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CARBONATED WATER SYSTEM

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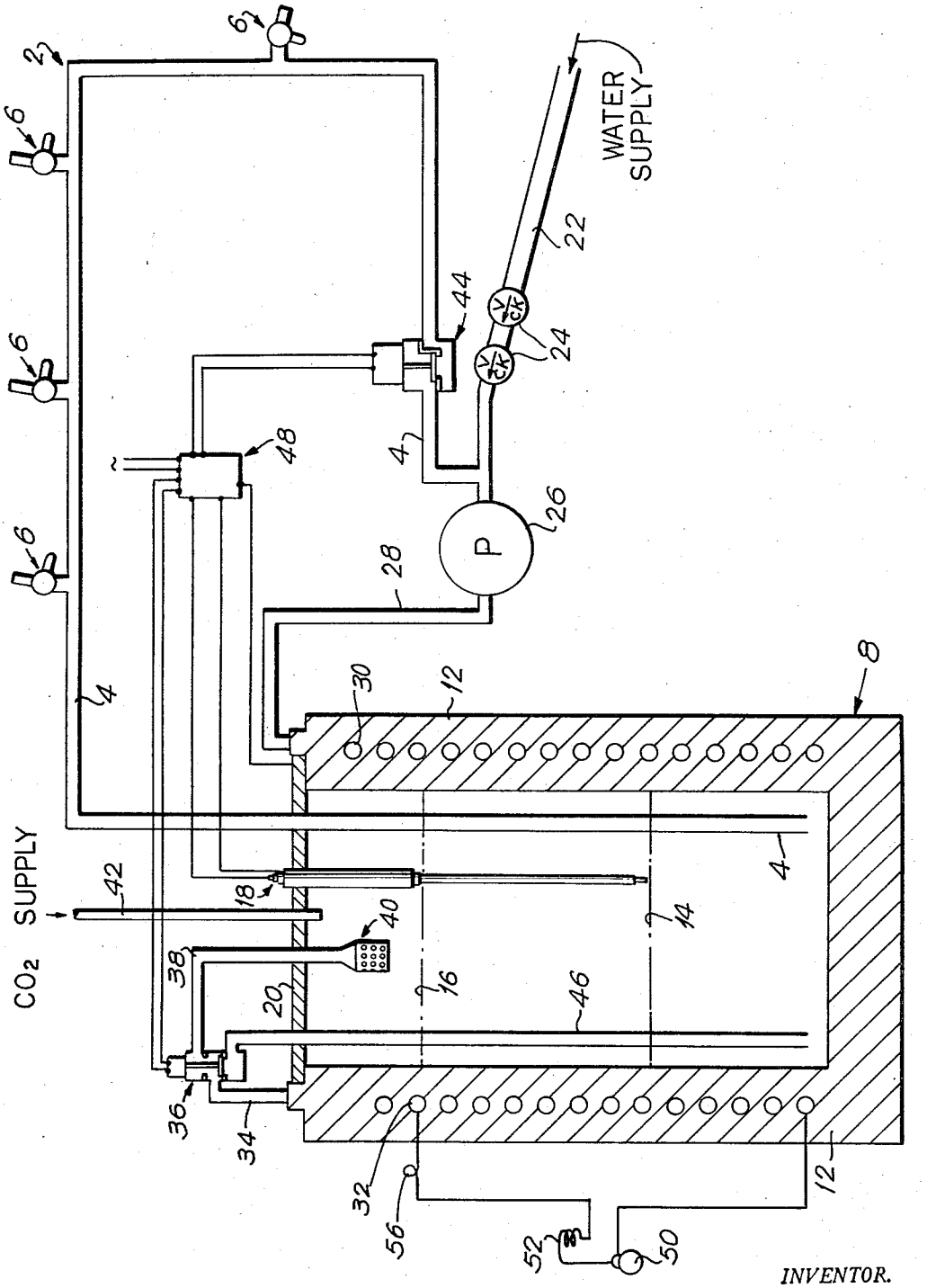


