Jan. 12, 1932. J. E. TREANOR 1,840,859

CARBONATING APPARATUS

Original Filed June 16, 1925 2 Sheets-Sheet 1

Fig.1.

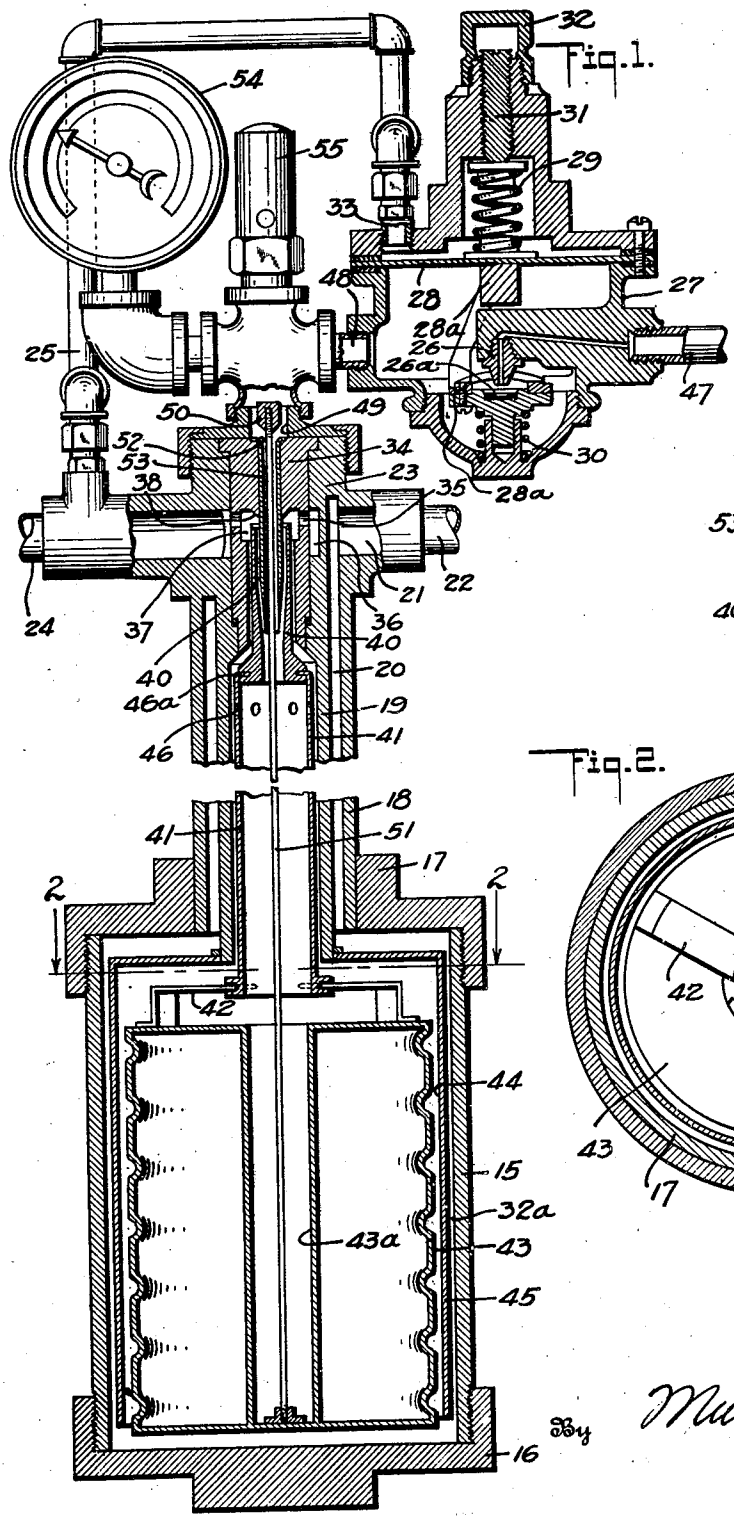


Fig.6.

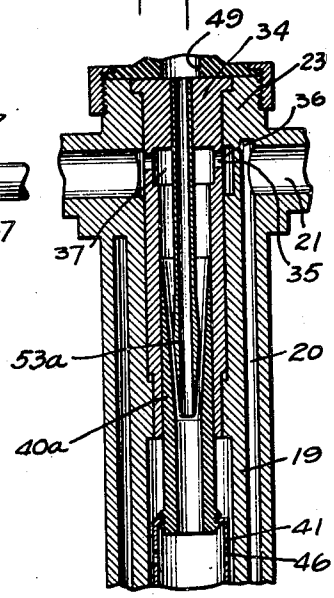
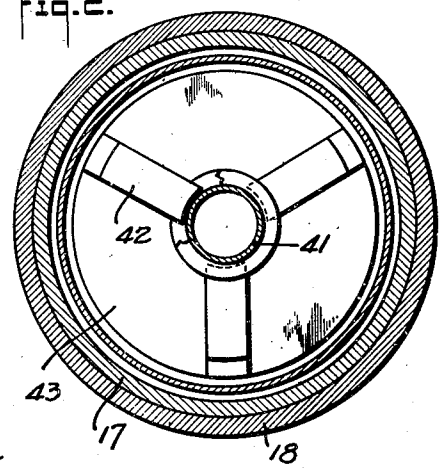


Fig.2.



Inventor

JOHN E. TREANOR

By Munn & Co.

Attorney

Jan. 12, 1932. J. E. TREANOR 1,840,859

CARBONATING APPARATUS

Original Filed June 16, 1925 2 Sheets-Sheet 2

Fig. 3.

