Sept. 21, 1937. J. R. KILLEN 2,093,839

REFRIGERATING APPARATUS

Original Filed Oct. 6, 1932 2 Sheets-Sheet 1

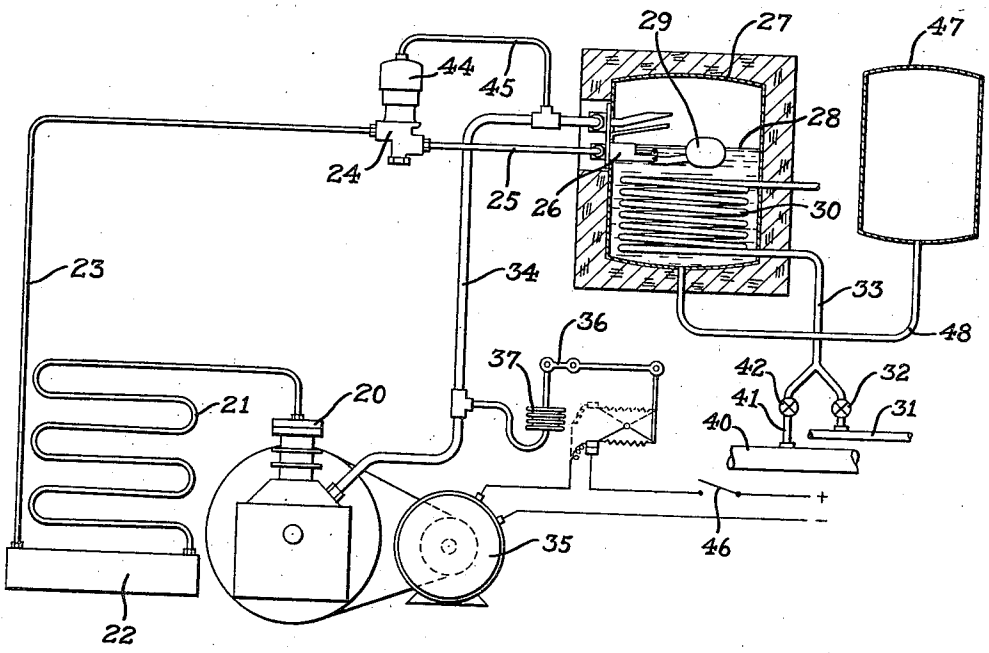


Fig. 1

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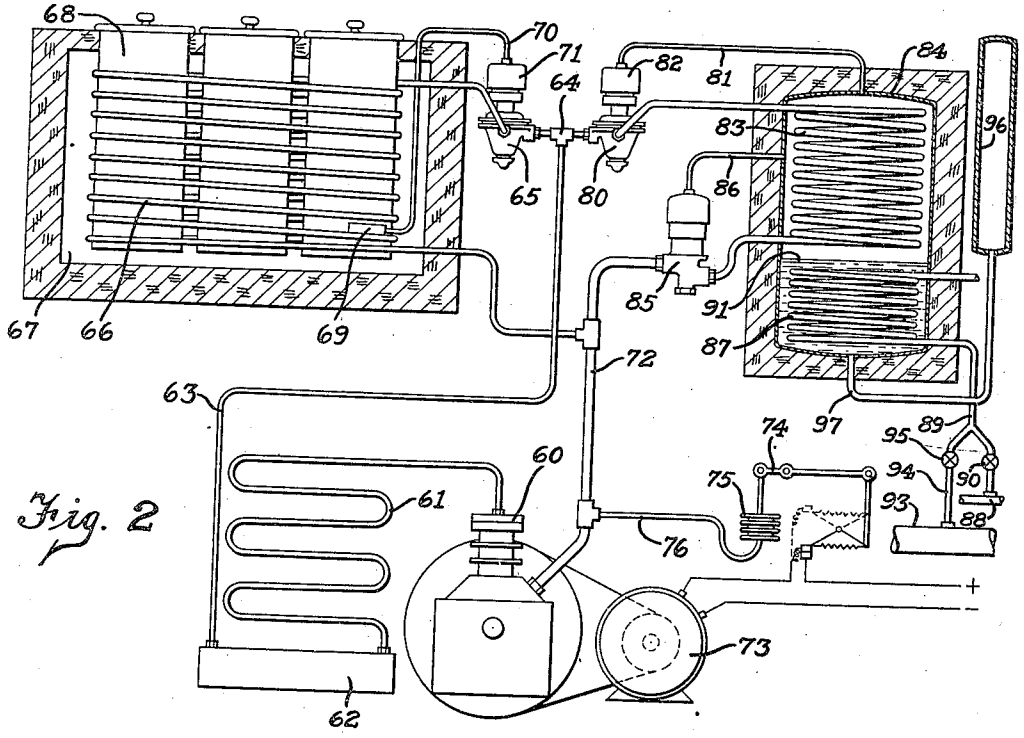


