Jan. 21, 1941. J. W. CARLSON 2,229,441

CARBONATOR

Filed May 31, 1938

Fig. 1.

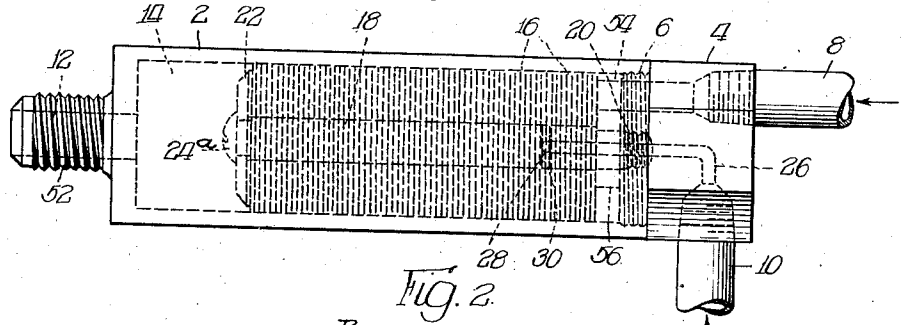


Fig. 2.

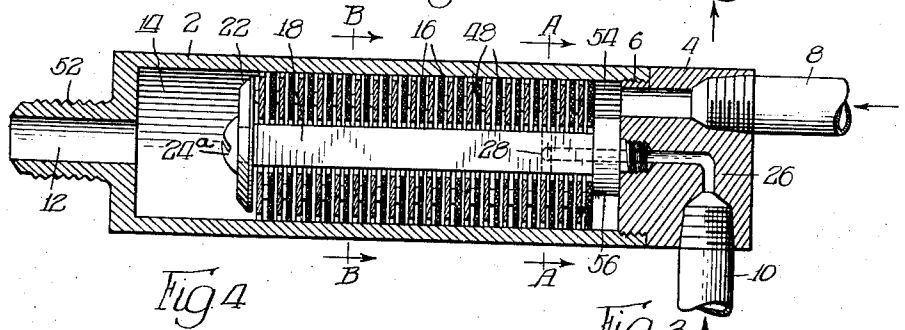
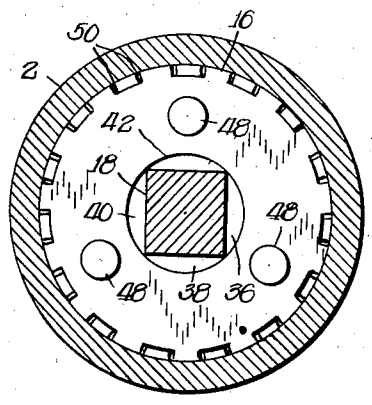


Fig 4

Fig. 3.



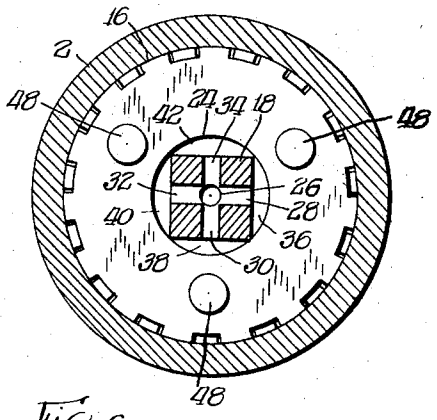
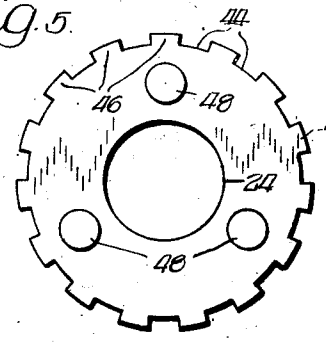


Fig. 5.



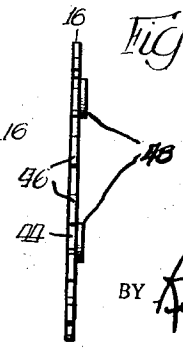


Fig. 6

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UNITED STATES PATENT OFFICE

2,229,441

CARBONATOR

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Application May 31, 1938, Serial No. 210,893

3 Claims. (Cl. 261—124)

This invention relates to an apparatus for mixing gases and liquids and more particularly to a carbonator adapted for use in mixing carbon dioxide with water in order to produce carbonated water.

