Sept. 25, 1951 G. W. BAYERS, JR 2,568,980

CARBONATING MACHINE

Filed April 16, 1948 2 Sheets-Sheet 1

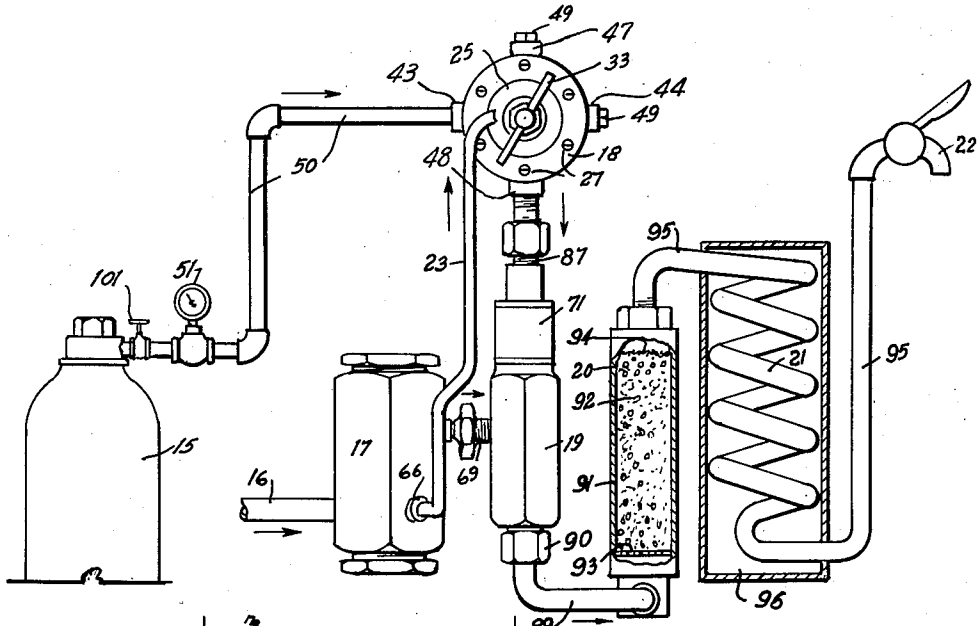


Fig. 1.

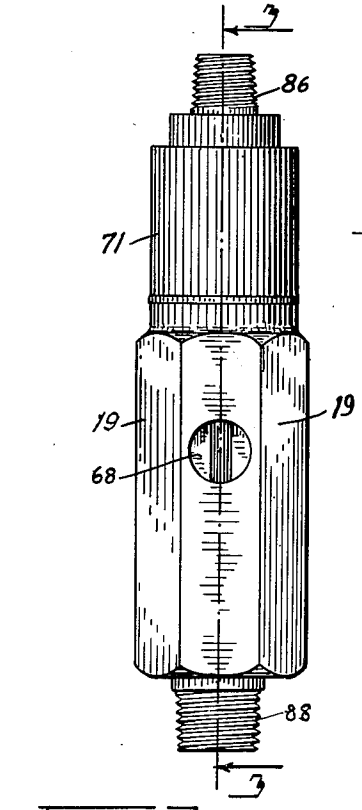


Fig. 2.

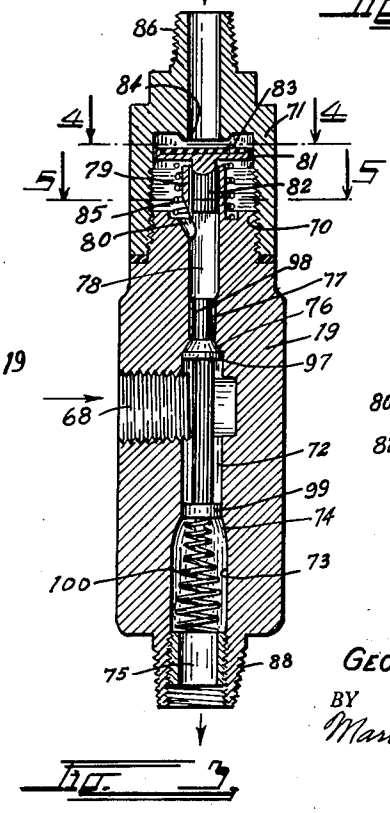


Fig. 3.

