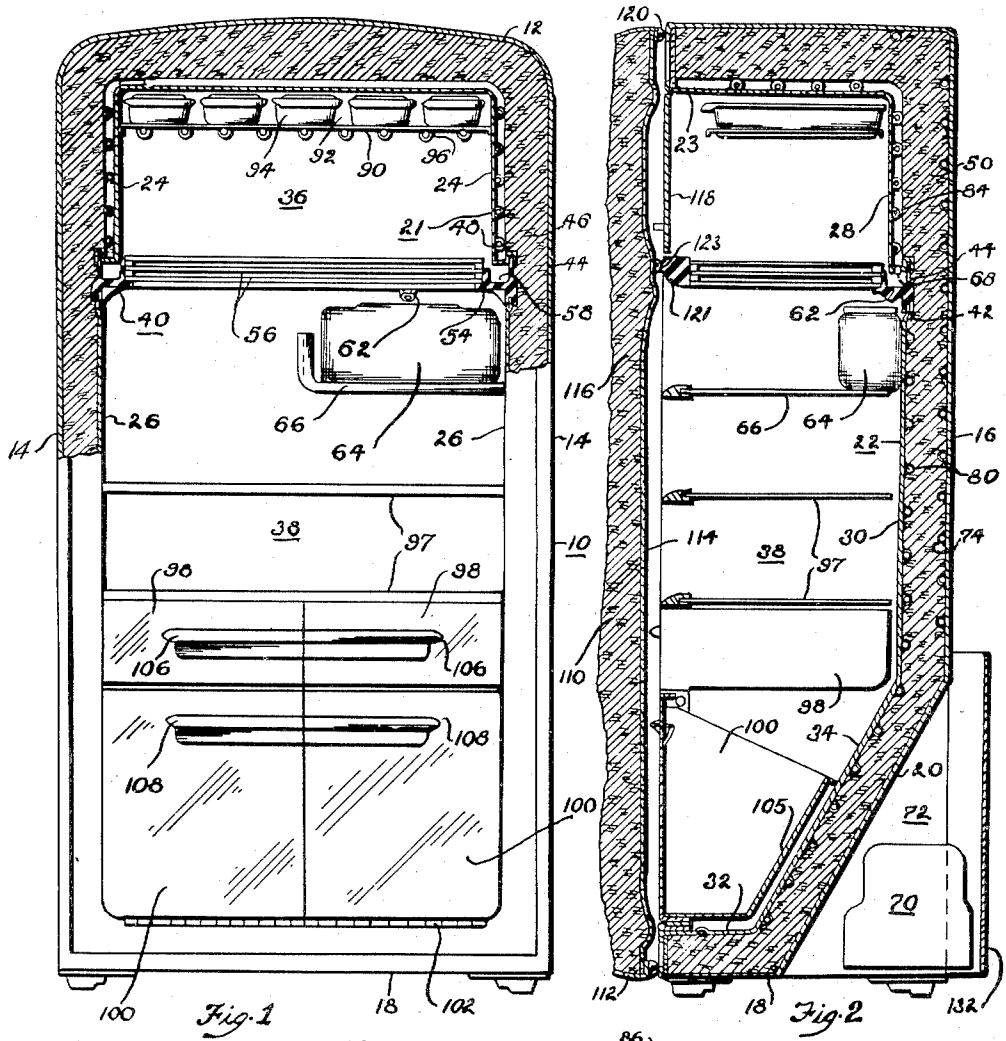
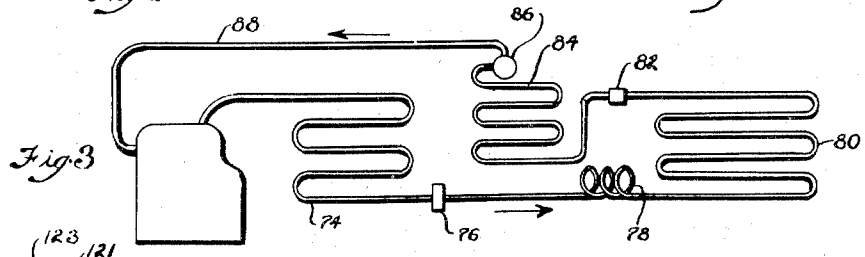
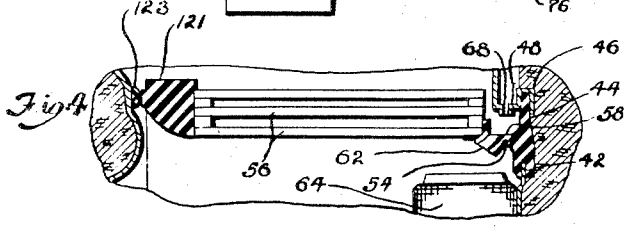
May 30, 1950 L. A. PHILIPP 2,509,610

