No. 783,386. PATENTED FEB. 21, 1905.

W. P. RICE.

APPARATUS FOR CHARGING LIQUIDS WITH GASES.

APPLICATION FILED SEPT. 26, 1903. RENEWED JAN. 16, 1905.

2 SHEETS—SHEET 1.

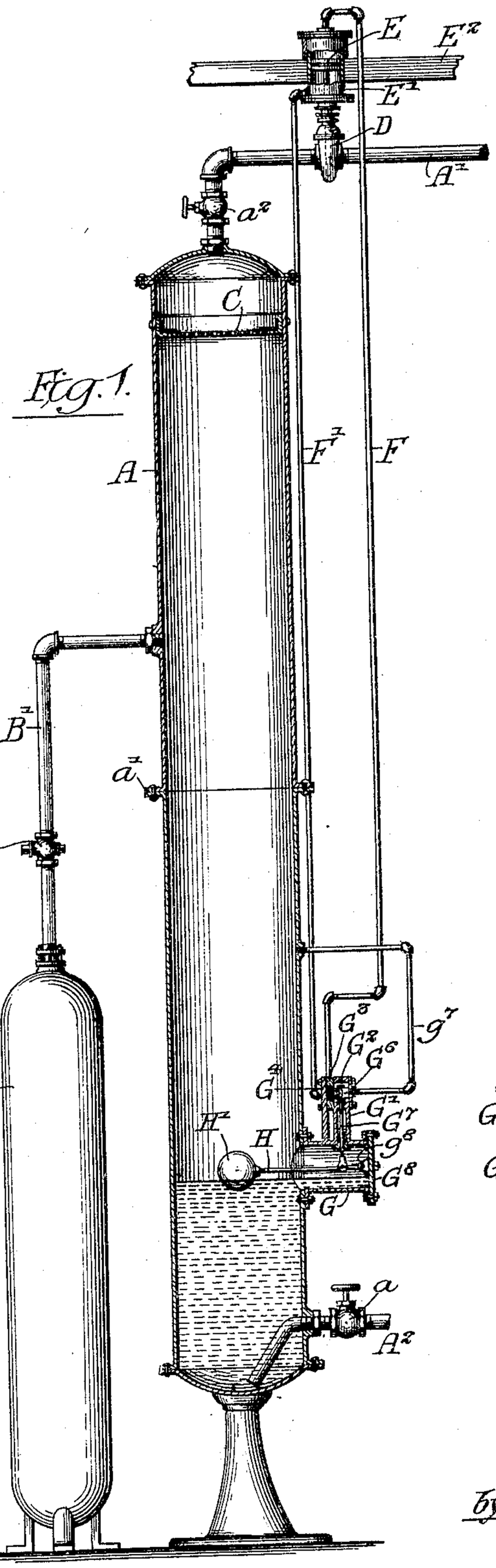

Fig. 1.

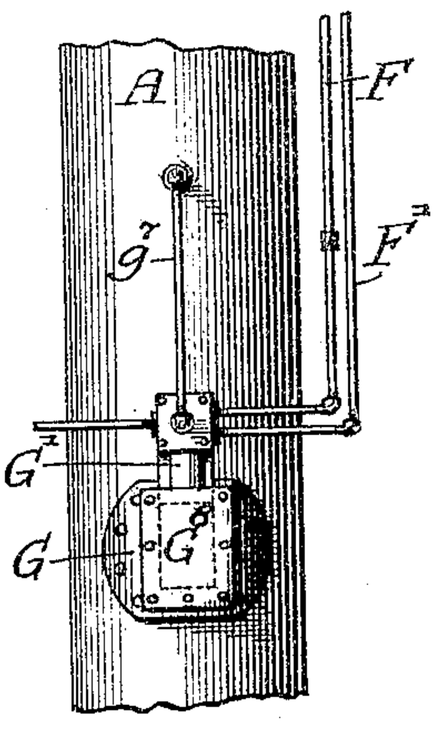

Fig. 2.

