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REFRIGERATING APPARATUS

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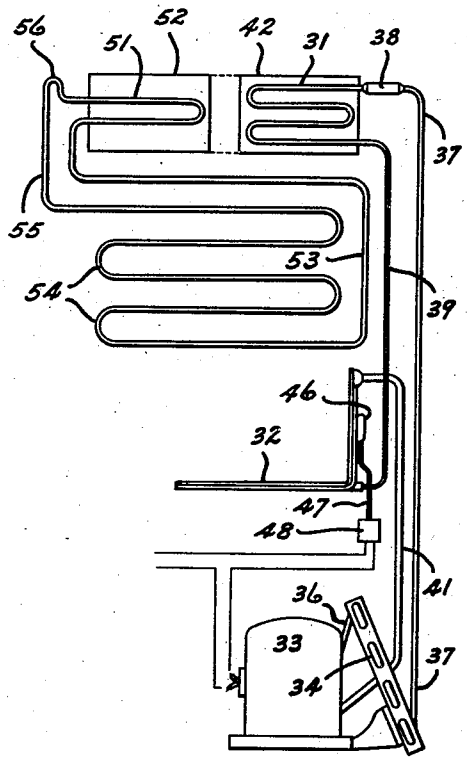


Fig. 3

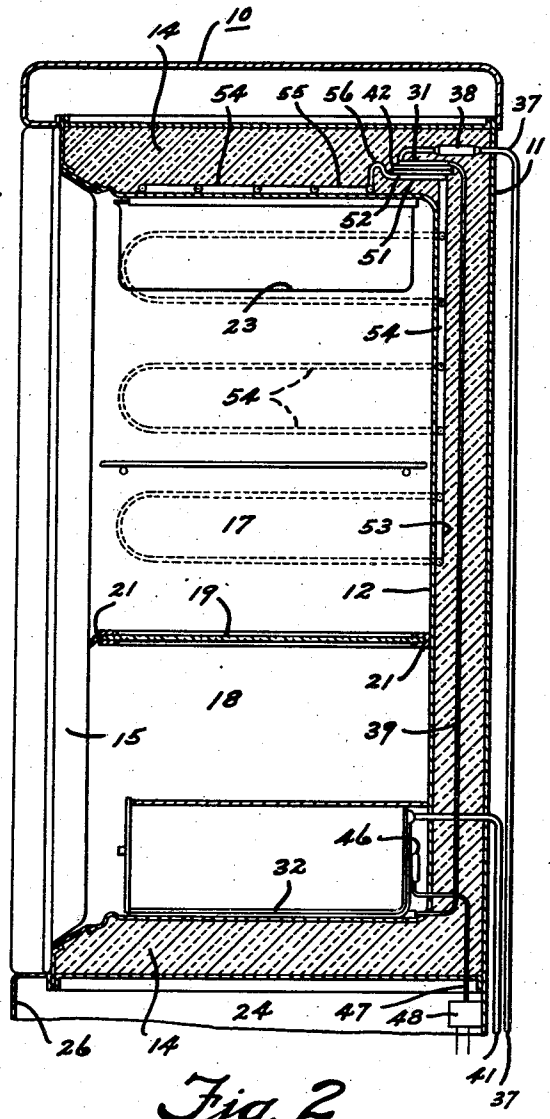


Fig. 2

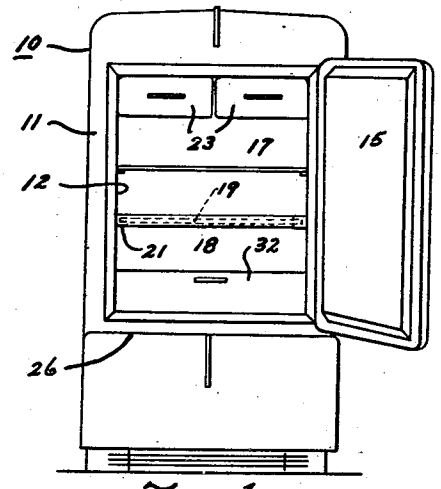


Fig. 1

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REFRIGERATING APPARATUS

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6 Claims. (Cl. 62—116)

This invention relates to refrigerating apparatus and more particularly to a two-temperature refrigerator cabinet.

