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APPARATUS FOR COOLING AND CARBONATING LIQUIDS

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Fig. 1

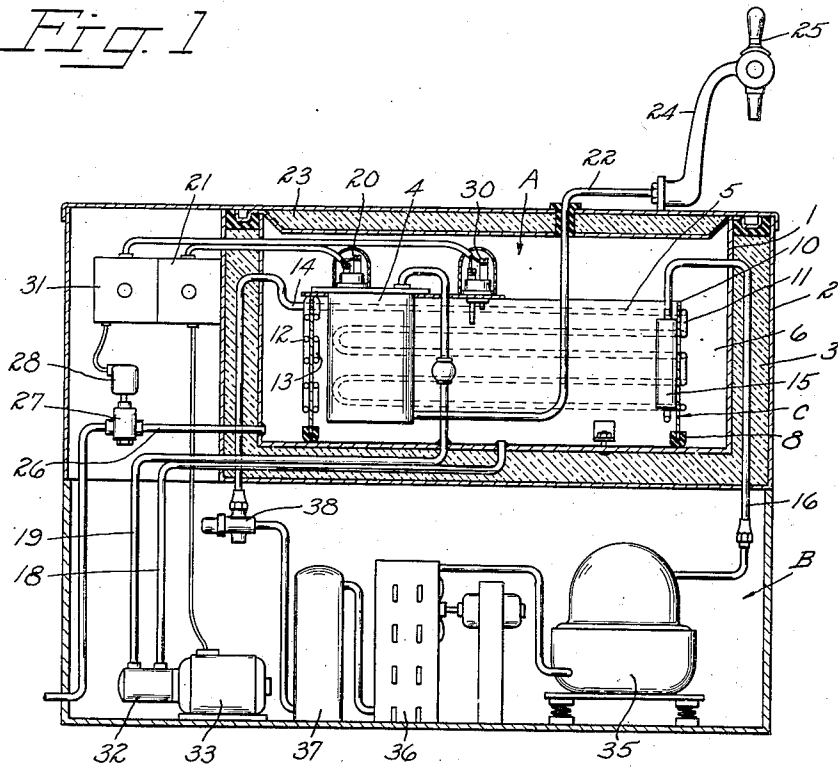
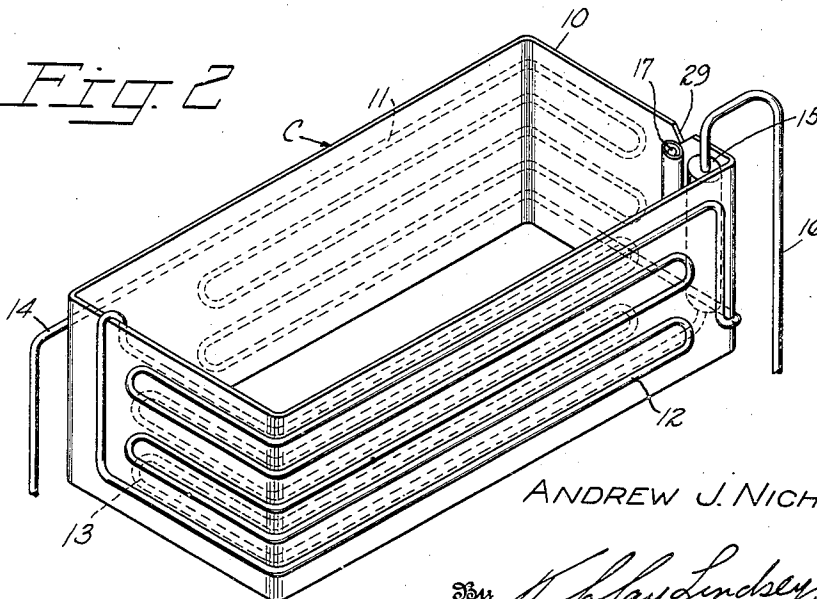


Fig. 2



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APPARATUS FOR COOLING AND
CARBONATING LIQUIDS

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6 Claims. (Cl. 62-141)

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The present invention relates to refrigeration means, and more particularly to a refrigerating apparatus of the mechanical type which may be utilized, for example, for providing cold carbonated water in a continuous or intermittent flow, and which has particular usefulness in connection with soda fountains and the like.