Fig. 2

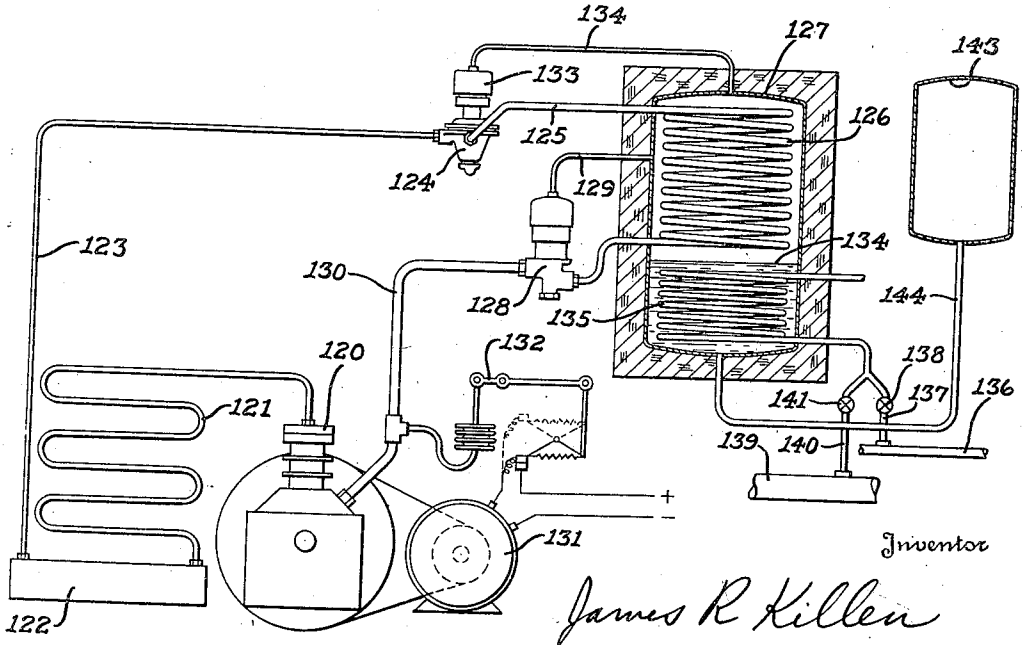


Fig. 3

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REFRIGERATING APPARATUS

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Renewed August 9, 1935

16 Claims. (Cl. 62—141)

This invention relates to refrigerating apparatus and more particularly to that type of cooling apparatus commonly called beverage coolers or water coolers.

In these types of coolers I have found that there are a number of difficulties involved. One of these is that of providing a very dependable and accurate control of the temperature of the beverage, water, or other fluid which is to be used. In fact, one of the difficulties is to prevent the beverage, water or other fluid from freezing during periods of inactivity when no fluid is being used.

It is therefore one of the objects of my invention to provide dependable and accurate means for controlling the final temperature of the fluid being cooled in a cooling apparatus.

More specifically, it is an object of my invention to provide a cooling apparatus having a primary and a secondary refrigerating system with a control for the primary evaporating system actuated by and responsive to the temperature of the secondary system for accurately controlling the final temperature of the fluid being cooled.

It is also necessary to provide a way in which to clean the tubes or conduits through which the beverage, water or other fluid flows. This is ordinarily done by passing live steam or hot cleaning solution through the tubes or conduits in order to remove the dirt, scale, deposits or any type of fungus growth which may grow within the tubing or conduits. Heretofore no adequate provision has been made for the protection of the refrigerating apparatus during the cleaning period.

