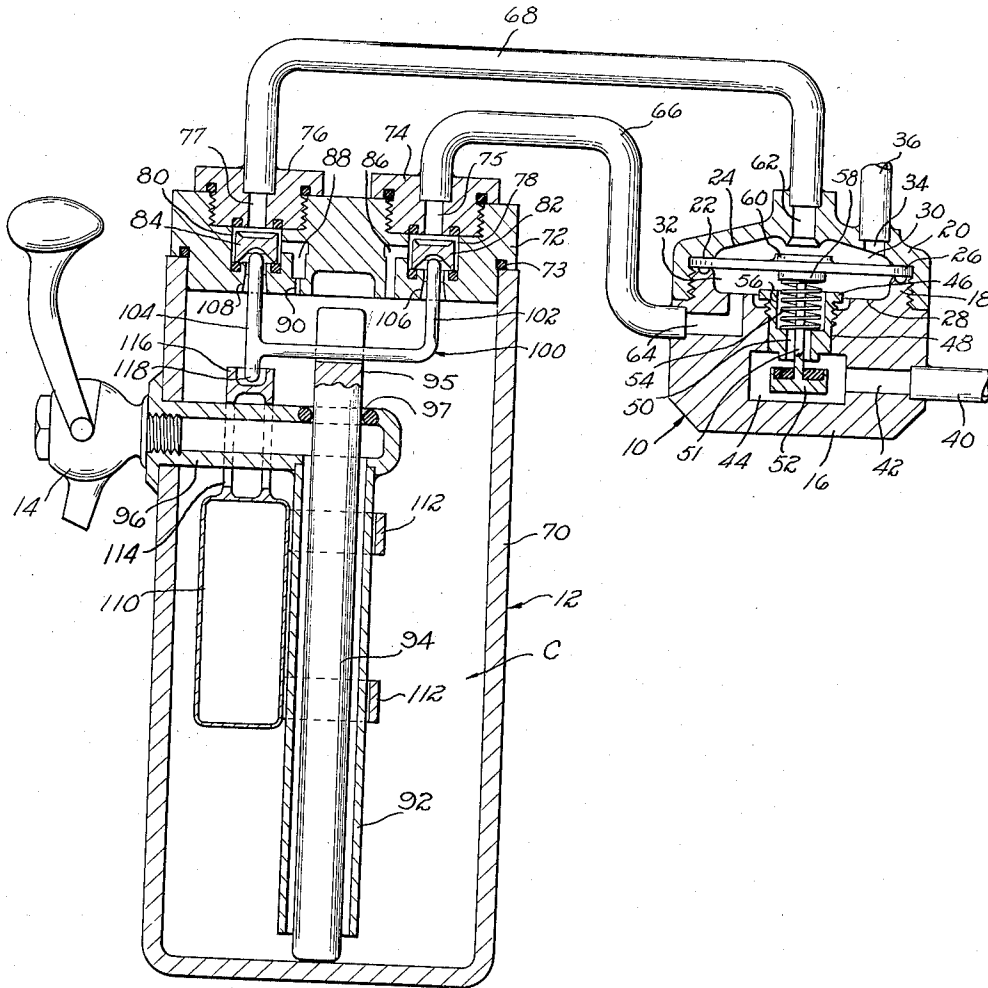


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HOUSEHOLD CARBONATOR
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HOUSEHOLD CARBONATOR

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This invention relates to liquid carbonating apparatus and more specifically to a carbonator which is particularly suited for household installations.

The use of carbonated water in the home is a common practice and substantial quantities of carbonated water are consumed in this manner. Heretofore, most carbonated water used in the home has been provided commercially in bottled form which creates a problem of storage, keeping adequate supplies on hand, breakage, etc. as well as being relatively expensive. One alternative to the use of bottled carbonated water has been to employ small batch type household carbonators which are relatively difficult and cumbersome to operate and which are only moderately efficient and generally unsatisfactory, particularly where continuous and ample supplies of carbonated water are desired. Another alternative has been to install relatively complicated and expensive carbonators of the commercial type which generally are unsuited for household use from a size and cost standpoint.

It is an object of this invention to provide a continuous type carbonator which may be connected directly to a home water supply system and which may be effectively and efficiently operated by utilizing the pressures generally encountered in the home water supply system without the need for additional pumps, etc.

It is another object of this invention to provide a carbonator which is characterized by its simplified and compact construction and yet which will be efficient in operation and produce a highly palatable and good grade carbonated water at all times.

A further object of the invention is to provide a carbonator which may be disposed within a conventional household refrigerator without modifying the same to any great extent and so as to avoid the need for auxiliary cooling apparatus.

