

Feb. 10, 1948.

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REFRIGERATED LIQUID DISPENSING APPARATUS

Filed Feb. 27, 1943

3 Sheets-Sheet 1

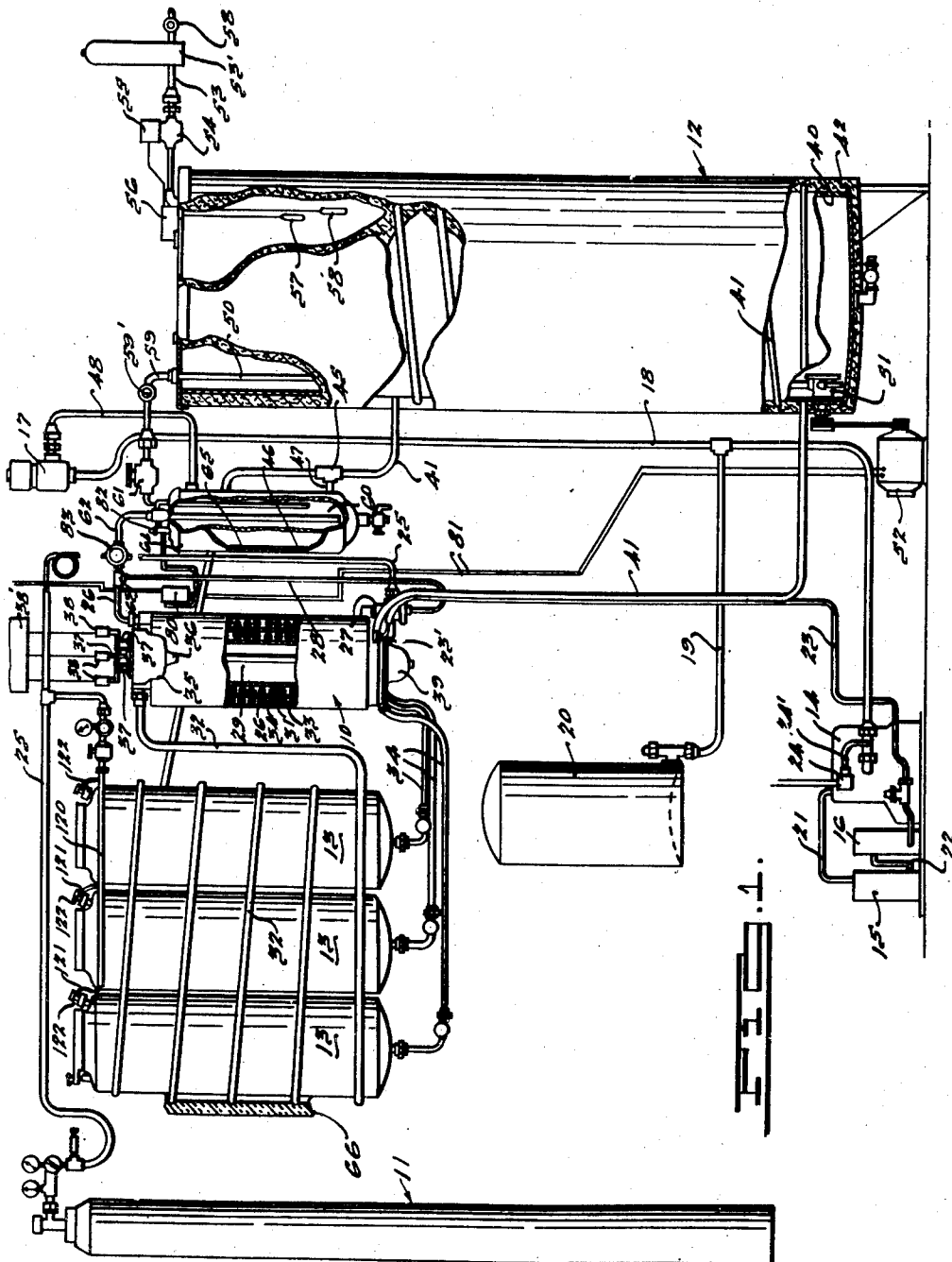


FIG. 1.

