Dec. 29, 1936. L. A. PHILIPP 2,065,536

REFRIGERATING APPARATUS

Original Filed June 20, 1932 2 Sheets-Sheet 1

Fig. 2.

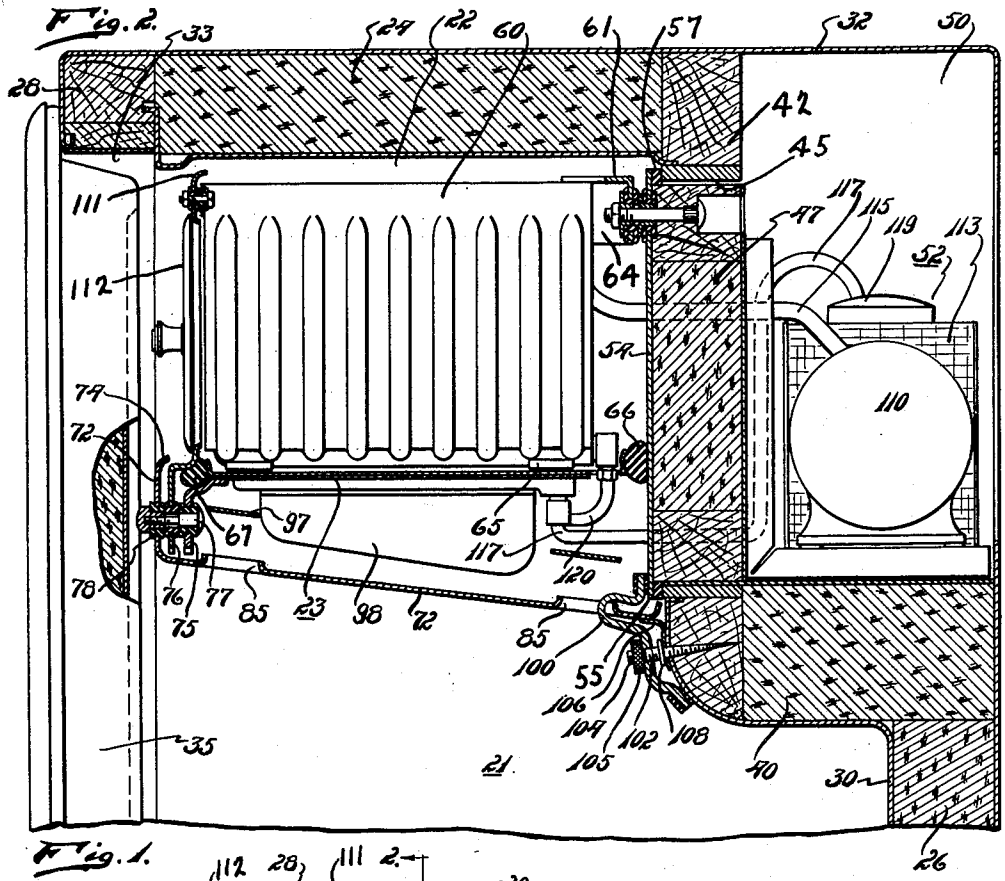


Fig. 1.

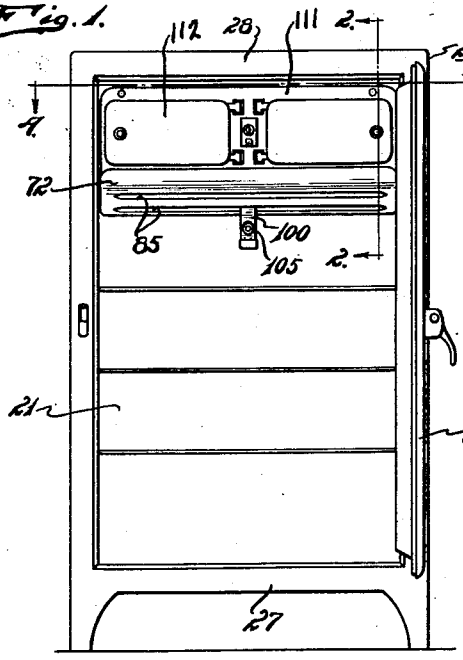
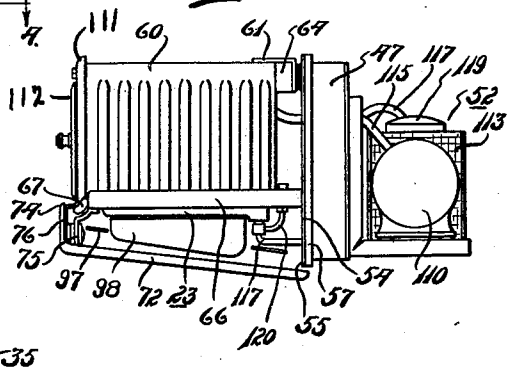