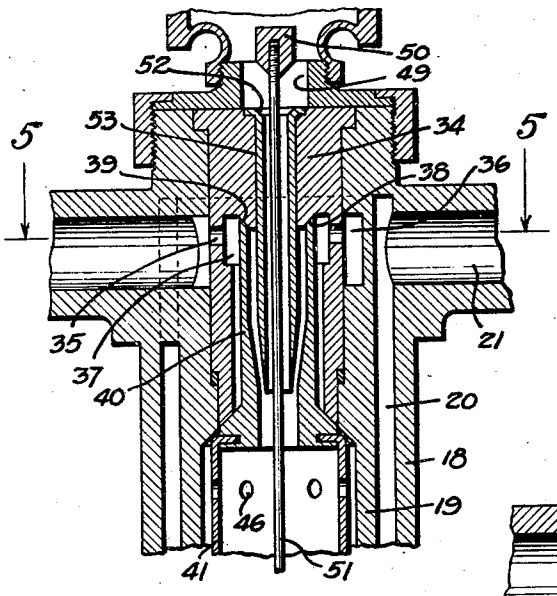


Fig. 5.

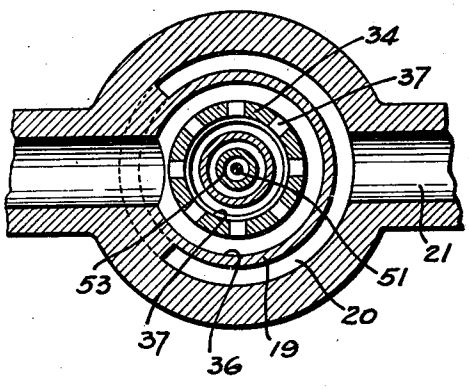
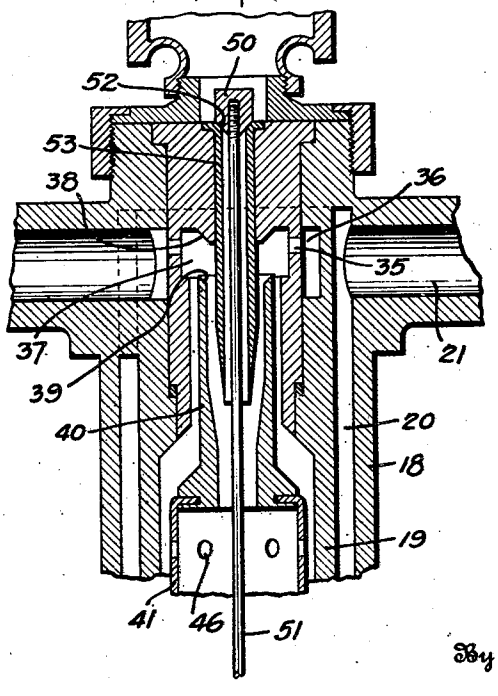


Fig. 4.



Inventor
JOHN E. TREANOR

By Munn & Co.

Attorney

Patented Jan. 12, 1932 1,840,859

UNITED STATES PATENT OFFICE

JOHN E. TREANOR, OF ALHAMBRA, CALIFORNIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO JOHN E. TREANOR, ERLE D. MORTON, AND CHARLES J. THOMPSON, A PARTNERSHIP DOING BUSINESS AT ALHAMBRA, CALIFORNIA

CARBONATING APPARATUS

Application filed June 16, 1925, Serial No. 37,584. Renewed July 1, 1930.

My invention relates to carbonating apparatus of the character of self-controlled and automatic operation, and the purpose of my invention is the provision of a carbonating apparatus in which is effected the perfect, absolute and automatic control of the water supply thereto and in such manner that a carbonating equilibrium of gas and water is constantly maintained and regulated in accordance with the absorption of the gas by the water.

I will describe only two forms of carbonating apparatus embodying my invention and will then point out the novel features thereof in claims.

In the accompanying drawings

Figure 1 is a view showing in vertical section and partly in elevation one form of carbonating apparatus embodying my invention.

Figure 2 is a horizontal sectional view taken on the line 2—2 of Figure 1.

Figure 3 is an enlarged fragmentary vertical sectional view of the assembly head and adjacent parts comprised in the apparatus shown in the preceding views with the water valve in closed position and the gas valve in open position.

Figure 4 is a view similar to Figure 3 showing the water valve in open position and the gas valve in closed position.

Figure 5 is a horizontal sectional view taken on the line 5—5 of Figure 3.

Figure 6 is a view similar to Figure 3 showing a modified form of gas nozzle and water nozzle embodying my invention.

Referring specifically to the drawings, in which similar reference characters refer to similar parts in each of the views, my invention in its present embodiment comprises a tank 15 having a lower closure cap 16 and an upper closure cap 17, the latter being formed with a central opening to receive the lower end of a suspension tube 18. The tube 18 is provided with a skirt suspension tube 19 preferably formed integrally therewith at its upper end and spaced from it to provide an annular chamber 20 which communicates with the tank 15 at its lower end and at its upper end with a discharge port 21 in communication with an outlet pipe 22, the latter in turn being connected to a conventional draught arm (not shown) through which the carbonated liquid is adapted to be dispensed. The discharge port 21 is formed in an assembly head 23, it being understood that such head is tapped to receive the outlet pipe 22, while at a diametrically opposed point the head is also tapped to receive a water supply pipe 24 provided with a branch pipe 25 which extends upwardly for connection with a fluid pressure reducing and regulating valve structure 27 which includes a nozzle 26 closed by a seat 26*a* (nozzle 26 and seat 26*a* will be referred to hereafter, collectively, as valve 26) engaged by a diaphragm 28 through a yoke 28*a* to move the seat 26*a* to open or closed position. At opposite sides of the diaphragm 28, springs 29 and 30 are arranged and adjusted to normally hold the diaphragm in such position that the valve 26 is closed. The spring 29 is adjustable through the medium of a screw 31 in the upper portion of the body and normally covered by a cap 32. This adjustment is here shown with two springs 29 and 30 but may be accomplished with but the one spring 30. The branch pipe 25 is connected to the valve body 27 so that water admitted to the body will operate upon the upper side of the diaphragm as will be more fully described hereinafter.