Another object is to provide a household carbonator having a minimum of moving parts which would be likely to wear out in service, which can be easily and inexpensively fabricated and assembled, and which will operate efficiently under normal conditions in the household.

Other objects will be in part obvious, and in part pointed out more in detail hereinafter.

The invention accordingly consists in the features of construction, combination of elements, and arrangement of parts which will be exemplified in the construction hereafter set forth and the scope of the application of which will be indicated in the appended claims.

In the drawings:

The figure is a vertical cross sectional view of liquid carbonating apparatus constructed in accordance with the present invention.

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The carbonating apparatus shown in the drawing may be briefly described as comprising a differential pressure regulator 10 and a carbonating and dispensing container 12. It is the function of the regulator 10 to receive a supply of uncarbonated or "sweet" water and carbon dioxide under pressure and to then regulate the pressure of the latter relative to the former. The water and gas under regulated pressure then flow to the container 12 which provides a carbonating chamber C wherein the carbon dioxide gases are introduced to the water and entrained therein. The carbonated water thus produced is stored within the chamber C until drawn off by dispensing valve 14.

Referring to the differential pressure regulator 10 in more detail, it will be noted that the housing comprises a channeled body 16 having a reduced upper end 18 which is externally threaded to receive a cap 20. The cap 20 has an internal annular shoulder 22 defining a circular recess 24. The shoulder 22 abuts the peripheral margin of a diaphragm 26 which is of substantially the same diameter as the reduced end portion 18 and the diaphragm 26 is secured against the end portion 18 by the threaded engagement of the cap 20 with the body 16. The reduced end portion 18 also defines a circular recess 28 in the body 16 so that the diaphragm 26 provides a resilient separating wall between an upper chamber 30 defined by the recess 24 and a lower chamber 32 defined by the recess 28.

The upper chamber 30 is provided with an inlet 34 through the cap 20 which receives one end of a water pipe or tube 36 preferably provided with a shutoff valve (not shown). The water inlet tube 36 communicates with a pressurized water supply such as the household water supply system and the tube 36 may be permanently tapped to the system. Thus, it will be seen that water under household pressure is introduced to the upper chamber 30, which will hereinafter be referred to as the water chamber.

Carbon dioxide is introduced to the regulator 10 from a conventional source (such as a tank or cylinder) by means of a pipe or tube 40 which communicates with a radially directed channel 42 in the body 16. The channel 42 in turn communicates with a centrally disposed valve chamber 44 which is capped by a plug 46 threaded into a vertical aperture 43 in the body 16. The plug 46 has a central opening 50 affording communication between the lower chamber 32 and the valve chamber 44. A valve body 52 is disposed in the chamber 44 and has a stem 51 projecting through the opening 50 into chamber 32 where it carries a disk 53 adjacent and below the diaphragm 26. The valve body 52 is biased upwardly by a coil spring 54 disposed within a well 56 in the upper end of the plug 46 so as to abut

the under side of the valve disk 58. In the upward position of the valve 52, the opening 50 is closed so that the gas cannot enter the lower chamber 32.

As previously mentioned, the disk 58 is closely adjacent the diaphragm 26, and in the closed position of the valve 52 the diaphragm 26 is shifted upwardly by the disk 58 so that a central boss 60 on the top surface of the diaphragm closes a centrally disposed outlet 62 in the water chamber 30.

In the aforedescribed closed position of the diaphragm 26 and the valve 52, the carbon dioxide gas under the pressure of a supply source is confined within the chamber 44 in the regulator 10. When water is initially introduced to the chamber 30, the diaphragm 26 is urged downwardly by the pressure of the water and the valve 52 is opened against the force of the spring 54. The carbon dioxide within the valve chamber 44 is permitted to escape through the aperture 50 and well 56 into the lower chamber 32, which will hereinafter be referred to as the gas chamber. If the pressure within the gas chamber 32, aided by the force of the spring 54, becomes greater than the pressure within the water chamber 30, the diaphragm 26 will be shifted upwardly to close the water outlet 62 and the valve 52 will close inlet 50 to the gas chamber 32. If, however, the combined forces of the spring and the gas pressure are equal to or less than the water pressure, the valve 52 and diaphragm 26 will remain open so that the gas and water chambers will accommodate the flow of their respective fluids. The gas chamber 32 is provided with an outlet 64 communicating with container 12 by means of conduit 66, and the water outlet 62 communicates with container 12 by means of conduit 68.