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3 Sheets-Sheet 2

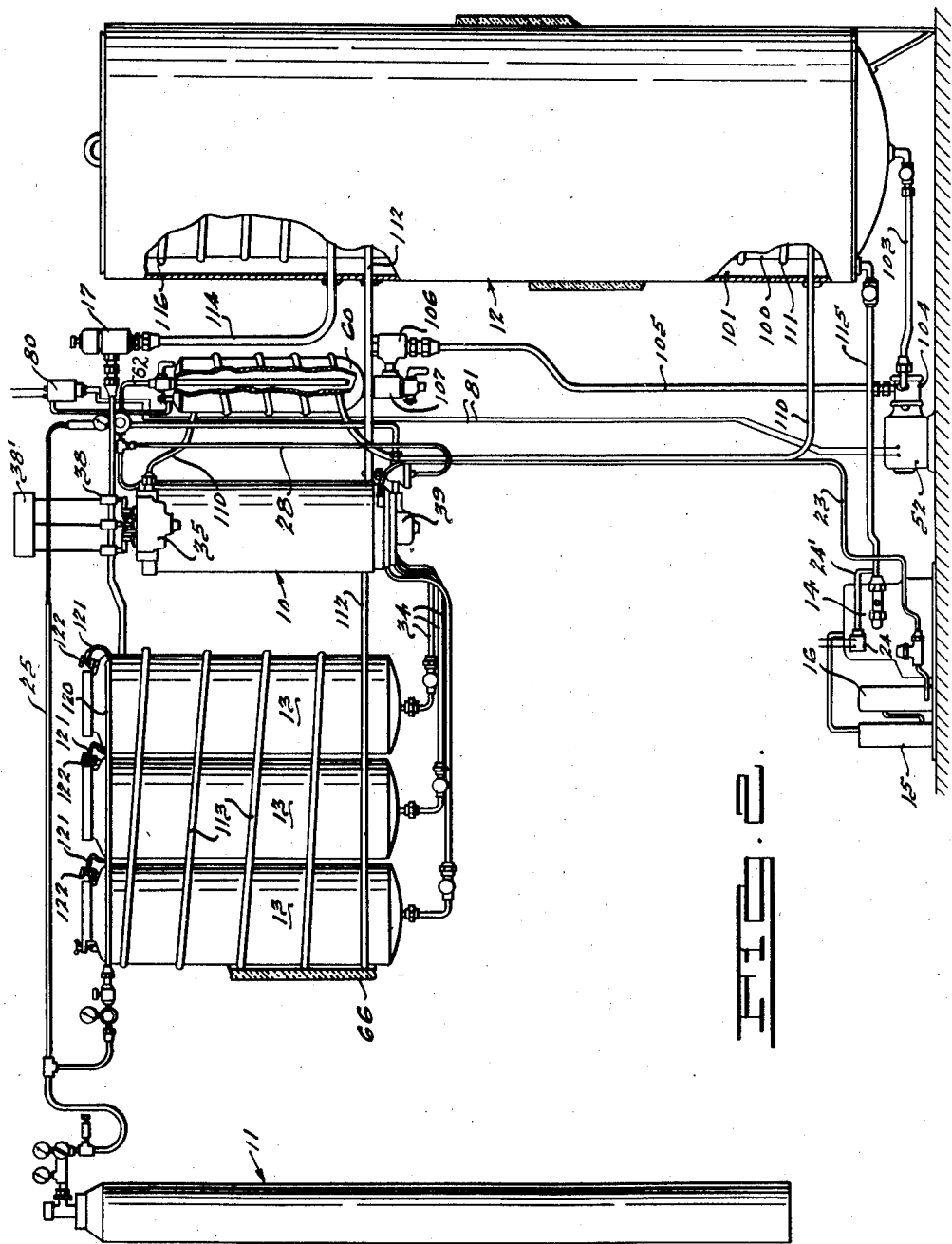


FIG. 2.