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# CARBONATED WATER SYSTEM

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## ABSTRACT OF THE DISCLOSURE

A system for carbonating, cooling and dispensing water is disclosed wherein a pump supplies fresh water to the top of the storage tank through a spray nozzle, so that the fresh water is carbonated. The same pump also recirculates carbonated water past the dispensing faucets to and from the body of water in the storage tank at such time as no fresh water is being supplied to the system. Valves are provided to control the flow of water to the pump, and to direct the fresh water to the nozzle and the carbonated water to the bottom of the tank.

This invention relates to dispensing carbonated water and carbonated beverages, and particularly to a system for producing and dispensing cold, carbonated water.

An object of this invention is to provide an improved system for dispensing carbonated water at the point of use in refrigerated condition. Another object is to provide a simplified system for dispensing carbonated beverages. A further object is to provide a simple and inexpensive system of the above character, which is free of the undesirable and objectionable features nad characteristics of similar prior systems. A further object is to provide for the above with equipment which is versatile in its application, dependable in its use, and which will operate efficiently with minimum attention and service. These and other objects will be in part obvious and in part pointed out below.

Systems have been provided for dispensing carbonated beverages in refrigerated condition at the point of use and in such a manner as to insure satisfactory carbonation. One such system is shown in United States Patent No. 1,663,683, where the refrigerated and carbonated beverage is circulated to and from the dispensing faucets. The continuous circulation of the carbonated beverage maintains the desired low temperature in the supply lines. Other such systems have been provided over the years, in which tap water is carbonated and refrigerated, and is then circulated in a continuous stream past two or more faucets in series, utilizing more recent types of carbonating and refrigeration equipment. However, many such systems are quite complicated, and some involve continuous carbonation of the water and some have more than one pump to provide the desired circulation.

It is an object of the present invention to provide improved and simplified systems which accomplish the desired functions of the prior systems, but which utilize the most modern components. It is a further object to avoid the difficulties which have been encountered with the similar systems which have been available in the past.

In the drawing, the single figure is a somewhat schematic representation of one embodiment of the invention.

Referring to the drawing, a carbonated water system 2 has a carbonated water supply and circulation line 4 which passes in series a number of faucets 6. Supply line 4 extends from a carbonator and storage unit 8 having a storage tank 12 which is cast within a cylindrical block of aluminum. Line 4 extends from the bottom of tank 12 and, during normal operation, the level of carbonated water in the tank is maintained between the lower level 14 and the upper level 16. As will be explained more fully below, this water level is maintained by a control unit having an electric probe unit 18 mounted in the top wall



20 of the tank. Fresh water from a city water supply or the like is supplied to the system through a supply line 22, having a series pair of check valves 24 therein which permit the water to flow from the supply to the system, but which prevent the reverse flow.

Fresh water is drawn into the system by a pump 26 which is driven by an electric motor (not shown), and which delivers the water under pressure through a line 28 to water cooling coil 30 embedded within the aluminum casting. Also embedded within the casting is an evaporator coil 32 of a refrigeration system which cools the incoming water and also maintains a low temperature for the water within tank 12. The cooled fresh water from cooling coil 30 flows through a line 34, a three-way valve 36 and a line 38 to a nozzle 40, through which the water is sprayed into the top of the tank. A supply of $CO_2$ under regulated pressure is provided through a line 42 which extends into the top of the tank. Hence, there is a body of $CO_2$ above the water level within the tank, and the water which is sprayed from nozzle 40 absorbs the $CO_2$ and becomes carbonated. An important additional feature is that the carbon dioxide maintains the carbonated water under sufficient pressure to cause it to flow from any one of the faucets 6 when the faucet is open.