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Fig. 3.

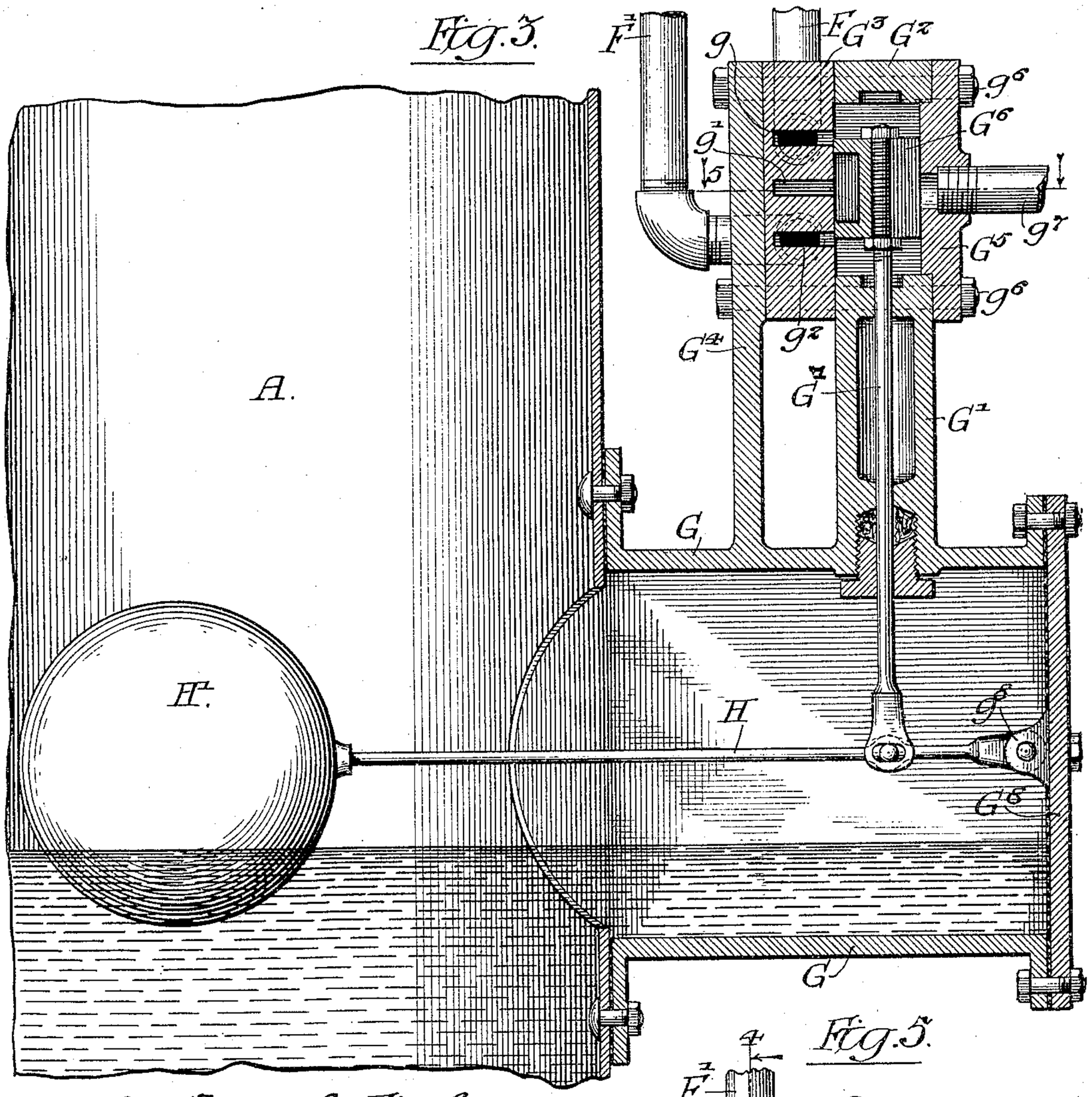


Fig. 4.