Within the assembly head 23 is a sleeve 34 provided with a circular series of circumferentially spaced ports 35 to provide communication between the water supply pipe 24, an annular chamber 36 in the assembly head, and a similar chamber 37 in the sleeve 34. The upper wall of the chamber 37 is formed with a valve seat 38 adapted to be engaged by a water valve 39 formed on the upper end of a water nozzle 40 mounted for vertical movement in the sleeve. This water nozzle 40 is operatively connected to a mixing tube 41, movable vertically in the skirt suspension tube 19 and operatively connected at its lower end to a spider 42 the latter in turn being fixed to a float 43 within the tank 15. The float 43 is movable vertically within the tank 15 and in a chamber 44 formed

by a skirt 45 having an open lower end and secured at its upper end to the skirt suspension tube 19. The center of the float is occupied by a carbonating well 43*a*. As clearly shown in Figure 1, this skirt 45 is interposed between the tank 15 and the float 43 so as to allow liquid to pass downwardly around the float and upwardly between the skirt and tank. The mixing tube 41 adjacent its connection with the water nozzle 40 is provided with a plurality of vent holes 46 through which gas passing upwardly in the skirt suspension tube 19 is admitted interiorly of the mixing tube.

As clearly shown in Figure 1, gas is adapted to be supplied to valve 26 of regulating valve unit 27 through a supply pipe 47 and to the lower side of the diaphragm 28 so that its pressure will act upon the diaphragm in opposition to the pressure of water admitted to the upper side of the diaphragm. An outward pipe 48 is connected to the body of the unit 27 and to the upper side of the assembly head 23 for communication with a gas inlet port 49 controlled by a gas regulating needle valve 50 mounted on the upper end of a stem 51 extending downwardly into the tank 15 and secured to the bottom of the float 43. This valve in closed position reposes on a seat 52 formed on the upper end of a gas nozzle 53 secured within the sleeve 34 and extending into the water nozzle 40. A pressure gage 54 is connected to the pipe 48 for indicating the pressure of the gas as supplied to the apparatus, and a safety valve 55 is likewise connected to the pipe 48 to relieve the apparatus of any excessive gas pressure.

The operation of this device is as follows: The gas inlet feed-pipe 47 is connected with the usual high pressure supply drum by suitable means and preferably through a pressure reducing valve. The district water supply is suitably connected and preferably through a pressure reducing valve to the water inlet pipe 24. The outlet or delivery pipe 22 is suitably connected to the draught arm of the fountain or other apparatus, which is in a closed position. None of these elements have been illustrated as they form no part of the present invention.

Before any gas or water is admitted to the apparatus, the diaphragm 28 of the regulating valve unit 27, acting with diaphragm springs 29 and 30, is in such adjustment as to close the valve 26 with but little more pressure than is required to keep it closed against the pressure of the gas entering through gas inlet 47, or maintaining it in closed equilibrium. The nozzle of the valve 26 being of very small diameter admits of a wide range in the pressure of the incoming gas, through pipe 47, without appreciably affecting the spring adjustment. The float 43 is in its lowest position, or resting upon closure cap 16. This leaves the water nozzle 40 at its low position and with an open passage at ports 35 for the entrance of water; with this low position of the float 43 the gas regulating valve 50 is closed and no gas can enter the float chamber 44.

The gas tank valve is now opened, and gas is admitted through gas inlet 47 to valve 26 which being in closed equilibrium by diaphragm 28 and springs 29 and 30, prevents gas from entering the apparatus. The water supply valve is now opened and water admitted through water inlet pipe 24. Water immediately fills pipe 25 and the regulating chamber of the regulating valve unit 27 and begins to exert pressure upon the regulating side of diaphragm 28, which responding to the pressure overcomes the tension of spring 30 on the gas side of the diaphragm and begins to admit gas through valve 26 into the gas chamber of regulating valve unit 27 and to fill the apparatus as far as regulating valve 50 which is yet closed. Water is entering ports 35, passing down through nozzle 40 and filling float chamber 44, the float 43 begins to rise, lifting with it gas regulating needle stem 51 which begins to open gas regulating needle 50 and gas immediately is admitting through gas nozzle 53 and carbonation begins. The float 43 continues to rise until the water nozzle 40 is moved toward gas nozzle 53, to a point where the converging nozzles 40 and 53 reduce the annular area between themselves to where it is just sufficient to permit the exact amount of water to pass to meet the draught arm requirements, assuming the latter to be open, or to the point of closing valve 39 if the draught arm be closed. This closure cuts off the further admission of water into water nozzle 40 and backs up the water pressure onto the regulating side of diaphragm 28, thus holding valve 26 open until the pressure in the mixing tube 41 builds up so that the pressure on the gas side of the diaphragm 28 is equal to the water pressure on the regulating side of the diaphragm. This condition closes the valve 26 against the entrance of more gas into the apparatus. Closure of valve 39 upon its seat 38 can only occur when the draught arm is closed, or the gas supply entirely cut off from the apparatus. The pressure in the mixing tube 41 must be the same as the pressure on the gas side of diaphragm 28 as the two chambers are connected by the open passageway through gas nozzle 53.