It is an object of the present invention to provide a refrigeration means which will provide large quantities of liquid at or near its freezing point while, at the same time, the apparatus is so designed that freezing over of the liquid in the apparatus is effectively prevented.

A further object of the invention is to provide an apparatus which is compact and of relatively small dimensions, and which at the same time will function as a heavy duty device in that it will have a large capacity for furnishing large quantities of cooled liquid either continuously or intermittently.

Another object of the invention is to provide a device for cooling liquids which may be combined with a carbonating apparatus and in which the reserve of cooled liquid is utilized as a source of liquid to be carbonated and as a coolant to cool the liquid after carbonation.

Another object of the invention is to provide a device which is fully automatic in operation and which may be easily and readily assembled and serviced.

The accomplishment of the above and other objects and advantages of the invention will be readily apparent from the following description of a specific embodiment of the invention shown in the drawings in which

Figure 1 is a cross sectional view of the assembled apparatus; and

Fig. 2 is a view in perspective of the refrigerant evaporator assembly formed in accordance with the invention.

Referring to the drawings, the device is shown in the form of a box-like casing comprising a fluid compartment A and an L-shaped compartment B. The compartment A is a fluid reservoir and cooling compartment and consists essentially of an inner casing 1 and outer casing 2 having insulated material 3 therebetween. Disposed within the inner casing 1 is a novel refrigerant evaporator assembly C, a carbonating device 4, and control means and connections, all of which will be described more particularly hereinafter.

Referring to the evaporator assembly C, which is designed in accordance with the invention and which is more particularly shown in Fig. 2, the assembly comprises an open top rectangular

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metal partition member 10 which is of smaller dimensions than the inner casing 1 and which is mounted on a gasket 8 on the base of the compartment A so as to form a watertight connection therewith. The partition member 10 thus divides the compartment A into an inner compartment 5 and the relatively narrow annular outer compartment 6. The exterior surfaces of the partition member 10 are covered with continuous tubing assemblies 11 and 12 adapted to function as refrigerant evaporator coils. Each of the tubing assemblies covers two adjacent outer sides of the partition member 10. For convenience in assembly and fabrication, the tubing assemblies 11 and 12 may be formed in identically the same way and then assembled to the exterior of the partition member 10.

The interior of the partition member 10 is provided with a similar tubing assembly 13 which, in the embodiment shown, covers only two adjoining inner sides of the partition member 10.

The tubing assemblies 11, 12 and 13 are so formed and so connected that refrigerant under compression may enter at the inlet tube 14 disposed at one corner of the partition member 10 and will follow a circuitous or tortuous path along the surfaces of the partition member 10. In this way, the refrigerant is caused to flow back and forth and from top to bottom through the tubing assembly 11 adjacent two outer sides of the partition member 10 and from thence the refrigerant is conducted to the top of the second tubing assembly 12 where it travels back and forth and from top to bottom across the remaining two outer surfaces of the partition member 10, and from there the refrigerant is piped over the top of the partition member 10 to enter the tubing assembly 13 where the back and forth and top to bottom flow is repeated, the refrigerant eventually reaching a conventional surge tank 15 positioned adjacent one corner of the partition member 10.

The remaining portions of the refrigerant circuit are conventional and will be only briefly described. The vaporized refrigerant from the surge tank 15 is conducted through pipe 16 to a conventional refrigerant compressor 35 and from there through the condenser 36 and liquid receiver 37, following which it is readmitted to the evaporator assembly C through a conventional expansion valve or capillary means 38 which controls the refrigerant pressure.

A conventional temperature control bulb 17 is mounted at the upper corner of the evaporator assembly C adjacent the surge tank 15 which

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location, being also adjacent the tubing assemblies 12 and 13, is at substantially the coldest point of the reservoir when there is no flow of liquid through the reservoir. Suitable connections, not shown in the drawings, are provided between the temperature control bulb 17 and the compressor 35 for starting and stopping the compressor motor as required by fluctuations of temperature within the liquid compartment A.

