No. 622,410.

Patented Apr. 4, 1899.

C. BARUS.

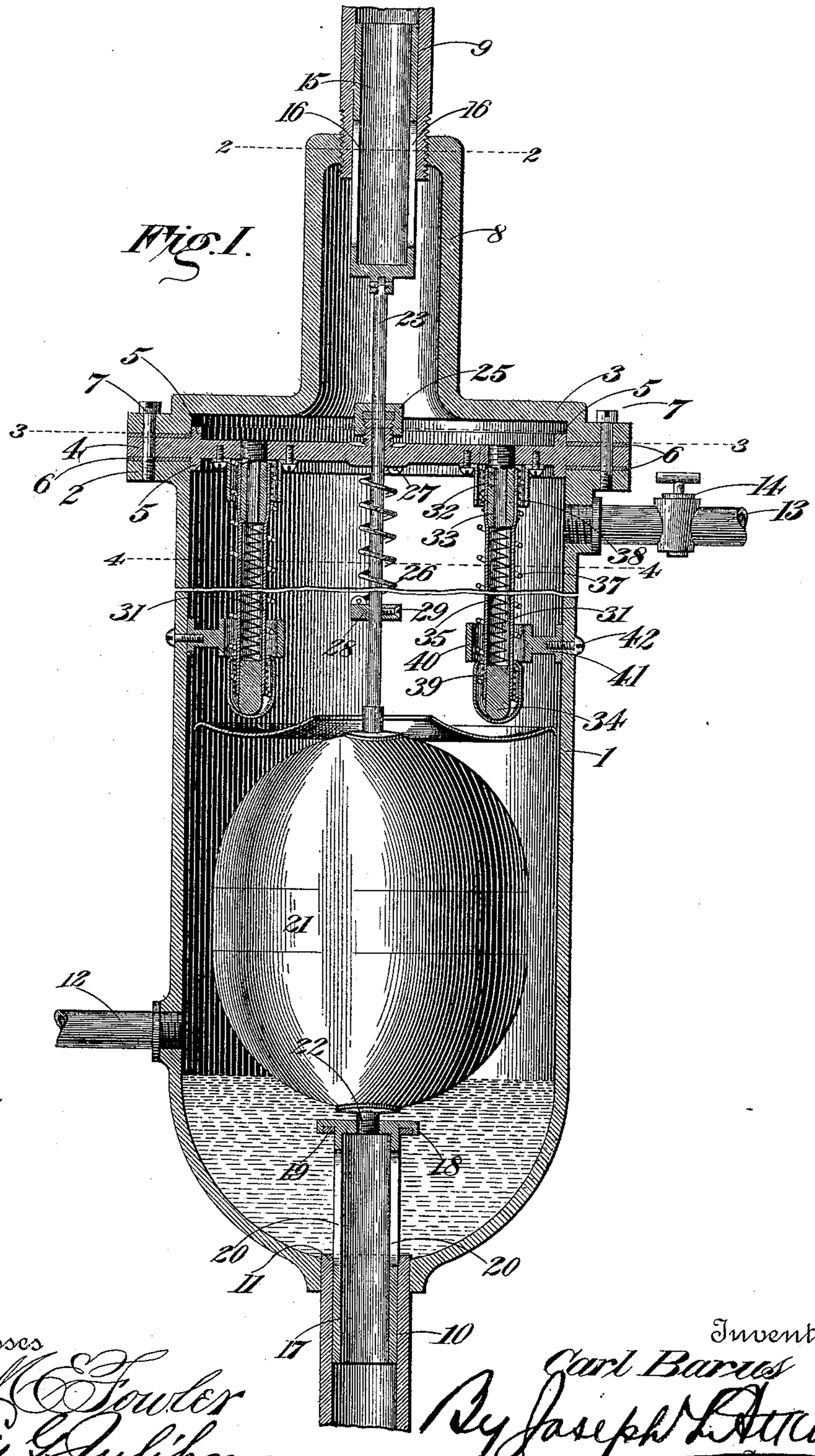
CARBONATING APPARATUS.

(Application filed May 17, 1895.)

(No Model.)

4 Sheets—Sheet 1.

Fig. 1.



Witnesses
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(No Model.) 4 Sheets—Sheet 2.

Fig. II.