It is well recognized that the quality of carbonated water depends entirely upon the thoroughness with which carbon dioxide is dissolved in the water. A good grade of carbonated water is highly effervescent by reason of the thorough dissolving of carbon dioxide with the water. If the carbon dioxide is not thoroughly mixed with the water it will not be properly dissolved. Under such circumstances much of the gas may be wasted and the quality or grade of the water obtained will be relatively poor.

It will be readily recognized that if carbon dioxide is brought into contact with water and mixed therewith extensively over a long period of time or in a relatively large scale apparatus where the carbon dioxide and water are brought into contact with each other many times, it is possible to produce a satisfactory carbonated water. Proper carbonation of the water becomes more difficult, however, where a relatively small scale apparatus is used and where the carbonator is occupy a relatively small space, as for example, in a drink dispensing machine in which the water is carbonated before use, the carbon dioxide being supplied from a cylinder of carbon dioxide associated with the machine.

One of the objects of the present invention is to provide a new and improved type of carbonator which is very efficient, occupies a relatively small space and is particularly adapted for use in drink dispensing machines.

Another object of the invention is the provision of a new and improved type of carbonator which is simple and inexpensive to construct.

Still a further object is the provision of a new and improved type of carbonator which is easily assembled and from which the various parts are easily removed and replaced if necessary.

An additional object is to provide a new and improved type of carbonator in which maximum efficiency in mixing carbon dioxide and water is obtained in a relatively short time.

In accomplishing these objects in accordance with this invention, a carbonator is provided in which the gas is broken up and mixed with the water in thin layers, preferably by introducing the gas centrally into a mixing chamber, subdividing said gas laterally into thin layers and mixing it thoroughly with water adjacent the walls of said chamber.

In its more specific aspects the carbonator of the present invention preferably comprises a chamber or mixing zone, a plurality of plate-like members transversely disposed in said chamber with their outer peripheries adjacent the walls of the chamber, said outer peripheries of said plate-like members having recesses therein at spaced intervals means for spacing said plate-like members from each other, means for passing water through said recesses in the peripheries of said plate-like members and means for passing carbon dioxide centrally through said plate-like members and outwardly in thin layers between said members whereby the carbon dioxide and water are thoroughly mixed.

Other features and advantages of the invention will be apparent by reading the following description thereof with reference to the accompanying drawing in which:

Figure 1 represents a side elevational view of a preferred type of carbonator constructed in accordance with the present invention;

Figure 2 represents a cross sectional view taken centrally through the carbonator illustrated in Figure 1;

Figure 3 represents a cross sectional view taken along the lines A—A;

Figure 4 represents a cross sectional view taken along the lines B—B;

Figure 5 is a view of one of the plate-like members provided for the purpose of dividing the gas into thin layers; and

Figure 6 is a cross sectional view of the member shown in Figure 5.

Referring to Figure 1, the carbonator shown comprises generally a casing 2 having a head 4 adapted to be removed by means of screw threads 6. At one end of the carbonator is an inlet 8 for water and at the same end, as illustrated, another inlet 10 is provided for gas. At the other end an outlet 12 is provided to remove the solution of gas and water after the gas and water have been thoroughly intermingled.

Inside of casing 2 is a chamber 14 which is occupied by a plurality of plate-like members 16 carried on a supporting member 18 which may be a bolt having threads 20 at one end thereof and adapted to fit into end portion 4. A cap or washer 22 held against the head 24 of bolt 18 serves to keep plate-like members 16 in position.

As shown by the cross sectional view in Figure 3 along lines A—A of Figure 2, bolt 18 is preferably square and fits into round holes 24 of plate-like members 16. Gas entering conduit 10 of Figure 1 passes into conduit 26 and is discharged into the space between the sides of holes 24 and the side of bolt 18, this discharging being effected through four openings 28, 30, 32 and 34, as illustrated in Figure 3. The gas thus discharged passes into four spaces 36, 38, 40 and 42, respectively. In the spaces the gas passes centrally through chamber 14 and outwardly between plate-like members 16.

As shown in Figure 5, each plate-like member

16 is preferably a substantially solid disk, impermeable to water and gas, having recesses 44 in the periphery thereof. These recesses are spaced from each other by lugs 46 which in their outer extremities form a part of the periphery of each disk 16. A hole 24 through the center of each disk permits the insertion of bolt or screw 18. Each disk is also provided with a plurality of spacing members 48 which serve to keep the disks apart and permit the formation of a thin layer of gas between them when the device is in operation. These spacing members may be merely slightly raised portions on the surfaces of the disks and may be formed in any convenient manner.