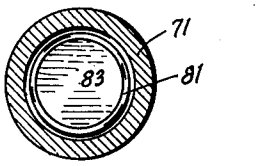


Fig. 4.

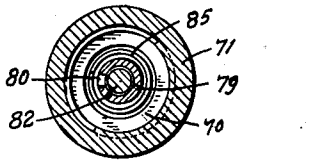


Fig. 5.

INVENTOR.
GEORGE W. BAYERS JR.
BY
Martin E. Anderson
ATTORNEY.

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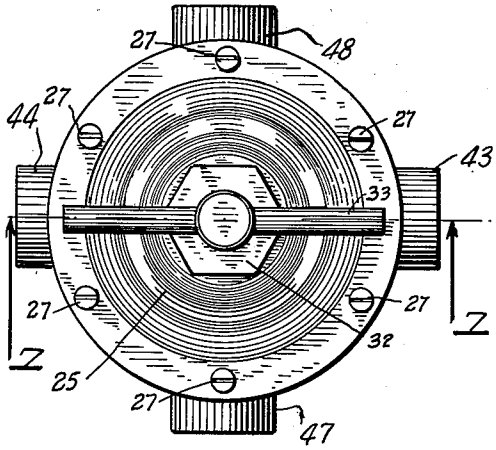


Fig. 6.

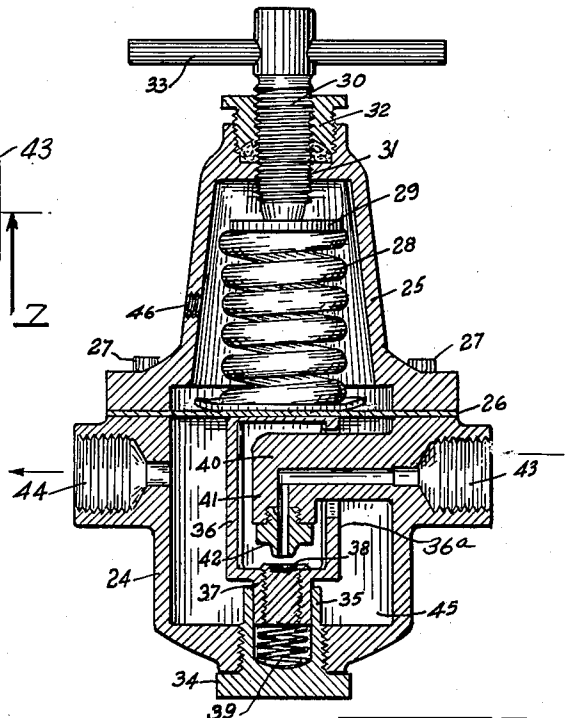


Fig. 7.

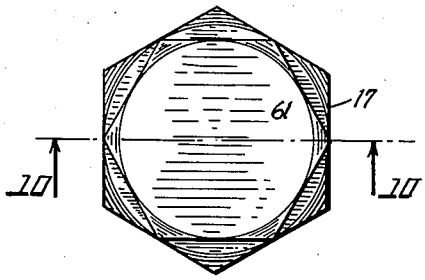


Fig. 8.

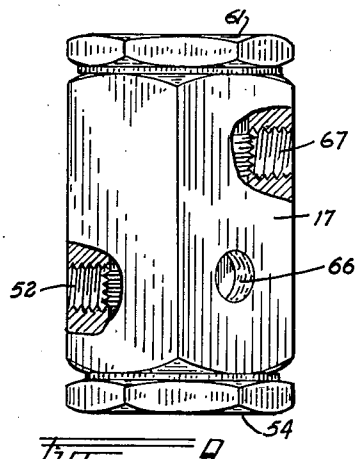


Fig. 9.

