

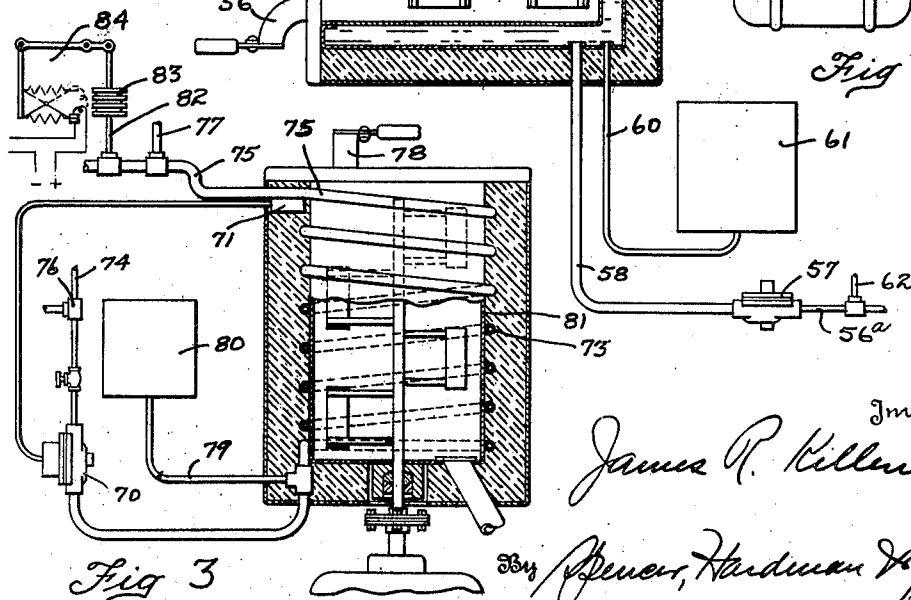
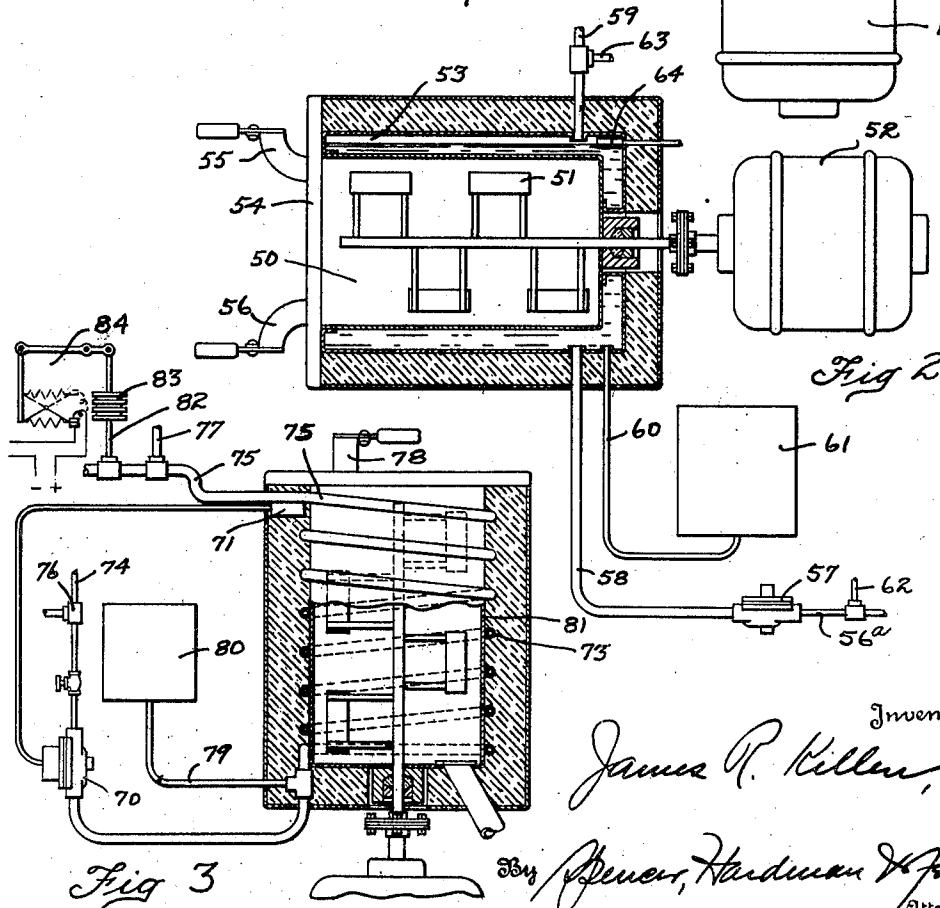
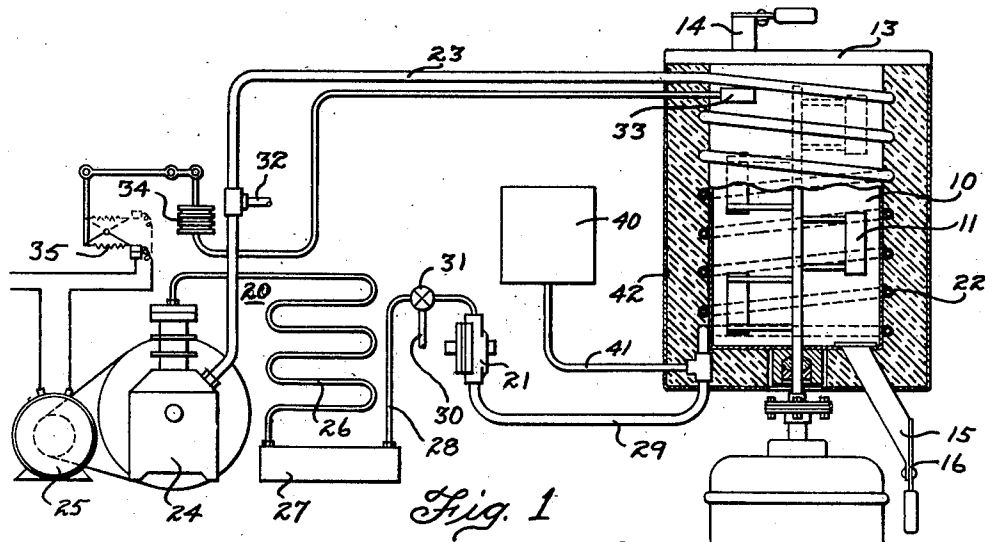
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REFRIGERATION

