March 2, 1937. G. L. STREBLER 2,072,347

REFRIGERATOR

Original Filed Nov. 8, 1933 3 Sheets-Sheet 1

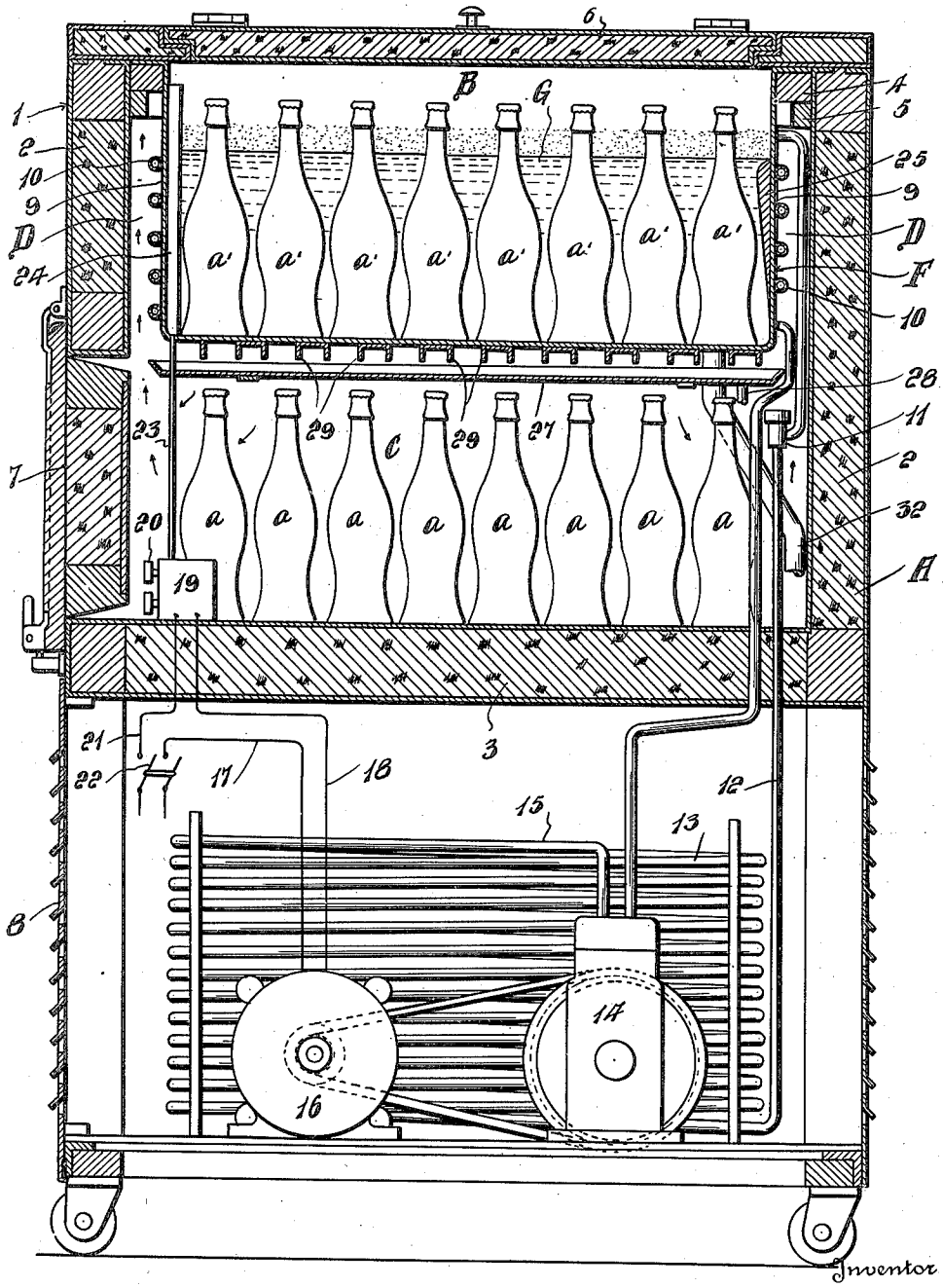


Fig. 1.