It is therefore an object of my invention to provide an adequate means for protecting the refrigerating apparatus during the cleaning period.

More specifically, it is an object of my invention to provide a means for preventing heat transfer from the member which is being cleaned with live steam and the evaporator of the primary refrigerating apparatus.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred form of the present invention is clearly shown.

In the drawings:

Fig. 1 is an illustration of one form of my invention partly diagrammatic;

Fig. 2 is an illustration of another form of my invention applied to a soda fountain installation, and

Fig. 3 is an illustration of another form of my invention somewhat similar to that shown in Fig. 2.

Referring to the drawings and more particularly to Fig. 1, there is shown a refrigerant liquefying apparatus comprising a compressor 20 for compressing refrigerant and for forwarding the compressed refrigerant to a condenser 21 where the compressed refrigerant is condensed and collected in the receiver 22. From the receiver 22 the liquid refrigerant is forwarded through the supply conduit 23 to a control valve 24 which is normally open and from the control valve 24 the liquid refrigerant is conducted through the conduit 25 to a float controlled valve 26 located within a closed insulated vessel 27. The closed insulated vessel 27 normally contains a volatile liquid such as a refrigerant, for example, difluorodichloro methane, up to the level indicated by the reference character 28. This level is normally maintained by means of the float 29 which controls the opening and closing of the valve 26 so as to admit the proper amount of liquid refrigerant into the closed vessel 27 to maintain the normal liquid level designated by the reference character 28.

Within the closed vessel 29 and beneath the surface of the liquid refrigerant designated by reference character 28, there is provided a cooling member 30 comprising a plurality of coils of tubing immersed within the liquid refrigerant. This cooling member 30 is normally supplied with beverage, water or other fluid to be cooled from a supply pipe 31 through a valve 32 and a supply conduit 33. The beverage, water or other fluid to be cooled flowing through the cooling member 30 causes the liquid refrigerant within the closed vessel 27 to vaporize and to remove heat from the fluid to be cooled, thereby lowering its temperature.

The vapor within the closed vessel 27 is returned to the compressor 20 through the return conduit 34. The compressor 20 is driven by an electric motor 35 which is controlled by a pressure responsive switch mechanism 36. The pressure responsive switch mechanism 36 has a bellows 37 which is connected to the return conduit 34 to cause the electric motor 35 to start at a predetermined high pressure within the return conduit 34 and to stop at a predetermined low pressure. Inasmuch as the pressure above the liquid refrigerant in the closed vessel 27 determines its evaporating temperature, the evaporating temperature is thereby controlled by the switch mechanism 36 which is responsive to the

vapor pressure. In this way the temperature of the liquid refrigerant within the closed vessel 27 is controlled so as to maintain the outlet or final temperature of the fluid flowing through the cooling member 30 at the proper temperature.

In order to clean the cooling member 30, there is provided a steam supply pipe 40 which has a branch connection 41 provided with a valve 42 which is connected to the fluid supply conduit 33. When the beverage, water or other fluid is normally supplied to the cooling member 30 through the conduit 33, the valve 32 is open while the valve 42 remains closed. When it is desired to clean out the cooling member, the valve 32 is closed and the valve 42 is opened, permitting live steam or hot cleaning solution to pass through the cooling member 30.

In order to protect the refrigerating apparatus during this period, the valve 24 is provided within the supply conduit to shut off the flow of liquid refrigerant to the closed vessel 27. This valve 24 has a pressure responsive control mechanism located within its upper portion 44 which is connected by a conduit 45 to the return conduit 34 of a refrigerating system. When the pressure within the closed vessel 27 becomes abnormally high because of the introduction of live steam or hot cleaning solution into the cooling coil 30, this high pressure will be conducted to the return conduit and through the conduit 45 to the pressure responsive mechanism within the valve 24 which increased pressure will cause the valve 24 to close to prevent further supply of liquid refrigerant to the closed vessel 27. In order to prevent the operation of the electric motor 35, the electric motor circuit is opened by a suitable switch 46 or other suitable means.