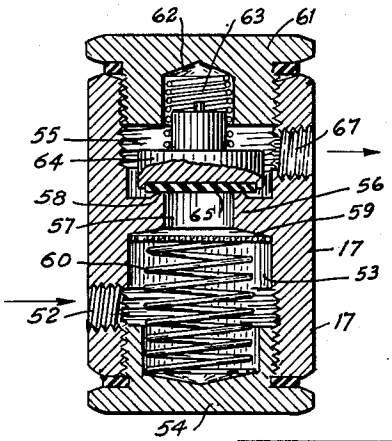


Fig. 10.

INVENTOR.
GEORGE W. BAYERS JR.
BY
Martin E Anderson
ATTORNEY.

Patented Sept. 25, 1951

2,568,980

UNITED STATES PATENT OFFICE

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CARBONATING MACHINE

George W. Bayers, Jr., Denver, Colo., assignor of one-half to George W. Bayers, Denver, Colo.

Application April 16, 1948, Serial No. 21,470

2 Claims. (Cl. 261—19)

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This invention relates to improvements in liquid carbonating devices of the general type shown and described in my copending application Serial No. 692,622, filed August 22, 1946.

Carbonated water is extensively employed and finds one of its greatest uses in connection with soda water fountains where carbonated drinks are sold.

Various devices have been invented for use in carbonating water for soft drinks. The one most extensively used today is large and expensive, employing an electric motor and a pump.

It is the object of this invention to produce a carbonating device that does not require a motor or a pump and which shall be of a very simple and substantial construction and in addition thereto be highly reliable in its operation.

Carbon dioxide for use in carbonating water is today dispensed in liquid form and sold in cylinders wherein the liquid is maintained under high pressure. The liquid carbon dioxide must be mixed with water at a much lower pressure, before the water is dispensed as a carbonated drink. It is the principal object of this invention to produce a device by means of which the carbon dioxide is delivered to a stream of flowing water at a pressure sufficiently greater than that of the water to effect a proper mixture and in which the gas pressure is automatically regulated by the water pressure in such a manner that a proper differential is at all times maintained.

The above and other objects that may become apparent as the description proceeds are attained by means of a construction and an arrangement of parts that will now be described in detail and reference for this purpose will be had to the accompanying drawings in which the invention has been illustrated, and in which:

Figure 1 is a diagrammatic view showing the manner in which the several elements are connected, one of said elements being shown in partial section;

Figure 2 is a side elevation of the mixing valve;

Figure 3 is a longitudinal diametrical section taken on line 3—3, Figure 2;

Figure 4 is a section taken on line 4—4, Figure 3;

Figure 5 is a section taken on line 5—5, Figure 3;

Figure 6 is a top plan view of a reducing valve;

Figure 7 is a section taken on line 7—7, Figure 6;

Figure 8 is a top plan view of a check valve;

Figure 9 is a side elevation of the check valve; and

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Figure 10 is a longitudinal section taken on line 10—10, Figure 8.

In the drawing reference numeral 15 designates a gas cylinder and reference numeral 16 designates a water pipe which is usually connected with the water system of the building in which the apparatus is employed. Reference numeral 17 designates a check valve that will be hereinafter described. Reference numeral 18 designates a reducing valve and reference numeral 19 designates a mixing valve while reference numeral 20 designates a mixing chamber through which the mixture of gas and liquid flows and from which it passes through the refrigerating coil 21 to the dispensing faucet 22. A pressure pipe 23 connects the check valve 17 with the bonnet of the reducing valve for a purpose and in a manner which will hereinafter appear. Where the device is employed in connection with a soda fountain, the operator, by controlling valve 22, dispenses a mixture of water and carbon dioxide which has been effected by the apparatus which will now be described in detail.

Referring now more particularly to Figures 6 and 7 which show the reducing valve, reference numeral 24 designates the body of the reducing valve and reference numeral 25 the bonnet of the valve. This reducing valve is constructed in the usual manner with one or two minor exceptions, but, in order to explain the operation, a general description of the valve will be given.

