LIQUID REFRIGERATING UNIT

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This invention relates to improvements in refrigerating apparatus, particularly adapted for use in connection with the cooling of a beverage or other liquids for spigot drawn service requiring a delivery at substantially constant and uniform temperature under variable volume and demand periods, and wherein material fluctuation in temperature is objectionable and must necessarily be avoided.

The improvement is directed primarily to a two tank or compartment type of refrigerating apparatus, in which a liquid cooling medium is recirculated between the tanks, one containing a condensing or refrigerating coil of a refrigerating unit for cooling the liquid cooling medium, and the second containing a beverage conducting coil. The liquid cooling medium is periodically, as required upon a determined drop in its temperature in one of the compartments, recirculated for correspondingly displacing the higher temperature liquid cooling medium in the second tank for that of a lower degree of temperature in the first tank. The method is highly adaptable for the cooling of a beverage, such as beer, dispensed at a counter or bar directly from a barrel or storage container carrying a bulk supply.

A major difficulty herebefore encountered with beverage cooling systems of the two tank type is the freezing of the beer when the same has not been drawn off for an extended period, as during the closing hours for the dispensary. The conduits connecting the tanks through the stream of liquid cooling medium therein or liquid connection of the two tank effects a convection or capillary action, causing a lowering of the temperature of the cooling medium in the tank containing the beverage coil to a degree to freeze the beverage in the coil.

The present invention overcomes or prevents the establishment of such condition by effecting an interruption or break in the stream in the receptacle conduit connecting lines commensurate with the cutting off of the enforced circulation of the liquid cooling medium between the two tanks.

The present apparatus also provides for a more adequate distribution of the colder liquid cooling medium as introduced into the beverage coil containing receptacle, and for its full volume height to obtain a uniform temperature throughout its entire contents and avoid variation in temperature between different elevations in the receptacle. A non-uniformity of the temperature causes absorption of the heat units by only the upper part of the beverage coil, while the lower part is maintained colder than it should be resulting in freezing of the beverage in the lower part of the coil. Such an adverse temperature condition also causes undue frequency of operation of the pumping mechanism for circulating the cooling medium, automatically controlled in its operation by the temperature of the liquid medium at a given point.

It is therefore an object of the invention to provide a refrigerating unit having a pair of cooling medium containing receptacles in conduit connection, wherein the cooling medium is circulated through and between the receptacles, one containing a refrigerant coil, and the other a beverage coil, to provide an interruption in the fluid stream in the conduits connecting said receptacles automatically established upon cessation of the means for enforcing the transfer of the cooling medium from one receptacle to the other, and therefrom in return, to prevent any change in temperature of the liquid cooling medium in the beverage coil containing receptacle by convection, capillary or otherwise, through a liquid connection with said refrigerant coil containing receptacle.

Another object of the invention is to provide a definite liquid level height in the beverage coil containing receptacle in relation to the intake and discharge openings of a pair of tubes extending into the upper part of said receptacle, connecting with said refrigerant coil containing receptacle, for fluid enforced circulation between said receptacles, and to effect a head pressure to normally break or disrupt the fluid stream between the receptacles when the enforced fluid circulation is stopped.

Various other features and advantages of the invention will be more fully set forth in a description of the accompanying drawing, in which the figure represents a diagrammatic view of the improved two tank type of refrigerator unit.

In the drawing, 1 and 2 indicate a pair of sealed tanks or receptacles, spaced apart, or they may be representative of a pair of compartments in an organized unit insulated from one another and from direct atmospheric exposure. The tank structure is optional, and in the form shown, the tanks are of companion cylindrical construction.

The tank 1 centrally and longitudinally thereof is provided with a refrigerant or evaporator coil 3, which has its inlet and outlet ends respectively in suitable circuit pipe connection with a conventional refrigerator unit including an electric motor driven compressor 4.
A thermostat or bulb 6, containing a volatile fluid responsive to the temperature of the liquid cooling medium within the tank 1, connects by means of a pipe 1 to a collapsible bellows 8. The bellows 8 connects and actuates an electric circuit controlling switch 5 for an electric motor as the transmission for the compressor 4. The switch will complete the motor circuit when the temperature of the liquid cooling medium in the tank 1 attains a certain high value, and will interrupt the circuit when the temperature of said cooling medium attains a certain low value. This feature is likewise of conventional form, and may include an expansion valve, not shown, to control and regulate the circulation and volume of refrigerant passing through the refrigerant coil.