Recently there has been placed on the market a type of refrigerator commonly referred to as a "Cold-Wall" refrigerator. This type refrigerator differs from conventional household refrigerators in that a partition is provided within the refrigerator chamber for dividing the interior thereof into upper and lower food storage spaces or compartments. In this type of refrigerator a secondary refrigerant circuit forming means has a portion thereof extending over or wrapped around the walls of the lower compartment and has another portion thereof disposed in contact or in intimate heat exchange relationship with an evaporator or freezer coil, located in the upper compartment, of a closed primary refrigerating system. It has, of course, been preferable to construct the secondary circuit as simple as possible so as to materially minimise manufacturing cost of the refrigerator. The secondary circuit of such refrigerators has been devoid of valves and is therefore a continuously open circuit wherein the volatile refrigerating fluid flows freely throughout the circuit. Consequently, it has been necessary, in obtaining the proper circulation of refrigerating fluid in such circuits, to cool the lower food storage compartment of the cabinet by the secondary circuit and to cool the upper compartment by the evaporator of the primary refrigerating system. Should this practice be reversed in an attempt to cool the upper compartment by the secondary circuit and the lower compartment by the evaporator of a primary refrigerating system, then valved heat pumps or the like are necessary to lift liquid refrigerant upwardly from the lower portion of the secondary circuit to the upper evaporator portion thereof. Such valved heat pumps in a secondary circuit in addition to being expensive are a source of continual trouble. Therefore, I contemplate the cooling of a lower food storage compartment of a two-temperature refrigerator cabinet by an evaporator of a primary refrigerating system and the cooling of the upper compartment thereof in a practical and improved manner by a secondary refrigerant circuit associated with the primary refrigerating system and without the use of valved heat pumps or troublesome devices interposed in the circuit.

An object of my invention is to provide an improved two-temperature refrigerator cabinet.

Another object of my invention is to provide an improved arrangement or association of a secondary refrigerating circuit with a primary refrigerating system whereby the upper compartment of a cabinet of a refrigerating apparatus can be cooled by the evaporating portion of a secondary refrigerating circuit without employing valves or pumps and the like in the secondary circuit.

A further and more specific object of my invention is to associate a primary refrigerating system, having two evaporators or two evaporating portions disposed one above the other, with a two-compartment refrigerator cabinet and wherein the lowermost of the primary evaporators is employed to cool the lower compartment of the cabinet and the other or uppermost primary evaporator is utilized to render a secondary refrigerant circuit, devoid of valves and/or heat pumps, effective to cool the upper compartment of the cabinet.

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 front view of a refrigerating apparatus having my invention embodied therein;

Fig. 2 is an enlarged fragmentary, vertical, sectional view of the refrigerator shown in Fig. 1; and

Fig. 3 is a diagrammatic showing of the refrigerating systems adapted to be associated with the refrigerator cabinet disclosed in Figs. 1 and 2.

Referring to the drawing, for illustrating my invention, I have shown in Fig. 1 thereof a refrigerating apparatus of the two-temperature household type. A cabinet 10 has a plurality of outer metal panels or walls 11 and an inner metal liner member 12 forming a chamber within the cabinet. Any suitable or desirable insulating material 14 (see Fig. 2) may be disposed between the liner 12 and the walls 11 to insulate the chamber. Liner member 12 has an aperture therein registering with an aperture formed in the walls 11 in the front of cabinet 10 to provide an access opening for the chamber. This access opening is normally closed by an insulated door structure 15. The chamber within cabinet 10 is divided into an upper food storage space or compartment 17, and a lower food storage space or compartment 18 by a glass plate or the like partition 19. Partition 19 has a rubber or the like gasket member 21 secured to all four edges thereof and the gasket 21 engages the