It will be noted that the pressures throughout the system are now in balance: The gas pressure on the gas side of diaphragm 28 balances, and is practically the same as the water pressure on the regulating side of the diaphragm 28. The gas pressure on the gas side of diaphragm 28 is the same as the gas and water pressures in the body of the apparatus while the water pressure on the reg-

ulating side of diaphragm 28 is the same as the water pressure in pipes 24 and 25.

The draught arm, or other apparatus, is opened so that the water will flow outward through outlet pipe 22. As water is lowered in float chamber 44 float 43 drops down and opens ports 35, allowing water to enter the water nozzle 40 and maintain the water level in float chamber 44. This opening of the draught arm and the release of the water, which is under pressure, creates a reduction of pressure at this point, with the flowing of the water a progressive reduction of pressure throughout the system takes place. When this reduction has reached the mixing tube 41 and the gas and water nozzles 40 and 53 (indicated by the lowering of the water level) a flow through these is induced. The gas being more mobile and responsive is probably a lap or two ahead of the water movement, enough earlier so that the pressure on the gas side of the diaphragm 28 is reduced and the valve 26 opened before the water pressure on the regulating side of the diaphragm 28 is reduced, which would keep the valve 26 closed. The flow of water through the water nozzle 40 reduces the water pressure on through the system as in pipes 24 and 25 and in the regulating chamber on the regulating side of diaphragm 28. Gas is flowing through gas nozzle 53 simultaneously with the water entering through nozzle 40 and they so continue to flow as long as carbonated water is drawn from outlet pipe 22. When the draught arm is closed the float 43 rises and cuts off the supply of water and gas, to the apparatus, by a reversal of the conditions as given for the opening of the draught arm.

If for any reason the water level in float chamber 44 is allowed to be unduly lowered an excess of gas would accumulate which could, on account of low water, pass under skirt 45 and up through annular space 32*a* to, and out through outlet pipe 22 to the draught arm, being indicated there by sputtering and a flow of gas instead of carbonated water. Such a condition is rendered impossible, however, by the closing of gas regulating valve 50 as soon as the float 43 reaches its low point, which is quite in advance of the danger period for gas to escape under skirt 45. By this means any gas flow into the apparatus is discontinued until the incoming water has absorbed or combined with enough of the uncombined gas that has accumulated in the float chamber 44 to allow the water level to rise in float chamber 44, when the float 43 again opens the gas regulating needle valve 50.

Thus it will be seen that at the extreme upper and lower positions of float 43, it operates valves that will completely cut off the incoming supply of water (when at upper position) or gas (when at lower position). The float 43 also has a sensitive balancing function to perform at about its normal medial position, namely; that of keeping in balance the proper proportions of water from nozzle 40 and the gas from nozzle 53, when the draught arm is open and carbonation is taking place.

Gas nozzle 53 is stationary in its position and has a straight inside bore, the outside being straight for most of its distance from the top down but when nearing the lower end it begins to taper toward the inside bore so that its lower end is a knife edge. The water nozzle 40 has a straight inside bore for a short distance from the upper end. It then converges to a smaller bore until near the lower end when it again becomes a straight bore of the same diameter as the smaller diameter of the converging bore, and continues this straight bore to the lower end. The carbonating well being located directly below the mixing tube, the carbonating stream plunges into it upon leaving the mixing tube 41 and flows from it by overflowing the top rim, as the bottom of the well is closed.

As the float 43 responds to the rise and fall of the water level, the water nozzle 40 is raised or lowered with respect to its relative position with the fixed gas nozzle 53. As water is withdrawn from the float chamber 44 the float 43 drops and the water nozzle 40 is lowered, its annular water channel around the end of the gas nozzle 53 is increased and more water can pass around the end of the gas nozzle 53 to again raise the water level in the float chamber 44. This increase in the flow of water through water nozzle 40 automatically decreases the flow of gas through gas nozzle 53 by decreasing the water pressure on the regulating side of diaphragm 28. When the withdrawal of water from the float chamber 44 is decreased the float 43 rises and the water nozzle 40 is raised. Its annular water channel around the end of the gas nozzle 53 is now decreased and less water can pass around the end of the gas nozzle 53. With less water passing, more gas will flow, owing to the water pressure backing up (as the flow is cut down) onto the regulating side of the diaphragm 28 and increasing the gas supply through valve 26.

Thus when the water nozzle 40 is in such relative position with the gas nozzle 53 that their respective flows are exactly in balance, that is to say, when there is just enough gas admitted to satisfy the carbonating of the water admitted, then the water level in the float chamber 44 will remain stationary, and it is seen that the movement of the float 43 and the movement of the nozzle 40 have been automatically stabilized by the above described regulation.

To be able to effect this regulation with so little effort the gas nozzle 53 and the water

nozzle 40 must be properly designed and proportioned in keeping with the laws of hydrodynamics, as well as with the needs of the service which demands that the water nozzle 40 must be large enough to supply a full flow for the draught arm and maintain the float level and the gas nozzle 53 must be large enough to furnish sufficient gas for the complete carbonation of the amount of water, and both must be capable of automatic regulation for any intermediate flow of carbonated water below the maximum.

The gas and water admitted to the apparatus is controlled and regulated entirely by the absorption from the limited volume of gas contained in the upper end of the float chamber 44 and in the skirt suspension tube 19 by the water supply as it plunges from water nozzle 40 into the carbonating well 43*a*, in the act of being carbonated. When much water is being carbonated, more gas will be called for and the absorption of the gas at constant pressure will reduce the volume of the gas, resulting in the rise of water level in float chamber 44 together with float 43, decreasing the annular area of the water nozzle 40, thus reducing the water flow and backing up the water pressure on diaphragm 28 which opens slightly more the valve 26, admitting more gas to float chamber 44, and again reestablishing carbonating equilibrium.