It is undesirable to permit the live steam within the cooling member 30 to evaporate the liquid refrigerant within the closed vessel 27. For one thing the evaporation of the liquid refrigerant would greatly increase the starting load upon the compressor 20 and would require an increased amount of electric energy to again liquefy this refrigerant and furthermore, the live steam or hot cleaning solution would be cooled to such an extent that it would be condensed to water which would be quickly cooled and would then no longer properly clean the cooling member. In order to prevent the cooling of the steam by the liquid refrigerant, I provide means for utilizing the vapor pressure within the closed vessel 27 for temporarily removing the liquid refrigerant therefrom during this cleaning period.

In order to do this, I provide a capacity vessel 47, which has its bottom portion connected by a connecting conduit 48 to the bottom of the closed vessel 27. When the live steam or hot cleaning solution is turned into the cooling member 30, sufficient liquid refrigerant will evaporate to raise the vapor pressure above the liquid refrigerant within the closed vessel 27 to cause the liquid refrigerant to be forced downwardly through the conduit 48 up into the capacity vessel 47. The liquid level 28 during this period will be lowered to the bottom of the closed vessel 27 so that the cooling member 30 is uncovered. During this cleaning period the pressure within the closed vessel 27 will be sufficiently high to prevent vaporization within the capacity vessel 47 and indeed will cause any vapor within the capacity vessel to condense during this period. Although the liquid level within the closed vessel 27 will drop during this period, thereby causing the float valve 26 to open, the supply of liquid refrigerant through the supply conduit 25 will be stopped by the closing of the valve 24 due to the high pressure existing within the closed vessel during this period.

When the cleaning period is over, the switch 46 is closed, the valve 42 is closed and the valve 32 is opened. The closing of the switch 46 will cause the electric motor 35 to operate and cause the compressor to reduce the pressure within the closed vessel 27. The reduction of pressure within the closed vessel 27 will reduce the temperature therein, and in this way the temperature of the closed vessel will then become less than the temperature of the capacity chamber. Due to the reduction of temperature and pressure within the closed vessel 27, the liquid within the capacity vessel 47 will vaporize and force the remainder of the liquid through the conduit 48 back into the closed vessel 27. The capacity vessel 47 is not provided with any insulation and is exposed to room temperature so that its temperature is normally higher than the temperature within the closed vessel 27 so that any liquid which might be in the capacity vessel 47 under normal pressure conditions will immediately turn into vapor and in this way during normal operation all of the liquid refrigerant will be kept in the closed vessel 27.

In Fig. 2, we have a modified form of the invention as applied to a soda fountain. In this figure, we have a compressor 60 for compressing the refrigerant and for forwarding the compressed refrigerant to the condenser 61 where it is liquefied and collected in the receiver 62. From the receiver 62 the liquid refrigerant is conducted through the supply conduit 63 to a T-connection 64. An expansion valve 65, preferably of the thermostatic type, is connected to the T-connection 64 and controls the supply of liquid refrigerant to an ice cream evaporating coil 66 located within the brine tank 67 of an ice cream cabinet and surrounding the plurality of ice cream receptacles 68. The thermostatic expansion valve 65 has an opposed dual control. One control is responsive to the pressure within the evaporating coil 66 to close the valve upon an increase in pressure while the other control is provided by a thermostatic bulb 69 which contains a volatile fluid which is responsive to the temperature adjacent the outlet end of the evaporator coil 66. The pressure within the thermostatic bulb 69, through its connection by the tube 70 with the valve 65, acts upon a pressure responsive means within the upper portion 71 of the valve to open the valve when the thermostatic bulb 69 is at a comparatively high temperature and pressure and tends to close the valve when the thermostatic bulb 59 is at a relatively low temperature and pressure. In this way the supply of liquid refrigerant to the evaporating coil 66 is controlled.

Vaporized refrigerant from the evaporating coil 66 is returned to the return conduit 72 which is connected to the intake portion of the compressor 60. The compressor 60 is driven by an electric motor 73, the operation of which is controlled by a pressure responsive switch 74. This pressure responsive switch 74 is operated by the bellows 75 connected by conduit 76 to the return conduit 72. Inasmuch as the evaporating temperature of a refrigerant corresponds to its evaporating pressure, the switch 74 is responsive to the temperature within the evaporating coil 66 and thereby controls the operation of the electric motor 73 and the compressor 60 according to the

evaporating temperature within the evaporating coil 83.