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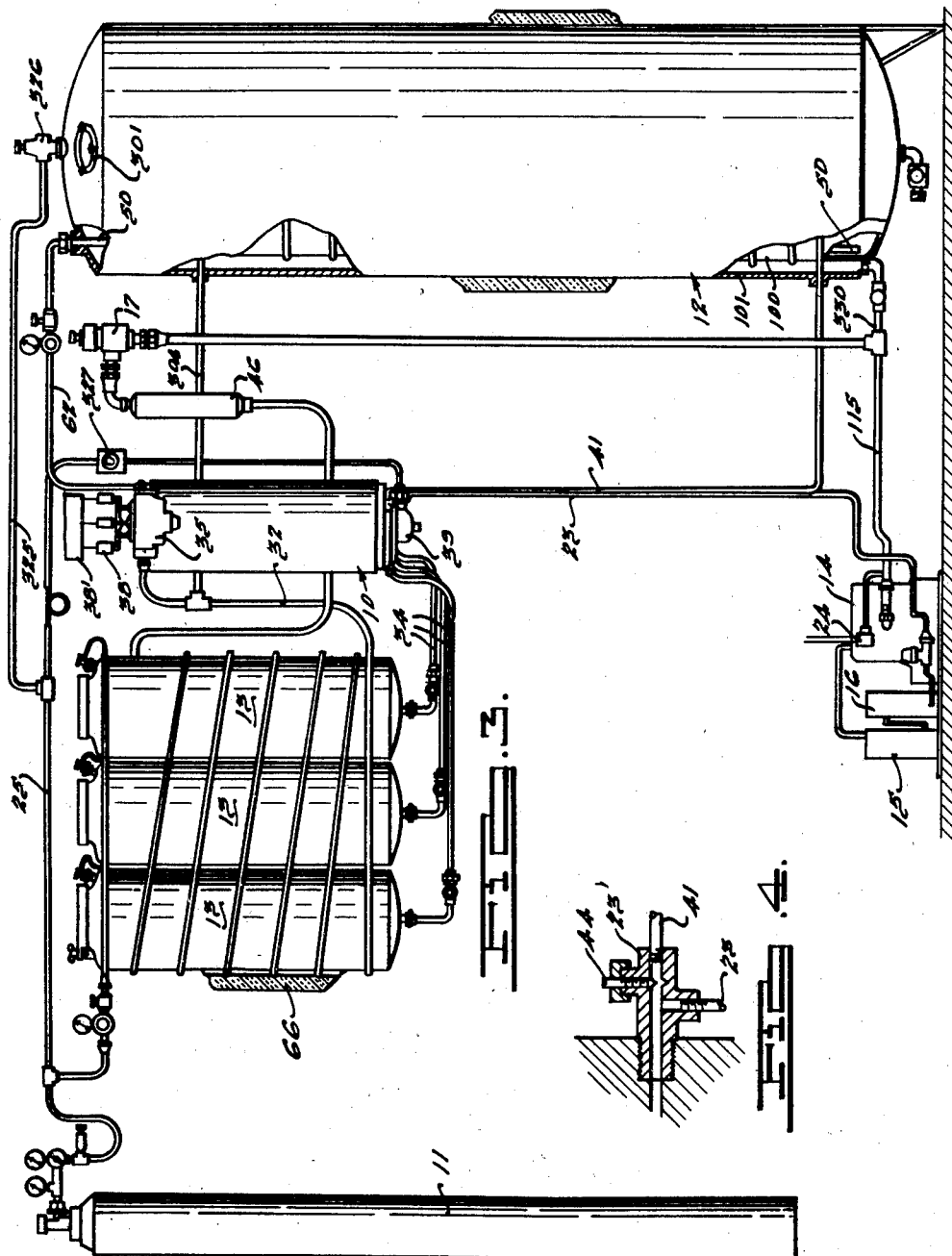
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REFRIGERATED LIQUID DISPENSING
APPARATUS

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Application February 27, 1943, Serial No. 477,465

18 Claims. (Cl. 62-141)

1

This invention relates to liquid dispensing systems and more particularly to mechanically refrigerated systems having an instantaneous carbonator device and a flavored liquid source arranged to automatically dispense beverages.

An object of the invention is to provide a system of the type referred to with a mechanical refrigerating system that will operate at maximum efficiency during peak draft periods.

Another object of the invention is to provide a system for dispensing beverages with which a relatively small capacity mechanical refrigerating system can be utilized to maintain a desired drink temperature at various rates of draft.

Another object of the invention is to improve the efficiency of a refrigerating system for carbonators by utilizing refrigerant during off cycles to precool a supply of water prior to entering the carbonator.

Another object of the invention is to utilize the expanded refrigerant gas flowing from a mechanically refrigerated carbonator for precooling a flavored liquid to be dispensed with carbonated water from the carbonator.

Other objects will appear as the description of the invention proceeds.

In the accompanying drawings,

Fig. 1 is a diagrammatic view of a system incorporating the invention;

Fig. 2 is a diagrammatic view of another system incorporating the invention;

Fig. 3 is still another diagrammatic view of another system incorporating the invention;

Fig. 4 is a sectional view of the refrigerant distributing coupling for the carbonator and the water tank shown in Figs. 1 and 3.

The refrigerated beverage dispensing system illustrated in Fig. 1 has a carbonator device 10, a carbon dioxide cylinder 11, a water supply storage tank 12 and a plurality of liquid containers 13. A mechanical refrigerating system is utilized to cool the tank, the carbonator device and the liquid containers, such system including a sealed electric motor and compressor unit 14, condenser 15, liquid refrigerant receiver 16, which may have a high side float, and suction control valve 17. The suction control valve is connected with the refrigerant return conduit 18 leading to the compressor, and leading off from the return conduit is a branch conduit 19 connected with a pressure equalizer chamber in tank 20. The compressor is connected with the condenser by conduit 21 and the condenser is connected with the liquid refrigerant receiver by conduit 22. Conduit 23 leads from the receiver

2

to feed refrigerant directly to the carbonator and the water tank and if a high side float is not used in receiver 16 conduit 23 is made small enough in diameter to restrict refrigerant flow therethrough. A cut-in switch 24 for the motor is under control of pressure in the return line by means of tube 24'.