The container 12 comprises an open top, shell-like housing 70 closed by a cap 72 fitted with O ring seal 73 to define the carbonating chamber C. The cap 72 is provided with apertured plugs 74 and 76 which receive the gas and water conduits 66 and 68, respectively. The plugs 74 and 76 are threaded into suitable cavities in the cap 72 and their respective apertures 75 and 77 communicate with valve chambers 78 and 80 in the cap 72 adjacent and below the plugs. The valve chambers 78 and 80 retain valve bodies 82 and 84, respectively, in spaced relation and the chambers are provided with outlets 86 and 88 leading to the carbonating chamber C. The water outlet 88 is provided with a reduced orifice or nozzle 90 which introduces the water to the chamber C as a spray so that the gas, which is concurrently discharged into the chamber, may be effectively entrained within the water.

The gas which enters the chamber C is at a lesser pressure than the water introduced to the chamber and it has been found that a 10 lbs per square inch differential is desirable. The differential occurs in the regulator 10 by means of providing valve 52 with a 10 lb. spring. The valve 52 is initially opened by the pressure of water in chamber 30. When the pressure of gas in the chamber 32 is within 10 lbs. of the water pressure, the valve 52 will close. The gas pressure does not reach such a figure during carbonation since flow continues through the gas chamber 32 and the chamber C will be supplied with a rising column of carbonated water. The rising column of liquid will increase the pressure on the unentrained carbon dioxide within the chamber C and the gas chamber 32. The increased gas pressure in the chamber 32 causes

the diaphragm 26 to rise when the gas pressure comes within 10 lbs. of the water pressure permitting valve 52 to close and at the same time the diaphragm will close water outlet 62 in the regulator 10. It has been found that the gas pressure reaches the point for closing operation when the chamber C is approximately two-thirds filled with carbonated water. The unentrained gas remaining in the chamber C is at a higher than normal pressure and a portion of this gas will be entrained within the standing column of water.

The carbonated water within the chamber C is drawn off through the dispensing valve 14 by means of a vertically arranged flow tube 92 which has its free end disposed in spaced relation to the bottom of the chamber C. The upper end of the tube 92 communicates with a horizontal flow tube 96 which receives the dispensing valve 14. Thus, when the valve 14 is opened, carbonated water will flow through the tubes 92 and 96 under the pressure within the chamber C. A rod 94 is disposed within the tube 92 in spaced relation and has a bifurcated upper end 95 which projects through a suitable aperture 97 in the flow tube 96. The bifurcated end 95 abuts the base of a generally U-shaped member 100 having upwardly extending legs 102 and 104 which project through suitable apertures 106 and 108 in the cap 72 so as to extend into valve chambers 78 and 80. When the dispensing valve 14 is opened and carbonated water flows through the tube 92 about the rod 94, the rod will be thrust upwardly by the action of the water and will in turn force the U-shaped member 100 upwardly. The free ends of the legs 102 and 104 which extend into the valve chambers 78 and 80 are nested in cavities in valve bodies 82 and 84, respectively, and when the rod 94 thrusts upwardly, the legs 102 and 104 will shift the valve bodies upwardly to close the gas inlet 75 and the water inlet 77. Thus, during the dispensing operation, chamber C is closed to the entry of carbon dioxide and water and the carbonated water is dispensed under its own pressure. Since the flow pressure decreases during the dispensing operation, the carbonated water dispensed has unusual effervescent and "bite" qualities. When the dispensing operation ceases, the pressure within the chamber C will have been reduced sufficiently to permit the regulator 10 to function in the previously described manner so that water and carbon dioxide may again be introduced to the chamber C.

Since in the preferred embodiment of the invention the household system provides the pressured water, it is conceivable that the water inlet pressure to the regulator 10 will vary as the system is tapped in other parts of the household. This will cause fluctuation of the diaphragm within the regulator 10 during the standby period when the chamber C is utilized merely as a storage chamber for the carbonated water. Due to the aforementioned fluctuations there is a tendency toward undesirable intermittent flow of water to the chamber C. This intermittent stream of water could not be effectively carbonated with the result that water stored within the chamber C would lose some of its effervescent quality.