At the other side of the T-connection 84 there is connected another expansion valve 80, also of the thermostatic type, which is responsive to pressures on the outlet side of the valve and is also responsive to pressures within a conduit 81 connected to the upper portion 82 of the valve 80 which contains a pressure responsive means, often called a thermostatic portion of the valve, which tends to open the valve upon an increase in pressure in the conduit 81 while on the other hand it tends to open the valve on a decrease in pressure in the conduit 81. The expansion valve 80 is connected on its outlet side to an evaporating coil 83 located within a closed vessel 84 which is heavily insulated.

The evaporating coil 83 preferably consists of a plurality of coils of tubing and has a valve 85 connected to its outlet portion. The outlet side of the valve 85 is connected to the return conduit 72. The valve 85 is operated by means of a tube 86 which connects to the closed vessel 84 and which transmits this pressure to a pressure responsive operating mechanism located within the valve 85 which causes the valve to open at a predetermined high pressure. Within the closed vessel 84 there is also provided a cooling member 87 for cooling beverages, water or other fluid to be cooled. This cooling member 87 preferably takes the form of a plurality of coils of tubing and is supplied with the fluid to be cooled from a supply conduit 88 and a branch conduit 89 under the control of a valve 90 located in the branch conduit 89.

The cooling member 87 is located in the lower portion of the closed vessel 84. This portion of the closed vessel 84 is normally filled with a volatile liquid, such as a refrigerant, to a level designated by the reference character 91. When the fluid to be cooled passes through the cooling member 87, the volatile liquid within the closed vessel 84 is vaporized and condenses on the surfaces of the evaporator coil 83. This causes liquid refrigerant within the evaporator coil 83 to vaporize. The valve 82 and particularly the valve 85 are subject to control by the pressure within the closed vessel 84. As stated before, the evaporating temperature is governed by the evaporating pressure. In this way the supply and withdrawal of refrigerant from the evaporator coil 83 is controlled by the pressure and therefore the temperature of the refrigerant within the closed vessel 84. The valves 80 and 85 also control the evaporating pressure within the evaporating coil 83 and therefore the evaporating temperature of the coil 82. This evaporating temperature within the evaporating coil 83 controls the condensation of the vapor of the volatile liquid within the closed vessel 84 on the surfaces of the evaporating coil 83. In this way, by means of these two valves 80 and 85, the temperature to which the beverage, water or other fluid is cooled, is controlled.

As explained before, at different times there is a need for cleaning the inner surfaces of the cooling member 87. In this modification a steam or hot cleaning solution supply pipe 93 is provided which is connected by means of a conduit 94 to the supply pipe 89. The flow of live steam or hot cleaning solution to the supply conduit 89 is controlled by a valve 95. When it is desired to clean the cooling member 87, the valve 90 is closed and the valve 95 is opened so that the live steam or hot cleaning solution is introduced into the cooling member 87.

In order to prevent an excessive and unnecessary load upon the refrigerating system, I provide a capacity vessel 96, exposed to room temperature, which is connected at its lower end by a conduit 97 to the lower end of the closed vessel 84. Normally, because of its higher temperature, the vapor pressure within the capacity vessel 96 will be sufficient to force any of the volatile liquid therefrom and to keep the liquid refrigerant in the closed vessel 84. However, when live steam or hot cleaning solution is introduced into the cooling member 87, the temperature of the volatile liquid becomes much higher than the vapor pressure within the capacity vessel 96 and the resulting vapor pressure within the closed vessel 84 will force the volatile liquid down through the conduit 97 up into the capacity vessel 96 so that the cooling member 87 is now exposed only to the refrigerant vapor since the removal of the volatile liquid has now uncovered the cooling member and so that heat transfer between the cooling member 87 and the volatile liquid is prevented. This prevents any effective transfer of heat between the evaporating coil 83 and the cooling member 87. In this way the live steam within the cooling member 87 will not materially affect the evaporating coil 83 and will not materially affect the refrigerating system. It should be understood that this cleaning process only takes a few minutes and the system is immediately thereafter restored to normal operation.

Therefore it is not necessary to open the circuit of the compressor motor 73 during this period. At this time the motor 73 and the compressor 60 operate normally under control pressure of the responsive switch 74.