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Original Filed Nov. 8, 1933 3 Sheets-Sheet 2

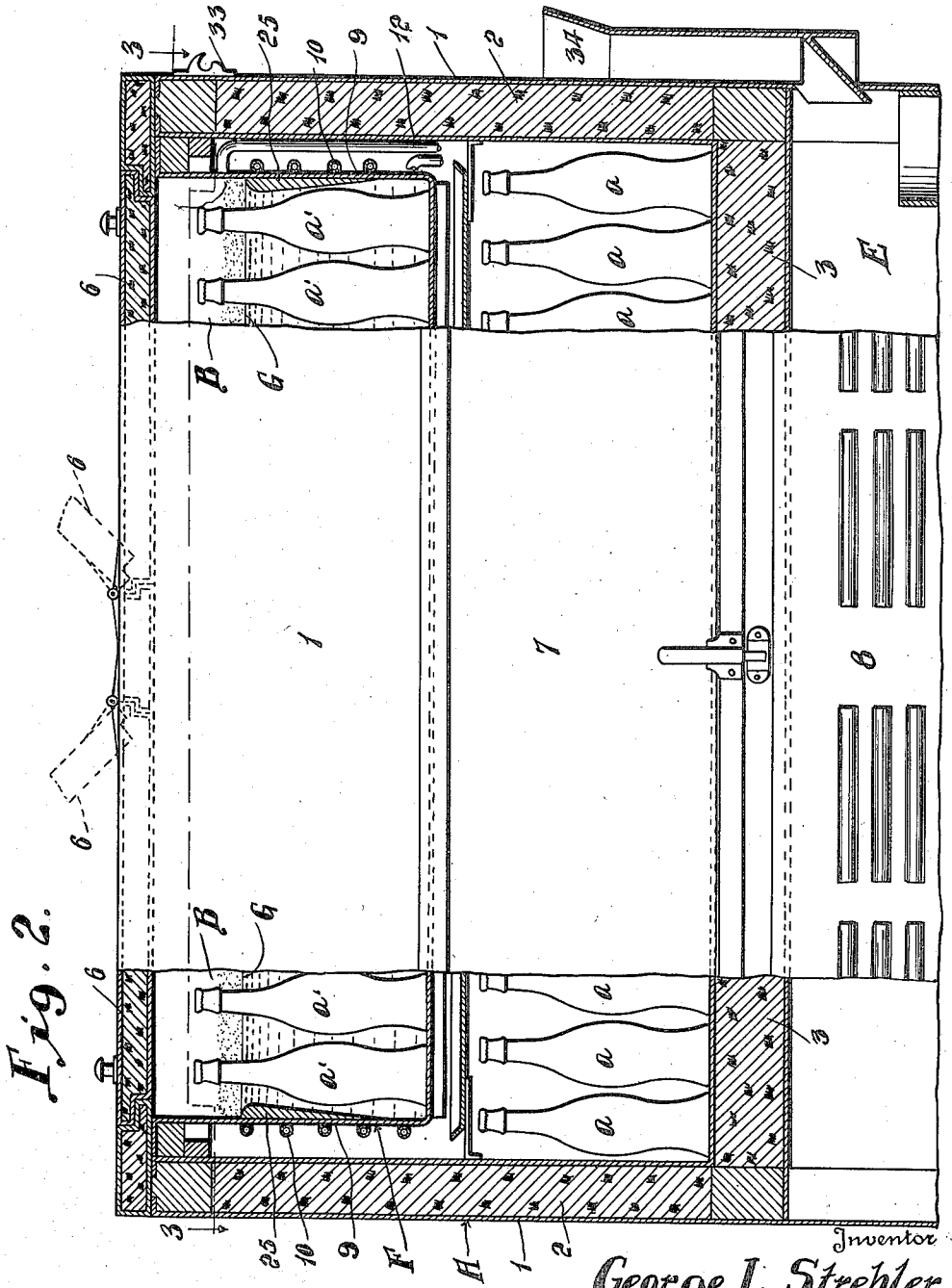


Fig. 2.