Fig. 3.



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REFRIGERATING APPARATUS

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Fig. 4

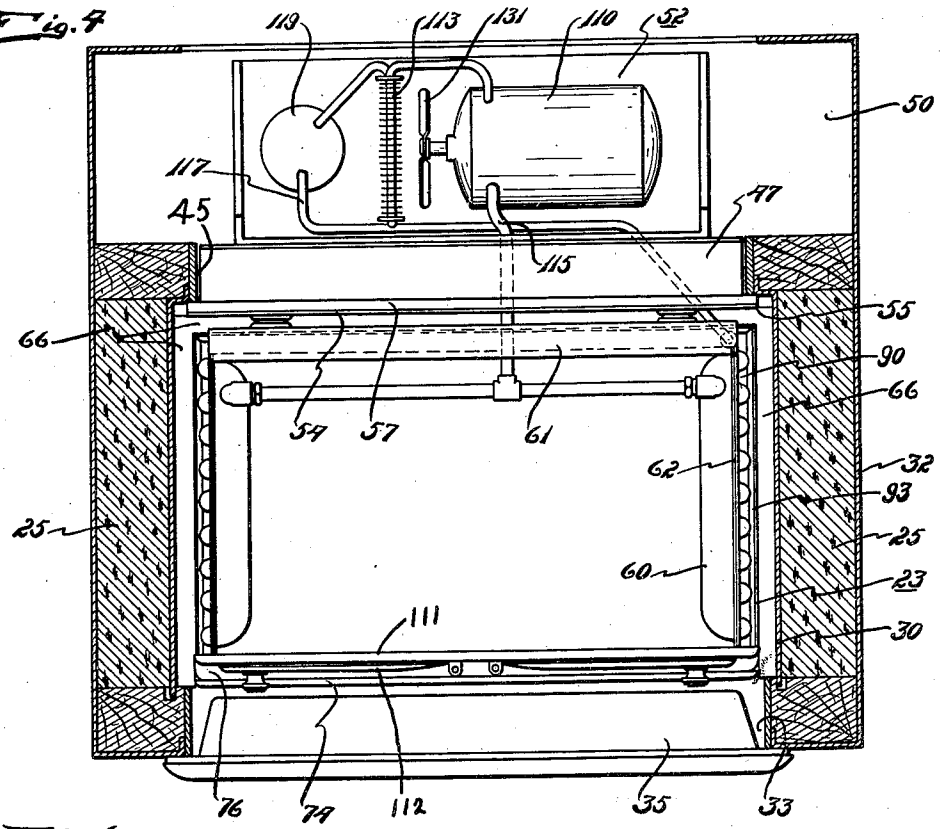


Fig. 6.