Positioned between the body and the bonnet is a flexible metal diaphragm 26, the two parts being held in position by means of bolts 27. A spring 28 is positioned in the bonnet and rests on the diaphragm. A plate 29 rests on the top of the spring and this is engaged by the inner end of screw 30, which is threaded to the bonnet at 31 and passes through a packing box or gland 32. Screw 30 may be rotated by means of the handle 33. It is evident that the pressure of the spring has a tendency to bow the diaphragm downwardly. The bottom of body 24 is threaded for the reception of a plug 34 which has a hollow extension 35 that projects into the chamber in body 24. A yoke having two parallel side arms 36 and 36a is provided at its lower end with a tubular hub 37 that has threadedly connected therewith a removable valve seat 38. A spring 39 is positioned in the opening in member 35 and is under compression and normally urges the yoke member against the under surface of the diaphragm as shown in the drawing. Arm 36a has an opening through which the tubular part 40 extends. This part has a downwardly

extending end 41 to which a valve member 42 is connected. The opening in member 40 connects with the threaded inlet opening 43. A threaded outlet hub 44 is provided on the opposite side of the body and communicates with the chamber therein. It is now apparent that if there is no pressure in chamber 45, the diaphragm will be bowed downwardly, due to the action of the spring 28, and this will move the yoke downwardly against the action of spring 39, thereby separating the two valve members 38 and 42 as shown in the drawing. By building up a pressure in chamber 45 that is greater than the pressure exerted by the spring 28, the diaphragm can be flexed upwardly so as to bring the valve members into engagement. It will be observed that the wall of the bonnet is provided with an opening 46 to which reference will presently be made. In the present embodiment, the body portion 24 is provided with two other threaded hubs which have been indicated by reference numerals 47 and 48, in Figure 6. The two threaded hubs 44 and 47 are closed by means of plugs 49, in the construction shown in the drawings. A pipe 50 connects the interior of the gas cylinder 15 with threaded hub 43 and with chamber 45. A pressure gauge 51 may be connected with pipe 50, if desired. Water pipe 16 is connected with the check valve 17 through opening 52.

The check valve construction will now be described. The body of the check valve is provided with an axial opening 53 extending inwardly from its lower end and this is closed by means of a threaded plug 54. Another axial opening 55 extends into the body of the check valve from the top. The two axial openings terminate in a partition 56 that is provided with a central opening 57. The upper edge of opening 57 has a valve seat 58. A foraminated plate 59 is positioned on the under side of partition 56 and is held against the latter by means of a spring 60. A plug 61 closes the upper opening 55 and this is provided with a central recess 62 that contains a compression spring 63. A movable valve member 64 is positioned in opening 55 and is provided on its under surface with a resilient seal 65 that normally rests on the valve seat 58 and is urged towards the latter by spring 63. The check valve body is provided with a threaded opening 66 to which the lower end of pipe 23 is connected, as shown in Figure 1. The check valve body is also provided with a threaded opening 67 positioned above partition 56. Opening 67 is connected with opening 68 in the mixing valve body 19 by means of pipe fittings 69 (Fig. 1).

Referring to Figures 2 to 5, inclusive, the construction of the mixing valve will now be described. The body of the mixing valve has been indicated by 19 and this is provided with a cylindrical threaded upward extension 70 to which cap 71 is connected. Extending through the body 19 is an axial opening having sections of different diameters. The center section of this opening has been designated by reference numeral 72 and terminates in an opening 73 of somewhat larger diameter. Curved walls 74 join the two opening sections. The lower end of opening 73 is threaded and a tubular threaded member 75 is positioned therein. The upper end of section 72 terminates in a valve seat 76 that, in turn, terminates in a cylindrical portion 77. An opening 78 of somewhat larger diameter than 77 extends to the upper end of body 19. Extending upwardly from the threaded portion 70 is a tubular extension 79. An opening 80 communicates the area surrounding tubular extension 79 with the interior of axial opening 78. A valve 81 has a cylindrical plug 82 that extends into tubular member 79 and serves as a guide for the valve. The upper surface of valve 81 is provided with a resilient disk 83 that engages the valve seat 84 when cap 71 is in position. In the drawing valve 81 has been shown as spaced from valve seat 84 but it is held normally in engagement with the valve seat by the action of spring 85. Cap 71 is provided at its upper end with a threaded projection 86 and connection is made from this to the threaded lug 48 of the reducing valve, by means of pipe fittings 87, as shown in Figure 1. The body 19 is provided at its lower end with a threaded plug 88 to which a pipe 89 is connected by means of a connector 90. Pipe 89 connects with the lower end of a mixing chamber 91 that contains a quantity of clean graded sand 92. The sand rests on a screen 93 and terminates underneath screen 94. The upper end of the mixing chamber has connected therewith a pipe 95 that has been shown as having formed therein a cooling coil 21 that is located in a refrigerating chamber 96. Pipe 95 extends to dispensing faucet 22.