The secondary tank 2, following the general practice, has immersed within the cooling liquid contained therein a beverage cooling coil 11 having a spigot 12 at its outlet end exterior of the tank, and the inlet end of the coil exterior of the tank connects with a keg or container 13 for the beverage supply.

The two tanks 1 and 2 are connected by a pipe 14, preferably having its opposite ends respectively extending axially or vertically into the tanks to bring the inlet section 15 toward the bottom of the refrigerant coil containing tank 1. The section 16 for the outlet end of the pipe 14 correspondingly extends within the beverage coil containing tank 2, likewise to within a short distance from the bottom of the tank, and is apertured at suitable spacing apart for approximately the full length within the tank and with its lower extremity sealed to provide a sprayer discharge of the liquid cooling medium when forced from the tank 1 into the tank 2. This provides for a centralized full column height discharge of the colder cooling medium into the tank 2 to obtain a uniform distribution and reduction of temperature throughout the entire column of cooling liquid, forcing the warmer portion thereof radially and upwardly as the colder liquid is forced into the tank 2 from the tank 1.

The tank connecting pipe 14 has a pump 17 interposed therein, preferably driven by an electric motor. The operation of the electric motor is automatically controlled by temperature responsive means similarly as utilized for the control of the refrigerating unit. This, as diagrammed, comprises a thermostat or bulb 18 within the tank 2, and containing a volatile fluid responsive to the temperature of the liquid cooling medium in the tank 2 which connects by means of a pipe 19 with a bellows 20. The bellows 20 actuates an electric circuit controlling switch 21 for the electric motor as a power transmission means for the pump.

The switch completes the motor circuit when the temperature of the liquid cooling medium in the tank 2 attains a certain high value, and will interrupt the circuit when the temperature of the cooling medium attains a certain low value. The on and off control of the pump is within a limited temperature range and primarily for approximately maintaining a temperature of the liquid cooling medium most suited for efficiently cooling the beverage to a desired degree, and avoid freezing of the beverage in the beverage coil 11.

The range generally is between 34° F. and 36° F. The pump is thus automatically set in operation when the liquid cooling medium in said tank 2 rises to say 36° F. and cut off when the temperature is reduced to say 34° F. These temperatures are given arbitrarily, and of course may be varied, and regulatable results can be obtained from different locations or elevations of the bulb or thermostat element within the tank although it is desirable that the low temperature should not reach a degree which will permit freezing of the beverage in the beverage coil between extended periods of draft.

The fluid return pipe 22 joins the two tanks with the inlet and outlet ends respectively extending into the tops of the tanks, with the inlet end 23 in the tank 2 to a depth in relation to an appropriate liquid level height normally maintained for the stationary or non-circulating periods of the liquid cooling medium between the tanks to permit a break in the fluid tank connecting streams within the beverage coil containing tank 2. The inlet end or section 23 may also be provided with one or more apertures 26 within the air space to assure an interruption in the return stream for the non-circulating period of the cooling fluid or liquid, the aperture being of a dimension to not materially interfere with the discharge or circulating flow of the cooling liquid.

One or more uppermost apertures 24 in the sprayer discharge 16 above the liquid level height, and likewise above the intake or receiving end of the return pipe 22, which also bears a relation to the level height of the column of liquid to produce a break in the stream lines, effected by an air head pressure maintained in the space above the column height or liquid level in said tank 2. Thus in starting a recirculation of the liquid cooling medium between the tanks, the pump will convey the colder liquid from the tank 1 for forcible delivery into the tank 2, and discharge it therein through the centrally and vertically disposed sprayer stem 16, raising the liquid level height above the intake or receiving end of the pipe 22, thereby increasing the head pressure whereupon the circulation continues uniformly during the pump operating period.

As soon as the pump stops, the head pressure will continue the fluid discharge from the tank 2 into the tank 1, until the stream lines in the circulating pipes are broken or interrupted. This will prevent a lowering of the temperature of the cooling medium in the secondary tank by capillary, convection or the like, through the stream lines connecting the colder cooling liquid in tank 1 to a degree below the temperature which will permit freezing in the beverage coil.