To permit such intermittent flow, a float 110 is provided in the chamber C and guided for vertical movement by brackets 112 which embrace the vertical flow tube 92. The float 110 carries an upwardly extending element 114 which is apertured to loosely embrace the horizontal flow tube

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96. The element 114 has an upwardly opened channel 116 which receives an appendage 118 on the U-shaped member 100 adjacent and below the leg 104. When the level of the carbonated liquid within the chamber C reaches the desired point (two-thirds filled) the float 110 moves upwardly thrusting against the appendage 118 on the member 100 which then acts as a lever fulcrumed on the bifurcated end 95 of the rod 94. The leg 104 is thrust upwardly to shift the valve body 84 and thus close the water inlet 77 so that water cannot enter the chamber C. The water valve 84 remains closed due to the thrust of float 110 so that fluctuations of the diaphragm 26 occasioned by opening and closing the spigots in the household water supply system will not cause further flow of water into chamber C. The supply of carbonated water within the chamber remains at a constant level and retains its effervescent quality although stored within the chamber for a relatively long period.

The afordescribed carbonating apparatus is characterized by its simplicity and compact arrangement and requires little, if any, maintenance. The carbonator functions without complicated valving and without the pumps and like equipment associated with commercial carbonating apparatus. Operating water pressure is supplied by the household system and a conventional source of pressured carbon dioxide is utilized. The pressure of the carbon dioxide is regulated relative to the pressure of the water by means responsive to the pressure of the water. Carbonating action occurs at a pressure considerably less than the pressure obtaining in most commercial installations, yet the water manufactured has an effervescent quality comparable to that produced by any known commercial installation. The apparatus, due to its compact construction, may be installed within a conventional household refrigerator without unduly restricting the available space and requires only a slight modification of the refrigerator for permanent installation so that a constant supply of chilled carbonated water will be available in the household.

As many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the language used in the following claims is intended to cover all of the generic and specific features of the invention herein described and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

I claim as my invention:

1. Carbonating apparatus comprising a housing defining a water chamber and a gas chamber, each of said chambers having an inlet and an outlet, the inlets of said chambers being connectible to sources of pressured water and carbon dioxide, respectively, wall means supported by said housing between said chambers, said wall means being movable in response to the differential fluid pressure in said chambers, valve means supported in said housing and movable with said wall means between an open position and a closed position wherein the outlet in one of said chambers and the inlet in the other of said chambers

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are closed, and means defining a carbonating chamber in communication with said outlets.

2. Carbonating apparatus comprising a housing defining a water chamber and a gas chamber, each of said chambers having an inlet and an outlet, the inlets of said chambers being connectible to sources of pressured water and carbon dioxide respectively, wall means supported by said housing between said chambers, said wall means being movable in response to the differential fluid pressure in said chambers, valve means supported in said housing for movement with said wall means between an open position and a closed position wherein the outlet in one of said chambers and the inlet in the other of said chambers are closed, means biasing said valve means toward closed position, and means defining a carbonating chamber in communication with said outlets.

3. Carbonating apparatus comprising a housing defining a water chamber and a gas chamber, each of said chambers having an inlet and an outlet, the inlets of said chambers being connectible to sources of pressured water and carbon dioxide respectively, a resilient wall supported between said chambers, said wall being movable in response to the differential fluid pressure in said chambers, valve means supported in said housing and movable with said wall between an open position and a closed position wherein the outlet in said water chamber and the inlet in said gas chamber are closed, means biasing said valve means toward closed position, and means defining a carbonating chamber in communication with said outlets.

4. Carbonating apparatus comprising a housing defining a water chamber and a gas chamber each of said chambers having an inlet and an outlet, the inlets of said chambers being connectible to sources of pressured water and carbon dioxide respectively, a resilient wall supported by said housing between said chambers, said wall being movable in response to differential fluid pressure in said chambers between a position wherein it closes the outlet in said water chamber to a position within said gas chamber, valve means supported in said housing and movable with said wall to close the inlet in said gas chamber when the outlet in said water chamber is closed and to open the gas inlet when the water outlet is open, and means defining a carbonating chamber in communication with said outlets.

5. Carbonating apparatus comprising means defining a carbonating chamber having inlets connectible to a source of pressured water and carbon dioxide gas, respectively, flow control means having an inlet in said chamber and an externally disposed dispensing outlet, and valve means disposed in said chamber responsive to flow in said control means to close the chamber inlets.

6. Carbonating apparatus comprising means defining a carbonating chamber having inlets connectible to sources of pressured water and carbon dioxide gas, respectively, flow control means comprising a flow tube having an inlet disposed in said chamber and a dispensing valve having an externally disposed outlet, and valve means disposed in said chamber for closing said inlets, said valve means including a rod shiftably supported in said tube and responsive to fluid flow therein to shift said valve means to closed position.

7. Carbonating apparatus comprising a pressure regulator for regulating the relative pres-

sures of water and carbon dioxide gas, said regulator having inlets connectible to a pressured supply of water and carbon dioxide respectively, and having a water outlet and a gas outlet, means defining a carbonating chamber having inlets in communication with said water and gas outlets, respectively, flow control means having an inlet in said chamber and an externally disposed dispensing outlet, and valve means disposed in said chamber responsive to flow in said control means to close the chamber inlets.