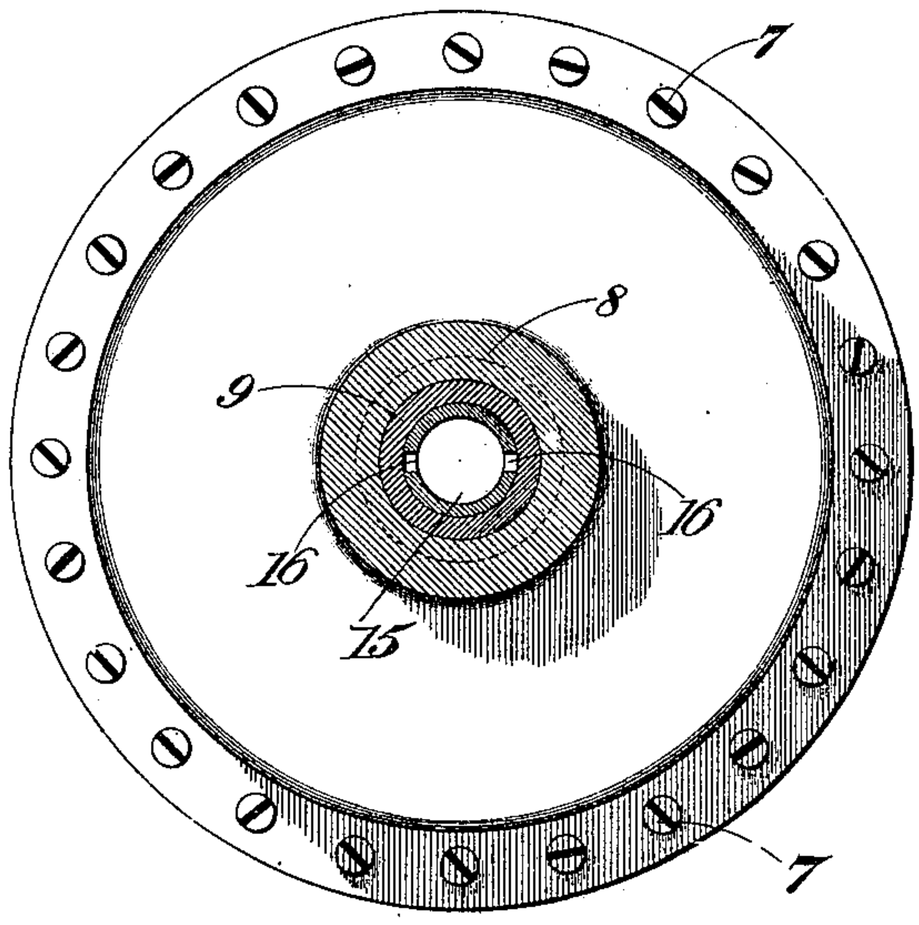


Fig. V.

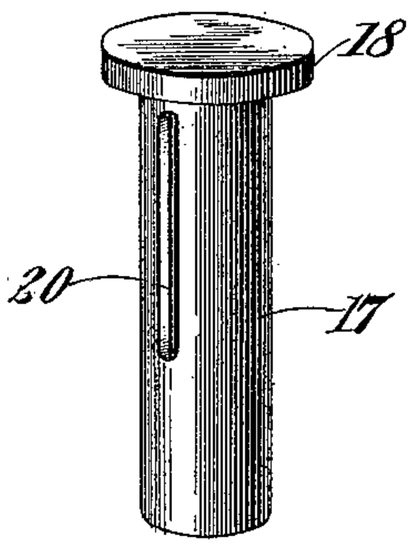


Fig. VI.

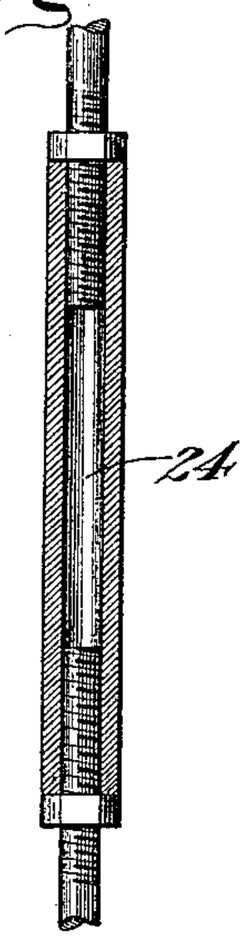
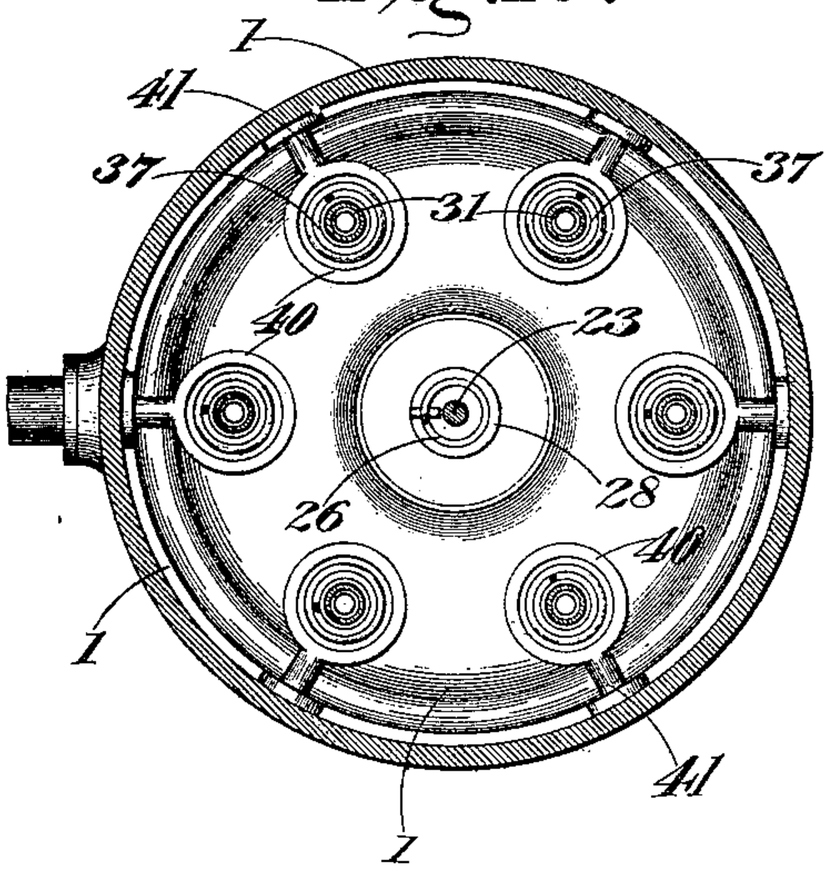


Fig. III.