The theoretical amount of carbon dioxide that water is capable of absorbing, at any certain pressure and temperature, is well known. When they are brought together in mass the absorption takes place very slowly and it is then a question of bringing the two together in as finely divided a state as possible for a rapid absorption to take place.

Carbonation begins at the lower point of the gas nozzle 53, where the gas and water first come into contact. The lower edge of both the gas nozzle 53 and the water nozzle 40 are left in a somewhat rough condition, as I find that when in such a condition a better spraying action is produced, which brings about a better intermingling condition between the gas and water, promoting more rapid carbonation.

When the gas issues from its nozzle 53, it does so with considerable velocity and enters the interior of a rapidly moving annular column of water. They move together in an ever increasing mingling (promoted by the unpolished walls of the tubes which causes a breaking up into particles as well as a flaring or spreading out from each column toward the other) as they pass on down through the mixing tube 41. As soon as this annular column of water, whose center is filled with incoming gas, issues from the lower edge of water nozzle 40 it enters an atmosphere of gas, so that there is a rapidly moving annular column of water whose inner and outer ragged surfaces are both exposed to an atmosphere of gas. This column passes down through the mixing tube 41 at a high velocity and plunges into the carbonating well 43*a*; here the breaking up of the water particles is completed, the liquid overflowing from the well as a foam or spume of the thinnest filmed bubbles which are filled with carbon dioxide gas. The bubbles break and the now thoroughly saturated water passes down between the outside walls of the float 43 and the inner wall of the skirt 45, passing down under the skirt, which acts as a gas baffle. It then rises between the outer wall of the skirt 45 and the inner wall of the body 15, passing on upward between the outer wall of the skirt suspension tube 19 and the inner wall of body suspension tube 18 and finally out through the outlet pipe 22 to the draught arm. When the spume, rising from the carbonating well 43*a* breaks up, the saturated liquid collects in the lower part of float chamber 44, while the gas fills the upper part of the chamber 44 and the annular space between the outer wall of the mixing tube 41 and the inner wall of the skirt suspension tube 19, and is drawn into the mixing tube at its upper end through the vent holes 46 and the loose connection 46*a*, by the injector action of the descending column of water and gas. Thus is supplied the gas for the carbonation of the outside of the annular column of water.

For perfect carbonation the filmed water must be properly introduced into an atmosphere of gas and not attempt it by introducing gas into a body of water. A gas filled space, for carbonation, is always maintained by my regulation and in this way I need and use the gas which in some carbonators collects in the dome of the tank, as surplus gas, and from where it must be vented to the atmosphere through a safety valve as it accumulates.

By my regulation I carbonate slightly below the pressure of the water supply.

The perfect, absolute, and automatic control of the gas and water supply to the apparatus is based upon the fact that when gas and water are violently agitated together while under pressure, gas is quickly absorbed by the water.

Full advantage is taken of this principle in the operation of the present invention, as witness the following: With the draught arm wide open and the apparatus delivering its maximum quantity of carbonated water, a water gauge if applied to the float chamber 44 would show complete and perfect regulation (evidenced by a stabilized water level) despite the fact that the draught arm is open. Now by closing the gas supply to the apparatus, the water level in float chamber 44 together with float 43 and the water nozzle 40, will rapidly rise to a point where valve 39 will close upon its seat 38 thus

shutting off practically all water from passing nozzle 40. The same result may be shown by closing the gas supply to any point insufficient for complete carbonation. Observation of the rising water level in float chamber 44, due to the gas absorption, is conclusive evidence that the regulation is entirely independent of the open draught arm and wholly dependent upon the principle of absorption. If now the gas supply be restored to the normal amount, the excess of gas after absorption is satisfied, will force out the excess of water that has accumulated in float chamber 44 through the open draught arm, to a point where equilibrium is restored and automatic carbonation again takes place. This shows that it is the absorption of gas by the water, at constant pressure, that regulates the carbonating equilibrium of gas and water in the apparatus.

Regulation by diaphragm 28, actuated by the varying water pressure is elastic and yet sensitive (if the nozzles and other passages are properly designed and proportioned). The normal position of the diaphragm 28 of the regulating valve unit 27, when not in operation and with no gas pressure on the nozzle side or water pressure on the regulating side, is that the two springs 29 and 30 hold it in closed equilibrium; that is, the nozzle seat is held firmly against the nozzle 26, though with but little more pressure than is needed to keep it closed against the pressure of the incoming gas at the valve 26 of the high pressure gas line 47. This balance can be adjusted to any desired degree of accuracy by the adjusting screw 31 which varies the tension on the regulating side of the diaphragm 28 by compressing or reducing the compression of spring 29, and once set need seldom be changed.

Upon turning on the water, which enters by pipe 24, the pressure is immediately transmitted through pipe 25 to the regulating side of diaphragm 28; this pressure forces the seat 26*a* away from the valve 26, and upon turning on the gas from the supply tank through the pipe 47, the gas fills the available space in the apparatus and restores equilibrium of the diaphragm by having a gas pressure upon the nozzle side of the diaphragm equal to the water pressure on the regulating side, and diaphragm 28 is again moved to normal position. As water is drawn from the apparatus through pipe 22, the pressures in the system are reduced and a flow of gas and water is admitted through nozzles 40 and 53.

By balancing the gas pressure as admitted through the regulating valve unit 27, with the working water pressure, I have the gas and water entering the apparatus, through the mixing nozzles 40 and 53, at practically the same pressures. By merely varying the pressure of the water admitted through pipe 24, I can carbonate at any desired pressure.

The float regulation, actuated by the rise and fall of the carbonated water in the float chamber 44 has a double function to perform; one being an act of regulation and the other serving as a positive cut off for either the water or the gas, depending upon which one is in excess, thus making regulation or control absolute.