three vertical walls of liner 12 and the inner face of door 15 to isolate the compartments 17 and 18 from one another. Vegetable storage hydrators 23 may be mounted in any suitable or desirable manner within the top portion of the upper food compartment 17. The outer cabinet walls 11 depend below the insulated chamber and form a machine compartment 24 (see Fig. 2) in the bottom of cabinet 10 for housing a refrigerant liquefying and circulating unit. This machine compartment is closed at the front of the cabinet by a cover or door 26.

A primary refrigerating system associated with the refrigerating apparatus or refrigerator cabinet includes an evaporating part or evaporator 31, embedded in the insulation 14 at the upper part of cabinet 10 and another or second evaporator 32 located below the level of evaporator 31 and disposed within the lower compartment 18. The refrigerant liquefying and circulating unit of the primary refrigerating system is usually mounted in machine compartment 24 and comprises a sealed motor-compressor unit 33 and a condenser 34 (see Fig. 3). Refrigerant compressed by the compressor of unit 33 is forwarded under pressure, through a pipe 36, to condenser 34 where it is cooled in any suitable or desirable manner and liquefied. The liquid refrigerant is circulated to evaporator 31 by way of pipe 37 under control of a suitable restrictor device 38. Restrictor 38 causes some of the liquid refrigerant to expand upon entering evaporator 31 and this expanding or evaporating refrigerant produces a refrigerating effect for a purpose to be hereinafter described. A small diametered restricting tube or pipe 39, leading from evaporator 31 to evaporator 32 conveys the remainder of the liquid refrigerant admitted to evaporator 31 along with the refrigerant evaporated therein to the evaporator 32. It is to be understood that while I have disclosed the long small diametered restricting tube 39 for controlling or conveying both gaseous and liquid refrigerant from evaporator 31 to evaporator 32, other forms of restrictors or an expansion valve can be used for this purpose. Refrigerant evaporated within evaporator 32 is withdrawn therefrom by the compressor of the motor-compressor unit 33 through a return conduit 41. Evaporator 31 is in the form of a flat serpentine coil secured to a metal plate 42 and the refrigerating effect produced by this evaporator or this part of the primary refrigerating system is utilized to render a secondary refrigerant circuit, to be hereinafter more fully described, effective to produce refrigeration. The evaporator 32 is preferably of the conventional sheet metal type and is mounted in any suitable or desirable manner in the lower food storage compartment 18 of cabinet 10 so as to cool this compartment to a low temperature. The temperature of evaporator 32 is at all times maintained below freezing in order to freeze water or other substances placed in trays and located thereon. The cooling compartment 18 at such low temperature causes frost to form on the walls of the primary evaporator 32 which also causes dehydration of the air within the compartment and the maintenance of a low relative humidity therein. Starting and stopping of the electric motor of the motor-compressor unit 33 may be carried out in response to the temperature of the evaporator 32. Thus I mount a thermostatic bulb 46 on a wall of evaporator 32 and connect this bulb, by a pipe 47, with an expansible and contractible bellows (not shown) contained within a control switch 48 which may be of conventional snap acting construction. Actuation of mechanism of switch 48 controls an electric circuit to the unit 33 to start and/or stop operation of the motor, and consequently the compressor of the primary refrigerating system.