Fig. IV.



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(No Model.) 4 Sheets—Sheet 3.

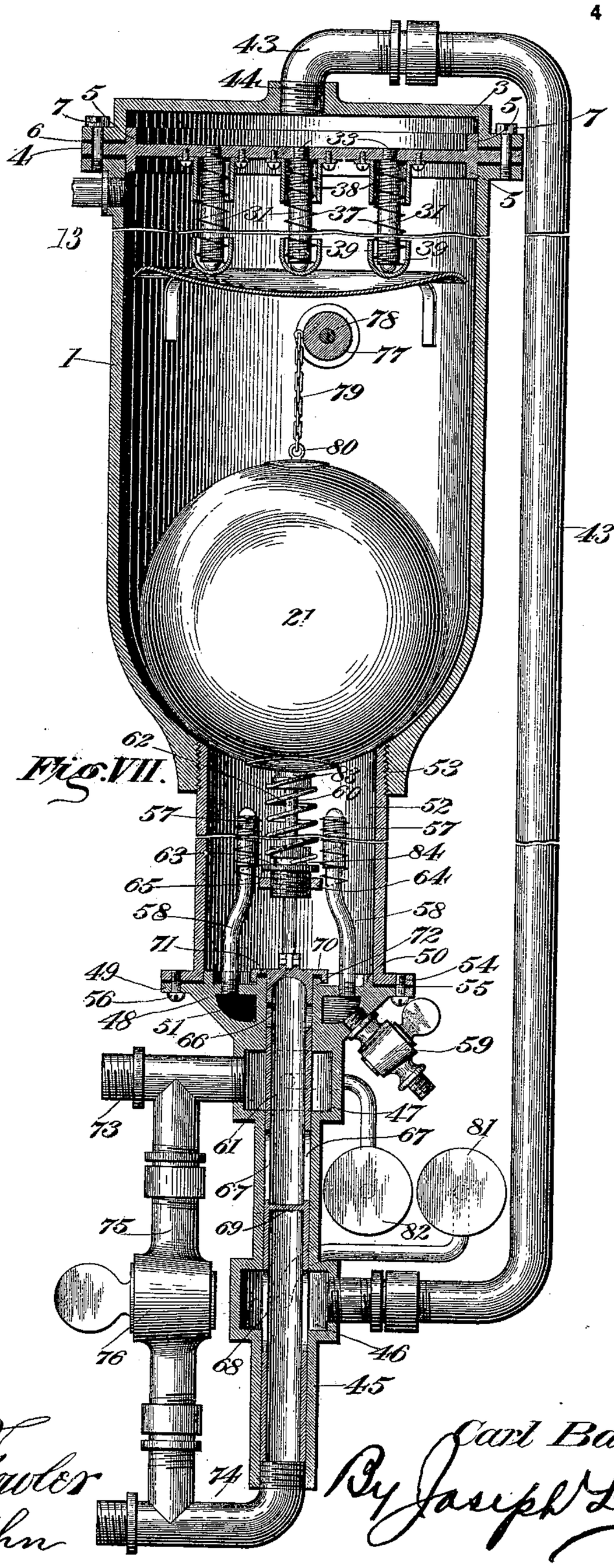

Fig. VII.

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(No Model.) 4 Sheets—Sheet 4.