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Original Filed Nov. 8, 1933 3 Sheets-Sheet 3

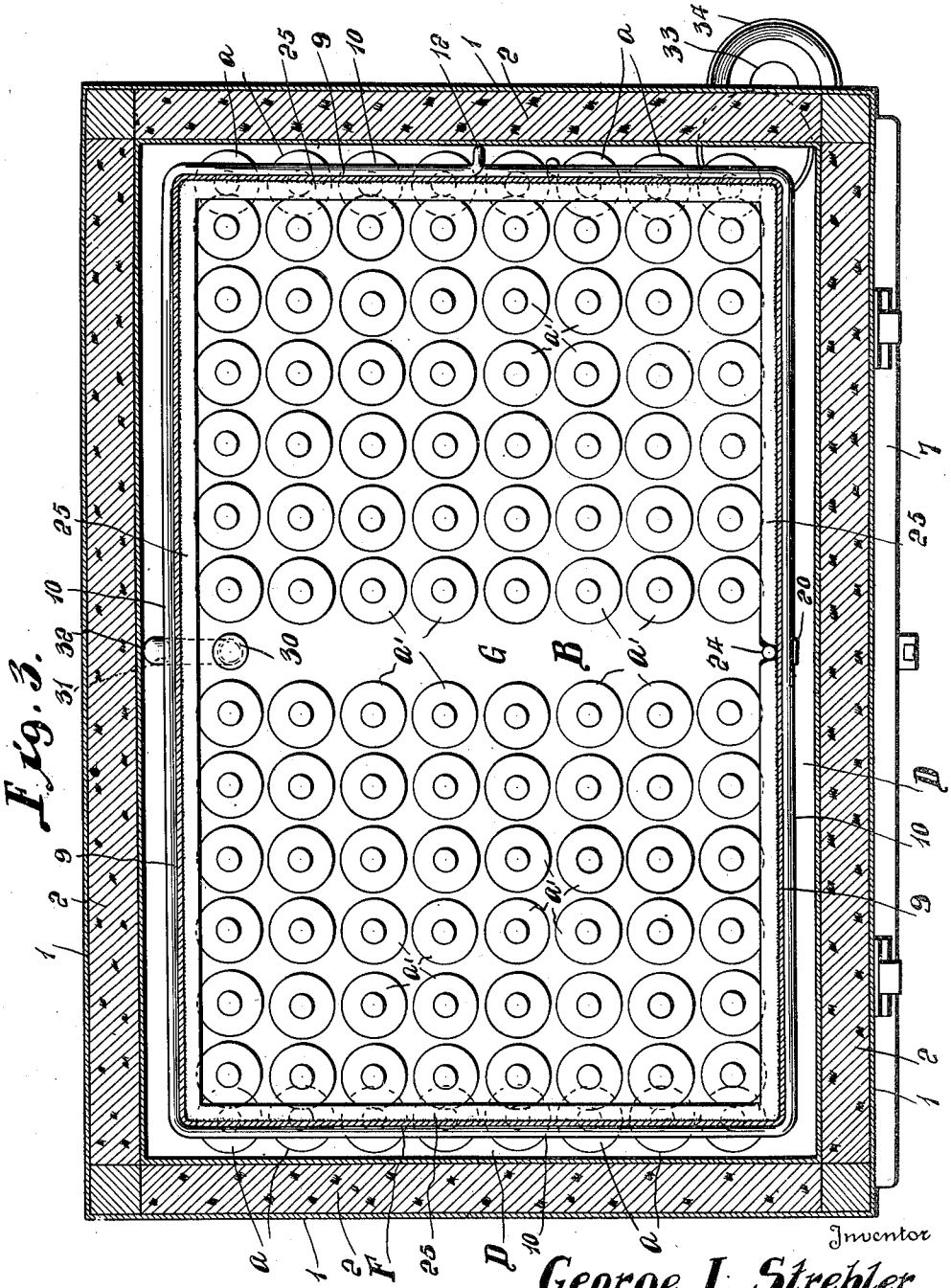


Fig. 3.

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UNITED STATES PATENT OFFICE

2,072,347

REFRIGERATOR

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Original application November 8, 1933, Serial No. 697,095. Divided and this application December 28, 1936, Serial No. 117,924

8 Claims. (Cl. 62—4)

This application is a division of an application for patent filed in my name on November 8th, 1933, Serial Number 697,095.

My invention relates to refrigerators, and, more particularly to a cabinet construction for cooling bottled goods, although not necessarily limited thereto, as various other classes of goods can be kept cool in one, or both of the compartments of the refrigerator.

The primary and most essential object of the present invention resides in the employment of means which is responsive to temperature variations of the sheet metal wall of a tank or vessel serving as a container for bottled goods and the like for actuating a refrigerator control device to effect starting and stopping of an electric motor driving a compressor.