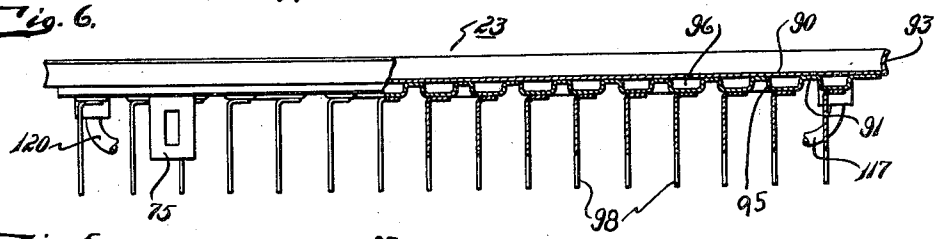
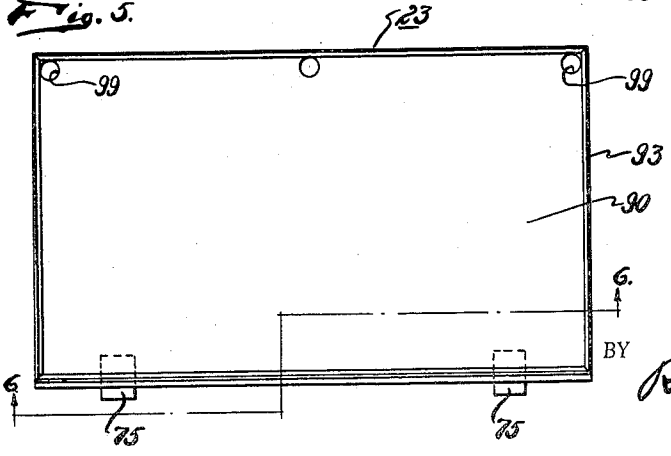


Fig. 5.



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2,065,536

REFRIGERATING APPARATUS

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Application June 20, 1932, Serial No. 618,127
Renewed January 16, 1936

15 Claims. (Cl. 62—116)

This invention relates to refrigerating apparatus and more particularly to refrigerating apparatus of the household type.

One of the objects of my invention is to provide a new and improved arrangement for refrigerating a refrigerator cabinet.

Another object of my invention is to provide a a refrigerating system including a refrigerant evaporator of relatively large heat capacity for freezing purposes and a refrigerant evaporator of relatively small heat capacity for refrigerating a food storage compartment of a refrigerator cabinet and to provide a new and improved arrangement of said evaporators within said cabinet.

Another object of my invention is to provide a refrigerant evaporator of relatively large heat capacity for freezing ice cubes, desserts and the like and one which has provisions for receiving large amounts of such substances to be frozen and to provide a refrigerant evaporator of relatively small heat capacity for refrigerating a food storage compartment of a cabinet whereby the small heat capacity evaporator may be operated at temperatures above that which would be likely to cause the formation of ice and frost on its outer surface due to moisture deposited thereon by the circulating air in the food compartment.

Another object is to remove the aforesaid evaporators as well as the condensing element therefor from the cabinet without disconnecting any of the refrigerating parts.

Other objects and advantages of the present invention will be readily apparent from the following description and by reference to the accompanying drawings.

In the drawings:

Fig. 1 is a front view in elevation of a refrigerating apparatus embodying features of my invention;

Fig. 2 is a side view in cross section, taken in the direction of the arrows 2—2 of Fig. 1;

Fig. 3 is a side view in elevation of the refrigerating system shown removed from the cabinet;

Fig. 4 is a view in cross section taken along the line 4—4 of Fig. 1;

Fig. 5 is a top plan view of a refrigerant evaporator embodying features of my invention; and

Fig. 6 is a view taken in the direction of the arrows 6—6 of Fig. 5.

Referring to the drawings 20 designates in general a refrigerator cabinet having a compartment 21 for the storage of foods to be refrigerated and a second compartment 22 separated by a refrigerant evaporator 23 which is preferably of small heat capacity and having a large exposed area for cooling the food storage compartment 21. The cabinet is constructed of insulated walls including a top wall 24, side walls 25, rear wall 26, bottom wall 27 and a front wall 28. An inner metallic lining member 30 is provided for forming the inner side walls, rear wall, and top wall of the compartment 22, and side walls, rear wall and bottom wall of compartment 21, while the evaporator 23 is adapted to form the uppermost wall of compartment 21 and the bottom wall of compartment 22. The inner metallic lining member 30 is preferably provided with a coating of vitreous enamel such as porcelain to provide neat appearing surfaces which may be easily cleaned. An outer casing 32 is provided for enclosing the walls of the cabinet. In the front wall 28 there is provided an opening 33 through which access to the food compartment and the compartment 22 may be had. A door 35 is provided for closing the opening 33.