2. Carbonating apparatus comprising a pressure regulator for regulating the relative pressures of the water and carbon dioxide gas, said regulator having inlets connectible to a pressured supply of water and carbon dioxide respectively, and having a water outlet and a gas outlet, means defining a carbonating chamber having inlets in communication with said water and gas outlets, respectively, flow control means comprising a flow tube having an inlet disposed in said carbonating chamber and a dispensing valve having an externally disposed outlet, and valve means disposed in said chamber for closing the valve inlets, said valve means including a rod shiftably supported in said tube and responsive to fluid flow therein to shift said valve means to closed position.

9. Carbonating apparatus comprising in combination a pressure regulator having means for accommodating the flow of water and carbon dioxide gas from pressured sources, said regulator having means for regulating the relative pressures of said fluids, fluid pressure responsive valve means for closing said regulator to the flow of gas, means defining a carbonating chamber having a water inlet and a gas inlet in communication with said regulator whereby said carbonating chamber will receive a column of carbonated water, thereby increasing the gas pressure in said chamber and said regulator to effect closure of the regulator valve means at a predetermined liquid level in said chamber, and liquid level responsive means disposed in said carbonating chamber for closing the water inlet to said carbonating chamber when the liquid therein reaches said predetermined level.

10. Carbonating apparatus comprising in combination a pressure regulator having means for accommodating the flow of water and carbon dioxide gas from pressured sources, said regulator having means for regulating the relative pressures of said fluids, fluid pressure responsive valve means for closing said regulator to the flow of gas, means defining a carbonating chamber having a water inlet and a gas inlet in communication with said regulator whereby said carbonating chamber will receive a rising column of carbonated water, thereby increasing the gas pressure in said carbonating chamber and said regulator to effect closure of the regulator valve means at a predetermined liquid level in said carbonating chamber, valve means disposed in said carbonating chamber in communication with the water inlet, and liquid level responsive means for closing said last mentioned valve means when the liquid in said chamber reaches said predetermined level.

11. Carbonating apparatus comprising in combination a pressure regulator having a water chamber and a carbon dioxide gas chamber separated by a resilient wall, each of said chambers having an outlet and an inlet connectible to a pressured source of their respective fluids, said wall being movable in response to fluid pressures,

valve means movable with said wall from an open position to a closed position whereby the gas inlet is closed, means defining a carbonating chamber having a water and a gas inlet in communication with the regulator outlets whereby said carbonating chamber will receive an increasing column of carbonated water, thereby increasing the pressure in said carbonating chamber and said gas chamber to effect closure of the regulator valve means at a predetermined liquid level in said carbonating chamber, and liquid level responsive means disposed in said carbonating chamber for closing the water inlet to said carbonating chamber when the liquid therein reaches said predetermined level.

12. Carbonating apparatus comprising in combination a pressure regulator having a water chamber and a carbon dioxide gas chamber separated by a resilient wall, each of said chambers having an outlet and inlet connectible to a pressured source of their respective fluids, said wall being movable in response to fluid pressures, valve means movable with said wall from an open position to a closed position whereby the gas inlet is closed, means defining a carbonating chamber having a water inlet and a gas inlet in communication with the regulator outlets whereby said carbonating chamber will receive a rising column of carbonated water, thereby increasing the pressure in said carbonating chamber and said gas chamber to effect closure of the regulator valve means at a predetermined liquid level in said carbonating chamber, valve means disposed in said carbonating chamber adjacent the water inlet, and liquid level responsive means disposed in said carbonating chamber for closing said last mentioned valve means when the liquid in said carbonating chamber reaches said predetermined level.

13. Carbonating apparatus comprising in combination a pressure regulator having a water chamber and a carbon dioxide gas chamber separated by a resilient wall, each of said chambers having an outlet and an inlet connectible to a pressured source of their respective fluids, said wall being movable in response to fluid pressures, valve means movable with said wall from an open position to a closed position wherein the gas inlet is closed, means defining a carbonating chamber having a water inlet and a gas inlet in communication with the regulator outlets, valve means disposed in each of said last mentioned inlets, flow control means having an inlet in said chamber and an externally disposed dispensing outlet, valve actuating means responsive to flow in said control means to close said last mentioned valve means, and liquid level responsive actuating means disposed in said carbonating chamber for closing the valve means at the water inlet when the liquid in said carbonating chamber reaches a predetermined level.

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