The components of carbonated water in system 2 are enclosed by heat insulating material. Hence, when carbonated water is being drawn at a fairly rapid rate from faucets 6, line 4 and the faucets are adequately cooled by the cold water flow. Also, pump 26 has sufficient capacity to maintain the desired level of the carbonated water in tank 12, and the $CO_2$ provides sufficient pressure to cause the water to flow to the faucets. At reduced rates of withdrawal of water from the faucets, the system also provides adequate cooling for line 4 so that there is always a proper supply of the carbonated water at each of the faucets. This cooling of line 4 is accomplished by causing pump 26 to circulate carbonated water through line 4 during the time that the pump is not being used to deliver water to the system from line 22. Accordingly, there is an extension on line 4 which leads to the inlet side of pump 26 and which has a valve 44 therein. In this embodiment valve 44 is closed when its solenoid is energized, and it opens when its solenoid is de-energized. Hence, when water is being delivered to the system, the solenoid of valve 44 is energized and the valve is closed, so that line 4 is a dead end supply line, as discussed above. However, when the solenoid is de-energized so that valve 44 is open, the pressure of the carbon dioxide in tank 12 produces a pressure in the carbonated water at the inlet side of the pump which is greater than the pressure of the water in the fresh water supply line 22. Therefore, the flow of water from line 22 is blocked by the carbonated water, and pump 26 withdraws only the carbonated water from line 4, thus causing circulation of the carbonated water throughout line 4.

The switch in the supply of water to pump 26 from the fresh water to carbonated water makes it desirable to return the recirculated water to tank 10 without passing it through spray nozzle 40. Accordingly, the three-way valve 36 is turned so that the carbonated water which flows to it from line 34 is diverted downwardly through a line 46 to the bottom of tank 12. Hence, the carbonated water is returned to the body of carbonated water in the tank, and during this mode of operation, it is merely circulated to and from tank 12 and maintains line 4 at the desired temperature.

In this embodiment, valves 44 and 36 are controlled by a control unit 48 which, in turn, is controlled by the electric probe unit 18. Control unit 48 acts to deenergize the valve solenoid so as to open valve 44 when the level of the carbonated water in tank 12 rises to the upper level 16, and it energizes the solenoid and recloses valve

44 when the water level drops to the lower level 14. When valve 44 is open, there is no fresh water being supplied to tank 12, and the water level drops relatively rapidly if the water is being withdrawn from the faucet. However, the capacity of pump 26 is so chosen that it adds water to the tank at only a slightly greater rate than water flows from the tank during maximum usage of the faucets. In practice, carbonated water is not withdrawn from any one faucet in a continuous stream, and the system need not be of sufficient size to provide continuous streams of carbonated water from all of the faucets. Hence, the system may operate for very substantial periods of time with a general balance between the withdrawal of carbonated water from the tank and the continuous supply of freshly carbonated water to the tank by the pump. Under such circumstances, the system continues to operate without the water level reaching the upper levels 16, and the water being dispensed through the faucets maintains line 4 in refrigerated condition. In this connection, it should be noted that the constant pressure in the supply of carbon dioxide insures that the carbonated water is maintained at the desired pressure at all of the faucets 6.

The carbonated water lines are of plastic, while, in an acceptable commercial version of this system, the tank 12 is provided with a stainless steel liner (not shown), and, the operating parts of pump 26, and valves 36 and 44 are of stainless steel which is not adversely affected by the carbonated water. Probe 18 and control unit 48 are standard controls which provide the functioning described above. Evaporator 32 is a component of a refrigeration system, illustratively represented by a compressor 50, a condenser 52, a capillary tube expansion device 56, interconnecting lines and standard controls. Pump 26 is driven by an electric motor which is turned when the system is placed into operation.

When the system has been turned off and then is started up, pump 26 is operated to circulate the carbonated water through line 4 for a sufficient time to cool the line. Carbonated water which is returned in some what warmed, and it is recooled when it is returned to tank 12 by the action of the refrigeration system. When carbonated water is warm, it tends to lose its carbon dioxide if sprayed through a nozzle or if it is subject to another sudden decrease in pressure. However, with the present system, the carbonated water is maintained under substantial pressure, and it is returned in a solid stream to the body of carbonated water at the bottom of tank 12, without being subjected to a reduction in pressure. Thus, it is cooled again while maintaining its carbonation.

