This invention relates to gas dissolving apparatus, and with regard to certain more specific features, to so-called water carbonators.

Among the several objects of the invention may be mentioned the provision of a water carbonator of compact form in which tap water received at tap water temperatures may be efficiently carbonated: the provision of a carbonator of the class described which, by means of a reliable construction, agitates the water for quickly effecting a high degree of carbonation and at the same time agitates the water for simple and efficient heat exchange with any cooling means available; and the provision of apparatus of the class described which requires few and simple parts in its construction. Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly comprises the elements and combinations of elements, features of construction, and arrangements of parts which will be exemplified in the structures hereinafter described, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings, in which one of various possible embodiments of the invention is illustrated,

Fig. 1 is a vertical section illustrating the invention:

Fig. 2 is an enlarged vertical section taken on line 2—2 of Fig. 1;

Fig. 3 is an enlarged horizontal section taken on line 3—3 of Fig. 1.

Similar reference characters indicate corresponding parts throughout the several views of the drawings.

Referring now more particularly to Fig. 1, there is shown at numeral 1 a non-magnetic pressure tank in which is carried water 3 to be carbonated. An abnormally low level of the water is shown at 9. A normal level is maintained by means of a float construction consisting of a ball float 7 held in a guide cage 9, the latter being fastened to the tank walls. On the outside of the tank 1 is a switch box 11 having leads 13. In the switch box 11 is an apparatus which, in connection with the ball float 7, constitutes a magnetic float switch operating on the general principles described in my United States patent application Serial No. 508,240, filed June 8, 1945, for Switch, now Pat. No. 2,541,592, issued May 4, 1946. Lever 15, pivoted intermediately its ends, carries at its lower end a magnet 19 and at its upper end a magnet 21. The float 7 is composed of magnetic material and functions when the float 7 is down as an armature to draw the lever 15 into the position shown in Fig. 1. When the float is elevated by increase in the elevation of the liquid level, it draws over the magnet 21. Connected with the lever 15 is a switch 23 which closes when the lever 15 descends below a certain point and opens when that level rises above that point. Thus when the float 7 is up, the contact is broken and when it is down, the contact is closed.

In the circuit 13 controlled by the switch 23 are the leads 25 of a vertical electric motor 27. This motor is built into a case 29 which is welded vertically to the top of the tank 1. The axis of the motor is preferably coaxial with the center line of the tank 1. The motor rotor is shown at 31 and its shaft at 33.

Details of the connection between the motor and the tank 1 are shown in Fig. 2, wherein a bearing for the shaft 33 is indicated at 35. The inner race of this bearing supports the shaft 33 and the outer race is carried in a stationary tube 37, welded at 39 to the top of the tank 1. Near the lower end of the tube 37 is carried the outer race of a second bearing 41. The inner race of this bearing also supports the shaft 33.

Below the bearing 41, and operative between the shaft 33 and the shaft 37, is a rotary shaft seal indicated generically at 43. This seal consists of a metal seat 45 supported in a resilient synthetic rubber ring 47. The ring 47 is supported upon bearing washers 49 which separate it from the outer race 51 of the bearing 41. Bearing against the floating metal seat 45 is a carbon ring 53, carried in a cup 55. Cup 55 is biased upward by means of a spring 57 reacting from an abutment 59 keyed to the shaft 33. The lower side of the abutment is conical for streamline flow. Its upper side includes a groove 61 which admits some liquid into the tube 57. This liquid escapes at a series of peripheral openings 59 near the seal and thus serves to cool the sliding contact portions of the sealing rings 45 and 53. It also lubricates the sliding surfaces of the seal.

Fastened to the shaft 33 and below the abutment 59 is an impeller 65 which has vanes 67 so formed that with the rotation indicated by the arrow 69 in Fig. 2, liquid will be impelled upward. In order to direct the impelled liquid, an outer sleeve or spinner tube 71 is permanently attached to the outer edges of the impeller 67. This tube is coaxial with the tube 37 and spaced around it. Rotation of the shaft 33 impels liquid up to the tube 71 to its upper end 75, from which the liquid spins in an umbrella or mushroom shape, breaking up and becoming finely divided as it leaves. The outlet 75 of the rotary tube 71...
terminates short of the upper concave dome 77 of the tank. The finely divided particles of water impinge on this dome and the side walls of the tank down which they cascade.

Instead of a single row of impellers 67, additional impeller units may be employed between the shaft 33 and the spinner tube 31 below the tube 37. Also, lift action may be obtained by flaring the tube 71 upward, thus causing a compositional lift thrust on the liquid under centrifugal force as the spinner tube 71 rotates.

In the lower end of the tank 1 is an opening around which is a collar 78 to which is bolted a gear pump 81. This pump has an inlet 83 and a set of driving gears 85 and 87, which draw tap water from the inlet 83 and inject it through an opening 89 into the tank 1. One of the gears 87 of the gear pump is attached to the lower end of the shaft 33 and is driven thereby. In the inlet 83 is a check valve 91. Tap water enters through the pipe 93. A carbon dioxide (CO₂) inlet is shown at 95 and includes a check valve 97. A carbonated water outlet is shown at 99 and includes manual control valve 101 leading to a faucet 103.