At the end of the evaporator assembly C opposite from the surge tank 15 there is disposed the carbonating device 4 previously referred to. Fluid connections 18 and 19 are provided between the carbonating apparatus 4 and the bottom of the inner compartment 5 through a conventional water pump 32 actuated by a suitable electric motor 33. An electric probe 20 is mounted in the top of the carbonating apparatus 4 and is connected through a solenoid operating switch 21 with the pump motor 33 whereby the liquid within the carbonating apparatus 4 is maintained within predetermined limits by the pump 32. A connecting line 22 to the carbonating apparatus 4 is provided extending through the insulated top member 23 of the assembly where it communicates with a draft arm 24 having a conventional withdrawal spigot 25.

The carbonating device 4 as such is not a part of the present invention and requires no detailed discussion. It comprises essentially a fluid container with means extending therein (not shown in the drawing) for carbonating water introduced therein. Examples of the type of carbonators which have been used successfully in the invention are shown in the patents to Phillips, No. 2,414,607, issued January 21, 1947, and No. 2,420,795, issued May 20, 1947.

Water is introduced into the bottom of the outer compartment 6 of the fluid compartment A by means of the line 26 which may be connected with any suitable supply of water under pressure, such as the usual water main. A valve 27 in the line 26 which is operated by solenoid means 28 is provided to control the flow of liquid into the compartment A. The liquid enters the bottom of the outer compartment 6 and by building up a sufficient volume overflows into the inner compartment 5. To insure that the water newly admitted will overflow into the evaporator assembly C adjacent the temperature control bulb 17 for the purpose hereinafter described, there is provided a V-shaped notch 29 in the partition member 10 adjacent the temperature control bulb 17.

A probe 30 is provided to control the liquid level within the inner compartment 5. The probe 30 actuates a switch 31 which is, in turn, connected to the solenoid means 28 for controlling the valve 27. When the level of water in the inner compartment 5 falls below a predetermined level, the valve 27 is opened to admit liquid to the outer compartment 6 which overflows into compartment 5 through the notch 29, and when the level of liquid in the inner compartment 5 has been raised in this way to a predetermined level, the valve 27 is again closed.

The operation of the device, when constructed as shown in the drawing and as described above, will be readily understood from the following description. The spigot 25 is turned on by the user to withdraw carbonated liquid from the carbonating device 4. When the liquid level in the carbonating device 4 drops below a predetermined level, the probe 20 actuates the switch 21 which, in turn, energizes the motor 33 thereby causing

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a fresh supply of water to be pumped into the carbonating device 4 from the bottom of the inner compartment 5. This pumping action continues until the probe 20 again shuts off the motor 33 when a predetermined maximum level of fluid is contained in the carbonating device 4. When the amount of fluid withdrawn from the interior of the evaporator assembly C causes the liquid level therein to drop below a desired minimum, the probe 30 energizes switch 31 which opens the water valve 27 and additional liquid is introduced into the bottom of the outer compartment 6. The relatively warm liquid thus introduced rises upwardly over the tubing assemblies 11 and 12 and, while still above freezing temperatures, flows over into the inner compartment 5 through the notch 29. This flow of liquid continues until sufficient level of liquid has been built up to cause the probe 30 to shut off the valve 27.

The flow of relatively warm water through the notch 29 is directed against the temperature control bulb 17 which may be set to turn off the compressor at substantially 32° F. and to turn it on at about 34° F. Thus the refrigerant compressor 35 is turned on at an early stage of the flow action even though the average temperature of the liquid in the inner compartment 5 has been little affected. The device thus is given inherent heavy duty characteristics in that the controls are extremely sensitive and the cooling means is actuated at an early stage of additional cooling requirement.