The carbonator is of the instantaneous type and can be of the same construction as shown in my pending application Serial No. 471,784, filed January 8, 1943, which has matured into Patent No. 2,396,460, granted March 12, 1946. The carbon dioxide gas cylinder is connected with the carbonator by conduit 25. Water flows to the carbonator through conduit 26 which extends downwardly through the carbonator to a mixing and metering device 30 in the bottom portion of the carbonator where it mixes with carbon dioxide gas from conduit 25. A control valve device 27 is arranged in conduit 25 and is under control of the water pressure in conduit 26 through means of conduit 28, such arrangement controlling carbon dioxide gas flow to the carbonator in accordance with water pressure in conduit 26, as shown in my pending application Serial No. 467,547, filed December 1, 1942, which has matured into Patent No. 2,401,915, granted June 11, 1946. The carbonator has an interior storage chamber 29 into which the mixture of water and carbon dioxide flows from the mixing and metering device 30 at the base of the carbonator. Water conduit 26 is coiled in chamber 31 surrounding the storage chamber and connects with the metering and mixing device, and the carbon dioxide conduit 25 also connects with such mixing device. Refrigerant conduit 23 is connected with the bottom of chamber 31 by a two-way fitting 23' and conduit 32 leads from the top of such chamber and coils around the containers 13. Another chamber 33 surrounds the refrigerant chamber in the carbonator and can be filled with a suitable liquid, such chamber having tubes 34 coiled therein. These coiled tubes are connected with receptacles 13 which can contain different kinds of syrup, fruit juices or other similar liquids to be mixed with the carbonated water.

A faucet structure 35 is fixed preferably to the carbonator and in thermal contact therewith and can be of the type shown in my Patent No. 2,396,460 previously referred to. The faucet has an outlet nozzle 36 communicating with the carbonated water chamber in the carbonator and communicating by separate passages with the upper ends of tubes 34. Valve mechanisms 37 are

3

arranged to control flow of carbonated water and a selected syrup through the faucet, such valves being of the type shown in my first referred to application and actuated by solenoids 38. The solenoids can be arranged to be controlled by suitable coin operated switches and suitable mechanism 38' for regulating the timing of liquid flow.

The water storage tank 12 can be formed of any shape metal shell 40 having a refrigerant conduit 41 coiled around and in thermal contact with it and enclosed by an insulation jacket 42. This conduit 41 branches off from conduit 23 adjacent the carbonator through a coupling 23' in which a valve 44 is arranged to restrict refrigerant flow to the water tank. The upper end of refrigerant conduit 41 leading from the water tank is connected with a coupling 45 and the refrigerant conduit 32 leading from receptacles 13 is also connected to this coupling.

The coupling 45 is connected with an accumulator chamber 46 by conduit 47. Conduit 48 leads from the accumulator chamber to the suction control valve 17 and forms a portion of the refrigerant return line 18.

It is desirable to maintain a certain level of water in the tank 12 and to move water from the tank through the carbonator metering and mixing device in the same volume as carbonated water is drawn from the carbonator. A water outlet tube 50 extends through the top of the tank and the inlet end of such tube is attached to the pump and is adjacent the bottom of the tank. Pump 51 is arranged in the tank to move water through tube 50 under pressure and is driven by an electric motor 52. Such inside pump arrangement prevents loss of refrigeration.

The water level in the tank can be maintained by automatic means. A water inlet conduit 53, connected with a suitable water supply under pressure, opens into the top of the tank and flow therethrough is controlled by a valve indicated by numeral 54. This valve can be operated by a solenoid 55 in an electric circuit having switch mechanism 56 under control of members 57 and 58 suspended in the tank. The valve 54 is opened when the water level drops below member 58 and the valve is closed when the water level contacts member 57, such electrical valve control mechanism being conventional. The water flow can be controlled manually by shut off valve 58. The conduit 53 can have a filter and deodorizer 53' therein.

Pipe 50 connects with pipe 53 leading into a pressure equalizing chamber 60 and back flow can be eliminated by check valve 61. A shut off valve 59' is arranged in pipe 59. A water outlet tube 62 leads from the bottom of the equalizer chamber and is connected by a coupling 63 with conduits 26 and 28. The water equalizer chamber and the refrigerant accumulator chamber 46 can be formed as a unitary structure consisting of telescoped shells 64 and 65. Shell 65 forms the interior water chamber and the refrigerant accumulator chamber is between the shells.