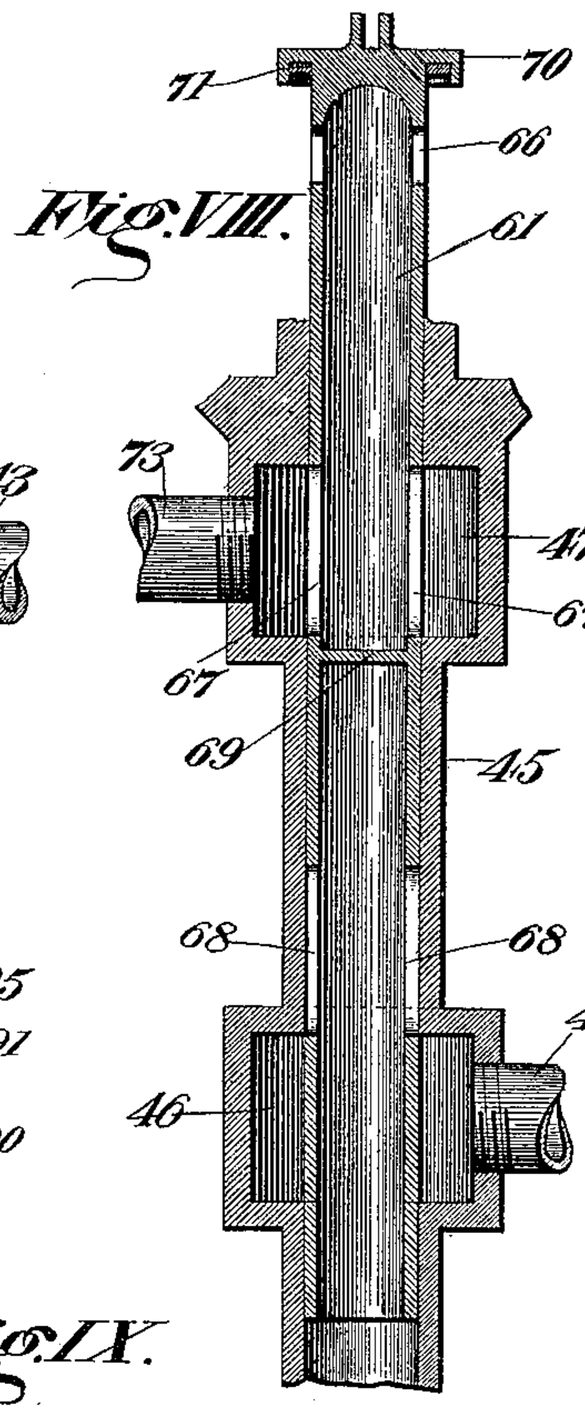

Fig. VIII.

Fig. IX.

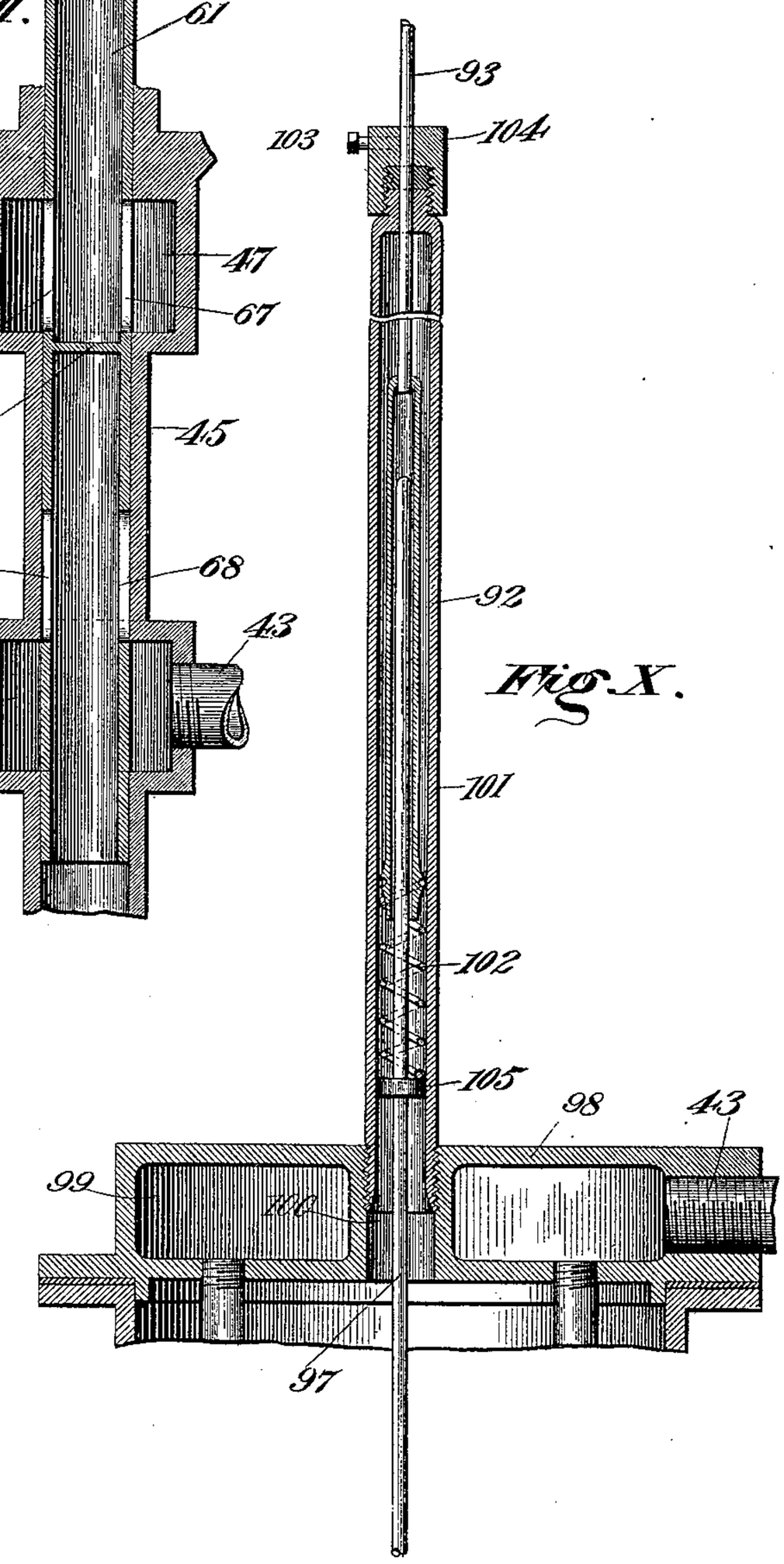

Fig. X.