If the water begins to accumulate and rise in the float chamber 44, due to an insufficient volume of gas to satisfy absorption, the float 43 rises which raises the water nozzle 40 upward with relation to the gas nozzle 53, which is stationary with its lower end located within the water nozzle 40. Owing to the converging shape of the lower part of the water nozzle 40 the gas nozzle 53 gradually reduces the water area as the water nozzle 40 is moved upward and thus reduces the amount of water flowing into the float chamber 44. But if for any reason water and float continue to rise the valve 39 will close, thus making the control of the water positive. This reducing of the amount of water flowing through the nozzle 40 in turn backs up the water pressure onto the regulating side of the diaphragm 28 which in turn increases the amount of gas admitted through valve 26. A decreasing water supply and an increasing gas supply through nozzles 40 and 53 soon readjust the water level to a normal position, causing the float 43 and the nozzle 40 to drop to a lower position, where the inflow of the water and the gas will be in carbonating equilibrium. When the float 43 and the water nozzle 40 find a position at which the supply of gas and water are in balance, and they in turn are just balancing the amount being drawn from the pipe 22, the float 43 then remains stationary until a change is made in the amount drawn from the pipe 22 when it again moves up or down in response to the position of the water movement.

If the gas and water flow is slightly unbalanced, so the gas flow is too large to be entirely absorbed, the pressure in the float chamber 44 will not be lowered, but the water level together with float 43 and water nozzle 40 will be lowered, this will increase the water flow through nozzle 40 and the accompanying decrease in backed up water pressure on diaphragm 28 will reduce the gas flow until the water level is again in a balanced condition. If, however, the lowering of the water level is due to an increased outflow of water at the draught arm, there will be a decreasing of pressures in the float chamber and the gas chamber, so there will be a proportionate increase in the flow of both the gas and the water, as long as their carbonating proportions are in balance.

The apparatus is so regulated as to keep the water level in the float chamber fairly

constant, or to maintain volume equilibrium of the water and the gas; this means that the space above the normal water level must be kept filled with gas, both the water and gas occupying the same chamber, they must be of the same pressure. If gas could be admitted at a higher pressure than the water, the gas would soon force the water out and would only be prevented from filling the entire apparatus and passing out through the outlet pipe 22 to the draught arm by the closing of gas regulating valve 50.

When the draught arm is closed and no liquid is passing through the apparatus, the pressures in the system are equal and at their maximum. The pressure of the liquid supply, or in the inlet pipe 24, is equal to the pressure at the draught arm or in the outlet pipe 22. But when the draught arm is open and liquid being drawn through the apparatus the pressures are progressively decreasing. The pressure in inlet pipe 24 is the highest pressure of the system, but is lower than when the draught arm is closed, and is lower in proportion to the amount of liquid passing. The pressure in the mixing tube 41 is lower than in inlet pipe 24 and the pressure in outlet pipe 22 is still lower, that at the draught arm being lowest.

Referring now to Figure 6, I have here shown a modified form of gas nozzle and water nozzle 53*a* and 40*a*, respectively, which are designed to eliminate the use of the valve 39. The gas nozzle 53*a* has an outer wall of frusto-conical form, and similarly the upper portion of the water nozzle is provided with a bore of frusto-conical form. The nozzle 40*a* is connected to the float 43 to move vertically with the latter, and as the float rises, the water nozzle moves upwardly from the position shown in Figure 6 so as to bring the smallest diameter of its bore into juxtaposition with the conical portion of the gas nozzle thereby cutting off the flow of water between the two nozzles. In this manner the water nozzle serves as a closing valve to take the place of the valve 39 and the seat 38 and permits them to be dispensed with. The cutting off of the water by this modified arrangement is somewhat more elastic and gradual especially near the position of final closure than when using the valve 39, and for some pressures and conditions is to be preferred. Under some conditions the two forms of closures could be used together.

When using this form of valve I prefer to dispense with the use of the gas regulating needle valve 50 and its stem 51.

Although I have herein shown and described only two forms of carbonating apparatus embodying my invention, it is to be understood that various changes and modifications may be made therein without departing from the spirit of the invention and the spirit and scope of the appended claims.

What I claim is:

1. In a carbonating apparatus, the combination of: a tank; a float movable vertically in the tank and having a well therein; a water inlet port; a gas inlet port; a gas nozzle; a gas valve controlling the passage of gas to said nozzle; a water nozzle surrounding the gas nozzle and connected to said float to move therewith, a water valve carried by said water nozzle, said gas and water nozzles being arranged above the float to discharge gas and water into said well, said water valve being adapted to close said water port when the float is in its uppermost position; and an operative connection between the gas valve and said float for closing the gas port when the float is in its lowermost position.

2. In a carbonating apparatus as embodied in claim 1 wherein a skirt is interposed between the tank and the float to cause the fluids discharged from the well to circulate downwardly around the float and upwardly to the outer side of the skirt.

3. In a carbonating apparatus, the combination of: a tank; a float movable vertically in the tank and having a well therein; a skirt within the tank interposed between the float and tank and having an open lower end and partly closed upper end; gas and water nozzles above and in vertical alignment with said well; and valves operable by said float for controlling the supply of gas and water through said nozzles.

4. In a carbonating apparatus as embodied in claim 3 wherein gas and water supply means are provided for the gas and water nozzles, and means responsive to difference in pressure of the water and gas in the supply means for controlling the gas supply means.

5. In a carbonating apparatus, the combination of: a tank; a float movable vertically in the tank and having a well therein; a gas inlet; a water inlet; a gas nozzle; and a water nozzle surrounding the gas nozzle to form an annular water passage and connected to said float to move therewith, said gas and water nozzles being arranged above the float to discharge gas and water into said well, the gas and water nozzles being shaped to close said annular water passage when the float is in its uppermost position.