As shown in Fig. 2 the cabinet is provided with a horizontally extending wall 40 which extends from the rear wall 26 inwardly to a vertical wall 42 while the top wall 24 extends rearwardly from the front of the cabinet to the vertical wall 42. The vertical wall 42 extends across the width of the cabinet and is provided with an opening 45 closed by a movable wall structure 47. The vertical wall 42 cooperates with the horizontal wall 40 and the outer casing 32 to provide a machine compartment 50.

Within the machine compartment 50 there is disposed a refrigerant condensing element 52. The element 52 is supported on an L-shaped angle iron support with the upright portion being suitably secured to the movable wall structure 47 and the base portion being adapted to rest on the horizontal wall portion 40. A plate 54 is carried by the wall structure 47 on the compartment 21 side. The edges of the plate 54 overextend the edges of the wall structure 47 providing a shoulder 55. To insure a complete seal between the compartment 22 and the machine compartment, gaskets 57 of some suitable material such as rubber are provided to be compressed between the edges of plate 54 and wall 42 when the wall structure 47 is in position within the cabinet.

Within the compartment 22 there is disposed a refrigerant evaporator 60 which is preferably of relatively large heat capacity for freezing ice cubes, desserts and the like. This evaporator is preferably U-shaped and occupies substantially the entire compartment 22. Consequently the

evaporator has but a small exposed area. Suitable receptacles (not shown) may be provided for substances to be frozen in the evaporator 60. Preferably the evaporator 60 is supported by and removable with the movable wall structure 42. For supporting the cooling element 60 by the wall structure 47 an angle iron 61 is provided. A horizontally extending portion is secured to the uppermost ends 62 of the U-shaped evaporator 60 preferably by welding and the vertically extending portion of the angle iron is secured to the wall structure 47 by bolts 63. Suitable reinforcing metal plates 64 are inserted in the corners of the angle iron where they are welded both to the angle iron and the rear edges of the evaporator.

As shown in Fig. 2 the small heat capacity evaporator 23 is provided to refrigerate the food compartment 21 and is disposed immediately below and adjacent the relatively large heat capacity evaporator 60, there being a small air space therebetween. The evaporator 23 is carried by the underside of the evaporator 60 and may be supported by brackets 65 or other suitable means preferably welded to each evaporator. As shown the evaporator has the general shape of a flat plate so as to occupy a minimum of space and extends substantially across the width of the cabinet and from the vertical wall 42 to a point adjacent the door 45. The evaporator 23 separates compartments 21 and 22 and prevents the warm circulating air in compartment 21 from entering compartment 22.

To aid in preventing air from the food compartment 21 rising to the relatively large heat capacity cooling element I have provided insulation 66 between the side and rear edges of the cooling element 23 and the inner corresponding walls of the cabinet. The insulation is preferably carried by the cooling element 23 and may be of any suitable material such as rubber. The cooling element 23 is also insulated from the cooling element 60 across the front by a strip of suitable insulating material, indicated at 67. Thus the space within the refrigerator cabinet 21 is divided by the cooling element 23 into two compartments, the cooling element 60 being disposed within the freezing compartment 22 and being substantially insulated from the food compartment 21.

As hereinbefore stated, the low heat capacity cooling element 23 does not extend to the front door to completely insulate the food and freezing compartments, so that there is some communication between them. This opening could be sealed if desired by providing a strip of rubber or other suitable means between the cooling element and the door to be compressed by the door when in closed position. However, it has been found that with the present construction this opening is so small as to permit only a small quantity of air to pass from the food compartment to the freezing compartment so that the heat transfer from compartment 21 to compartment 22 is negligible for all practical purposes.

In order to direct the air circulating within the food compartment over the cooling surface of the evaporator 23, and also to provide means for catching the water drip when the system is defrosted, a baffle plate 72 is provided. This baffle is preferably formed of sheet metal and is arranged immediately below the cooling element 23. The baffle extends substantially across the width of the cabinet and from the upright wall 42 to a point adjacent the door 45.

