which supports the ice over the coil *j*; thirdly, a pipe *j'*, connected with the coil; fourthly, a valve-casing *h'*, connected with the pipe *j'*; fifthly, a pipe *l*, connected with the casing *h'*; sixthly, a passage a^3, formed in the wall of the chamber *c* and connected with the pipe *l*; and seventhly, a vertical casing *f*, the lower portion of which communicates with the passage a^3, while its upper portion is connected by a passage *m* with the liquid-inlet *s*. The casing *h'* contains a main valve h^2, formed to close a seat, through which water passes to the pipe *l* and normally held against said seat by a spring h^3, aided by water-pressure on the upper side of a piston h^4 on the stem of the valve h^2, said piston fitting the casing somewhat loosely, so that water from the pipe c^3 can pass around it into a chamber h^5 in the upper portion of the casing. h^6 is an auxiliary valve supported by a lever h^7, which is pivoted at h^8 to the valve-casing and is forked at its other end, Fig. 2^a, and connected with a fork h^8, secured to the upper end of a stem or rod h^9. Said rod passes through a guide-tube h^{12}, which is affixed to the bottom of the chamber *c* and extends upwardly through the column of wire disks *u* in said chamber, the disks being held in place by a nut h^{13}, screwed upon the upper end of the tube h^{12}. A float h^{10} is attached to the rod h^9 and is supported by the liquid in the reservoir *a*. When the float is raised, the auxiliary valve closes an outlet h^{14} from the chamber h^5, causing an accumulation of water-pressure in said chamber, which, in connection with the spring h^3, closes the valve h^2 and shuts off water from the carbonating-chamber *c*. When the float descends, the auxiliary valve opens the outlet h^{14}, whereupon the water that flows around the piston h^4 escapes into the carbonating-chamber, relieving the pressure above the piston h^4, so that the water-pressure below said piston raises it and opens the valve.

The casing *h'*, its valves, and the float h^{10} constitute an automatic check-valve, which prevents an over-accumulation of carbonated liquid in the receptacle *a*. When the flow of liquid through the liquid-conduit is shut off by the described action of the automatic check-valve, the action of the steam-pump ceases. Any suitable steam-pump, such as the Knowles or the Blake, may be employed. Either type of pump mentioned is, as is well known, adapted to have its operation automatically checked when the outflow is shut off.

The gas is admitted to the inlet *s'* from a suitable source of supply, which may be a generator or a flask *d* in which the liquefied gas under heavy pressure is stored, by means of a conduit comprising a pipe *e*, connected with the flask *d* or other source of gas-supply, a nozzle b^2, Fig. 3, connected with the pipe *e* and having a contracted bore or pas-

sage b' formed at an angle, a chamber y, surmounting the casing f and receiving the gas that enters through the nozzle b^2, the latter passing through the wall of the chamber y, a pipe v', connected by a coupling or fitting g' with the chamber y and extending downwardly through the casing f, and a helical extension v^2 of said pipe extending upwardly through the casing f to the gas-inlet s'.

An automatic valve regulates the admission of gas to the chamber y from the nozzle b^2, said valve comprising a taper-pointed screw a', adjustably inserted in a yoke z, which is supported by a flexible diaphragm f' in the upper portion of the chamber y and is pressed downwardly by a spring d' in a casing e^3, affixed to the top of the chamber y, the pressure of said spring being adjustable by means of a screw e^{10}. The diaphragm f' is subjected to pressure of gas in the chamber y, and when the pressure exceeds a predetermined degree the diaphragm is raised against the pressure of the spring d', causing the screw a' to close the nozzle b^2.

It will be observed that the fitting g', which forms the bottom portion of the chamber y, also forms the top of the casing f, which is a part of the liquid-conduit, so that the liquid in the casing f comes in contact with the fitting g'. The object of this arrangement is to prevent freezing of the gas in the chamber y and in the tube v' v^2, sufficient heat being absorbed from the liquid and conducted through the fitting g' and the walls of the tube v' v^2 to prevent freezing in consequence of the reduction of temperature due to the expansion of gas as it enters the chamber y. Incidentally the liquid in performing this function has its temperature reduced, a result which is obviously desirable.

I do not limit myself to the details of construction of the various parts of the above-described apparatus, as the same may be variously modified without departing from the spirit of my invention.

Fig. 6 shows the bottom c^2 of the carbonating-chamber provided with small perforations s^{20} instead of the single outlet s^2, said perforations delivering the liquid in the form of spray, so that the liquid is subjected to three spraying operations—first by the nozzle s^3, then in the casing o, and finally by the bottom c^2.