REFRIGERATING APPARATUS

Filed Jan. 5, 1946 2 Sheets-Sheet 1







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REFRIGERATING APPARATUS

Filed Jan. 5, 1946 2 Sheets-Sheet 2

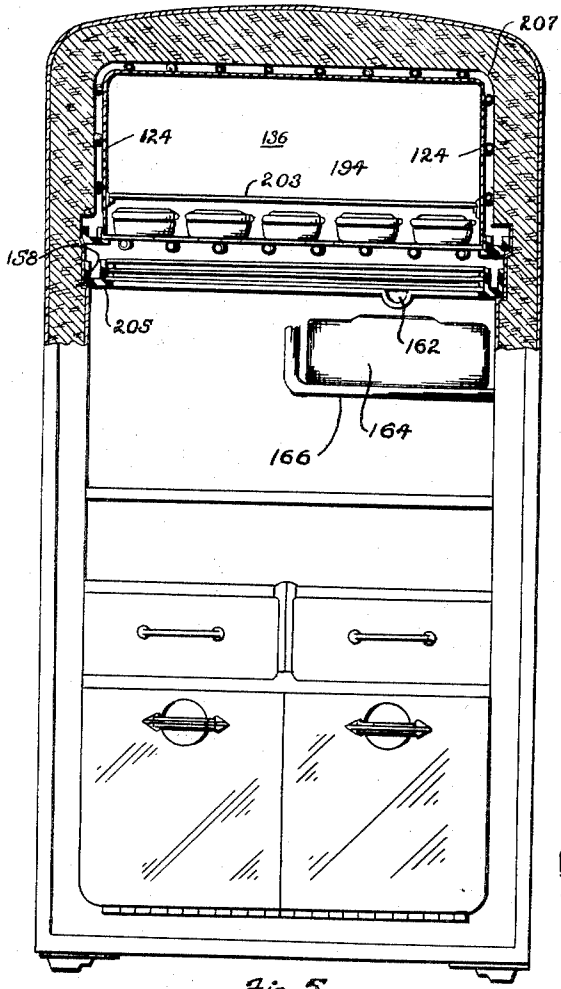


Fig. 5

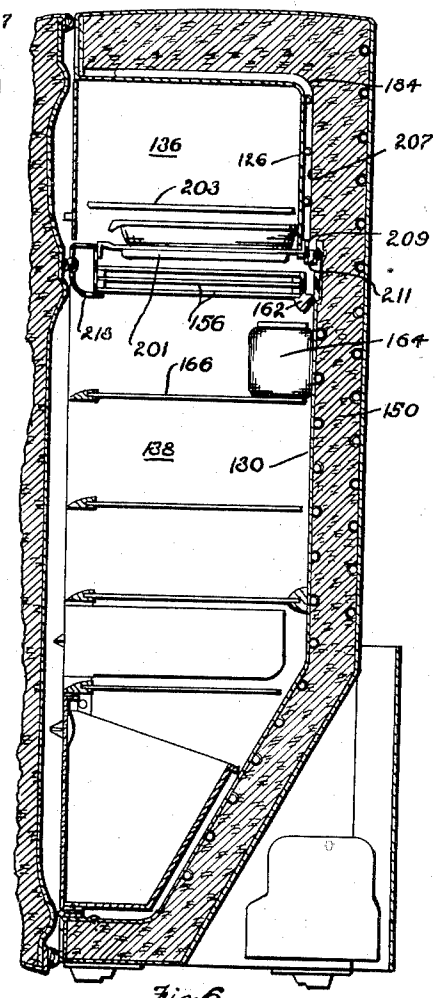
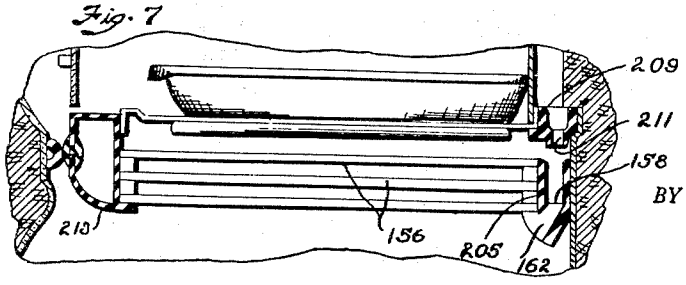