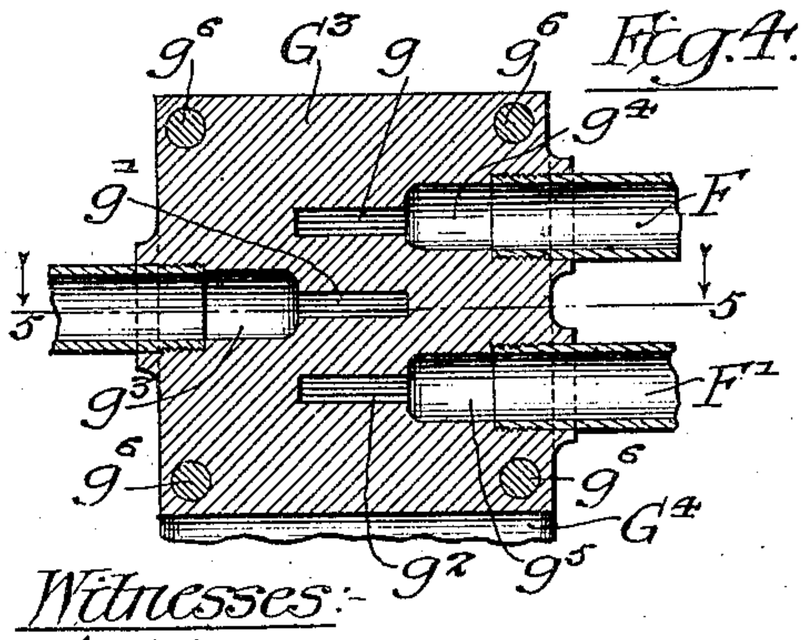
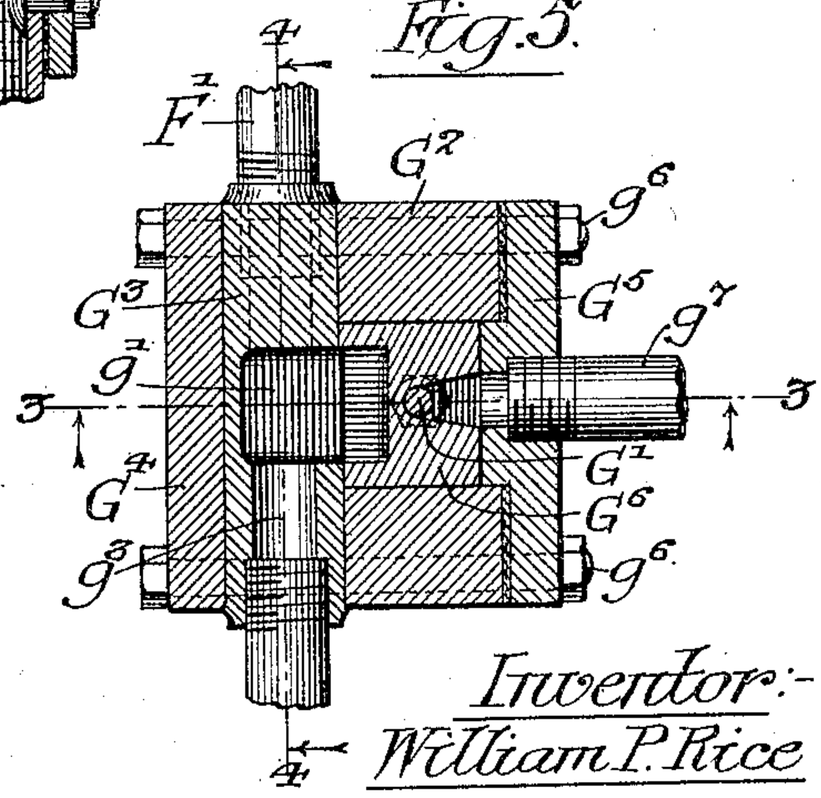


Fig. 5.