The baffle plate 72 is detachably secured at its front edge to the cooling elements 23 and 60 and at its rear edge to the upright wall 42 so that it may be removed from the cabinet as a part of the refrigerating system or separately as desired. The front edge of the baffle is formed with an upturned flange 74 which extends across the width of the cabinet. The cooling element 23 is provided with lugs 75 which extend downwardly adjacent to and substantially parallel with the upturned flange 74. Similar downwardly extending lugs 76 are provided on the cooling element 60 and may be welded thereto. The lugs 75 and 76 and the flange 74 are provided with aligning holes through which may extend bolts 77. As shown, the holes are provided with grommets 78 of some suitable non-heat conducting material such as rubber to prevent the conduction of heat between the cooling elements and the baffle.

The baffle plate 72 is preferably arranged at an angle having its rear edge at a lower point than the front edge. This arrangement improves its efficiency in influencing the air of the food compartment to circulate over the cooling element 23 in the desired manner. Transversely extending openings 85, one at the front and the other at the rear, are provided in the baffle through which the circulating air of the food compartment passes over the cooling surface of the cooling element 23.

As shown in Figs. 5 and 6, the evaporator 23 is formed by two pieces 90 and 91 preferably sheet metal, the upper piece of metal 90 being substantially flat with an upturned flange 93 extending around the perimeter thereof, and the lower sheet 91 being provided with depressed portions or corrugations 95 which serve to provide a passage 96 for refrigerant, preferably a serpentine passage therefor. The flange 93 serves to retain the insulation 66 and 67 in position. The evaporator 23 is provided with a plurality of downwardly extending heat absorbing fins 98. As shown the evaporator 23 is provided with a plurality of openings 99. These openings permit the passage of drip water received when defrosting the evaporator 60 to the baffle 72. Guards 97 are provided to prevent moisture from dropping through openings 85. If desired a suitable removable drain pipe (not shown) may be connected to the baffle 72 for conducting the drip water out of the cabinet.

By the present arrangement of providing two evaporators, one of relatively large heat capacity for freezing ice cubes and the like and one of relatively small heat capacity and one which has a large exposed area for cooling circulating air in the food compartment, it is possible to operate the small heat capacity evaporator at temperatures above that which would be likely to cause the formation of frost and ice thereon due to moisture deposited thereon from the circulating air. This avoids the necessity of periodically defrosting the evaporator 23. Also by the present arrangement the evaporator 60 which has a small exposed area, it being confined to the small compartment 22, is not exposed to the circulating air of the food compartment and consequently requires less defrosting than if it were exposed to such circulating air. When the evaporator 60 is being defrosted, the drip water therefrom is received by the evaporator 23 whence it passes

through openings 99 to the baffle 72 to be later conducted away through the drain pipe.

It is desirable that the rear end of the baffle plate 72 and the lower end of the closure plate 54 be held in position in a manner such that they may be readily and conveniently detached to be removable as a part of the unitary structure from the cabinet. To this end I have provided a single detachable clamp 100 to serve the dual purpose of supporting the rear end of the baffle plate 62 and to urge the closure plate 54 against the gaskets to seal the opening 45.

The clamp 100 is formed in this instance to straddle the baffle plate 72, the upper end extending through the opening 85 in the baffle to bear against the closure plate 54 and the lower end extending to bear against the wall 40. A hole 102 is formed in the clamp 100 between the bearing ends to receive a screw 104. A thumb nut 105 is provided for the screw by means of which the clamp is urged against the plate 54 and the wall 40. The rear end of the baffle plate 72 is provided with a flange portion 106 extending downwardly adjacent the wall 40. In the end of the flange portion 106 is provided a hole to receive the screw 104, and the flange is secured between the wall 40 and a circular shoulder 108 formed on the screw 104.

A baffle or closure 111 is detachably secured to the front of evaporator 60 to prevent warm air entering the interior thereof from the food compartment or when door 35 is open. The baffle is provided with doors 112 for gaining access to the interior of evaporator 60.

The condensing element comprises in general a motor-compressor unit enclosed in a sealed casing 110 and a condenser 113. In the operation of the refrigerating system, gaseous refrigerant is withdrawn from the large heat capacity evaporator 60 through conduit 115 and delivered to the condenser wherein it is liquefied. The liquid refrigerant is then delivered through conduit 117 to the small heat capacity evaporator 23 after first passing through a high side float mechanism 119. The liquid refrigerant then passes to the large heat capacity evaporator 60 through conduit 120 and the cycle is repeated. Preferably the condenser is air cooled and for this purpose I have provided a motor driven fan 121. This fan also circulates the air through the machinery compartment which air enters through the rear opening of the machinery compartment to remove heat generated therewithin.