In Fig. 3 there is disclosed another modification which has a compressor 120 for compressing the refrigerant and forwarding the compressed refrigerant to a condenser 121 where the compressed refrigerant is liquefied and collected in a receiver 122. From the receiver 122 the liquid refrigerant is forwarded through a supply conduit 123 to an expansion valve 124 of the thermostatic type which controls the flow of liquid refrigerant through a conduit 125 to an evaporating coil 126 located within a heavily insulated closed vessel 127. At the outlet of the evaporator coil 126 there is provided a valve 128 which is provided with pressure responsive means operated by the pressure within the closed vessel 127 through the medium of a connecting conduit 129. This valve 128 thereby controls the withdrawal of refrigerant from the evaporating coil 126 according to the pressure within the closed vessel 127. The refrigerant passing through the valve 128 is returned through a return conduit 130 to the compressor 120. The compressor 120 is driven by an electric motor 131 whose operation is controlled by a pressure responsive switch 132 connected to the return conduit 130 and operated by the pressure therein. The valve 124 has a pressure responsive means actuated by the pressure on its outlet side which tends to close the valve upon an increase in pressure. This valve also has an upper thermostatic portion 133 having a pressure responsive means which tends to open the valve upon an increase in pressure within the conduit 134 which connects the thermostatic pressure responsive means to the closed vessel 127 so that this valve is also responsive to pressures within the closed vessel 127.

The insulated closed vessel 127 normally contains a volatile liquid, such as a liquid refrigerant, for example, difluorodichloro methane, up

to a certain level 134. The cooling member 135 preferably is made of a plurality of coils of tubing and is located in the lower portion of the closed vessel 127 beneath the level of the liquid refrigerant therein so that it is normally immersed within the liquid refrigerant. The cooling member 135 is supplied with the beverage, water or other fluid to be cooled from a supply pipe 136 and a branch pipe 137 provided with a valve 138 which controls the supply of this liquid to the cooling unit.

The cooling member at times needs cleaning and for this purpose a supply of steam or hot cleaning solution pipe 139 is provided which has a branch conduit 140 provided with a valve 141 for controlling the supply of steam or hot cleaning solution to the cooling member 135. When it is desired to send live steam or hot cleaning solution into the cooling member 135, the valve 138 is closed and the valve 141 is opened for several minutes. This sends live steam or hot cleaning solution through the passages in the cooling member 135 for the purpose of cleaning the passages therein.

In order to prevent the refrigerant system from being placed under a heavy load, I have provided a capacity vessel 143 which is connected at the bottom by a conduit 144 to the bottom of the closed vessel 127. When the live steam or hot cleaning solution is caused to flow into the cooling member 135 some of the volatile liquid will vaporize and create a relatively high pressure within the closed vessel 127. This high pressure will cause the secondary liquid refrigerant to be forced from the closed vessel 127 into the capacity vessel 143 which is exposed to room temperature. This will uncover the cooling member of the secondary liquid refrigerant. The pressure within the closed vessel 127 during the cleaning period is so high that it will prevent vaporization in the capacity vessel 143 during this period.

When the cleaning period is over, the temperature within the closed chamber 127 will be lower by evaporation within the evaporator coil 126, thereby condensing the vapor within the closed vessel 127 to reduce the vapor pressure therein which will permit the volatile liquid in the capacity vessel to return to the closed vessel and to re-establish the normal liquid level therein. The capacity vessel 143, being at room temperature, will be filled with vapor at room temperature during the normal operation of the system. By providing the particular valve control described above, the temperature of the fluid to be cooled is properly controlled and by providing the capacity chamber the refrigerating system is protected during the cleaning period.

While the form of embodiment of the invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. Refrigerating apparatus including a primary refrigerant circuit comprising a primary liquefying apparatus and a primary evaporating means, a closed vessel containing a volatile liquid, said primary evaporating means having an evaporating coil located in the closed vessel, a thermostatic expansion valve for controlling the flow of refrigerant to the evaporating coil, said thermostatic expansion valve having its thermostatic control portion connected to the closed vessel, and a cooling member located in heat exchange relation with the volatile liquid in the closed vessel.