A closed secondary circuit containing a volatile liquid refrigerant is associated with the refrigerator 10 and comprises a refrigerant condensing portion 51 in the form of a conduit loop secured to a metal plate 52. The plate 52, to which the condenser of the secondary circuit is secured, is clamped or secured in any suitable or desirable manner in face to face contact with the plate 42, carrying the refrigerant evaporating part or evaporator 31 of the primary refrigerating system so as to be in intimate thermal heat exchange relationship therewith. Plates 42 and 52 are located above the level of the top of liner 12 and a liquid feeding conduit 53 is connected with and depends from the condenser 51 of the secondary circuit for forwarding condensed liquid refrigerant to an evaporating portion 54 of the circuit. This evaporator or evaporating portion 54 of the secondary circuit comprises a plurality of conduit loops secured to and extending over the outer surface of liner 12 so as to substantially traverse the top, back and side walls of the upper food compartment 17 of cabinet 10. A conduit 55 connects the evaporating portion or loops 54 of the secondary circuit with the condenser 51 thereof and has a goose-neck trap 56 formed therein adjacent the condenser 51 as is customary in such systems to prevent any liquid condensing in the condenser 51 from draining directly into the conduit 55. It will be noted that the secondary circuit is disposed below the level of the first evaporator 31 of the primary refrigerating system and that the refrigerant evaporating portion 54 of the secondary circuit is located intermediate the level of the two primary evaporators 31 and 32 or above the evaporator 32. Volatile refrigerant evaporating within evaporator 54 of the secondary circuit cools the walls of the upper food storage compartment 17 of cabinet 10 and maintains the interior of this compartment at a temperature above freezing. The interior of compartment 17 is inherently maintained between certain temperature limits in accordance with the normal temperature limits of the primary evaporator 32 and consequently the temperature of primary evaporator 31 due to the association of condenser 51 of the secondary circuit with evaporator 31. Refrigerant, after evaporating and flowing upwardly in the loops 54 of the secondary circuit, enters the condenser loop 51 by way of conduit 55 and trap 56. This evaporated refrigerant is condensed and liquefied by the refrigerating effect or low temperature of the primary evaporator 31 and the liquefied refrigerant then flows downwardly from the condenser 51 by way of the liquid feeding conduit 53 to the lowermost evaporator loops 54. In a structure of the type disclosed, it is the purpose of partition 19 to divide the cabinet chamber into two compartments wherein the one or lower compartment 18 is maintained at a low temperature and low relative humidity in the manner described and wherein the other or upper compartment is maintained at a higher temperature, and consequently high humidity for providing a two-temperature cabinet for the storage of various food products.

From the foregoing, it will be apparent that I have provided an improved refrigerating apparatus of the household type wherein a secondary refrigerant circuit is associated with a primary refrigerating system in a novel manner to provide for the cooling of the upper food storage compartment of a refrigerator cabinet to a higher temperature than the temperature of a lower compartment thereof cooled by the evaporator of the primary system. This is, in the present disclosure, accomplished by a secondary circuit which is devoid of valves or heat pumps to thereby provide a refrigerating apparatus that is simple in construction, practical, of low manufacturing costs and efficient in operation. The contact between the one primary evaporator and the condenser of the secondary circuit is predetermined so as to insure the maintenance of a substantially constant temperature and high humidity within the high temperature upper food storage compartment of the refrigerator cabinet, while the second evaporator freezes water into ice and maintains the low-temperature lower food storage compartment between its predetermined desired low temperature limits. It will be understood that by associating the condenser of the secondary circuit with a refrigerant evaporating portion of the primary system disposed above the primary evaporator employed for cooling the lower of the compartments of the refrigerator cabinet, the condensing portion and the evaporating portion of the secondary circuit are normally in continuously open communication with one another and function in the well known and conventional manner to cool the upper compartment of the cabinet. This secondary circuit, being devoid of heat pumps and the like, is of low manufacturing costs as compared to other complicated and troublesome secondary circuits employed to cool a compartment above a compartment in which a primary evaporator is located.

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 in combination, a cabinet having an upper food storage compartment and a lower food storage compartment therein, a closed primary refrigerating system associated with said cabinet and including an evaporator disposed in said lower food compartment for cooling same, a closed secondary refrigerating circuit containing a volatile liquid and including a condensing portion associated with a part of said primary refrigerating system disposed above said evaporator thereof, said secondary circuit also including an evaporating portion extending over walls of said upper food compartment for cooling the interior thereof, said condensing portion and said evaporating portion of said secondary circuit being in continuously open communication with one another and means for circulating refrigerating fluid to and from said evaporator of the closed primary refrigerating system.