Another object of the invention is to provide a heat responsive element in direct contact with a wall of a tank employed in refrigerating apparatus for actuation of a control element for starting and stopping an electric motor driving a compressor.

Another object of my invention is the provision of a refrigerator having a dry pre-cooling compartment, a wet refrigerating compartment formed within a sheet metal tank, a relatively narrow annular compartment surrounding the wet refrigerating compartment and having communication at its lower end with the pre-cooling chamber, and heat absorbing means surrounding the wet refrigerating compartment for reducing the temperature of all of the compartments.

A further object of the invention resides in a refrigerator, as above set forth, and including a compartment for housing a suitable electric motor operated refrigerating unit.

A still further object of the invention resides in the provision of refrigerating apparatus which possesses advantages in points of simplicity and efficiency, and, at the same time proves itself comparatively inexpensive in cost of manufacture.

With the above and other objects in view, the invention consists in the novel features of construction, arrangement and combination of parts hereinafter more fully described and finally pointed out in the claims hereto appended.

Referring to the accompanying drawings forming a part of this specification, wherein like characters of reference denote similar parts throughout the several views:

Fig. 1 is a transverse vertical sectional view of a refrigerator embodying the features of my invention, and showing bottled goods therein.

Fig. 2 is a view partly in side elevation and partly in sectional elevation of the refrigerator showing bottled goods therein.

Fig. 3 is a horizontal sectional view taken on line 3—3 of Fig. 2, and clearly illustrating the features of my invention.

In carrying out the aim of my present invention, I have shown as one embodiment of the invention, a suitable case A, the side walls 1 of which are provided with suitable insulation 2. The case, or cabinet may be of any size and made from any suitable materials.

The case, or cabinet structure A is divided in any suitable manner as to provide therein a wet refrigerating or liquid bath compartment B, a dry pre-cooling compartment C and a relatively narrow annular compartment D surrounding the wet refrigerating compartment, which compartment D is suitably open at the bottom end thereof to the pre-cooling compartment C. Another compartment designated E is formed within the case A, by means of a suitable dividing or insulating member 3, which compartment serves to house a suitable refrigerating unit, or mechanism, hereinafter described. The dividing member 3 in the one embodiment shown, serves to form a floor for the pre-cooling compartment.

The wet refrigerating compartment B is formed by the employment of a suitable sheet metal tank designated generally as F, which is adapted to contain plain water G. Compartment B can be utilized as a cold dry compartment when not containing water. The tank is supported in position by means of non-heat conducting members 4, which are supported by cleats 5. The wet refrigerating compartment also serves, as is manifest, as a dispensing tank. Bottled goods, which may be first stored in the pre-cooling compartment can, after having been initially cooled, be transferred to the wet refrigerating compartment, or dispensing tank and immerged in cold water therein until dispensed therefrom. It is to be understood that various articles or foods may be placed in the dry pre-cooling compartment for preservation thereof and without the necessity of transfer to the wet cooling compartment. The wet refrigerating compartment B is open to the top thereof, and the case is provided with suitable doors 6 to serve as a closure therefor. The pre-cooling compartment C is provided on one side with a suitable closure 7, while the refrigerating unit compartment E is provided with a suitable closure 8.

The annular compartment D is formed between the side walls of the case A and the side walls 9

of the tank F by causing the side walls of the sheet metal dispensing tank to be spaced therefrom due to the outside diameters of the tank being smaller than the inside diameters of the case A.

The annular compartment D is closed at its upper end by the members 4 and open at its lower end for communication with the pre-cooling compartment, as will be apparent from the drawings.

A suitable refrigerating coil 10 is disposed within the annular compartment D. The coil 10 is shown, as in practice, as wound around the tank F within the annular compartment D and in contact with the outer face of the wall of the tank F. The refrigerating coil 10 is shown as provided with a suitable expansion valve 11 and connected to one side thereof is a liquefied refrigerant line 12 leading from a suitable condenser 13. A suitable compressor 14 is shown as having connection with the condenser through the medium of a tubular connection 15. The return end of the coil 10 is shown as having suitable connection with the compressor 14 to effect a circuit for a suitable refrigerating agent. The compressor is shown as driven by means of a suitable electric motor 16. While I have shown one conventional type of refrigerating unit, or mechanism, any suitable type of refrigerating mechanism may be employed that will cause the circulation of a refrigerating agent.