The tank 1 at its upper end is provided with an air releasing or vent valve 25 for periodic manual operation to discharge any accumulation of air collected in the top of the tank 1 to maintain a relative static condition therein. Discharging the colder cooling liquid from tank 1 centrally for the approximate full height of the column of liquid in the tank 2 provides a uniform distribution throughout the entire volume, forcing the warmer liquid outwardly and upwardly for return to tank 1, and thereby avoiding inadequate circulation which results in the temperature at certain points being many degrees colder than at other higher points.

The temperature of the liquid cooling medium of both tanks is automatically differentially controlled, in tank 1 for maintaining a relatively low degree temperature, and in tank 2 for a temperature to appropriately cool a beverage flowing through a coil immersed in the cooling medium. The circulatory course for circulating the cooling medium from one tank into the other,
and in return to the first when the pump for propelling the same is in operation, takes the colder liquid from the bottom of tank 1 and distributes it centrally at various levels throughout the entire volume in the tank 2, and is taken from the top of the tank 2 for a return delivery back into the upper part of tank 1. The propulsion and distribution of the liquid cooling medium for the particular circulating course described is more efficient over known methods where the liquid cooling medium is introduced from the bottom of one tank to the bottom of the other, or from the bottom of one into the top of the other.

It is evident that the apparatus may be employed for cooling liquids other than beverages and therefore the term "beverage coil" employed herein is merely given for identification purposes and not as a limitation for its use only for beverages.

Having described my invention, I claim:

1. A liquid refrigerating unit, comprising: a pair of receptacles, each providing a closed compartment adapted to hold a circulating liquid refrigerant, a refrigerant coil in one compartment, a beverage coil in the other compartment, a pair of conduits connecting said compartments, one for a forward course having an inlet adjacent the bottom of the refrigerant coil containing compartment, and a sprayer discharging steam extending centrally and longitudinally vertical within the beverage coil compartment, the second conduit for a return course of the liquid, connecting with the tops of the compartments and for the beverage coil compartment extended to a point to bring its inlet normally above the liquid level height in said compartment for an interruption of a liquid connection, and a pump interposed in said conduit for the forward course for propelling the liquid from said refrigerant coil containing compartment extended to a point to bring its inlet normally above the liquid level height in said compartment for an interruption of a liquid connection, and a pump interposed in said conduit for the forward course for propelling the liquid from said beverage coil compartment extended to a point to bring its inlet normally above the liquid level height in said compartment for an interruption of a liquid connection, and a pump interposed in said conduit for the forward course for propelling the liquid from said beverage coil compartment extended to a point to bring its inlet normally above the liquid level height in said compartment for an interruption of a liquid connection.

2. A liquid refrigerating unit, comprising: a pair of closed compartments adapted to hold a circulating liquid refrigerant, a refrigerant coil in one compartment, a beverage coil in the other compartment, a pair of conduits connecting said compartments, one for a forward course connecting said compartments, the second conduit for a return course of the liquid, connecting with the tops of the compartments and for the beverage coil compartment extended to a point to bring its inlet normally above the liquid level height in said compartment for an interruption of a liquid connection, and a pump interposed in said conduit for the forward course for propelling the liquid from said refrigerant coil containing compartment extended to a point to bring its inlet normally above the liquid level height in said compartment for an interruption of a liquid connection.

3. A liquid refrigerating unit, comprising: a pair of compartments, each adapted to hold a circulating liquid refrigerant, a refrigerant coil in one compartment, a beverage coil in the second compartment, the beverage coil containing compartment having less than a full liquid refrigerant content to provide a pressure space thereabove, separate supply and return conduits connecting said compartments, each having an opening exposed to the pressure space in said beverage coil containing compartment for an interruption of liquid connection with the liquid contents in said compartments, and a pump interposed in the supply conduit for an interchange circulation of the liquid refrigerant in said compartments, the pump during a liquid impelling period elevating the liquid level in said beverage coil containing compartment above said conduit openings exposed to the pressure space for connection with the liquid refrigerant contents thereof.

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