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REFRIGERATION

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4 Claims. (Cl. 62-4)

This invention relates to refrigeration. In certain types of refrigerating apparatus, it is often desirable or necessary to heat periodically the object being cooled far above the normal operating temperatures. For example, in ice cream freezers, it is often desirable or necessary to introduce a quantity of hot water into the freezing chamber to clean the same. Also in certain types of liquid coolers, where a beverage or the like is being cooled, it is often desirable or necessary to shut off the beverage supply and introduce into the beverage cooling chamber or pipe a quantity of hot water to clean the same.

It is among the objects of this invention to provide a refrigerating apparatus or method capable of permitting the introduction of a heating or washing medium into the object or chamber being cooled without danger of injuring the refrigerating apparatus and without the necessity of stopping the refrigerating mechanism.

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

In the drawing:
Fig. 1 is a diagrammatic representation of one form of my invention;

Fig. 2 is a diagrammatic representation of a slightly modified form; and

Fig. 3 is a diagrammatic representation of a further modification.

In the embodiment shown in Fig. 1, the object to be cooled is shown as an ice cream freezer which is provided with a freezing chamber 10 having the usual dasher 11 operated by a motor 12. The chamber 10 is cylindrical in form and provided with a removable cover 13 having a valved filling funnel or fitting 14. Chamber 10 is also provided with a discharge spout 15 having a valved opening 16 as is usual in this type of apparatus. The refrigerating system cooperating with the freezer includes a refrigerant liquefying unit 20 wherein refrigerant is liquefied and from which liquefied refrigerant is discharged through an automatic expansion valve 21 into the evaporator or evaporating zone 22, from whence the evaporated refrigerant returns through the pipe 23 to the liquefying unit 20 to be reliquefied. In this particular form the refrigerant liquefying unit includes a compressor 24 driven by a motor 25. The compressed refrigerant from the compressor 24 is discharged into the condenser 26 which discharges into a liquid refrigerant receiver 27. Liquid refrigerant flows from the re-

ceiver 27 through the liquid refrigerant line 28 to the expansion valve 21 and from thence the expanded refrigerant flows through the connection 29 to the evaporator 22. Sometimes the liquefying unit 20 is also connected to some other apparatus such as an ice cream hardening tank or the like, and, under such conditions, the liquid refrigerant line 28 may be provided with a branch 30 connected by means of a two-way valve 31 which is manually operated and can be operated to direct the liquid refrigerant either to the evaporator 22 or to the other apparatus, such as the evaporator of the hardening tank. The evaporated refrigerant from the evaporator of the other apparatus or hardening tank returns through the branch 32 to the line 23. It is to be understood that if the capacity of the unit 20 is sufficiently large, the two-way valve 31 may be dispensed with and liquid refrigerant may be supplied as required to either or both the freezer 10 and to the other apparatus as required.