According to a preferred construction, adjacent disks are arranged in staggered relationship with each other, as illustrated in Figures 3 and 4, and for this purpose it is preferable that recesses 44 be somewhat larger than lugs or separating members 46 between the recesses, thus leaving openings 50 through which water and gas may pass and be intermingled. This staggered arrangement causes the water to be divided into fine streams following a tortuous path, thereby producing better mixing and commingling of the water and gas.

The entire carbonating device may be screwed or fitted into a conduit or any apparatus into which the water containing the dissolved gas is to be discharged. This may be accomplished, for example, by placing screw threads 52 around outlet 12 on one end of the apparatus.

In order to insure that water entering through conduit 8 is uniformly and thoroughly dispersed over the outer peripheries of plate-like members 16, an annular passage 54 is provided through which the water can circulate prior to passing through plate-like members 16. In order to hold plate-like members 16 in position above said passage 54 a washer or the like 56 is provided.

The operation of the carbonating apparatus just described is as follows. Water is introduced through inlet conduit 8 and flows into passage 54 from whence it passes through recesses 44 in the peripheries of plate-like members or disks 16. Simultaneously with the introduction of water through conduit 8, a gas such as carbon dioxide is introduced into the apparatus through conduit 10 and passes through conduit 26 to openings 28, 30, 32 and 34 and thence into spaces 36, 38, 40 and 42 (Figure 3). Gas flows through said spaces and outwardly between plate-like members 16 and thus comes into contact with water flowing along the walls of chamber 14 and through recesses 44 in the peripheries of plate-like members 16. In this way the gas is divided into thin layers and mixed with the water, thus insuring the maximum solubility of gas in the water and producing a carbonated water of high quality in a relatively short time. The resultant carbonated water flows outwardly through one end of chamber 14 and through outlet 12 to any suitable container, valve or the like.

It will be understood that the width and depth of recesses 44 are subject to variation. Likewise the distance between adjacent plate-like members 16 may vary. For example, according to one embodiment of the invention the recesses are about ⅛ in. wide. The depth of said recesses might be, for instance, 1/64 in., and the spaces 50, as shown in Figure 4, when the recesses are arranged in staggered formation, may be about 1/64 in. The distance between plate-like members is preferably very small, as, for example, on the order of about 1/1000 in. It will be understood that these dimensions are all subject to variation.

The apparatus described is preferably small and compact. Thus, for use in a drink vending machine, external dimensions may be approximately those shown in Figures 1 and 2 of the drawing. The apparatus described is preferably operated in a substantially horizontal position, as shown in the drawing, but may be operated in a tilted position or in a substantially vertical position with either the inlets or the outlets downward. It will be understood that the gas is normally supplied under pressure and therefore the mixing zone should be substantially gas-tight.

Having thus described the invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. A carbonator comprising, in combination, a chamber, a plurality of plate-like members transversely disposed in said chamber with their outer peripheries adjacent the walls of the chamber, said outer peripheries of said plate-like members having shallow recesses therein at spaced intervals, said recesses being aligned in staggered relationship with recesses in adjacent plate-like members, means for spacing said plate-like members from each other, means for passing water through said recesses in the peripheries of said plate-like members and means for passing carbon dioxide gas centrally through said plate-like members and outwardly between said members whereby said gas is thoroughly mixed with the water.

2. A carbonator comprising, in combination, a chamber, a plurality of plate-like members transversely disposed in said chamber with their outer peripheries adjacent the wall of the chamber, said plate-like members being mounted centrally on a carrying member and being substantially solid and impermeable to water and gas, said plate-like members having shallow recesses in their outer peripheries, means for spacing said plate-like members from each other, means for passing water through said recesses in the peripheries of said plate-like members and means for passing carbon dioxide centrally through said carrying member for the plate-like members and outwardly between said plate-like members whereby the carbon dioxide and water are thoroughly mixed.

3. A carbonator comprising, in combination, a tubular gas-tight chamber, a plurality of thin disks transversely disposed in said chamber with their outer peripheries adjacent the walls of the chamber, said outer peripheries having recesses therein at spaced intervals, said recesses being aligned in staggered relationship with recesses in adjacent disks, means associated with said disks for spacing said disks from each other, a central passageway through said disks adapted to permit the passage of gas from said passageway to spaces between said disks, a supporting member for said disks passing through said passageway with spaces between the exterior surface of the supporting member and the interior of the disks, means for passing carbon dioxide gas through said spaces and means for passing water through the recesses in the peripheries of said disks whereby gas passing centrally through said disks and outwardly between them is thoroughly mixed with the water.

JOHN W. CARLSON.