The refrigerating system disclosed herein is preferably intermittently operated for maintaining substantially constant temperature within the compartments 21 and 22. Any suitable means such as an automatic switch (not shown) responsive to changes in pressures within the conduit 115 for connecting and disconnecting the electroc motor to the source of supply may be provided.

To remove the refrigerating system from the cabinet, it is only necessary to remove the single nut 105 clamp 104 and rubber insulation 66 after which the entire system including the baffle may be bodily removed as a unitary structure through the front door opening.

It will be apparent from the foregoing description that I have provided a new and improved arrangement of a refrigerating system within a cabinet. It will also be appreciated that by the arrangement shown and described the temperature of the food compartment may be maintained constant and that the difficulties inherent in prior refrigerating systems employing two evaporators in regards to their occupancy of cabinet space has been obviated.

Another advantage of the invention is that the refrigerating system including two evaporators and a baffle plate may be readily removable as a unitary structure through the food compartment door without the necessity of disconnecting the units.

Although only a preferred form of the invention has been illustrated, and that form described in detail, it will be apparent to those skilled in the art that various modifications may be made therein without departing from the spirit of the invention or from the scope of the appended claims.

What I claim as my invention is:

1. Refrigerating apparatus comprising in combination a cabinet having its interior divided into a plurality of refrigerating compartments by a refrigerant evaporator of relatively small heat capacity, a refrigerant evaporator of relatively large heat capacity disposed in one of said compartments, one wall of said cabinet being provided with opening means leading to said compartments, and closure means for said opening means.

2. Refrigerating apparatus comprising in combination a cabinet having a freezing compartment and a food storage compartment, a refrigerant evaporator supported in said freezing compartment, a refrigerant evaporator supported by said first named refrigerant evaporator and forming the bottom wall of said freezing compartment and a partition between said compartments, and baffle means supported by one of said evaporators and below said second named evaporator.

3. Refrigerating apparatus comprising in combination a cabinet having a compartment to be refrigerated and a freezing compartment, a refrigerant evaporator supported in said freezing compartment for freezing substances, a refrigerant evaporator supported directly below said first named evaporator for cooling circulating air in the cabinet and having provisions for receiving the drip from said first named evaporator during periods when said first named evaporator is being defrosted, said latter evaporator dividing said two compartments, and means below said second named evaporator for receiving the drip from said second named evaporator.

4. Refrigerating apparatus comprising in combination a cabinet having a stepped wall portion including an upright portion and a plurality of horizontally extending portions, a refrigerant condensing element disposed on one side of said upright wall and supported on one of said horizontally extending portions, a refrigerant evaporator disposed on the opposite side of said upright wall and a refrigerant evaporator disposed immediately below said first named evaporator.

5. Refrigerating apparatus comprising in combination a cabinet having a machine compartment, a freezing compartment, adjacent said machine compartment and a food compartment below said freezing compartment; a refrigerant evaporator disposed in said freezing compartment, a refrigerant evaporator separating said food and freezing compartments and being arranged for cooling said food compartment and a refrigerant condensing element disposed in said machine compartment operatively connected to said evaporators.

6. Refrigerating apparatus comprising in combination a cabinet having a machine compartment in the rear thereof, a freezing compartment in advance of said machine compartment, and a food compartment below said freezing compartment; a refrigerant evaporator disposed in said freezing compartment, a refrigerant evaporator separating said food and freezing compartments and being arranged for cooling said food compartment and a refrigerant condensing element disposed in said machine compartment for supplying refrigerant to said evaporators.

7. Refrigerating apparatus comprising in combination a cabinet having a food compartment and a second compartment separated by a refrigerant evaporator, said cabinet including means providing a machine compartment, said means including movable wall means, a refrigerant evaporator carried by said movable wall means, a refrigerant condensing element disposed in said machine compartment on the opposite side of said movable wall means, one of the walls of said cabinet being provided with an opening leading to said compartments and conduits connecting said condensing element to said evaporators, said movable wall means, condensing element and said evaporators being removable bodily as a unitary structure from said cabinet through said opening.