6. In a carbonating apparatus, the combination of: a tank; a float movable vertically in the tank and having a well therein; a gas inlet; a water inlet; a gas nozzle; a water nozzle surrounding the gas nozzle forming an annular water passage and connected to said float to move therewith, said gas and water nozzles being arranged above the float to discharge gas and water into said well, the gas and water nozzles being shaped to close said annular water passage when the float is in its uppermost position and to open said passage when in lowermost position; a valve regulat-

ing the supply of gas to the gas nozzle; and means responsive to variance in water flow between the nozzles for actuating said valve to vary the gas supplied to the gas nozzle in a manner to maintain a carbonating equilibrium of the two.

7. In a carbonating apparatus, the combination of: mixing means adapted to produce an intimate mixture of a carbonating gas and a liquid; gas supply means so placed as to supply said carbonating gas to said mixing means; liquid supply means so placed as to supply liquid to said mixing means; a gas valve so placed as to shut off the flow of gas through said gas supply means; gas supply valve regulating means adapted to open said gas supply valve whenever the rate of flow of liquid through said liquid supply means exceeds a certain minimum rate; a liquid valve so placed as to regulate the flow of liquid through said liquid supply means; walls forming a carbonated liquid chamber into which said mixing means discharges; control means connected to said liquid valve for regulating the opening in said liquid valve in inverse proportion to the amount of liquid in said carbonated liquid chamber; and means for delivering said carbonated liquid from said carbonated liquid chamber.

8. In a carbonating apparatus, the combination of: mixing means adapted to produce an intimate mixture of a carbonating gas and a liquid; gas supply means so placed as to supply said carbonating gas to said mixing means; liquid supply means so placed as to supply liquid to said mixing means; a gas valve so placed as to shut off the flow of gas through said gas supply means; gas supply valve regulating means adapted to open said gas supply valve whenever the rate of flow of liquid through said liquid supply means exceeds a certain minimum rate; a liquid valve so placed as to regulate the flow of liquid through said liquid supply means; walls forming a carbonated liquid chamber into which said mixing means discharges; a float in said carbonated liquid chamber and connected to said liquid valve for regulating the opening in said liquid valve in inverse proportion to the amount of liquid in said carbonated liquid chamber; and means for delivering said carbonated liquid from said carbonated liquid chamber.

9. In a carbonating apparatus, the combination of: walls forming a mixing chamber; a gas nozzle so placed as to deliver a jet of gas into said chamber; means for delivering the liquid to be carbonated into said chamber; means for delivering a carbonating gas to said gas nozzle; walls forming a carbonated liquid chamber into which said mixing chamber delivers its fluids; and means for withdrawing carbonated liquid from said carbonated liquid chamber, said mixing chamber being provided with means for delivering unabsorbed gas from said carbonated liquid chamber to said mixing chamber in such a manner that it is drawn into said mixing chamber and mixed therein with the liquid to be carbonated.

10. In a carbonating apparatus used to intimately charge one fluid in a liquid state with another fluid in a gaseous state, the combination of: a nozzle through which one of said fluids is forced in the form of a jet; means for mixing the other of said fluids with said jet; a control valve for one of said fluids; and a fluid supported member in the path of said jet controlling said valve.

11. In a carbonating apparatus used to intimately charge one fluid in a liquid state with another fluid in a gaseous state, the combination of: a nozzle through which one of said fluids is forced in the form of a jet; means for mixing the other of said fluids with said jet; a control valve for one of said fluids; and a float so placed that it is forced downwardly against its own buoyancy by said jet, said float tending to open said valve when so forced.

12. In a carbonating apparatus, the combination of: a carbonating gas nozzle; a water nozzle surrounding said gas nozzle but with an annular space therebetween, the upper end of said water nozzle constituting a valve element; a closure member having a seat against which the upper valve end of said water nozzle may be forced; means for supplying to said gas nozzle one of the fluids used in producing the carbonated product; means for supplying the other of said fluids to the space outside said water nozzle in such a manner that a portion of said other fluid can pass between said seat and water nozzle when said water nozzle valve element is out of contact with said seat; and means for controlling the position of said water nozzle in such a manner as to insure the proper proportioning of said fluids.

13. In a carbonating apparatus, the combination of: a carbonating gas nozzle; a water nozzle surrounding said gas nozzle but with an annular space therebetween, the upper end of said water nozzle constituting a valve element; a closure member having a seat against which the upper valve end of said water nozzle may be forced; means for supplying to said gas nozzle one of the fluids used in producing the carbonated product; means for supplying the other of said fluids to the space outside said water nozzle in such a manner that a portion of said other fluid can pass between said seat and water nozzle when said water nozzle valve element is out of contact with said seat; a corbonated liquid chamber into which the mixture produced by the action of said nozzles is delivered; and a float in said carbonated liquid chamber, said float being connected to and actuating said water nozzle.

14. In a carbonating apparatus, the combination of: a carbonating gas nozzle; a water nozzle surrounding said gas nozzle but with an annular space therebetween, the upper end of said water nozzle constituting a valve element; a closure member having a seat against which the upper valve end of said water nozzle may be forced; means for supplying to said gas nozzle one of the fluids used in producing the carbonated product; means for supplying the other of said fluids to the space outside said water nozzle in such a manner that a portion of said other fluid can pass between said seat and water nozzle when said water nozzle valve element is out of contact with said seat; a carbonated liquid chamber into which the mixture produced by the action of said nozzles is delivered; and a float in said carbonated liquid chamber, said float being connected to and actuating said water nozzle, said float being so placed that it is forced downwardly against its own buoyancy by the impact of the jet produced by said nozzles.