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No. 783,386. Patented February 21, 1905.

UNITED STATES PATENT OFFICE.

WILLIAM P. RICE, OF CHICAGO, ILLINOIS.

APPARATUS FOR CHARGING LIQUIDS WITH GASES.

SPECIFICATION forming part of Letters Patent No. 783,386, dated February 21, 1905.

Application filed September 26, 1903. Renewed January 16, 1905. Serial No. 241,195.

To all whom it may concern:

Be it known that I, WILLIAM P. RICE, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Apparatus for Charging Liquids with Gases; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to improvements in apparatus for charging or impregnating liquids with gases—such, for instance, as carbonic-acid gas—for the purpose of preserving or rendering potable such liquids; and the invention consists in the matters hereinafter set forth, and more particularly pointed out in the appended claims.

In the drawings, Figure 1 is a side elevation of a carbonating apparatus made in accordance with my invention. Fig. 2 is a fragmentary side elevation of the mixing-chamber tank, showing part of the automatic regulating devices for the incoming liquid. Fig. 3 is an enlarged sectional detail of a part of the automatic liquid-controlling device, the section of the valve being taken in line 3 3 of Fig. 5. Fig. 4 is a section taken in line 4 4 of Fig. 5. Fig. 5 is a section taken on lines 5 5 of Figs. 3 and 4.

As shown in the drawings, A designates an elongated tank made of or lined with a suitable non-corrosive material and constituting a mixing-chamber within which the liquid and gas are to be intermingled. Said mixing-chamber is provided at its upper end with a liquid-delivery pipe A′ and at its lower end with a carbonated-liquid effluent-pipe A^2, having a cut-off valve *a*. The tank is preferably made of two or more plain tubular sections joined together by overlapping flanges *a′* and provided with end walls which are fixed to the body of the tank by overlapping flanges and rivets. The delivery-pipe A′ is desirably provided with a cut-off valve a^2 and with an automatically-controlled regulating device, hereinafter to be described.

B designates a tank or cylinder for the carbonic-acid gas with which the liquid is to be impregnated in the mixing-chamber. Preferably said gas will be contained within the cylinder in a suitably-compressed gaseous state, and the pipe B′, which joins the cylinder to the mixing-chamber, is provided with a reducing-valve *b*, by which the working pressure of the impregnating-gas is controlled. The liquid-delivery pipe A′ is designed to be connected with a pump or other liquid-forcing device (not shown) to deliver the liquid to the mixing-chamber at the pressure required to force the same against the pressure of gas within the tank B.

Contained within the mixing-chamber, near the top thereof and extending entirely across the chamber, is a screen or perforated diaphragm C, the function of which is to finely break up or subdivide the incoming liquid, so that it falls through the space below the screen in the form of drops or spray, which facilitates and promotes the impregnation of the gas with the liquid. The tank is preferably made of considerable length relatively to its diameter, so that the liquid after being subdivided by said screen C drops through a relatively long space filled with gas under pressure, and an appreciable time is given for a thorough intermingling of the gas with the liquid. The use of a single screen in connection with a relatively long mixing-chamber is advantageous, for the reason that, first, as before stated, ample time is given for the proper intermingling of the gas with the liquid, and, second, a single screen adds but little resistance to the passage of the liquid through the mixing-chamber, whereby a large amount of liquid may be passed through said chamber in a reasonably-short time. In other words, if a large number of screens or other analogous devices in the nature of an obstruction be located in the path of the liquid the resistance due to such obstruction would decrease the rate at which the liquid could be passed through the chamber, and therefore decrease the capacity of the apparatus.