8. Refrigerating apparatus comprising, in combination, a cabinet, an inner metallic lining member arranged to provide inner walls for the cabinet, a flat-like refrigerant evaporator positioned within the confines of said lining member in such a manner so as to divide the interior of the cabinet into a low temperature compartment and a food compartment, and being arranged to cooperate with portions of said lining member to prevent the circulation of air from the food compartment into the low temperature compartment, and a relatively low temperature evaporator positioned in said low temperature compartment.

9. Refrigerating apparatus comprising, in combination, a cabinet, an inner metallic lining member arranged to provide inner walls for the cabinet, a flat-like refrigerant evaporator horizontally positioned within the confines of said lining member and comprising an imperforated metallic wall structure arranged in such a manner so as to divide the interior of the cabinet into an upper or low temperature compartment and a lower or food storage compartment, and being arranged to cooperate with portions of said lining member to prevent the circulation of air from from the food compartment into the low temperature compartment, and a relatively low temperature evaporator positioned in said low temperature compartment.

10. Refrigerating apparatus comprising, in combination, a cabinet having four vertical walls, a structurally separate refrigerant evaporator cooperating with at least three of said walls to divide the interior of said cabinet into a food compartment and a freezing compartment, and a relatively low temperature refrigerant evaporator disposed in said freezing compartment.

11. Refrigerating apparatus comprising, in combination, a cabinet having a stepped wall portion including an upright portion and a plurality of horizontally extending portions, a refrigerant condensing element disposed on one side of said upright wall, a refrigerant evaporator disposed on the opposite side of said upright wall and a refrigerant evaporator of flat partition like conformation supported immediately below said first named evaporator to divide said cabinet into separated compartments.

12. Refrigerating apparatus comprising in combination, a heat insulating cabinet, a structurally independent refrigerant evaporator supported within said cabinet, and a partition like refrigerant evaporator supported by the first named evaporator in cooperative relation to the cabinet walls to provide a separate compartment.

13. Refrigerating apparatus comprising, in combination, heat absorbing means including a portion adapted to be positioned in a compartment for cooling circulating air therein and having a large area exposed to said circulating air, and said heat absorbing means including a second portion shielded from said circulating air whereby the moisture in said circulating air is not deposited on said second portion and the heat of the circulating air does not warm up said second portion as rapidly as the first portion, means for delivering liquid refrigerant first to said first portion and then both liquid and gaseous refrigerant from said first portion to said second portion, and means for controlling the operation of said apparatus in such a manner that frost does not accumulate on said first portion at least part of the time and said second portion operates below the freezing point of water.

14. Refrigerating apparatus comprising, in combination, a cabinet, heat absorbing means including a portion adapted to be positioned in said cabinet to divide said cabinet into a food storage space and a second space for cooling circulating air in said food storage space and having a large area exposed to said circulating air, and said heat absorbing means including a second portion shielded from said circulating air whereby the moisture in said circulating air is not deposited on said second portion and the heat of the circulating air does not warm up said second portion as rapidly as the first portion, means for delivering liquid refrigerant first to said first portion and then to said second portion, and means for controlling the operation of said apparatus in such a manner that frost does not accumulate on said first portion at least part of the time and said second portion operates below the freezing point of water.

15. Refrigerating apparatus comprising, in combination, a cabinet, heat absorbing means including a flat portion adapted to be positioned in said cabinet to divide said cabinet into a food storage space and a second space for cooling circulating air in said food storage space and having a large area exposed to said circulating air, and said heat absorbing means including a second portion shielded from said circulating air whereby the moisture in said circulating air is not deposited on said second portion and the heat of the circulating air does not warm up said second portion as rapidly as the first portion, means for delivering liquid refrigerant first to said first portion and then to said second portion, and means for controlling the operation of said apparatus in such a manner that frost does not accumulate on said first portion at least part of the time and said second portion operates below the freezing point of water.

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