In this embodiment, valve 36 is operated after a predetermined time delay following the operation of valve 44. That is, after the supply of water to pump 26 is changed from fresh water from line 22 to carbonated water from line 4, valve 36 continues to direct the water through line 38 to nozzle 40 until the fresh water in line 28 and the cooling coil 30 has flowed through valve 36. Hence, all of the fresh water is sprayed through the nozzle so as to carbonate it. Also, when valve 44 has been open and then is closed, there is a similar time delay before valve 36 diverts the water from line 46 back to line 38. Hence, the carbonated water in line 28 and coil 36 is delivered through line 46 to the bottom of the tank, rather than through line 38 to nozzle 40.

It should be noted that he flow of carbonated water from tank 12 to the faucets is caused by the controlled pressure of the carbon dioxide gas, independently of the operation of pump 26. The pump functions to deliver fresh water through the carbonating unit to the tank, and the discharge pressure of the pump is greater than the pressure of the carbon dioxide within the tank. In the illustrative embodiment, the single pump 26 also circulates the carbonated water through line 4 to provide the necessary cooling. However, this circulation is intermittent, and there may be substantial periods of time



when no such circulation takes place. The invention contemplates that separate pumps can be used to deliver fresh water to the tank and to circulate water through the distribution line. Under such circumstances, the circulation of the carbonated water to cool the distribution line may be under the control of a thermostat.

What is claimed is:

1. A system for supplying carbonated water in refrigerated condition at the point of use which comprises, a carbonating and cooling unit which comprises a storage tank for a body of carbonated water with a carbonating section which is adapted to be occupied by an atmosphere of carbon dioxide gas and refrigeration means to cool the tank and the water, faucet means, a distribution line extending from adjacent the bottom of said tank to said faucet means, means to provide for the flow of carbon dioxide to said carbonating section at a controlled pressure which is such as to cause the carbonated water to flow from said tank to said faucet means, spray means within said carbonating section which is adapted to spray fresh water into the carbon dioxide atmosphere thereby to produce carbonated water, means constituting a supply of fresh water, pump means, means connecting an inlet side of said pump means to said means constituting a supply of fresh water and a discharge side of said pump means to said spray means whereby fresh water is delivered to said carbonating section and is thereby carbonated, a carbonated water return line extending into said tank and having a water discharge opening below the level of water in said tank, said distribution line having a remote end which provides a flow path beyond said faucet means from said tank, a normally closed first valve means connected at one side to normally close said remote end of said distribution line and connected at its other side to said inlet side of said pump whereby the opening of said first valve means connects said pump to receive carbonated water from said remote end of said distribution line, and second valve means operative to disconnect said discharge side of said pump means from said spray means and to connect it to said carbonated water return line.

2. A system as described in claim 1 which includes, control means which operates said first and second valve means automatically whereby substantially all fresh water is delivered to said spray means and substantially all carbonated water is delivered through said return line to the body of carbonated water within said tank.

3. A system as described in claim 2 wherein said control means includes, a water level control unit which opens said first valve means and operates said second valve means in response to a rise in the level of carbonated water in said tank to a predetermined level and which closes said first valve with a corresponding operation of said second valve upon a predetermined drop in said level.

4. A system as described in claim 1 wherein said faucet means comprises a plurality of faucets positioned in series and wherein said refrigeration means includes an evaporator enclosed within an aluminum casting positioned around the sides of said tank.

5. A system as described in claim 1 which includes, a water-cooling coil connected in series between said pump means and said second valve means to cool the water discharged by such pump means.

6. A system as described in claim 1 wherein said pump means comprises a single pump which is operated continuously.

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