In the embodiment shown, an electrical conductor 17, of a service line, is shown as connected to the motor 16. A second electrical conductor 18 is shown as connecting the electric motor with a suitable refrigerator control device 19 including a cold control member 20. A third electrical conductor 21 is shown as having connection with the refrigerator control device 19 and leading to a suitable main switch 22 in the service line. The refrigerator control device 19 has suitable connection, as at 23, with a suitable thermal bulb 24, or equivalent device, which is disposed within the tank in direct heat transfer contact with the sheet metal wall of the tank forming the refrigerating compartment and the thermal bulb is partly surrounded by the water within the tank before ice is formed. In practice, the cold control member 20 is manually operated, that is turned one way or the other to selected position, to cause the refrigerator control device 19 to automatically open an electrical circuit when a predetermined low temperature has been established at the sheet metal wall of the tank forming the wet refrigerating compartment and thereby stopping operation of a refrigerating mechanism, and, when the tank wall temperature rises to a predetermined temperature causes the cold control device to function to automatically close the electrical circuit therethrough at a predetermined high temperature to again set the refrigerating mechanism into operation, thereby controlling the temperature of the water in the wet refrigerating compartment within a desired temperature range, more or less, as is within the setting of the cold control device 20 of the refrigerator control 19, which is a standard device that can be bought for that purpose. The temperature control employed, for one embodiment thereof, is what is known as a gas filled type of control employing a sylphon or bellows, and the gas therein being volatile, the gas pressure rises or falls in accordance with the temperature to which it is subjected. When the refrigerating unit operates to the point where a shut off is desired, an adjustment screw on the control which has been set by turning control knob 20, sets up a desired spring tension against the bellows in the refrigerator control device 19. Such spring tension overcomes the lessened gas pressure in the sylphon or bellows, thus actuating levers in the device 19 which control the opening and closing of the electric circuit.

In practice, bottled goods can, if desired, be first stored in the dry or pre-cooling compartment C of the refrigerator, thus the heat from the bottled goods is gradually extracted and after they have been pre-cooled, they can be transferred to the wet refrigerating compartment B and immersed in the water G therein. Such bottled goods are designated *a'*. The water being kept at a substantially predetermined temperature, the bottled goods can be dispensed at the liquid temperature in the tank.

During refrigerating, or operating periods of the refrigerating unit, an ice ring 25 is formed on the inner face of the sheet metal wall of the wet refrigerating chamber B due to the absorbing of heat from the wet refrigerating compartment through the sheet metal wall thereof by a moving refrigerating agent in the coil 10, and, as this ice formation 25 builds up around the thermostatic device 24, it forms an insulation between the liquid bath and the sheet metal wall of the tank F. The thermostatic device, it will be understood, contacts the inner face of the sheet metal wall of the wet refrigerating chamber in positive heat transfer relation therewith. The thermostatic device 24 is directly affected by the water bath temperature until such time as the ice ring formation 25 builds up to, for illustration approximately, three-fourths inch in thickness on the sheet metal wall of the wet refrigerating compartment to provide a definite insulating barrier between the water bath and the thermostatic device, at which time the refrigerant coil structure temperature, which is lower than either the water bath or ice temperatures, begins to effect the thermostatic device, reducing it in temperature subsequently to where a shut off is effected, or in other words, where the entire refrigerating unit becomes inoperative. The entire refrigerating unit thus remains inoperative until such time as, through usage of either refrigerating compartment by introducing warm articles to be cooled, or by normal heat leakage, rising temperatures cause said ice formation on the walls of the wet refrigerating chamber to release therefrom, and thereby permitting temperature of the water bath and rising heat in the annular chamber to again effect the control device, causing the entire refrigerating unit to become operative, whereby a new ice formation builds up on the sheet metal wall of the wet refrigerating chamber until such time as the temperature again reaches such a degree F. to effect the thermostatic device and again rendering the entire refrigerating unit inoperative for ice release.