2. Refrigerating apparatus including a primary refrigerant circuit comprising a primary liquefying apparatus and a primary evaporating means, a closed vessel containing a volatile liquid, said primary evaporating means having an evaporating coil located in the closed vessel above the normal liquid level therein, a cooling member located within the closed vessel below the normal liquid level therein, a capacity vessel having its bottom portion connected to the bottom of the closed vessel, and means for conducting hot fluid into the cooling member for causing the liquid level within the closed chamber to be lowered.

3. Refrigerating apparatus including a primary refrigerant circuit comprising a primary liquefying apparatus and a primary evaporating means, a closed vessel containing a volatile liquid, said primary evaporating means having an evaporating coil located in the closed vessel above the normal liquid level therein, a cooling member located within the closed vessel below the normal liquid level therein, a capacity vessel having its bottom portion connected to the bottom of the closed vessel, means for conducting the medium to be cooled to the cooling member, and means for conducting a warmer fluid to the cooling member for causing the volatile liquid within the closed vessel to vaporize and force the volatile liquid from the closed vessel to the capacity vessel for preventing heat transfer between the cooling member and the evaporator coil.

4. Refrigerating apparatus including a primary refrigerant circuit comprising a primary liquefying apparatus and a primary evaporating means, a closed vessel containing a volatile liquid, said primary evaporating means having an evaporating coil located in the closed vessel above the normal liquid level therein, a cooling member located within the closed vessel below the normal liquid level therein, a capacity vessel having its bottom portion connected to the bottom of the closed vessel, means for conducting the medium to be cooled to the cooling member, means for conducting a warmer fluid to the cooling member for causing the volatile liquid within the closed vessel to vaporize and force the volatile liquid from the closed vessel to the capacity vessel for preventing heat transfer between the cooling member and the evaporator coil, and means for preventing the effective operation of the evaporator coil.

5. Refrigerating apparatus including a primary refrigerant circuit comprising a primary liquefying apparatus and a primary evaporating means, a closed vessel containing a volatile liquid, said primary evaporating means having an evaporating coil located in the closed vessel above the normal liquid level therein, a cooling member located within the closed vessel below the normal liquid level therein, a capacity vessel having its bottom portion connected to the bottom of the closed vessel, means for conducting the medium to be cooled to the cooling member, means for conducting a warmer fluid to the cooling member for causing the volatile liquid within the closed vessel to vaporize and force the volatile liquid from the closed vessel to the capacity vessel for preventing heat transfer between the cooling member and the evaporator coil, and means responsive to the pressure within the primary evaporating coil for preventing the supply of liquid refrigerant thereto.

6. Refrigerating apparatus including a primary refrigerant circuit comprising a primary liquefying apparatus and a primary evaporating means, a closed vessel containing a volatile liquid, said primary evaporating means having an evaporating coil located in the closed vessel, a valve responsive to pressures within the closed vessel for controlling the withdrawal of refrigerant from the evaporating coil, and a cooling member located in heat exchange relation with the volatile liquid in the closed vessel.

7. Refrigerating apparatus including a primary refrigerant circuit comprising a primary liquefying apparatus and a primary evaporating means, a closed vessel containing a volatile liquid, said primary evaporating means having an evaporating coil located in the closed vessel, a valve responsive to pressures within the closed vessel for controlling the supply of refrigerant to the evaporating coil, and a cooling member located in heat exchange relation with the volatile liquid in the closed vessel.

8. Refrigerating apparatus including a primary refrigerant circuit comprising a primary liquefying apparatus and a primary evaporating means, a closed vessel containing a volatile liquid, said primary evaporating means having an evaporating coil located in the closed vessel, a valve responsive to pressures within the closed vessel for controlling the supply of refrigerant to the evaporating coil, a second valve responsive to pressures within the closed vessel for controlling the withdrawal of refrigerant from the evaporating coil, and a cooling member located in heat exchange relation with the volatile liquid in the closed vessel.

9. Refrigerating apparatus including a closed vessel containing a volatile liquid and vapor from the volatile liquid to form a refrigerant evaporator therein, means for condensing the vapor, a capacity vessel having its bottom portion connected to the bottom portion of the closed vessel, a cooling member located within the closed vessel below the normal liquid level therein, means for conducting the medium to be cooled to the cooling member, and means for conducting a warmer fluid to the cooling member for causing some of the volatile liquid within the closed vessel to vaporize and force the remainder of the volatile liquid from the closed vessel to the capacity vessel for preventing heat transfer between the cooling member and the evaporator.