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UNITED STATES PATENT OFFICE.

CARL BARUS, OF WASHINGTON, DISTRICT OF COLUMBIA, ASSIGNOR OF ONE-HALF TO ALBERT LIEBER, OF INDIANAPOLIS, INDIANA.

CARBONATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 622,410, dated April 4, 1899.

Application filed May 17, 1895. Serial No. 549,637. (No model.)

To all whom it may concern:

Be it known that I, CARL BARUS, of Washington, in the District of Columbia, have invented certain new and useful Improvements in Carbonating Apparatus, of which the following is a specification, reference being had to the accompanying drawings.

The object of my invention is to produce an improved apparatus for carbonating liquids by the injection of comminuted or atomized liquid into a confined volume of gas, and in apparatus for practicing the method either separately or in conjunction with means of carbonating liquids previously described by me in my Patents Nos. 523,450 and 531,356, issued, respectively, July 24 and December 25, 1894.

In accordance with the plan of carbonation previously proposed by me gas is introduced in an atomized state into a body of liquid by means, for example, of a porous receiver, elastic or not, through the walls of which the gas is forced to pass. It was not in those patents suggested that the operation might be reversed by atomizing liquid and passing it through a porous receiver into a confined body of gas; but I have discovered that it is not only practicable, but that distinctly valuable results are by that method obtainable. Among other advantages gained by the new process and apparatus which I now employ may be enumerated the more complete carbonation of the liquid within a given time, means for automatically regulating the influx and efflux of liquid, the prevention of waste of the liquid to be carbonated, the shutting off of the apparatus as soon as the inflowing liquid is exhausted, the prevention of the passage of gas into the source of liquid to be carbonated, the prevention of the passage of liquid into the source of gas-supply, and means for automatically maintaining a nearly constant difference of effective pressure between the parts of the apparatus containing uncarbonated liquid and gas, respectively.

In the accompanying drawings, Figure I is a central vertical longitudinal section of a simple form of my apparatus. Fig. II is a cross-section of the entire apparatus, taken as on the plane 2 2 of Fig. I. Fig. III is a cross-section of the entire apparatus, taken as on the plane 3 3 of Fig. I. Fig. IV is a cross-section of the entire apparatus, taken as on the plane 4 4 of Fig. I. Fig. V is a perspective view of the lower valve. Fig. VI illustrates in section adjustment mechanism for lengthening or shortening the valve-connecting stem. Fig. VII is a central vertical longitudinal section of the compound form of my apparatus. Fig. VIII is a longitudinal sectional view of the valve mechanism in the elevated position. Fig. IX is an axial section of an improved form of the compound valve with spring-regulator. Fig. X is an axial section of spring-regulator applied at the cap.

Referring to the figures on the drawings, 1 indicates the shell of the carbonating chamber or receptacle. It is preferably provided around its upper edge with an annular flange 2, that is designed to afford means of securing to the shell the cap 3 and the intermediate partition-diaphragm 4.

5 indicates annular fillets on the interior of the diaphragm that are located opposite the respective planes of division between it, the flange 2, and the cap 3 and are designed to afford inside bearings for gaskets or packing-rings 6, which are employed to secure gas-tight joints between the parts, respectively, aforementioned.

The parts enumerated may be united and firmly secured together by a crown of bolts 7, passing through the cap, diaphragm, and packing-rings and screwing into the flange 2.

As illustrated in Fig. I, the cap is provided with a peak or extension 8, into the extremity of which is screwed a pipe 9, communicating with a source (not illustrated) of liquid to be carbonated, and which may be called the "influx-pipe."

10 indicates the efflux-pipe, communicating with the bottom of the carbonating-chamber at its lowest point and preferably projecting a short distance above the surface of the interior, as indicated at 11.

12 indicates a gas-supply tube designed to communicate with a source of gas-supply. (Not illustrated.) 13 indicates an air-vent, and 14 a cock controlling the same. The tube 12 preferably communicates with the interior of the chamber 1 near its bottom and the pipe 13 with it near its top.

15 indicates a slide-valve working in a

smooth seat in the interior of the pipe 9 and provided with slits 16, which are covered and uncovered by its reciprocation in its seat. 17 indicates a similar valve working in the pipe 10, that is also preferably provided with a dished annular flange 18 around its upper edge and a packing-ring 19, contained therein, the ring 19 being adapted to form, with the projection 11 of the pipe 10, a specially tight joint.

20 indicates lateral slits in the valve 17.

21 indicates a float of suitable shape, size, and dimensions which, as by a screw-nipple 22 at its lower end, is secured to the valve 17. At its upper end, as by a stem 23, it is secured to the valve 15. The length of the stem may be adjustable, as by a turnbuckle 24. (See Fig. VI.)

25 indicates a packing-box which makes a tight joint around the stem 23 where it passes through the diaphragm 4. The weight of the float 21 is preferably counterbalanced, as by a helical spring 26, coiled around the stem, secured at its upper end 27 to the bottom of the diaphragm 4 and adjustably secured at its lower end (as by a ring 28, to which at that end it is fastened, as by an abutment-screw 29) to the stem. The spring preferably acts both by extension and by compression in a way and for the purpose to be hereinafter described.