Operation is as follows:

Whenever abstractions of carbonated water are made from the outlet 99 via valve 101. Several advantages will be clear from the above.

A. The tank charge is thoroughly agitated and atomized each time that make-up tap water is admitted. This is aided by the bubbling of the carbon dioxide gas entering at the bottom.

B. The natural direction of exit of the liquid from the upper end 73 of the spinner tube 71 is such as to deliver a large percentage of water in contact with the large surface to CO₂ absorption and to heat transfer. This is in addition to the absorption surface presented by the atomized liquid itself as it spins off the edge of the outlet 75. All of the rotary pump and motor parts are on the same shaft, including the impeller 67 and the spinner lift tube 71. By having the shaft seal 45, 53 near the lower end of the stationary tube 37, in the spinner tube 71 and immersed in the liquid, several advantages occur. First there is the cooling effect of the by-passed fluid upon the seal, and second, the seal protects everything above it in the tube 37. Thus both bearings 35 and 41 are protected. In addition, these bearings are separated a substantial distance from the liquid which provides for more accurate alignment and steady action of the shaft 33. No seal is needed at the upper end of the tube 37, except the welding at 39 for preventing leakage between it and the upper end of the tank 1. The vertical coaxial construction is very compact and there are no reciprocating parts. Thus the device is silent and smooth in operation.

It is to be understood that although the particular disclosure of the invention is in reference to a water carbonator, its principles apply to any gas dissolving apparatus of analogous requirements.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results obtained.

As many changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. A carbonator comprising an upright cylindrical pressure tank carrying a liquid supply having a free surface, a fixed tube extending into the tank from its upper end, a motor outside of the tank above said tube, said motor having a rotor, a shaft extending from said rotor into the tank through said fixed tube, a pump driven by said shaft adapted to induct water into the tank when the shaft is rotating, a spinner tube attached to said shaft and partially surrounding said fixed tube, said spinner tube having a lower inlet and an outlet around said fixed tube, and an impeller joining said spinner tube with the shaft below said fixed tube and adapted to force water from said inlet through said outlet for projection upon the walls of the container for rotation along said walls to the supply of water in the tank.

2. A carbonator comprising an upright cylindrical pressure tank carrying a liquid supply having a free surface, a fixed tube extending into the tank from its upper end and coaxial therewith, a motor outside of the tank above said tube, said motor having a rotor, a shaft extending from said rotor into the tank through said fixed tube, a pump in the tank below said fixed tube and being driven by said shaft, said
pump being adapted to induct water into the tank when the shaft is rotating, a spinner tube attached to said shaft below the fixed tube and partially surrounding the latter, said spinner tube having an inlet below said free surface and an outlet around said fixed tube, an impeller joining said spinner tube with the shaft below said fixed tube and adapted to force water from said inlet through said outlet for projection upon the walls of the container and return along said walls to the water in the tank, bearings for said shaft in said fixed tube, and a liquid seal between the fixed tube and the shaft below said bearings.

3. A carbonator comprising a tank carrying liquid having a free surface, a fixed tube extending into the tank from its upper end, a motor outside of the tank above said tube, said motor having a rotor, a shaft extending from said motor into the tank through said fixed tube, a pump in the tank driven by said shaft and adapted to induct water into the tank when the shaft is rotating, a spinner tube attached to said shaft and partially surrounding said fixed tube, said spinner tube having an inlet below said free surface and an outlet around said fixed tube, an impeller joining said spinner tube with the shaft below said fixed tube and adapted to force water from said inlet through said outlet for projection upon the walls of the container and return along said walls to the water in the tank, bearings for said shaft in said fixed tube, and a liquid seal between the fixed tube and the shaft below said bearings, said fixed tube having inlet means and outlet means adjacent said seal whereby some of the fluid flowing through said spinner tube is bypassed through the fixed tube.

4. A carbonator comprising an upright cylindrical tank having a rounded dome, said tank carrying water having a free surface, a coaxial vertical motor supported upon said dome, said motor having a rotor, a coaxial shaft extending from said rotor into the tank, a coaxial fixed tube attached to the top of the tank and extending therein, said shaft entering the tank through said tube, bearings between the shaft and the tube, a coaxial spinner tube attached to the shaft and partially surrounding said fixed tube, said spinner tube having an inlet below said surface and an outlet above it, an impeller connecting the shaft and the spinner tube adapted to force liquid from said inlet to said outlet, a rotary pump near the bottom of the tank, a connection between said shaft and said pump, said pump being adapted to induct water into the tank, a motor float switch in the tank adapted to start the motor at a minimum level of liquid in the tank and to stop it at a maximum level, a liquid outlet from the tank and an inlet thereto below said liquid level for introducing carbon dioxide.

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