15. In a carbonating apparatus, the combination of: a tank; a float movable vertically in the tank and having a well therein; a water inlet port; a gas inlet port; a gas nozzle; a gas valve controlling the passage of gas to said nozzle; a water nozzle surrounding said gas nozzle and connected to said float to move therewith; a water valve carried by said water nozzle, said gas and water nozzles being arranged above the float to discharge gas and water into said well, said water valve being adapted to close said water port when said float is in its uppermost position; and means connecting said gas valve and said float adapted for closing the gas port when the float is in its lowermost position.

16. In a carbonating apparatus, the combination of: a tank; a float movable vertically in the tank and having a well therein; a water inlet port; a gas inlet port; a gas nozzle; a gas valve controlling the passage of gas to said nozzle; a water nozzle surrounding said gas nozzle and connected to move with said float; a water valve carried by said water nozzle, said gas and water nozzles being arranged above the float to discharge gas and water into said well, said water valve being adapted to close said water port when said float is in its uppermost position; and means for closing the gas port when the float is in its lowermost position.

17. In a carbonating apparatus used to intimately charge one fluid in a liquid state with another fluid in a gaseous state, the combination of: a nozzle through which one of said fluids is passed in the form of a jet; means surrounding said nozzle adapted for mixing the other of said fluids with said jet; a control valve for one of said fluids; and a fluid supported member in the path of said jet controlling said valve.

18. In a carbonating apparatus used to charge one fluid in a liquid state with another fluid in a gaseous state, the combination of: a nozzle through which the fluid in a gaseous state is forced in the form of a jet; means for intimately delivering the fluid in a liquid state with said jet; a control valve for the fluid in a gaseous state; and a float disposed in the path of said jet and adapted to be forced downwardly against its own buoyancy by said jet, said float tending to open said valve when so forced.

19. In a carbonating apparatus, a tank, a gas inlet to said tank, a valve for controlling admission of gas to said tank through said inlet, a liquid inlet to said tank, means responsive to an increased height of liquid in said tank for reducing the amount of liquid supplied thereto, and means responsive to a reduction in flow of liquid to said tank, by operation of the first said responsive means, for operating said gas control valve for admitting gas to said inlet.

20. In a carbonating apparatus, a tank, a gas inlet to said tank, a valve for controlling admission of gas to said tank through said inlet, a liquid inlet to said tank above the normal level of liquid therein, means responsive to the level of liquid in said tank for controlling the supply of liquid thereto, and means responsive to operation of the first said responsive means for controlling said gas control valve.

21. In a carbonating apparatus, a mixing tank, gas and liquid supply lines including inlets to said tank above the normal liquid level therein, a valve normally closing said gas supply line against the supply pressure of the gas therein, a valve for controlling the admission of liquid to said tank from the liquid line, means for operating said liquid controlling valve to reduce the flow of liquid to said tank as the liquid level rises therein, and means controlling said gas valve for increasing the flow of gas to said tank as the flow of water thereto is decreased by the first said means.

22. In a carbonating apparatus, a tank, a gas inlet to said tank, a valve for controlling admission of gas to said tank through said inlet, a liquid inlet to said tank above the normal level of liquid therein, means responsive to an increased height of liquid in said tank for controlling the supply of liquid thereto, and means responsive to the operation of the first responsive means for controlling said gas control valve.

23. In a carbonating apparatus, a mixing tank, gas and liquid supply lines including inlets to said tank above the normal liquid level therein, a valve normally closing said gas supply line against the supply pressure of the gas therein, a valve responsive to an increased height of liquid in said tank for controlling the admission of liquid to said

tank from the liquid line, means for operating said liquid controlling valve to reduce the flow of liquid to said tank as the liquid level rises therein, and means controlling said gas valve for increasing the flow of gas to said tank as the flow of liquid thereto is decreased by the first said means.

24. In a carbonating apparatus, a tank, a gas inlet communicating with said tank, a valve for controlling admission of gas to said tank through said gas inlet, a liquid inlet communicating with said tank, means responsive to the level of liquid in said tank for controlling the supply of liquid thereto, and means responsive to a reduction in flow of liquid to said tank, by operation of the first said responsive means, for operating said gas control valve for admitting gas to said inlet.

25. In a carbonating apparatus, a tank, a pressure liquid inlet and outlet to said tank, a manually operated draft arm for controlling withdrawal of liquid from said tank through said outlet, means responsive to varying withdrawals of liquid from said tank for varying the amount of liquid supplied thereto, a gas inlet to said tank, a valve for controlling admission of gas to said tank through said inlet, and means responsive to a variation in flow of liquid to said tank for operating said gas control valve for admitting gas to said inlet by operation of the first said responsive means.

26. In a carbonating apparatus, a tank, a liquid inlet to said tank above the normal level of the liquid therein, means responsive to the varying level of liquid in said tank for controlling the supply of liquid thereto, a gas inlet to said tank, a valve for controlling admission of gas to said tank through said inlet, and means responsive to the operation of the first said responsive means for controlling said gas control valve.

27. In a carbonating apparatus, a tank, a mixing well in said tank, liquid and gas supply lines including inlets to said tank above the normal level of liquid therein, an outlet leading from said tank, a valve normally closing said gas supply line against the supply pressure of gas therein, a manually operated valve for controlling the withdrawal of liquid from said tank, means responsive to withdrawals of liquid from said tank for increasing the flow of liquid thereto as the liquid level falls therein, and means controlling said gas valve for increasing the flow of gas to said tank as the liquid level therein is raised by the first said means.

JOHN E. TREANOR.