The containers 13, the carbonator 10 and the accumulator and equalizer unit are preferably enclosed by suitable insulation as indicated by numeral 66. Insulation can be utilized for the component parts of the system as may be desirable. It will be understood that the parts of the system described can be arranged and formed to fit within the confines of a cabinet chamber outside of which only the faucet nozzle may project.

Liquid refrigerant in the carbonator cools the

4

water inlet conduit 26 in chamber 31 therewith, it cools the carbonated water stored in chamber 29 and the mixing device and faucet in thermal relation therewith. Refrigerant in the carbonator structure also cools the syrup tubes in the surrounding chamber 33. As the liquid refrigerant is expanded in the carbonator chamber 31, it flows out into conduit 32 as a moist gas which has the effect of keeping the liquids in containers 13 at a lowered temperature, but not sufficiently low to interfere with flow when the faucet valves are opened. Thus the liquids in the containers are precooled, without reducing the efficiency of the refrigerating system, before entering the carbonator while passing through the carbonator device and the faucet. Because liquids are precooled in the chambers during idle dispensing periods, beverage may be dispensed at a rapid rate without adding load to the compressor and the cold syrup will prevent liberation of gas from the finished drink or cause excessive foam.

Water has been previously cooled in the conduit through which it flows to a remote carbonator by direct heat transfer, but the capacity of such refrigerating systems used in automatic beverage dispensing cabinets has not been sufficient to maintain desired low water temperature when the draft rate is at peak loads because the compressor can not maintain low enough suction pressure to continuously dispense beverages at desired temperature. In another water cooling system, a refrigerant coil is immersed in water in a tank and an ice formation is built up on the coil during the idle draft periods. In this system the water is cooled by a coil immersed in the water bath. The heat of the water in the coil has to be transferred by water conductivity to the ice formation by thermo syphon action which is relatively slow and the cooling capacity is further limited by the ice bank and the capacity of the compressor operating at low suction pressure to replenish the ice. While such system stores refrigeration when no beverage is being drawn, its efficiency is low compared to one having a compressor of similar capacity which can operate at a higher suction pressure, such as this system which utilizes that idle time to cool the whole body of water by the direct heat transfer method previously referred to. With the present system, liquid refrigerant flows from the receiver to the carbonator and water cooling tank through conduit 23. The opening in the conduit leading to the carbonator is larger than the restricted orifice leading to the tank refrigerant supply. The amount of and rapidity of cooling in the tank can be controlled by the valve 44. Refrigerant will continuously flow to the tank even though the float valve is closed in the receiver because the liquid refrigerant in the carbonator will flow downward through conduit 41 when the compressor is inactive. When the demand for instantaneous cooling is great the major portion of compressor capacity will be utilized by the carbonator because the refrigerant passages are larger and the resistance is less. Therefore, greater amount of liquid refrigerant will flow to the carbonator and less to the tank coil. Thus with this system there is instantaneous or direct cooling of the water at maximum efficiency because of the advantage gained by refrigerating the water tank at full compressor capacity when refrigeration supply is not required by the carbonator.

As the expanded refrigerant from the water

5

tank and from around the containers 13 flows into the accumulator, the interiorly located water pressure equalizer will to some degree be maintained at low temperature. Also, this arrangement accumulates liquid refrigerant and thereby prevents frosting back on line 18. The water pressure equalizer chamber has an air cushion therein above the open bottom ends of the water tubes 62 and 59 against which the water from the tank is pumped. Connected with the top of the water chamber 60 is a conventional pressure responsive switch 80 cooperating with wires 81 in an electric system for cutting the electric pump motor 52 in and out. The chamber 60 has an air check valve 82 connected therewith by means of which air can be pumped into the chamber to some suitable pressure, such as 60 pounds, when the water pressure is below such pressure. The pressure responsive switch will cut in at some pressure above the mentioned air pressure, say at 65 pounds, and will cut out at a higher pressure, say at 105 pounds, such switch operating pressure being higher than the pressure regulating setting of water control valve 83 between conduit 62 and conduit 26 leading to the carbonator. This air cushion acts against the water to retard pressure reduction in chamber 60 upon water withdrawal and by so reducing pressure drop the control switch 80 will be actuated to prevent short cycling of the pump operating motor. The beverage dispensing system is cooled by direct heat transfer at maximum efficiency because of high suction pressure operation of the compressor. Thus, peak dispensing loads can be adequately taken care of with a refrigerating system and carbonator device that can be housed in a relatively small cabinet or dispensing station.