Fig. 6

Fig. 7



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REFRIGERATING APPARATUS

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11 Claims. (Cl. 62—103)

1

This invention relates to refrigerators, and more particularly to an improved domestic refrigerator having more conveniently located food freezing and food storage compartments.

An object of this invention is to arrange ice freezing and food storage compartments in a refrigerator in an improved manner whereby more economical use may be made of the space within the refrigerator.

A further object of the invention is to provide a refrigerator having ice and food freezing compartments positioned above a food storage compartment and separated therefrom by a plurality of transparent insulating plates to position the compartments closer together and to increase the efficiency of the device.

Another object of the invention resides in the provision of a low temperature or food freezing compartment wherein insulation surrounding the ice freezing compartment is positioned to lie inside of the insulation surrounding the food storage compartment, and wherein interconnected ducts are provided to drain the water of condensation from the ice freezing compartment and from adjacent the insulation associated therewith.

Still a further object of the invention resides in the provision of an improved baffle construction formed of non-conducting material for separating the space between ice freezing and food storage compartments.

Still another object of the invention is to provide a refrigerator having an angularly inclined back wall defining the mechanism compartment, and wherein angularly movable bins positioned forwardly of the angularly inclined back wall are provided in the food storage compartment for the reception of articles that cannot be conveniently positioned on shelves.

Other objects and advantages of this invention will be apparent from the following detailed description considered in connection with the accompanying drawings, submitted for purposes of illustration only, and not intended to define the scope of the invention, reference being had for that purpose to the subjoined claims.

In the drawings, wherein similar reference characters refer to similar parts throughout the several views:

Fig. 1 is the front elevation partly in section of a refrigerator embodying the present invention, with the access door removed;

Fig. 2 is a longitudinal sectional view of the device illustrated in Fig. 1 with the access door in place;

2

Fig. 3 is a schematic view illustrating the refrigerating cycle embodied in this refrigerator;

Fig. 4 is an enlarged fragmentary view in cross section of the separator between the freezing and food storage compartments showing how the system engages walls of the compartment liners;

Figs. 5 and 6 are views similar to Figs. 1 and 2 illustrating a modified form of the invention; and

Fig. 7 is an enlarged fragmentary view of Fig. 6.

Before explaining in detail the present invention it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also, it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

Referring now more particularly to the drawings, the embodiment of the invention illustrated in Figs. 1 and 2 includes an outer cabinet 10 having top, side, back and bottom walls 12, 14, 16 and 18, respectively, interconnected by an angularly inclined wall 20 to provide a vertically extended open faced compartment.

Inner metallic liner means, or shells, 21 and 22 formed of a top wall 23, vertically spaced side walls 24 and 26, vertically spaced back walls 28 and 30, connected with a bottom wall 32 through an angularly inclined back wall 34 are provided to divide the space within the cabinet 10 into upper and lower ice freezing and food storage compartments 36 and 38, respectively. The liner means may be of any suitable material and may be of one or more sections or shells insofar as concerns the broad aspect of my invention.

The space between the ice freezing compartment defined by the upper shell consisting of the top wall 23, side walls 24 and back wall 28 and food storage compartment 38 defined by the side walls 26 and back wall 30 is closed by a fitting 40. The fitting 40 has a groove 42 to receive the side and back walls 26 and 30 of the shell defining the food storage compartment 38 and an upwardly extended projection 44 to receive the contoured portion 46 of the side and back walls 24 and 28 of the shell defining the ice and food freezing compartment 36.