Because of the combination of location of control means and the path through which the water enters the compartment A as discussed above, it has been found that freezing over of the liquid in the compartment A is avoided even though the liquid is maintained at temperatures within a degree or two of freezing. However, a certain amount of icing takes place on the tubing assemblies 11, 12 and 13 during stand-by periods which has an additional or reserve refrigerant effect, that is, it increases the capacity of the apparatus whereby additional cooling means is built up during the stand-by periods of intermittent operation. As the relatively warm water enters the compartment A, the thickness of the ice on the tubing assemblies 11, 12 and 13 is reduced which, in addition to cooling the newly admitted water, has the added advantage of keeping the efficiency of the evaporator assembly C at a maximum value. In general, several repeated fillings of the carbonating device 4 is necessary in order to remove all of the ice.

The carbonating device 4 being immersed in the cooled liquid contained within the inner compartment 5 is maintained at a corresponding temperature so that carbonated water withdrawn through the spigot 25 is at a desired low temperature for most uses, such as the preparation of beverages which preferably are dispensed at a temperature below 40° F.

In view of the above description, it will be apparent that, in accordance with the invention, there is provided a self-contained packaged unit adapted for continuous automatic operation and having a large capacity despite its relatively small dimensions. As a specific example, a device prepared in accordance with the invention utilizing a one-third horsepower motor has been constructed with an eight and one-fourth gallon water cooler capacity, a carbonation rate of forty-two gallons per hour and a withdrawal rate of thirty to thirty-five gallons per hour, the whole

unit being no larger than fifteen inches wide, twenty-seven and one-half inches high, and thirty inches long.

Having thus described the invention, it will be apparent that the same may be modified by one skilled in the art within the scope of the invention, and all such modifications are intended to be included within the scope of the following claims.

I claim as my invention:

1. Refrigeration means comprising an insulated tank forming a fluid reservoir, an evaporator assembly disposed within said tank comprising a partition member dividing said reservoir into an inner compartment and an outer annular compartment and refrigerant conducting coils supported on the partition member, a carbonating device comprising a fluid container disposed within the inner compartment, means for supplying water to the outer compartment, means for permitting water to overflow from the outer compartment into the inner compartment, pumping means for pumping water from the inner compartment into the carbonating device, means for withdrawing carbonated water from the carbonating device, means in said device responsive to liquid level for controlling the pumping means to maintain the liquid level in said device within predetermined limits, means in said inner compartment responsive to liquid level for controlling said water supplying means to maintain the liquid level in said inner compartment within predetermined limits, means for supplying refrigerant to said refrigerant conducting coils, and temperature responsive means in said inner compartment adapted to control the operation of said refrigerant supplying means.

2. Refrigeration means comprising an insulated tank forming a fluid reservoir, an evaporator assembly disposed within said tank comprising a partition member dividing said reservoir into an inner compartment and an outer annular compartment and refrigerant conducting coils supported on the partition member, a carbonating device comprising a fluid container disposed within the inner compartment, means for supplying water to the bottom of the outer compartment at one end thereof, means at the opposite end of the compartment for permitting water to overflow from the outer compartment into the inner compartment, pumping means for pumping water from the bottom of the inner compartment into the carbonating device, means for withdrawing carbonated water from the carbonating device, means in said device responsive to liquid level for controlling the pumping means to maintain the liquid level in said device within predetermined limits, means in said inner compartment responsive to liquid level for controlling said water supplying means to maintain the liquid level in said inner compartment within predetermined limits, means for supplying refrigerant to said refrigerant conducting coils, and temperature responsive means in said inner compartment adjacent said overflow means adapted to control the operation of said refrigerant supplying means.

3. Refrigeration means comprising an insulated tank forming a fluid reservoir, an evaporator assembly disposed within said tank comprising a partition member dividing said reservoir into an inner compartment and an outer annular compartment and refrigerant conducting coils supported on the inner and outer surfaces of the partition member and forming a circuitous path from top to bottom of the surfaces

in sequence and communicating with a surge tank supported in the inner compartment, a carbonating device comprising a fluid container disposed within the inner compartment, means for supplying water to the bottom of the outer compartment at a point opposite from the surge tank, overflow means adjacent the surge tank for permitting water to overflow from the outer to the inner compartment, pumping means for pumping water from the bottom of the inner compartment into the carbonating device, means for withdrawing carbonated water from the carbonating device, means in said device responsive to liquid level for controlling the pumping means to maintain the liquid level in said device within predetermined limits, means in said inner compartment responsive to liquid level for controlling said water supplying means to maintain the liquid level in said inner compartment within predetermined limits, means for supplying refrigerant to said refrigerant conducting coils, and temperature responsive means in said inner compartment adjacent said overflow means adapted to control the operation of said refrigerant supplying means.