The diaphragm 4, as above suggested, preferably separates the interior of the chamber 1 from the interior of the cap and peak 8. The chamber is designed to be filled with carbon dioxid, while the compartment above the diaphragm receives liquid to be carbonated under pressure.

The purpose of my invention is to introduce the liquid from the upper receptacle into the gas in comminuted form, so that it may readily take up the gas. For this purpose I provide in the apparatus means for comminuting the liquid as it passes through the diaphragm 4, and prefer to employ one or more porous bags 31, preferably made of punctured elastic material, which constitutes besides comminuting apparatus automatic valves. These bags may be secured, as by wrapping wires 32 to nipples 33, that screw into the diaphragm and are similarly wired at their lower end to a plug 34. The collapsing of the walls of the bags may be prevented by an interior helical wire 35, preferably secured at its upper end to a nipple 32, while the exterior of the walls may be reinforced and the weight of the bag suspended by an exterior helical wire 37, secured at its upper end, as to the interior of a collar 38, secured to the bottom of the diaphragm, and at its lower end to a cup 39, that supports the plug 34. The lower ends of the bags may be steadied by rings 40, whose shanks 41 are secured to the interior of the shell, as by screws 42. A shallow horizontal dish may be provided below the bags to catch the drippings from the bags and to convey them to the lake below, so that they will not spatter on the float 21.

The apparatus just described comprehends the embodiment of my invention in its simple form. It is operated as follows: Gas is admitted through the tube 12 into the interior of the chamber 1 under pressure, the valve 17 being closed. The cock 14 is opened and the air, being lighter than the gas, is expelled until the chamber 1 is completely filled with the gas at required pressure. This operation needs to be performed but once at the outset. The cock 14 is then closed and the liquid to be carbonated is admitted to the pipe 9 under pressure by forcing it through the pores or apertures in the walls of the bags 31 in a state of comminution into the body of the gas contained in the chamber 1. The comminuted particles of liquid reunite and form a lake in the bottom of the chamber 1, which as it rises lifts the float 21, that in proportion to the height of its elevation tends to close the valve 15 and to open the valve 17, or, in other words, to promote the efflux of liquid and to retard its influx. If the liquid in the chamber 1 should rise sufficiently high, the valve 15 will become entirely closed and check the influx until the liquid in the chamber has been sufficiently exhausted to permit the continuation of the operation. By this means if the flow of liquid from the pipe 10 is checked at any time the operation of the apparatus is automatically checked, as required. Furthermore, the gas cannot pass into the bags 31, for their pores close by external pressure; neither can the gas escape from the chamber 1, for the ring 19 is tight-fitting.

In the compound form of my apparatus shown in Fig. VII the parts, which are the same in both forms of apparatus, are similarly lettered and the specification is equally descriptive of them. In this form, however, the peak 8 and the upper valve are dispensed with. Consequently the stem 23 is omitted and its place may be supplied with a central porous bag. 43 indicates a pipe which communicates, as indicated at 44, with the cap 3 at one end and at its lower end with the pipe 45 through an enlarged chamber 46 thereof. 47 indicates a second enlarged chamber similar to the chamber 46. 48 indicates the head of the pipe 45, the pipe and its chamber being preferably cast or manufactured in one piece. The head is provided with a flange 49 and a fillet 50 and is constructed to accommodate a gas-chamber 51. 52 indicates a barrel united, as by a threaded joint 53, to the lower end of the chamber 1, and as by an annular flange 54, a gasket 55, and a crown of bolts 56 to the flange 49 of the head 48. This barrel is designed to accommodate gas-injection bags 57. These bags are preferably substantially the same as the bags 31 above described and are secured to and supported by upright pipes 58, screwed into the head 48 and com-

municating with the interior of the gas-reservoir 51. 59 indicates a cock communicating with a source of gas-supply (not illustrated) and with the interior of the reservoir, and adapted, as required, to supply gas under pressure to the bags 57. In this form of apparatus the float 21 is fastened to a stem 60 at one of its ends, whose other end is fastened to a compound valve 61. The float may be balanced by a helical spring 62, supported by an adjustable flanged nut 63, which screws into a collar 64, supported by a spider 65, secured to the walls of the barrel 52. In order that the spring may work both by extension and compression, its ends are bent radially inward, so as to be revolubly secured in annular grooves 83 and 84 of the blocks, to which it is fastened. The valve 61 is provided with a barrel-discharge aperture 66, efflux-slits 67, and influx-slits 68, the efflux-slits and the influx-slits being separated by a transverse partition 69. The valve 61 works vertically in a seat extended the length of the pipe 45. It is provided at its upper end with a flange 70 and a packing-ring 71, which forms a tight joint over the annular boss 72 around the central bore of the head 48. 73 indicates an efflux-pipe communicating with a chamber 47, and 74 an influx-pipe communicating, preferably, with the bottom of the pipe 45, the end of the valve 61 being, if that construction is employed, open. 75 indicates a commingler-pipe establishing communication between the efflux-pipe 73 and the influx-pipe 74 and controlled by a cock 76. 77 indicates a drum secured on a shaft 78, that works in gas-tight bearings in the shell 1 and which may be operated from the exterior. 79 indicates a chain secured at one end of the drum and at the other end to an eyelet 80 on the top of the float 21. By the rotation of the drum the float may be manually raised or lowered, as required, for cleaning the apparatus in case of accident.