The fitting 40 is preferably formed of non-conducting material, such for example as a phenolic resinous product or hard rubber, to retard the flow of heat and cold. The side and back walls 24 and 28 of the shell forming walls of the ice

freezing compartment 36 are contoured to provide a trough 48 between the contoured portion 46 and the lower extremity of the side and back walls 24 and 28.

Suitable insulation 50 is interposed between the walls defining the outer cabinet 10 and the inner shells defining the ice freezing and food storage compartments 36 and 38, respectively. The walls 24 and 28 of the shell defining the ice freezing compartment 36 being offset inwardly with reference to the walls 26 and 30 of the shell defining the food storage compartment 36 provides greater space for the reception of insulation surrounding the ice freezing compartment than is provided for the reception of the insulation surrounding the food storage compartment 38.

The member 40 is provided with a horizontal flange 54 extending around the ice freezing and food storage compartments for the reception of a divider plate, preferably in the form of a plurality of transparent sheets or plates 56 spaced apart to provide dead air spaces therebetween to thermally insulate the spaces between the ice freezing and food storage compartments 36 and 38. If desired, the spaces between the plates 56 may be evacuated to still further increase the insulating characteristics of the divider. The member 40 is contoured to provide a channel portion 58 extending along the side and back walls of the ice freezing compartment 36 adjacent the bottom thereof. An opening 62 is provided in the member 40 to permit the escape of liquid from the channel 58 to a container 64 positioned on a shelf 66 in the food storage compartment 38.

An opening 68 is positioned in the shell or liner 21 defining the ice freezing compartment, preferably between the back wall 28 and the contoured portion 46 to permit the escape of moisture or liquid from the channel 48 extending around the insulation space surrounding the ice freezing compartment adjacent the bottom thereof to permit liquid condensation to flow into the channel 58 through the aperture 62 into the container 64.

A refrigerant motor compressor unit 70 is positioned in a mechanism compartment 72 positioned beneath the angularly disposed back wall 20 of the cabinet 10 to withdraw gaseous refrigerant from a refrigerant evaporator and transmit it to a refrigerant condenser to complete the refrigerating cycle.

The refrigerant condenser is preferably in the form of a series of interconnected conduits 74 bonded to the inner surface of the outer walls of the cabinet in heat exchange relation therewith to dissipate heat from the compressed gaseous refrigerant to convert it to the liquid form. Liquid refrigerant flows from the condenser 74 through a strainer 76 to a capillary tube 78 of small diameter connected to a refrigerant evaporator 80 in the form of a series of interconnected conduits bonded to the outer surface of the walls of the shell defining the food storage compartment 38 to absorb heat therefrom to reduce the temperature therein.

After passing through the evaporator 80 the liquid refrigerant flows through a fixed restriction 82 adapted to maintain a substantially predetermined pressure differential between the liquid refrigerant in the evaporator 80 and another evaporator 84 in the form of series of interconnected conduits bonded to the outer surface of the shell defining the ice or food freezing

compartment 36. As the liquid refrigerant expands in the refrigerant evaporator 84 it absorbs heat from the ice freezing compartment 36 and is converted to the gaseous form in an accumulator 86 communicating by way of a conduit 88 with the inlet side of the motor compressor unit 70.

The space within the ice freezing compartment 36 is divided by a shelf 90 into an upper chamber 92 adapted to receive a plurality of ice trays 94 to freeze ice cubes therein. Suitable refrigerant evaporator tubes 96 connected with the refrigerant evaporator tubes 84 are bonded to the shelf 90 in heat exchange relation therewith as illustrated to absorb heat from the water in the pans 94 to form ice blocks. The space between the upper of the shelves 56 and the shelf 90 is available for the reception of food stuffs or other objects to be frozen.