During non-refrigerating, or idle periods of the refrigerating unit, warm air currents developed within the pre-cooling chamber C, which is cooled by the coil 10, rise into the annular coil compartment D between the cabinet walls and the tank wall and together with warm air in the wet compartment, causes a defrosting effect on the inner wall of the tank F, by the rising temperature in the annular chamber D which surrounds the tank wall and the temperature within the wet compartment. When the frost area is defrosted, the melted frost drippings flow over the

ice ring. The ice ring gradually becomes loose on the tank wall and the operator can break the ice ring by gently tapping it with a bottle, and when broken, the ice fragments will float in the water. When the refrigerating unit again becomes operative through the medium of a refrigerator control device 19 and thermostatic device 24, an ice ring will again be formed on the tank wall to become loosened during idle periods of the refrigerating unit.

In order to catch any dripping from the coils 10 during defrosting periods set up by idle periods of the refrigerating unit, I suitably support a suitable drip pan 27 adjacent the upper end of the pre-cooling chamber C and spaced below the tank F and coils 10 to underlie the tank and coils. The pan is provided with a suitable drain member 28. The tank F is shown as provided on the bottom thereof, with suitable metallic fins 29 and the tank is also shown as being provided with a drain opening 30 closed by means of a suitable stopper 31. A suitable drain hose 32 is shown as having connection with the tank drain opening 30.

The refrigerator cabinet is illustrated as provided with a suitable bottle cap remover 33 and a cap receiving chute 34 disposed below the cap remover 33 which leads to the inside of the cabinet.

In practice, the coil 10 and refrigerating agent therein surrounding the wet refrigerating compartment B, and dispensing tank F, absorbs the heat from the inside of the tank as well as heat units ascending into the annular compartment D from the pre-cooling compartment C. The refrigerator control device 19 is so adjusted as to shut off after the ice ring formation in the dispensing tank has reached the desired proportion, and is also automatically closed when gas in the thermal bulb 24 expands due to a rise in temperature of the metal tank wall caused by a rise in temperature in the annular chamber or water bath, which rise in temperature releases the ice ring.

While the control device may be initially set to maintain the temperature of the water in the dispensing tank at a desired substantially constant degree, it has been found in actual practice that a more definite control of the water may be obtained when the thermal bulb is in direct contact with the wall of the tank. As an example, the temperature of the water seldom varies more than one half (½) degree, such as 33½° to 34° F., while the coil 10 associated with the tank maintains the temperature of the tank wall at substantially 22 degrees to 23 degrees F. The ice formed on the inner walls of the tank acts as an insulating barrier between the water in the tank and tank wall and substantially insulates the thermal bulb 24 from the water in the tank so that the temperature of the tank wall becomes the prime factor in actuation of the control element 19, which in turn controls operation of the motor and compressor, as distinguished from such devices wherein the control element leads directly to an expansion valve without controlling operation of a motor and compressor.

The coils 10 are positioned high enough above the normal water level in the dispensing tank to form a definite frost line area above the water level and ice ring formation.

In the off cycle of the refrigerating unit, the frost absorbing the heat from the surrounding air in the wet refrigerating compartment and the heat transmitted to and through the tank wall from rising temperatures within the pre-cooling compartment, melts, thereby allowing the water from the melted frost to flow over the ice ring formation and assist in loosening the same from the tank wall. This assists the ice ring formation to loosen itself from the tank walls and allows it, when broken, to float in the water within the tank to absorb more thoroughly the heat from the center of the dispensing tank.

The thermostat 24 is so positioned in contact with the wall of the tank as to be effected by a rise in temperature of the sheet metal wall of the tank F with which the tube 24 contacts, thereby maintaining the desired liquid temperatures in compartment B. The quantity of low temperature liquid or water bath in the dispensing tank is in proportion to the area to be cooled in the pre-cooler compartment and is of such proportion as to bring about the desired temperatures in the pre-cooler compartment without reducing the tank liquid temperature to a point where too much ice or an over abundance of ice will be formed for practical purposes. The temperature in the pre-cooling compartment C is usually several degrees higher than in the liquid in the wet refrigerating compartment.

The many advantages of the herein described invention will readily suggest themselves to those skilled in the art to which it appertains.

From the foregoing description, it is evident that a simple and highly efficient device for the purpose intended has been disclosed, but it is to be understood that I do not desire to restrict, or limit myself to the very details of the construction shown and described, which is merely illustrative, as it is clearly obvious that changes, not involving the exercise of invention, may be made without conflicting or departing from the spirit of the invention within the scope of the appended claims.