The operation of the compound form of my apparatus, as illustrated in Fig. VII, is as follows: Gas is admitted through the cock 59, and the air is expelled through the air-vent pipe 13, as explained with reference to the simple apparatus. Next the liquid to be carbonated is admitted through the pipe 74, the valve 61 being closed, and, passing through the influx-slits 68, enters the pipe 43, and through it the compartment above the diaphragm 4, when in the comminuted form it enters the interior of the chamber and accumulates in the barrel 52. After filling the barrel 52 it begins to rise in the bottom of the chamber 1, and as it rises elevates the float 21. For a considerable time before it raises the float 21 the liquid is subjected to the injection of the gas through the bags 57 into the volume thereof confined in the barrel 52, and after the first operation of the machine the barrel 52 is kept full. When the float 21 rises sufficiently, it lifts the valve 61, and, uncovering the discharge-aperture 66, allows the escape of the carbonated liquid into the chamber 47 and thence through the pipe 73. Through the arrangement of the valve 61 the operation of the apparatus is equally as automatic as the simple apparatus for shutting off the discharge of liquid whenever the supply is exhausted, for shutting off the supply when the discharge liquid is in excess, and for keeping the gas out of the supply-pipes. It also keeps the liquid out of the gas-supply pipes automatically, because the pores of the gas-bags 57 close by external pressure. The superior density of the liquid which collects as a lake in the bottom of the chamber and surrounds the gas-supply valves over the gas in the pipes is partially relied upon to effect the perfect operation of the valves. Furthermore, the lake in 52 is more highly charged by gas passing through it in an atomized form. The commingling-pipe 75 is provided in order that the carbonated liquid in the pipe 73 may be supplied with still liquid if required and the amount of gas to the volume of liquid thereby diminished.

Pressure-gages 81 and 82, communicating, respectively, with the chambers 46 and 47, may be provided for determining the degree of pressure of the liquid in each of the chambers. Preferably, however, an ordinary differential gage (not shown) at the top of the carbonator showing the difference of pressure above and below the diaphragm 4 is to be used.

Thus far no mention has been made of the final important function of the compound valve in maintaining, in combination with the spring 26 or 62, Figs. I and VII, an adjustable and nearly-constant difference of pressure between the chamber of uncarbonized liquid above the diaphragm 4 and the gas-pressure below the diaphragm. The pressure in the supply-pipe 74, Fig. VII, will in general increase when the influx-valve rises or closes by reason of the stricture at the ports. As a result the velocity of the liquid at the ports will increase, and the valve will be lifted upward by an increasing pressure. For simplicity suppose the gas-pressure to be constant and let the influx-pressure increase. If now the spring—as, for instance, 62 in Fig. VII—be set so as to compensate a certain part of this increased pressure by extension, then in view of the increased velocity of the influx at the ports a nearly-constant current of liquid will tend to enter the pipe 43, and thus the nearly-constant difference of pressure in question is maintained. The same reasoning holds for decreased influx-pressure and for increased and decreased gas-pressure, since the lift on the valve is due to pressure difference above and below it.

In view of the important functions of the spring methods are indicated in Figs. IX and X for placing it in a way more easily accessible from the outside of the carbonator to facilitate adjustment. In this case the drum

and chain 77 78 79 80 may be dispensed with, as well as the internal spring 62, Fig. VII, and its spider support and adjustment. Fig. IX shows the compound valve essentially like the preceding, except that a lower end of the chamber 45 has been provided with an enlargement 85 for the reception of the influx-pipe 74. The slide-valve is now provided with a spider at its lower end 86, (parts of its sides being notched, as at 87, to prevent stricture,) into which a long rod 88 is axially fixed, as by a screw. Near the top of the rod a flange 89 is adjustably fixed. This flange has three purposes. It regulates the reciprocating play of the valve in combination with the upper flange 70. It is an additional means of shutting off the influx absolutely, even if the slide-valve should become worn. It finally serves for the upper attachment of the spring 90, the functions of which have just been stated. This attachment is made revoluble, as by annular groove 91 and inflexed end of the spring. The other end of the spring 90 is similarly attached to a tube 92, admitting the rod 88, closed at the lower end and prolonged there by another rod 93. The whole is contained in an external tube 94, which is an axial prolongation of the chamber 85 and is closed below by a stuffing-box 95. The rod 93 passes through this stuffing-box, and the adjustment of the spring is regulated by means of a set-screw 96. In Fig. X the valve is supposed to be left as in Fig. VII. The spring 62 and lower attachments are removed. The top of the float is provided with a stem, as in Fig. I, which passes through the top of the carbonator, as shown at 97, Fig. X. The diaphragm has been removed, and its place is supplied by the lid 98, containing an annular chamber 99, fed as by the supply-pipe 43. The lid is pierced, as shown at 100, and in this hole 100 the pipe 101 is axially secured, as by screw-threads. The adjustable spring mechanism within this pipe is very similar to that shown in Fig. IX, so that similar parts are similarly lettered. The spring 102 in this case acts by compression only, (which usually suffices for the purpose of maintaining constant pressure differences,) and the final adjustment is now secured by a screw 103, passing through a stuffing-box 104 and actuated manually from without. An adjustment-collar against which the spring 102 abuts is shown at 105.