Positioned in the opening in body 19 is a valve comprising a frustoconical valve member 97 that fits against the valve seat 76. The valve has a guide stem 98 that extends into the opening 77. The valve stem below valve 97 terminates in a cylindrical flange 99 that is positioned a short distance above the juncture of sections 72 and 73. A spring 100 urges the valve upwardly into the position shown in Figure 3. Spring 100 is a weak spring but has been shown to an exaggerated scale in the drawing.

From Figure 1 it will be seen that a pipe 23 is connected at its lower end with threaded opening 66 in the check valve 17 and has its upper end in communication with the interior of bonnet 25 through opening 46. It is therefore apparent that any pressure in opening 53 is communicated to the interior of bonnet 25 through pipe 23 and therefore this pressure is added to the force exerted by spring 28 for the purpose of moving diaphragm 26 downwardly.

Let us now assume that the parts are connected as shown in Figure 1 and that valve 101 is open letting CO_2 gas pressure from cylinder 15 into chamber 45 through pipe 50. This pressure is greater than the combined pressure of spring 28 and the pressure of the fluid communicated thereto through pipe 23 and therefore diaphragm 26 will bow upwardly until the two valve members 38 and 42 come into engagement. Water from pipe 16 enters opening 53 and exerts an upward pressure on valve 64 and passes by this valve through opening 67 and pipe 69 into the center section 72 of the axial opening in mixing valve 19. If valve 22 is closed, there is, of course, no flow of water, especially after the pipe has been completely filled with water. It will now be apparent that since pipe 23 communicates the interior of check valve 17 with the interior of bonnet 25, the pressure of the water will be exerted on the diaphragm as above mentioned. So long as no water is flowing, the parts remain in substantially the position shown in Figures 3 and 10.

Attention will now be called to the fact that the pressure at which the gas valve 38, 42 opens is slightly greater than the pressure of the water in section 72 of the mixing chamber and therefore when valve 22 is opened to permit water

to flow, the movement of the water will, first of all, move the valve assembly, comprising valves 97 and 99 downwardly. Since the pressure of the gas in chamber 45 is higher than the pressure of the water, gas will now flow downwardly through pipe connection 87 and flow around valve 81 and mix with the stream of water where it enters through opening 68. The mixture of gas and water will now pass through the mixing chamber and through the sand 92 positioned therein, and finally emerge through valve 22, as carbonated water. The proportion of gas and water can be regulated by changing the pressure exerted on the diaphragm by spring 28.

In the above specification it has been pointed out that the pressure of the water is somewhat variable and due to this fact and to the fact that the proportion of gas and water depends upon the differential pressure at which they come into contact, the mixture would be variable unless some means were taken to maintain the pressure differential substantially constant at all normal variations in water pressure. For the purpose of regulating the gas pressure in accordance with the water pressure, the interior of the check valve assembly has been communicated with the interior of the bonnet by means of pipe 23 as above pointed out, and therefore if the water pressure drops, the pressure against the diaphragm will also diminish in the same proportion, and, conversely, if the water pressure increases, the pressure on the diaphragm will also increase. With this simple interconnection, a constant differential in the gas and water pressure can be maintained at all times.

Particular attention is called to the great advantage of communicating the water pressure to the diaphragm of the reducing valve, by means of a tubular connection as shown. In the first place there is a great advantage inherent in the tubular connection and the hydraulic means of communicating the pressure over any mechanical means that might be designed for this purpose, and in the second place, the connection shown is of utmost simplicity and does not involve any difficult mechanical design. That part of the valve stem 98 is of slightly smaller diameter than opening 77 so that gas may pass by at this point in amounts proportionate to the distance valve 99 has moved downwardly when valve 76 is unseated. It is also necessary to have flange 99 of somewhat less diameter than the opening 72.