2. A refrigerating apparatus comprising in combination, a cabinet having an upper food storage compartment and a lower food storage compartment therein, a closed primary refrigerating system including a first evaporator in the upper portion of said cabinet and a second evaporator disposed in heat exchange relationship with said lower food compartment for cooling same, a closed secondary refrigerating circuit containing a volatile liquid, said secondary circuit including a condensing portion in intimate heat exchange relationship with said first primary evaporator and an evaporating portion located above said secondary primary evaporator and disposed in heat exchange relationship with said upper food compartment for cooling same; and means for circulating refrigerating fluid to and from said evaporator of the closed primary refrigerating system.

3. A refrigerating apparatus comprising in combination, a cabinet having a plurality of walls forming a chamber therein, said chamber being provided with an access opening normally closed by a door, means cooperating with the inner face of said door and with the upright walls of said chamber for dividing the chamber into an upper food storage compartment and a lower food storage compartment, a closed primary refrigerating system including a first evaporator in the upper portion of said cabinet and a second evaporator disposed in heat exchange relationship with said lower food compartment for cooling same, a closed secondary refrigerating circuit including a condensing portion in intimate heat exchange relationship with said first primary evaporator and an evaporating portion located above said second primary evaporator and disposed in heat exchange relationship with said upper feed compartment for cooling same, and means for circulating refrigerating fluid to and from said evaporators of the closed primary refrigerating system.

4. A refrigerating apparatus comprising in combination, a cabinet having an upper food storage compartment and a lower food storage compartment therein, a closed primary refrigerating system including a first evaporator disposed exteriorly of said upper compartment and located in the top portion of said cabinet and a second evaporator disposed within said lower compartment for cooling same, a closed secondary refrigerating circuit containing a volatile liquid, said secondary circuit including a condensing portion in intimate heat exchange relationship with said first primary evaporator and an evaporating portion located above said second primary evaporator and disposed in intimate thermal contact with walls of said upper compartment for cooling the interior thereof, and means for circulating refrigerating fluid to and from said evaporators of the closed primary refrigerating system.

5. A refrigerating apparatus comprising in combination, a cabinet having a plurality of walls forming a chamber therein, said chamber being provided with an access opening normally closed by a door, means cooperating with the inner face of said door and with the upright walls of said chamber for dividing the chamber into an upper food storage compartment and a lower food storage compartment, a closed primary refrigerating system including a first evaporator disposed exteriorly of said upper compartment and located in the top portion of said cabinet and a second evaporator disposed within said lower compartment for cooling same, a closed secondary refrigerating circuit containing a volatile liquid, said secondary circuit including a condensing portion in intimate heat exchange relationship with said first primary evaporator and an evaporating portion located above said second primary evaporator and disposed in intimate thermal contact with walls of said upper compartment

for cooling the interior thereof, and means for circulating refrigerating fluid to and from said evaporators of the closed primary refrigerating system.

6. A refrigerating apparatus comprising in combination, a cabinet having a lower low temperature compartment and an upper higher temperature food storage compartment therein, a closed primary refrigerating system having a low pressure side including an evaporator disposed in heat exchange relation with said lower compartment, a closed secondary refrigerating circuit including a heat dissipating portion and a heat absorbing portion disposed below said heat dissipating portion, said heat dissipating portion of said circuit being in heat exchange relation with the low pressure side of said primary refrigerating system at a point above the primary evaporator, said heat absorbing portion of said circuit being disposed in heat exchange relation with said upper food compartment, said secondary circuit being normally maintained at substantially the same pressure throughout the heat dissipating and heat absorbing portions thereof, and means for circulating refrigerating fluid to and from said evaporator of the closed primary refrigerating system.

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