It may be observed that while the valve 61 and its actuating mechanism ordinarily serve to maintain the effective difference of pressure the arrangement of the collapsible liquid and gas valves insures the maintenance of such effective pressure. The liquid-valves, as will appear from the drawings, are so constructed that an excessive gas-pressure, due to the rising of the liquid and the consequent compression of the gas, will close the valves and prevent the further influx of liquid.

It may be noted that the devices of Figs. IX and X may be used together to secure a more variable adjustment.

What I claim is—

1. In a carbonating apparatus, the combination of a closed carbonating-receptacle designed to receive and discharge a liquid, a movable influx-valve controlled by the level of the liquid within the receptacle, and arranged to gradually open and close the liquid-influx opening as the liquid-level falls and rises, and an efflux-valve operatively connected with and actuated by the influx-valve, and arranged to gradually open and close the efflux-liquid opening inversely as the influx-valve controls the liquid-influx opening, substantially as set forth.

2. In a carbonating apparatus, the combination of a closed carbonating-receptacle, a gradually opening and closing influx-valve controlling the liquid-supply to such receptacle, a gradually opening and closing efflux-valve controlling the discharge from such receptacle, a rigid connection between such valves, and a float within the receptacle operated by the liquid-level therein, and rigidly connected with the said connection between the valves, substantially as set forth.

3. In carbonating apparatus, the combination with a stationary closed receptacle, of separate gas-supply and liquid-supply pipes communicating therewith, and automatic valve mechanism adapted to be operated from pressure within the receptacle dividing each of the pipes from the interior of the receptacle, substantially as set forth.

4. In carbonating apparatus, the combination with a closed receptacle, gas and liquid supply pipes, respectively, communicating with the interior thereof, of automatic valve mechanisms, operating to close by pressure from within the receptacle, dividing the liquid-supply and the gas-supply pipes, respectively, from the interior of the receptacle, whereby, when the gas-pressure in the gas-pipe exceeds the internal pressure within the receptacle, the gas flows into the receptacle, and when the liquid-pressure in the liquid-pipe exceeds the internal pressure within the receptacle the liquid flows into the receptacle, substantially as set forth.

5. In carbonating apparatus, the combination with a closed receptacle, and liquid-supply and gas-supply pipes communicating, respectively, with the interior thereof, of porous or punctured elastic bags dividing the gas-supply and liquid-supply pipes, respectively, from the interior of the receptacle, said bags constituting automatic valves opening and closing, respectively, through variation in the ratio between gas-pressure and liquid-pressure, respectively, communicated through the respective pipes, substantially as set forth.

6. In carbonating apparatus, the combination with a closed receptacle, liquid-supply and gas-supply pipes, communicating, respec-

tively, with the interior thereof, of an influx-valve inserted into the liquid-supply pipe, means adapted to operate the valve by the height of the level of the liquid within the receptacle, and an automatic valve interposed between the carbonator and the liquid-supply pipe closing by excessive gas-pressure from within the receptacle, and opening by excessive liquid-pressure from within the pipe, whereby if the gas-pressure should diminish to any considerable extent below the liquid-pressure, and the liquid should, in consequence, flow in in excessive quantity, the rise of the liquid in the receptacle will operate at once to actuate the valve, and in that way diminish, or altogether shut off, the liquid-pressure, substantially in the manner and for the purpose specified.

7. The method of carbonating liquids, which consists in discharging liquid and gas separately and in a comminuted state into a common receptacle, and in controlling the discharge of the liquid by the pressure of gas in the receptacle, and in controlling the discharge of the gas by the pressure of the treated liquid therein, substantially as set forth.

8. In carbonating apparatus, the combination with a receptacle designed to receive and discharge liquid, of influx and efflux valves, a diaphragm, and automatic valves controlling the flow of liquid through the diaphragm designed to be regulated by the variation of liquid-pressure above and gas-pressure below the diaphragm, and mechanism controlled by the liquid within the receptacle and designed to simultaneously actuate the influx and efflux valves, substantially as specified.

9. In carbonating apparatus, the combination with a receptacle and liquid influx and efflux valves actuated by the liquid within the receptacle, of automatic liquid-valves between the liquid-influx valve and the interior of the carbonating-chamber, and automatic gas-influx valves within the carbonating-chamber and communicating with a gas-supply, said automatic liquid-valves being controlled by the difference of pressure between the uncarbonated liquid and the interior of the carbonating-chamber, and said automatic gas-valves being controlled by the difference of pressure between the interior of the carbonating-chamber and the gas within the gas-supply, substantially as specified.

10. In carbonating apparatus, the combination with a receptacle, of interdependent influx and efflux valves arranged in a manner to cause the gradual regulation of the influx and efflux, a float within the receptacle, and mechanism operatively connected with said valves and designed to counteract the effect upon the valves of the increase in pressure incident to the gradual restriction of the influx, substantially as specified.

In testimony of all which I have hereunto subscribed my name.

CARL BARUS.

Witnesses:
LOUIS G. JULIHN,
JOSEPH L. ATKINS.