The refrigerant liquefying unit 20 may be automatically controlled in accordance with conditions in some part of the apparatus, and in this particular embodiment it is controlled by means of a thermostatic bulb 33 which in turn operates a snap switch 35 which starts and stops the motor 25. Here also, the automatic control may be connected to the hardening tank heretofore referred to or to any other part of the apparatus desired.

As indicated in Fig. 1, the bulb 33 may be placed adjacent the outlet end of the coil or evaporator 22, just outside the freezer chamber 10. The casing of the freezer chamber is indicated in elevation in the upper portion with the coil 22 wrapped around the casing, and is shown in cross section in the lower half. The change from elevation to cross-section is indicated by the irregular substantially horizontal line just above the lead line of the character 10.

When the freezing chamber 10 is abnormally heated, such as by the introduction of hot water through the funnel 14 or by pouring after removal of cover 13, for the purpose of cleaning, the pressure of the liquid refrigerant in the coil or evaporator 22 is increased above a predetermined limit, and, in order to prevent the overloading of the unit 20, which ordinarily may be permitted to continue to operate, there is provided a reservoir 40 connected by means of the pipe 41 with the lower portion of the evaporator or coil 22 and which forms a gas trapping, liquid refrigerant storage space. The reservoir 40 is constructed to trap the gas formed by evaporation of refrigerant therein and the reservoir 40

is placed in an environment where it will be maintained at a temperature above the normal operating temperature of the evaporator 22, but where it will be below the temperature created when the freezer 10 is subjected to the abnormal heating operation. Thus the reservoir 40 may be placed in the normal atmosphere outside the insulation 42 which surrounds the evaporator 22 and the chamber 10.

The valve 21 admits refrigerant into the evaporator 22 automatically and inversely in accordance with the refrigerant pressure in the evaporator 22, and substantially stops the flow of refrigerant when the pressure rises above a predetermined limit. Thus when the hot water is introduced into the chamber 10, the refrigerant pressure in the evaporator 22 rises above this predetermined limit because of the abnormal evaporation of liquid refrigerant at a faster rate than can be liquefied by the liquefying unit. This rise in pressure causes valve 21 to stop the flow of liquid refrigerant into the evaporator 22. The liquid refrigerant already in the evaporator 22 is forced through the pipe 41 into the reservoir 40 which is now at a lower temperature than the refrigerant in evaporator 22 and where the refrigerant remains at a pressure lower than in the evaporator, the pressure in reservoir 40 corresponding substantially to the refrigerant vapor pressure at atmospheric temperature. When the hot water is removed through the spout 15 or chilled, the evaporation of the slight amount of liquid refrigerant remaining in the evaporator 22 becomes slower and permits the liquefying unit to reduce the pressure in the evaporator gradually until it falls below the pressure prevailing in the reservoir 40. When this occurs, the vapor pressure in the reservoir 40 forces the liquid refrigerant in the reservoir back into the evaporator 22 and the apparatus resumes its normal operation.

In the modification shown in Fig. 2, a cylindrical ice cream freezing chamber is shown at 50, and, in this modification it is horizontally disposed and has a horizontal dasher 51 driven by the motor 52. The evaporating 53 is in the form of an annular chamber surrounding the chamber 50. The freezer is provided with a removable cover 54 having an intake connection 55 and a discharge spout 56. Liquid refrigerant from a refrigerant liquefying unit similar to 20, is discharged through the line 56^a through the automatic expansion valve 57, similar to the valve 21, from whence the expanded refrigerant flows through the pipe 58 to the evaporator 53. The evaporated refrigerant flows through the line 59 to the refrigerant liquefying unit where the refrigerant is reliquefied for re-use in the system. When hot water is introduced through connection 55, the refrigerant pressure in evaporator 53 rises and the liquid refrigerant is forced through the pipe 60 into reservoir 61 similar to the reservoir 40 where the liquid refrigerant remains until the hot water is withdrawn or is cooled in a manner similar to the operation heretofore described with respect to Fig. 1. Here also, the refrigerant liquefying unit may be connected by connections 62 and 63 with some other apparatus such as the evaporator of an ice cream hardening tank and the refrigerant liquefying unit may be automatically controlled by the thermostatic bulb 64 operating similarly to the bulb 33 shown in Fig. 1.