4. Refrigeration means comprising an insulated tank forming a fluid reservoir, an evaporator assembly disposed within said tank comprising a partition member dividing said reservoir into an inner compartment and an outer annular compartment and refrigerant conducting coils supported on the inner and outer surfaces of the partition member, a carbonating device comprising a fluid container disposed at one side of the inner compartment, means for supplying water to the bottom of the outer compartment adjacent the position of the carbonating device, overflow means for permitting water to overflow from the outer compartment into the inner compartment at the side opposite to the position of the carbonating device, pumping means for pumping water from the bottom of the inner compartment into the carbonating device, means for withdrawing carbonated water from the carbonating device, means in said device responsive to liquid level for controlling the pumping means to maintain the liquid level in said device within predetermined limits, means in said inner compartment responsive to liquid level for controlling said water supplying means to maintain the liquid level in said inner compartment within predetermined limits, means for supplying refrigerant to said refrigerant conducting coils, and temperature responsive means adjacent said overflow means in said inner compartment adapted to control the operation of said refrigerant supplying means.

5. Refrigeration means comprising an insulated tank forming a substantially rectangular fluid reservoir, an evaporator assembly disposed within said tank comprising a substantially rectangular metal partition member smaller than and dividing the reservoir into an inner compartment and a relatively narrow annular outer compartment and refrigerant conducting coils supported on the inner and outer surfaces of the partition member for conveying refrigerant in a circuitous path from top to bottom of the inner and outer surfaces in sequence, a carbonating device comprising a fluid container disposed at one side of the inner compartment, means for supplying water to the bottom of the outer compartment adjacent the position of the carbonating device, overflow means for permitting water to overflow from the outer compartment into the

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inner compartment at the side opposite to the position of the carbonating device, pumping means for pumping water from the bottom of the inner compartment into the carbonating device, means for withdrawing carbonated water from the carbonating device, means in said device responsive to liquid level for controlling the pumping means to maintain the liquid level in said device within predetermined limits, means in said inner compartment responsive to liquid level for controlling said water supplying means to maintain the liquid level in said inner compartment within predetermined limits, means for supplying refrigerant to said refrigerant conducting coils, a surge tank connected to said coils within the inner compartment at the side opposite from the carbonating device, and temperature responsive means adapted to control the operation of said refrigerant supplying means, said temperature responsive means being located adjacent said surge tank and overflow means within said inner compartment.

6. Refrigeration means comprising an insulated tank forming a substantially rectangular fluid reservoir, an evaporator assembly disposed within said tank comprising a substantially rectangular metal partition member smaller than and dividing the reservoir into an inner compartment and a relatively narrow annular outer compartment and refrigerant conducting coils supported on the partition member for conveying refrigerant in a circuitous path from top to bottom of two outer adjacent sides of the partition member thence from top to bottom of the other two outer sides and thence from top to bottom of two inner adjacent sides of the partition mem-

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ber, a carbonating device comprising a fluid container disposed within the inner compartment, means for supplying a flow of fresh water to the bottom of the outer compartment adjacent one side thereof, overflow means for permitting water to overflow from the outer to the inner compartment at a point opposite from the supply flow of fresh water, pumping means for pumping water from the bottom of the inner compartment into the carbonating device, means for withdrawing carbonated water from the carbonating device, means in said device responsive to liquid level for controlling the pumping means to maintain the liquid level in said device within predetermined limits, means in said inner compartment responsive to liquid level for controlling said water supplying means to maintain the liquid level in said inner compartment within predetermined limits, means for supplying refrigerant to said refrigerant conducting coils, and temperature responsive means in said inner compartment adjacent the overflow means adapted to control the operation of said refrigerant supplying means.

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