The clearance between guide stem 98 and the wall of opening 77 and between flange 99 and the wall of opening 72 is of major importance because they control the proportioning of the CO_2 gas to the volume of water flowing, as the volume of water flowing increases valve 97 and guide stem 98 move downwardly and allows more gas to flow.

The purpose of the check valve shown in Figure 10 is to prevent reverse flow of water and gas in case the water pressure should accidentally fall to an abnormally low value and in a similar manner valve 81 serves to prevent water from flowing upwardly into chamber 45 in case the pressure therein should be lowered for any particular reason.

It will be observed from Figure 3 that valve 97 is positioned in a cylindrical opening and therefore when liquid is withdrawn at a capacity rate, valve 97 will move down below the cylindrical wall in which it is seated, thereby producing a wide opening for the entrance of gas.

From the above description it will be seen that by means of this simple apparatus which comprises, in combination, the check valve 17, the pressure valve, the mixing valve 19 and the filter 91, a very satisfactory carbonation of water can be obtained. It will be noticed that there is no motor or pump connection with this device and further that there is automatic regulation of the gas pressure to conform to variations in the water pressure.

Particular attention is called to the construction of the mixing valve which is considered to be the most important element in the combination.

Having described the invention what is claimed as new is:

1. A carbonating element for use in a carbonating device having a supply of water under pressure, a tank containing liquid CO_2 and a dispensing faucet, said element comprising an elongated body having an axial opening forming a carbonating chamber, the opening extending through the body from one end to the other, a removable cap threadedly connected with one end of said body, said cap having an opening axially aligned with the aforesaid axial opening adapted to be communicated with the gas supply through a pressure reducing valve, an axially movable check valve in said cap opening inwardly and adapted to rest on a seat surrounding the opening in the cap, the body having a water inlet opening in communication with the carbonating chamber, the wall of the latter having an integral valve seat positioned between the water inlet opening and the check valve in the cap, said valve seat flaring towards the water inlet opening, a valve in the carbonating chamber positioned to engage the valve seat, spring means for urging the valve against the seat, the last named valve having a stem that extends across the water inlet and a free end forming a guide stem extending into the axial opening in a direction beyond the valve seat toward said cap, the stem that extends across the water inlet having a radial flange on the outlet side of the water inlet, whereby when water flows towards the dispensing faucet, it will exert a force tending to move the valve from the seat to permit free flow of CO_2, the carbonating chamber having an enlarged portion into which said last named valve may move to provide a relatively large CO_2 passageway when the valve is open to maximum flow capacity, the other end of the axial opening in the body forming an axial discharge conduit for connection with the faucet.

2. A carbonating element for use in a carbonating device having a supply of water under pressure, a tank containing liquid CO_2, and a dispensing faucet, said element comprising an elongated body having an axial opening of circular cross section, forming a carbonating chamber, the opening extending the entire length thereof, a removable cap threadedly connected with one end of the body, said cap having an opening to be communicated with the gas supply through a pressure reducing valve, a check valve in said cap, opening inwardly, means comprising a spring for urging the check valve to closing position, the body having a water inlet opening of larger diameter than the carbonating chamber in communication with the latter at a point between its ends, the wall of the carbonating chamber having a valve seat positioned between the check valve and the water inlet opening, at a point spaced from the latter, the seat facing the water inlet opening, a poppet type valve in the carbonating

chamber, positioned to engage the valve seat, the valve having a guide stem extending into that part of the carbonating chamber between the valve seat and the check valve, the guide being of smaller diameter than the carbonating chamber at that point, and another stem extending across the water inlet opening terminating in that part of the carbonating chamber on the other side of the water inlet opening, the end of the stem having a circular flange of slightly smaller diameter than that of the carbonating chamber at that point, the carbonating chamber being outwardly flared beyond said flange, spring means for urging the valve against its seat, the parts being so proportioned and arranged that the flange will move to a position in the enlarged

part of the carbonating chamber and the valve will move into the water inlet opening when the dispensing faucet is wide open.

GEO. W. BAYERS, JR.

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