10. Refrigerating apparatus including a closed vessel containing a volatile liquid and vapor from the volatile liquid, automatically controlled means for condensing the vapor, a float controlled valve controlling the flow of volatile liquid into said vessel, a capacity vessel connected to the closed vessel, a fluid flow conduit located in heat exchange relation with the volatile liquid within the closed vessel, means for introducing fluid to be cooled to the conduit, and means for conducting a warmer fluid to the conduit for causing some of the volatile liquid to vaporize and force the remainder of the volatile liquid into the capacity vessel for preventing heat transfer between the cooling member and the volatile liquid during this period.

11. Refrigerating apparatus including a primary refrigerant circuit including a primary liquefying apparatus having an intake portion and a discharge portion and a primary evaporating means, a closed vessel containing a volatile liquid, said primary evaporating means having an evaporating coil located in the closed vessel, a valve responsive to pressures within the closed vessel for controlling the supply of liquid refrigerant to the evaporating coil, a cooling member in heat exchange relation with the volatile liquid in the closed vessel, and means responsive to the pressures within the intake portion of the primary liquefying apparatus for controlling the operation of the primary liquefying apparatus.

12. Refrigerating apparatus including a primary refrigerant circuit including a primary liquefying apparatus having an intake portion and a discharge portion and a primary evaporating means, a closed vessel containing a volatile liquid, said primary evaporating means having an evaporating coil located in the closed vessel, a valve responsive to pressures within the closed vessel for controlling the supply of liquid refrigerant to the evaporating coil, a valve responsive to the pressures within the closed vessel for controlling the withdrawal of liquid refrigerant from the evaporating coil, a cooling member in heat exchange relation with the volatile liquid in the closed vessel, and means responsive to pressures within the intake portion of the primary liquefying apparatus for controlling the operation of the primary liquefying apparatus.

13. Refrigerating apparatus including a primary refrigerant circuit comprising a primary liquefying apparatus and a primary evaporating means, a closed vessel containing a volatile liquid, said primary evaporating means having an evaporating coil located in the closed vessel, means for automatically controlling the flow of liquid refrigerant into said evaporating coil, a valve responsive to pressures within the closed vessel for controlling the withdrawal of refrigerant from the evaporating coil, and a cooling member located in heat exchange relation with the volatile liquid in the closed vessel.

14. Refrigerating apparatus including a primary refrigerant circuit comprising a primary liquefying apparatus and a primary evaporating means, a closed vessel containing a volatile liquid, said primary evaporating means having an evaporating coil located in the closed vessel, means for automatically controlling the flow of liquid refrigerant into said evaporating coil in response to pressures within the closed vessel, a valve responsive to pressures within the closed vessel for controlling the withdrawal of refrigerant from the evaporating coil, and a cooling member located in heat exchange relation with the volatile liquid in the closed vessel.

15. Refrigerating apparatus including a primary refrigerant circuit comprising a liquefying apparatus and an evaporating means, said primary evaporating means being disposed in a closed vessel, said closed vessel containing a volatile refrigerant and forming a secondary refrigerant circuit, said secondary refrigerant circuit including a portion for evaporating refrigerant therein and a portion for condensing the evaporated refrigerant, said secondary refrigerant circuit also including a tank communicating with said portions thereof and adapted to receive volatile refrigerant from said closed vessel, and means for increasing the temperature within said closed vessel to cause the volatile liquid refrigerant to flow therefrom into said tank.

16. Refrigerating apparatus including a primary refrigerant circuit comprising a liquefying apparatus and an evaporating means, said primary evaporating means being disposed in a closed vessel, said closed vessel containing a vola-

tile refrigerant and forming a secondary refrigerant circuit, said secondary refrigerant circuit including a portion for evaporating refrigerant therein and a portion for condensing the evaporated refrigerant, said secondary refrigerant circuit also including a tank communicating with said portions thereof and adapted to receive volatile refrigerant from said closed vessel, and means within said closed vessel for increasing the temperature therein to cause volatile liquid refrigerant to flow therefrom into said tank.

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