Referring now to the automatic mechanism for regulating the delivery of liquid to the mixing-chamber in accordance with the rate of withdrawal of said liquid, said mechanism is made as follows: D designates what

may be called a "common" form of gate-valve, which is located in the fluid-delivery pipe A'. The stem of said valve is attached to a piston E, fitting closely in a cylinder E', which latter is supported in any suitable manner above or below the pipe, as upon a beam E^2. (Shown in Fig. 1.) Leading into the upper and lower ends of the cylinder, respectively, are pipes F F', which deliver a motive fluid to and discharge it from the cylinder E and by which the piston is moved endwise within the cylinder to open and close the valve D. Said pipes F F' are connected at their ends remote from the cylinder E' with a source supplying said motive fluid, and located between said source and the pipes is an automatically-operated valve which is controlled by the level of the liquid in the mixing-chamber or the rate of its withdrawal therefrom, said valve being operated to regulate the pressure of the motive fluid on the opposite sides of said piston, and thereby open and close said valve D. The valve for so controlling the pressure on opposite sides of the piston consists in this instance of a three-ported valve having a chamber to which is delivered the motive fluid under any given or desired pressure, two ports of which valve are connected, respectively, with the pipes FF' and the other port opening into the atmosphere. The ports are so arranged that when the valve-chamber is fully open to one side of the piston the other side of the piston communicates with the atmosphere, whereby the superior pressure acting on one side of the piston forces the piston in the opposite direction and opens or closes the valve, as the case may be, and intermediate differential or equal pressures maintain the valve D partially open. Conveniently the motive fluid for operating the piston E is the gas taken from the mixing-chamber. The movable part of said valve is operated by means of the float within the mixing-chamber, which rises and falls with the rise and fall of the liquid in the lower end thereof. Said valve is shown more clearly in Figs. 3, 4, and 5, and is made as follows: G designates a hollow casing which is attached to the mixing-chamber wall, near the lower end thereof, and extends laterally therefrom. The interior of said casing is in open communication with the mixing-chamber. Extending upwardly from said casing (or it may be downwardly) is a tubular neck G', desirably made integral with the casing G and having at its upper end a hollow head G^2, which is open at both of its lateral sides. G^3 designates a valve-plate contained between the hollow head and the outer end of an arm G^4, extending from the casing G, parallel with the neck G'. Said valve-plate contains in its lateral face adjacent to the hollow head G' three parallel transverse ports g g' g^2. The central port g' discharges through an opening g^3 into the atmosphere, while the port g communicates through an opening g^4 with the pipe F, and the other side port g^2 communicates through an opening g^5 with the pipe F'. G^5 designates a cover-plate which fits over the lateral face of the hollow head G' remote from the valve-plate G^3 and is attached to said head by bolts g^6, extending through the arm G^4, the valve-plate, head, and cover-plate, as clearly shown in Fig. 3, said bolts acting to hold in place not only the cover-plate but also the valve-plate. The opening in the head G^2 constitutes the valve-chamber, and said chamber is in communication with the mixing-chamber or other source of motive fluid through a pipe g^7, which enters an opening in the cover-plate, as more clearly shown in Figs. 3 and 5. G^6 designates a D-slide-valve closure located in said chamber and sliding over the ported face of the valve-plate. Said closure is provided with an endwise-reciprocating valve-stem G^7, which extends through the neck G' and through a stuffing-box into the casing G. Said valve-stem is loosely connected at its end remote from the closure with the lever H of a float H', located in the mixing-chamber, and which float rises and falls with the liquid-level in said chamber. Said float-lever is pivoted at its outer end to a lug g^8, extending inwardly from the removable cover G^8 of the casing G. The length of the valve-closure is such that when it is in its central position, as shown in Fig. 3, both of the side ports g g^2 are partially uncovered, so that communication is established between the valve-chamber and both sides of the piston in the cylinder E', and the valve attached to said piston is therefore held in an intermediate position with the valve partially open. When the closure G^6 is moved to one limit of its throw, it fully uncovers one of the side ports, thereby establishing free communication between the valve-chamber and the side of said piston E with which said side port communicates through one of the pipes F F', while the other of the side ports is brought into communication with the central release-port through the hollow valve-closure G^6, so that the motive fluid is free to escape from one side of the piston into the atmosphere and permit the piston and the connected valve to be moved to one limit of its movement and thereby fully open or close the valve, depending upon the direction of movement of the piston.