Fig. 2 shows a modified dispensing system similar in many characteristics to that shown in Fig. 1. In the tank 12 is arranged a shell 100 for containing water and spaced from such tank to form a refrigerant chamber 101. Water is poured into the shell from time to time through the top and the water outlet tube 103 leads from the bottom of the tank to an exterior pump 104 driven by electric motor 52. The pump connects with the water pressure equalizer chamber 60 by means of conduit 105 having a check valve 106 and a screen 107 therein. Water flows from the equalizer chamber to the carbonator through conduit 62 and the chamber has the air ceiling cushion and pressure control switch 80 communicates with the chamber for controlling the pump motor as in Fig. 1. The carbonator device, the mixing and metering device, the faucet and the containers for syrup and the connections to the faucet are the same as previously described. Likewise, the carbon dioxide connections with the syrup containers and the metering device are the same as described in connection with Fig. 1.

The refrigerating system is different in Fig. 2 from that previously described in that the feed line 23 carries all the refrigerant from the high side float valve controlled receiver 16 to the refrigerant chamber 31 in the carbonator. In Fig. 2, the refrigerant outlet conduit 110 is coiled around the water pressure equalizer and then extends into the bottom of chamber 101, as indicated at 111, then it coils upwardly around the water shell 100 and passes out of the water tank as indicated at 112. The conduit portion 112 continues in a coil 113 around containers 13 and is connected with suction control valve 17. A coiled refrigerant conduit 114 lies in the upper part of chamber 101 and conduit 114 leads from the suc-

6

tion control valve into the chamber 101 above conduit coil 111, and coils upwardly around the water shell. The upper end 116 of this coiled conduit 114 opens into the top of chamber 101 and the bottom of chamber 101 is connected with the compressor by return conduit 115.

In Figs. 1 and 2, the CO² feed line 25 has a branch line 120 having arms 121 leading into the tops of the containers to create pressure on the liquid therein to cause its flow through conduits 34 when the faucet is opened. Check valves 122 are arranged in arms 121 so that the flavors of the liquids in the containers will not pass into the CO² feed conduit 25.

In the form of the invention shown in Fig. 2, the motor for the compressor can be controlled by pressure switch 24 as in Fig. 1. In this form of the invention the refrigerant pressure equalizer is formed by chamber 101 and functions the same as in tank 20 in Fig. 1, to prevent short cycling of the compressor.

In Fig. 2, the refrigerant upon leaving the suction control valve passes around the upper portion of the water shell 100 and forms ice on the inside thereof. In this form of the invention, the refrigerating system has a larger refrigerant charge than the system in Fig. 1 and sufficient so that when the compressor has functioned to reduce temperature in the carbonator, water tank and containers, enough liquid refrigerant passes the suction control valve at a low pressure and temperature to build up ice on the inside of the water shell. With such arrangement, the ice formed in the tank has direct contact with the water thereby aiding in lowering the water temperature when a supply of warm water is introduced. This water cooling system for the tank could be used equally as well with the system shown in Figs. 1 and 3.

The modified form of the invention shown in Fig. 3 has some of the features of the invention as shown in Figs. 1 and 2 together with somewhat different arrangements of the refrigerant and water circuits. The water tank 12 has the interior shell 100 of Fig. 2 for storing water and also the surrounding chamber 101. Water can be supplied to the shell through a port 301 and an outlet tube 50 similar to that in Fig. 1 is provided, such tube being connected directly with the carbonator inlet tube 62.

The water chamber in the tank is connected to the carbon dioxide feed conduit 25 by a branch conduit 325 and a shut off valve 326 is arranged in the branch conduit. The water will mix with the gas in the tank and such carbonated water flows through conduit 62 to the carbonator mixing and metering device 39. The gas pressure in this form of the invention eliminates the necessity of the water pump and water equalizer tank required in the previously described forms of the invention. Carbon dioxide gas flows to the mixing device through conduit 25 as in the other forms of the invention where it mixes with the carbonated water mixture from the tank. As the pressure in the tank and the gas conduit are the same, no water pressure regulation of the gas supply will be required to obtain a constant mixture ratio, however, an automatic timer 327 is arranged in the gas conduit to decrease flow after the water and gas in the tank have been in contact a sufficient length of time for saturation. Thus, the ratio of gas to water mixture in the carbonator is maintained substantially constant.

Water is poured into the tank at intervals as required through port 301 when a suitable clo-

sure is removed and valve 326 must be closed during such times. This system is of particular advantage where replenishment of the water is required only occasionally and during off draft times.