The space within the food storage compartment 38 is divided by means of a plurality of shelves 66 and 97 to permit more efficient use of the space within the food storage compartment 38. A pair of spaced drawers 98 are provided beneath the lower shelf 97 for the reception of articles to be stored in high humidity conditions. A pair of angularly movable bins 100 are hinged at 102 to permit the bins to be moved angularly between open and closed positions. The bins have angularly inclined back walls 105 conforming with the angular inclination of the walls 20 and 34 defining the lower surface of the food storage compartment. Spaced handles 106 and 108 are provided to permit actuation of the drawers 98 and angularly movable bins 100.

The open vertical face of the cabinet 10 is closed by a door 110 having outer and inner walls 112 and 114 providing therebetween a space for insulation 116 to thermally seal the ice freezing and food storage compartments 36 and 38, respectively. An inner access door 118 is provided to close the entire front of the ice freezing compartment 36 to minimize the loss of cold therefrom when the access door 110 is opened. A suitable gasket 120 is carried by the door to engage the cabinet to seal the front of the refrigerator.

A plate 121, preferably formed of non-conducting material, is provided to engage and support the front ends of the spaced panels 56 interposed between the ice freezing and food storage compartments 36 and 38, respectively. A gasket strip 123 carried by the inner panel 114 of the door 110 engages the front surface of the plate 124 to thermally seal the space between the ice freezing and food storage compartments when the access door 110 is closed.

The operation of this embodiment of the invention is as follows. The motor compressor unit 70 is effective to withdraw gaseous refrigerant through the conduit 88 from the accumulator 86 and direct it through the refrigerant condenser 74 secured in heat exchange relation with the inner surface of the outer walls forming the cabinet 10. As heat is absorbed from the gaseous refrigerant it is converted to the liquid form and flows through the strainer 76 and capillary metering tube 78 to the first stage refrigerant evaporator 80 bonded to the outer surface of the walls defining the food storage compartment 38. The liquid refrigerant expands absorbing heat from the food storage compartment and passes through the fixed restriction 82 to the refrigerant evaporator 84 bonded in thermal relation to the walls defining the ice freezing compartment 36 where the

liquid refrigerant expands still further, absorbing heat and eventually being converted to the gaseous form in the accumulator 86. The cycle is then repeated.

Heat developed by the operation of the motor compressor unit 70 is dissipated from the mechanism compartment 72 by convection air currents flowing over the motor compressor unit 70 from the open bottom of the cabinet and through flue 132 secured to the back wall 16 of the cabinet 10 are provided to assist in the development of convection currents over the motor compressor unit 70 to assist in dissipating heat therefrom.

In a system of this type it is desirable to operate the evaporator 80 at such a temperature that it will absorb heat through the thin metallic liner 22 without the collection of frost on the liner. Thus this part of the system does not require defrosting. If any moisture should be present in the air in the insulation it would not collect on evaporator 80 because evaporator 84 operates considerably below the freezing point of water and under these conditions such moisture would be frozen out on evaporator 84. Preferably, the insulation is spaced from evaporator 84 so that water does not contact the insulation when evaporator 84 is being defrosted. When evaporator 84 is being defrosted any ice or frost on evaporator 84 will melt therefrom and flow to trough 48 and through opening 68 into channel 58 whence it flows through opening 62 into receptacle 64. The separator 40 with spaced glass or plastic plates serves as a barrier to the flow of heat and prevents any possibility of frost or ice forming in compartment 38. Preferably, shelves 66 and 97 are made of transparent glass which limits the flow of air about compartment 38. These shelves are spaced slightly from the rear wall 30 to allow limited circulation only. Thus, some air may flow up the rear wall through opening 62 into compartment 36 where some of the moisture in said air will be removed. This prevents the formation of excess moisture in compartments 38. The humidity conditions in drawers 98 and bins 100 will be relatively higher than in compartment 38 above the drawers 98 because the drawers and bins have imperforate fronts thereon which prevents loss of moisture in the drawers and bins when door 110 is opened. Also, when evaporator coils 96 and the liner 21 are defrosted the defrost water will flow over plates 56 and down the liner walls into fitting 40 through aperture 54 into vessel 64.

The embodiment of the invention illustrated in Figs. 5 and 6 is similar in many respects to that illustrated in Figs. 1 to 3. Corresponding parts have, therefore, been given corresponding numbers with the addition of 100.