I claim—

1. An apparatus of the character specified, comprising a chamber or casing having a liquid-inlet, a gas-inlet, and an outlet for carbonated liquid; means in said casing for mechanically combining the liquid and gas which enter it, said means comprising an injector-nozzle; a carbonated-liquid receptacle communicating with said outlet; a liquid-conduit connected with the liquid-inlet; an automatic check-valve operated by an accumulation of carbonated liquid to close said conduit; and a steam-pump connected with the conduit and with a source of liquid-supply, the action of said pump being stopped by the closing of the automatic check-valve.

2. An apparatus of the character specified, comprising a chamber or casing having a liquid-inlet, a gas-inlet, and means for mechanically combining liquid and gas admitted through said inlets; a liquid-conduit connected with the liquid-inlet and including a casing or enlargement; and a gas-conduit connected with the gas-inlet and including a chamber having an automatic gas-valve, a portion of said gas-conduit passing through the casing f.

3. An apparatus of the character specified, comprising a carbonating-chamber, a receptacle for carbonated liquid below the carbonating-chamber, and an intermediate air-trap having an automatic blow-off valve.

4. An apparatus of the character specified, comprising a carbonating-chamber, a carbonated-liquid receptacle below said chamber, an intermediate air chamber or space communicating with the liquid-receptacle, an elongated outlet extending from the carbonating-chamber below the upper portion of the air-chamber, and an automatic blow-off valve connected with the air-chamber.

5. An apparatus of the character specified, comprising a carbonated-liquid receptacle having a dome, a carbonating-chamber a portion of which is located above and a portion within said dome, and means for removing air from the dome.

6. An apparatus of the character specified, comprising a carbonated-liquid receptacle having a dome, a carbonating-chamber a portion of which is located above and a portion within said dome, the said carbonating-chamber having a guide in its lower portion, a float in the reservoir below the carbonating-chamber, a rod or stem on said float extending through said guide, a check-valve controlling the entrance of liquid into the carbonating-chamber, and connections between the float-rod and check-valve.

7. An apparatus of the character specified, comprising a carbonating-chamber having a liquid-inlet and a gas-inlet, a casing within said chamber having provisions for receiving and mixing gas and liquid, a check-valve controlling the admission of liquid to said chamber and casing, a lever connected to said valve and forked at one end to partially embrace said casing, a liquid-receptacle below the carbonating-chamber and provided with a dome that incloses a part of the said chamber, a float in said liquid-receptacle, and a rod secured to the float and extending through a guide in the bottom of the carbonating-chamber, said rod having a fork at its upper end that partly embraces the casing in the carbonating-chamber and is connected with the forked end of the lever.

8. An apparatus of the character specified, comprising a carbonated-liquid receptacle having a dome, a carbonating-chamber a portion of which is located above and a portion

within said dome, a series of wire disks in the lower portion of the casing, a tube affixed to the bottom of the casing and projecting upwardly through the series of disks, and a disk-clamping device on the upper end of the tube.

9. In an apparatus of the character specified, a mechanical mixing device comprising a casing having means for the admission of liquid and gas to its upper portion, and discharge-orifices at its lower portion, and a cup located between the receiving and discharge ends of the casing and having a closed bottom and outlets above said bottom.

10. In combination with a closed receptacle, a valve-casing on said receptacle and having a portion projecting into the interior of said receptacle, a liquid-inlet connected to said valve-casing, a liquid-conduit between the inner and outer portions of the valve-casing and opening into the interior of said receptacle, a main valve located in the portion of the valve-casing outside of the closed receptacle and controlling the main liquid-passage leading to said closed receptacle, an auxiliary valve located in the portion of the valve-casing within the closed receptacle and controlling the said liquid-conduit in the valve-casing and adapted upon closing said liquid-conduit to cause the closing of the main valve controlling the said main liquid-passage by the pressure of the liquid entering through said liquid-inlet, and a float within said receptacle arranged to act on said auxiliary valve which is adapted to close or open said liquid-conduit by the rise and fall of the float.

11. In combination with a closed receptacle, a valve-casing on said receptacle and having a portion projecting into the interior of said receptacle, a liquid-inlet connected to said valve-casing, a liquid-conduit between the inner and outer portions of the valve-casing and opening into the interior of said receptacle, a main valve located in the portion of the valve-casing outside of the closed receptacle and controlling the main liquid-passage leading to said closed receptacle, an auxiliary valve located in the portion of the valve-casing within the closed receptacle and controlling the said liquid-conduit in the valve-casing and adapted upon closing said liquid-conduit to cause the closing of the main valve controlling the said main liquid-passage by the pressure of the liquid entering through said liquid-inlet, a float within said receptacle arranged to act on said auxiliary valve which is adapted to close or open said liquid-conduit by the rise and fall of the float, and a steam-pump, the action of said pump being stopped by the closing of said liquid-conduit by said auxiliary valve.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 23d day of January, A. D. 1897.

EDWARD E. MURPHY.

Witnesses:
A. D. HARRISON,
P. W. PEZZETTI.