Refrigerant flows to the carbonator as previously described in the embodiment of the invention shown in Fig. 1. Refrigerant flows from the carbonator around the syrup containers through conduit 32 and back to accumulator 46 but the refrigerant conduit 41 around the tank flows into conduit 32. The accumulator connects with suction control valve 17 and refrigerant flows from the valve to conduit 115 through which it returns to the compressor, such conduit having a branch 330 opening to the tank chamber 101 as shown in Fig. 3 to provide pressure equalizing of the returning refrigerant to prevent short cycling of the compressor.

Various changes can be made in the several embodiments of the invention shown and described without departing from the spirit of the invention and the scope of the appended claims.

What is claimed is:

1. In a dispensing apparatus for carbonated water, the combination with a carbonator having a cooling chamber therein and a tank for supplying water to the carbonator and having a cooling coil in thermal relation therewith, of a mechanical refrigerating system comprising a liquid refrigerant feed conduit connected with the chamber in the carbonator, a branch conduit connecting the feed conduit directly with the tank coil, said branch conduit extending downwardly in relation to drain the carbonator chamber of refrigerant when the system is not operating, and a return line connected with the outlet ends of the chamber and the coil.

2. In a beverage dispensing apparatus, the combination with a carbonator having a cooling chamber therein, a tank for supplying water to the carbonator, and a container for flavored liquid to be mixed with carbonated water from the carbonator, of a refrigerating system comprising a conduit for feeding liquid refrigerant to the carbonator chamber, a branch conduit open to the other conduit and coiled around and in thermal contact with the tank, a refrigerant return conduit connected with the chamber and coiled around the container, and means connecting the conduit coiled around the tank with the return conduit.

3. A mechanical refrigerating system, in combination with a carbonator and a water tank connected to said carbonator, said system including means for feeding liquid refrigerant to said carbonator and in thermal relation with said tank, an accumulator, means connecting the carbonator and the means in thermal relation with the tank to conduct refrigerant to the accumulator, a refrigerant return conduit connected with the accumulator, a suction pressure control valve in the return conduit, and pressure equalizing means connected with the return conduit.

4. In a beverage dispensing apparatus, a carbonator, a source of carbon dioxide gas connected with said carbonator, a water supply means for said carbonator including a storage tank, a cooling chamber in the carbonator, a coiled conduit in thermal relation with said tank, a syrup container connected to dispense syrup at a station with carbonated water from the carbonator, and a mechanical refrigerating system having liquid refrigerant feeding means connected directly with the chamber in the carbonator and with the coiled

conduit around the tank, a conduit connected with said carbonator chamber and coiled around the syrup container, an accumulator connected with said coiled conduits, a return conduit leading from the accumulator, and a suction pressure control valve in the return conduit.

5. A mechanical refrigerating system of the compressor-condenser-receiver type, in combination with a carbonator and a tank for water connected to said carbonator, said system including liquid refrigerant feeding means connecting the receiver with the carbonator, means in thermal relation with the tank connected with the refrigerant feeding means, a refrigerant accumulator connected with the carbonator and the means in thermal relation with the tank, a refrigerant return connection between the accumulator and the compressor, a suction pressure control valve in the return connection, a pressure equalizer connected with the return connection between the valve and the compressor, an electric motor for operating said compressor, and means responsive to equalizer influenced pressure conditions for controlling operation of said motor.

6. In a carbonated water dispensing apparatus, a carbonator, a source of water under fluctuating pressure, conduit means through which water flows from the source to the carbonator, pressure equalizer means in the conduit means, and a mechanical refrigerating system connected to transfer heat from the source of water, the carbonator and the equalizer means.

7. In a dispensing apparatus for carbonated water, the combination with a carbonator having a refrigerant chamber therein and a water tank, said tank having a water connection with the carbonator and a refrigerant chamber, of a mechanical refrigerating system comprising a compressor, a condenser, a receiver, liquid refrigerant feeding conduit means leading from the receiver and branching to the carbonator and the tank refrigerant chambers, the conduit means leading to the tank chamber having less capacity than the conduit means leading to the carbonator chamber, said conduit means leading to the tank chamber being arranged to receive liquid refrigerant from the carbonator chamber when the compressor is inactive, and return refrigerant conduit means leading from the chambers to the compressor.

8. In a dispensing apparatus for carbonated water, the combination of a carbonator having a refrigerant chamber, a water tank having a surrounding pressure equalizer chamber and a water connection with the carbonator, and a mechanical refrigerating system having a compressor, a condenser, a receiver, a liquid refrigerant conduit leading to the carbonator chamber from the receiver, a return conduit leading from the carbonator chamber to the compressor, a connection establishing communication between the tank chamber and the return conduit, and a suction pressure control valve in the return conduit between the carbonator chamber and the connection with the equalizer chamber.