In the modification shown in Fig. 3, the apparatus may be substantially the same as in Fig. 1,

with the exception that the valve 70 is made normally responsive to a thermostatic bulb 71 placed at or near the outlet 75 of the evaporator 73. Liquid refrigerant is received from the liquefying unit through the line 74 and returns to the unit through the line 75. Connections to the hardening tank or the like may be provided at 76 and 77. During normal operation, the thermostatic bulb 71 causes the valve 70 to admit sufficient liquid refrigerant into the evaporator 73 until the bulb 71 is cooled to a predetermined limit after which the liquid refrigerant will be stopped or throttled to maintain a normal liquid refrigerant level or condition in the evaporator 73. When hot water is introduced through the intake 78, the pressure rises in the evaporator 73 above a predetermined limit where the pressure acting on the diaphragm in valve 70 overcomes the pressure from the bulb 71 and stops the flow of liquid refrigerant through valve 70 into the evaporator 73. The liquid refrigerant in the evaporator 73 is forced through the line 79 into the reservoir 80 similar to the reservoir 40 heretofore described with respect to Fig. 1 where liquid refrigerant remains until the hot water is discharged or cooled in the freezing chamber 81. In this particular modification, the liquefying unit may be started and stopped in accordance with refrigerant pressure prevailing in the line 75. Thus the branch 82 is connected to the bellows 83 which operates the snap switch 84 which controls a motor similar to motor 25 shown in Fig. 1.

This application is a continuation in part of my copending application Serial No. 636,540 filed October 6, 1932, for refrigerating apparatus.

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. A refrigerating apparatus comprising a refrigerant liquefying unit, an evaporator receiving liquid refrigerant from said unit and discharging evaporated refrigerant into said unit, an automatic expansion valve between said unit and evaporator said valve throttling the flow of refrigerant into said evaporator from said unit with the rise in refrigerant pressure in said evaporator and stopping the flow of refrigerant from said unit into said evaporator when the refrigerant pressure in said evaporator rises above a predetermined limit, said refrigerant liquefying unit being automatically controlled in accordance with conditions in the apparatus and a reservoir connected to the lower portion of said evaporator, said reservoir having means for trapping evaporator liquid refrigerant therein.

2. A refrigerating apparatus comprising a refrigerant liquefying unit, an evaporator receiving liquid refrigerant from said unit and discharging evaporated refrigerant into said unit, an automatic expansion valve between said unit and evaporator said valve throttling the flow of refrigerant into said evaporator from said unit with the rise in refrigerant pressure in said evaporator and stopping the flow of refrigerant from said unit into said evaporator when the refrigerant pressure in said evaporator rises above a predetermined limit, said refrigerant liquefying unit being automatically controlled in accordance with conditions in the apparatus and a reservoir connected to the lower portion of said evaporator, said reservoir having means for

trapping evaporated liquid refrigerant therein.

3. A refrigerating apparatus comprising a refrigerant liquefying unit, an evaporator receiving liquid refrigerant from said unit and discharging evaporated refrigerant into said unit, an expansion valve between said unit and evaporator said valve controlling the flow of refrigerant into said evaporator from said unit in accordance with refrigerant pressure in said evaporator, a thermostatic bulb in thermal contact with the refrigerant in said evaporator controlling the effective normal liquid refrigerant level in said evaporator and a reservoir connected to the lower portion of said evaporator, said reservoir having means for trapping evaporated liquid refrigerant therein.

4. A refrigerating apparatus comprising a compressor, condenser and evaporator in refrigerant flow relationship, an automatic expansion

valve between said condenser and evaporator, said expansion valve automatically closing as the pressure of the refrigerant in said evaporator rises above a predetermined limit, an electric motor driving said compressor, a thermostat in thermal contact with said evaporator adjacent its outlet end, said thermostat automatically starting said motor when the temperature rises above a predetermined limit and stopping said motor below a predetermined limit, a closed refrigerant reservoir away from the cooling environment of said evaporator and connected to the lower end of said evaporator, whereby said motor and compressor automatically continue to operate, said valve automatically closes and said evaporator automatically empties into said reservoir when said evaporator is heated abnormally.

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