What I claim is:

1. In a refrigerator of the character described, a case, a sheet metal tank in the case, a pre-cooling chamber below the tank, a chamber surrounding the tank and open at its lower end to the upper end of the pre-cooling chamber, a refrigerating mechanism including a coil, said coil surrounding the tank in heat transfer relation thereto, a thermal element arranged in position to be affected by the temperature of the contents of the tank and the temperature of the surrounding chamber and in contact with a wall of the tank, and a control for said mechanism operated by the thermal element.

2. In a refrigerator of the character described, a case, a sheet metal water tank in the case, a dry pre-cooling chamber below the tank, a chamber surrounding the tank and open at its lower end to the upper end of the pre-cooling chamber, a refrigerating mechanism including a coil, said coil surrounding the tank in heat transfer relation thereto, a thermal element arranged in position to be affected by the temperature of the water in the tank and the temperature of the surrounding chamber and in contact with a wall of the tank, and a control for said mechanism operated by the thermal element.

3. In a refrigerator of the character described, a case, a sheet metal water tank in the case, a refrigerating mechanism including a coil, said coil surrounding the tank in heat transfer relation thereto, and means for controlling the operation of said mechanism, said means including a thermal element arranged in contact with a wall of said tank in position to be insulated from the

water in the tank by formation of an ice barrier while said mechanism is operating and to receive heat from said wall to release said ice barrier from the element after the mechanism has stopped operating.

4. In a refrigerator of the character described, a case, a sheet metal tank in the case, a pre-cooling chamber below the tank, a chamber surrounding the tank and open at its lower end to the upper end of the pre-cooling chamber, a refrigerating mechanism including a coil, said coil surrounding the tank in heat transfer relation thereto, a drip pan in the upper end of the pre-cooling chamber and spaced from the bottom of the sheet metal tank, said drip pan being dimensioned to underlie the tank and coil to prevent the dripping of condensate from the tank and coil into the pre-cooling chamber during idle periods of the refrigerating mechanism, a thermal element arranged in position to be affected by the temperature of the contents of the tank and the temperature of the surrounding chamber and in contact with a wall of the tank, and a control for said mechanism operated by the thermal element.

5. In a refrigerator mechanism, in combination, a refrigerator chamber of heat conducting material adapted to contain a liquid in which bottled goods are immerged, a dry pre-cooling chamber below the refrigerator chamber in which bottled and other goods are stored and from which chamber bottled goods after being initially chilled may be transferred to the refrigerator chamber, a narrow chamber surrounding the refrigerator chamber and open to the pre-cooling chamber, a refrigerating unit including a coil wound around the refrigerating chamber in heat transfer contact therewith and means contacting a wall of the refrigerator chamber actuated by variations of temperature in said chamber and of said wall for controlling the operation of the refrigerator unit.

6. In a refrigerator of the character described, a case, a sheet metal tank in the case, said tank having vertical walls and open at its upper end, a pre-cooling chamber below the tank, a chamber surrounding the tank and open at its lower end to the upper end of the pre-cooling chamber, a refrigerating mechanism including a coil having a series of vertically spaced convolutions surrounding the vertical walls of the tank in contact therewith, a vertically positioned elongated thermal element arranged to be affected by the temperature of the contents of the tank and in contact with the inner face of a vertical wall thereof, and a control for said mechanism operated by the thermal element.

7. In a refrigerating apparatus, a case, a sheet metal tank in the case, said tank having vertical walls and an open top, a refrigerating mechanism including a coil having a series of vertically spaced convolutions surrounding the vertical walls of the tank in contact therewith, a vertically positioned elongated thermal element to be affected by the temperature of the contents of the tank and surrounding temperature thereof and with a minor portion of the thermal element in thermal contact with the inner face of a vertical wall of the tank, and a control for said mechanism operated by the function of the thermal element.

8. The method of maintaining the water of a bath for bottles in a container at a substantially constant refrigerating temperature, while the temperature of the wall of the container fluctuates to a greater degree, said method consisting of causing a refrigerant to flow in heat absorption relation to the outer wall of the container, checking the flow of such refrigerant by the operation of a thermostat and transmitting heat, received by said wall after the flow has stopped, directly to the thermostat to release therefrom any ice barrier formed thereon during the flow of the refrigerant.

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