9. In a dispensing apparatus for carbonated water, a carbonator, a water supply tank, means through which water from the tank is moved under pressure to the carbonator including a pressure stabilizing device, and a mechanical refrigerating system for the carbonator having a return line in thermal contact with the stabilizer and the tank.

10. In a dispensing apparatus for beverages, a carbonator, a water supply tank, means for mov-

ing water under pressure from the tank to the carbonator, syrup containers, a mechanical refrigerating system having a refrigerant conduit leading to the carbonator, and a refrigerant return conduit leading from the carbonator into thermal contact with the containers and then in thermal contact with the tank.

11. In a dispensing apparatus for beverages, a carbonator, a water supply tank connected with the carbonator, containers for syrup connected to dispense syrup with the carbonated water from the carbonator, and a mechanical refrigerating system having means for conducting refrigerant to have thermal relation with the carbonator, then with the tank, then with the containers and back again with the tank.

12. In a dispensing apparatus for beverages, a carbonator having a refrigerant chamber therein, containers from which syrup is dispensed with carbonated water from the carbonator, a water supply tank connected with the carbonator, a chamber around the tank, and a mechanical refrigerating system having a compressor, a condenser, a receiver, a feed line leading to the carbonator chamber from the receiver, a conduit leading from the carbonator chamber and around the lower portion of the tank, the containers and the top portion of the tank, said conduit leading from the carbonator chamber finally opening into the chamber around the tank, and a return conduit leading from the chamber around the tank to the compressor.

13. In a dispensing apparatus for beverages, a carbonator having a refrigerant chamber therein, containers connected to dispense syrup with carbonated water from the carbonator, a water tank connected to supply water under pressure to the carbonator, a chamber around the water tank, and a mechanical refrigerating system having a liquid feed line connected with the carbonator chamber, a return line connected with the tank chamber, an intermediate conduit having a portion leading from the carbonator chamber and coiled around the tank in the surrounding chamber, said intermediate conduit having a portion coiled around the containers and another portion coiled around the tank and open to the surrounding chamber, and a suction pressure control valve in the intermediate conduit between the portion around the containers and the portion open to the tank chamber.

14. In a dispensing apparatus for beverages, a carbonator having a refrigerant chamber, syrup containers connected to dispense syrup with carbonated water from the carbonator, a water tank connected to supply water under pressure to the carbonator, and a mechanical refrigerating system having a compressor, a condenser, a receiver, a liquid refrigerant conduit leading from the receiver to the carbonator chamber, another liquid refrigerant conduit connected with the receiver and coiled around the water tank, and a return refrigerant conduit leading from the carbonator chamber to the compressor and in thermal contact with the containers, said conduit coiled around the water tank communicating at its outlet end with the return line between the carbonator and the containers.

15. In a dispensing apparatus for a beverage, a carbonator having a refrigerant receiving chamber therein, a water tank connected with the carbonator, means for moving water under pressure from the tank to the carbonator, a pres-

sure equalizer chamber around the tank, syrup containers connected for draft with carbonated water, and a mechanical refrigerating system comprising a compressor, a condenser, a receiver, means for feeding refrigerant from the receiver to the carbonator chamber, a refrigerant conduit leading from the carbonator chamber and in thermal contact with the tank and the syrup containers and connected with the pressure equalizer chamber, and a conduit connecting the equalizer chamber with the compressor.

16. In a dispensing apparatus for carbonated water, a carbonator having a refrigerant receiving chamber, a water supply tank connected with the carbonator, a pressure equalizer chamber around the tank, and a mechanical refrigerating system having a compressor, a condenser, a receiver, a refrigerant feed conduit from the receiver to the carbonator chamber, a refrigerant conduit connecting the carbonator chamber with the chamber around the tank, and conduit means connecting the equalizer chamber with the compressor.

17. In a dispensing apparatus for carbonated water, a carbonator having a refrigerant receiving chamber, a water supply tank, means through which water can flow from the tank to the carbonator including a pressure stabilizing device, and a mechanical refrigerating system having a compressor, a condenser, a receiver, a conduit connecting the receiver with the carbonator chamber and a refrigerant return conduit between the carbonator and the compressor in thermal contact with the stabilizing device.

18. In a dispensing apparatus for carbonated water, the combination of a carbonator having a refrigerant chamber, a water tank having a water connection with the carbonator, and a mechanical refrigerating system having a compressor, a condenser, a liquid receiver, a liquid refrigerant conduit means leading from the receiver to the carbonator, a refrigerant return means leading from the carbonator chamber to the compressor and having a portion thereof in thermal relation with the water in the tank, and a suction pressure control valve in the return means between said carbonator and the portion in thermal relation with the water in the tank.

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