The operation of the apparatus described will be obvious from the foregoing, but may be briefly stated as follows: The charging-gas is delivered from the cylinder B to the mixing-chamber at the desired pressure, regulated by the valve b, and the liquid to be charged is delivered to the chamber through the pipe A' at a pressure necessary to force it against the mixing-chamber pressure. The liquid in passing through the screen C becomes finely divided and in a condition to absorb and become impregnated with large quantities of the

charging-gas and falls to the bottom of the mixing-chamber, from whence it is drawn through the draw-off pipe A^2. The liquid collects in the bottom of said mixing-chamber, and as the level of the accumulated charged or carbonated liquid rises in said chamber it raises the float, thereby operating the motive-fluid valve in the manner described to deliver said motive fluid to and release it from the cylinder E′ in a manner to open and close the gate-valve of the delivery-pipe A. Thereafter in the continued withdrawal of the charged liquid from the bottom or lower end of the mixing-chamber the liquid-level rises and falls, due to variations between the supply and discharge of the liquid from and to the chamber, and maintains the valve D in position to deliver the required amount of liquid to the mixing-chamber.

It is obvious that changes may be made in the structural details of the apparatus shown without departing from the spirit of my invention, and I do not wish to be limited to said details except as hereinafter made the subject of specific claims.

I claim as my invention—

1. An apparatus for charging liquids with gas comprising a mixing-chamber provided with liquid delivery and effluent pipes, the former leading into the top of said chamber, means for delivering a charging-gas to said chamber, a valve in said liquid-delivery pipe located closely adjacent to its discharge end, a closed cylinder or chamber, a movable part therein connected with and operating said valve, pipes communicating with said cylinder or chamber on opposite sides of the movable part respectively, a valve comprising a chamber provided with two ports with which the other ends of said pipes communicate, and with a third port which discharges into the atmosphere, a pipe leading from said mixing-chamber to the valve-chamber, a movable valve-closure in said chamber, and a float in said mixing-chamber which is directly connected with and operates said closure.

2. An apparatus for charging liquids with gas comprising a mixing-chamber provided with liquid delivery and effluent pipes, means for delivering a charging-gas to said chamber, a valve in said delivery-pipe, a cylinder or chamber, a movable part therein connected directly with and actuating said valve, means for delivering a motive fluid to said chamber, a multiported valve for controlling the supply of a motive fluid thereto and its discharge therefrom embracing a movable, recessed closure, the casing of which valve is connected by a pipe with said mixing-chamber, a float in said mixing-chamber, a hollow casing extending laterally from said chamber, a stem attached to the float and extending outwardly into said casing and hinged therein, a hollow neck rising from said casing and supporting at its upper end said multiported valve, and a rod or stem connected at one end with the closure of said multiported valve and loosely connected at its other end with the stem of said float.

3. An apparatus for charging liquids with gas comprising a mixing-chamber provided with liquid delivery and effluent pipes, the former leading into the top of said chamber, means for delivering a charging-gas to said chamber, a valve in said liquid-delivery pipe located closely adjacent to its discharge end, a closed cylinder or chamber, a movable part therein connected with and operating said valve, pipes communicating with said cylinder or chamber on opposite sides of the movable part respectively, a valve comprising a chamber provided with two ports with which the other ends of said pipes communicate, and with a third port which discharges into the atmosphere, a passage leading from a source of fluid under pressure to said valve-chamber, a movable valve-closure in said chamber, and a float in said mixing-chamber which is directly connected with and operates said closure.

In testimony that I claim the foregoing as my invention I affix my signature, in presence of two witnesses, this 15th day of September, A. D. 1903.

WILLIAM P. RICE.

Witnesses:
WILLIAM L. HALL,
GEORGE R. WILKINS.