It will be noted that the side and back walls 124 and 126 of the shell forming walls of the freezing compartment 136 are aligned with and secured to a shelf 201 positioned adjacent the bottom of the compartment 136 to receive the ice trays 194. A shelf 203 positioned above the ice trays 194 is provided for the reception of food stuffs and other articles to be frozen.

An insulated fitting 205 positioned on the side and back walls 126 and 130 of the food storage compartment 138 is provided to receive the spaced apart shelves or plates 156 to separate the ice freezing and food storage compartments 136 and 138, respectively. The fitting 205 is preferably made of a phenolic resinous product

or hard rubber and has the channel 158 extending around the side and back walls and is provided with an aperture 162 aligned with the receptacle 164 positioned on the shelf 166 in the food storage compartment 138 to permit liquid condensation to be removed from the ice freezing compartment 136. The space surrounding the insulation 150 is cut out, as illustrated at 207, adjacent the refrigerant evaporator passages 184 to permit defrost liquid condensation to flow into the insulated channelled member 209 communicating with the channelled portion 158 through an orifice 211, preferably positioned adjacent the bottom of the back wall 128 as illustrated in Fig. 6. The front portion of the member 205 is contoured as illustrated at 213 in Fig. 6 to reduce its weight and to provide a dead air space to more thoroughly insulate the food storage and ice freezing compartments from each other, particularly when the access door 210 is in the closed position. Preferably, the fitting 209 is made of a phenolic resinous product or hard rubber and rests on upper part of the liner, forming the compartment 138.

The remaining parts of the refrigerator shown in Figs. 5 and 6 are the same as that shown and described in connection with Figs. 1 and 2 including the cabinet and refrigerating system including the operation of the system. For these reasons further description of Figs. 5 and 6 is deemed unnecessary.

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.

I claim:

1. A refrigerator comprising a cabinet having vertically spaced ice freezing and food storage compartments, an insulating separator between the ice freezing and food storage compartments comprising a plurality of spaced plates formed of non-conducting material, a horizontally disposed channel between the ice freezing and food storage compartments, a receptacle in the food storage compartment, a passageway through the channelled member in alignment with the receptacle to discharge liquid condensation from the ice freezing compartment, a channeled member surrounding the exterior of the ice freezing compartment, and a passageway through the channelled member in alignment with the channel between the ice freezing and food storage compartments whereby a space between the cabinet and the shell defining the ice freezing compartment may be dehydrated.

2. In a refrigerator having spaced ice freezing and food storage compartments, an insulating member interposed between the ice freezing and food storage compartments comprising a rectangular frame having a horizontally disposed apertured channel, a plurality of spaced apart superimposed plates of transparent material positioned on said rectangular frame, an ice tray supporting shelf in the ice freezing compartment, refrigerant evaporator tubes associated with the ice freezing compartment and tray supporting shelf, insulation surrounding the ice freezing compartment, and means to conduct liquid condensation from the ice freezing compartment and from adjacent the insulation surrounding the ice freezing compartment when the refrigerator is defrosted.

3. A refrigerator comprising an outer casing, an inner upper liner forming walls of a freezing compartment, an inner lower liner forming walls of a food storage compartment, a fitting of insulating material between and engaging said liners, a low temperature evaporator coil surrounding the upper liner, a relatively high temperature evaporator coil surrounding the lower liner, said fitting having a trough below said upper liner and low temperature evaporator coil for receiving the defrost water therefrom and said fitting being provided with an aperture for allowing such defrost water to flow into said food storage compartment.

4. In a refrigerator having spaced ice freezing and food storage compartments, an insulating member interposed between the ice freezing and food storage compartments comprising a rectangular frame having a horizontally disposed apertured channel, and a plurality of spaced apart superimposed plates positioned on said rectangular frame, said frame and plates cooperating with refrigerator walls to separate said compartments.

5. A domestic refrigerator comprising, a cabinet casing, vertically spaced shells within said casing forming storage space, a fitting between the vertically spaced shells, a plurality of spaced superimposed plates positioned on said fitting and dividing the storage space into freezing and food storage compartments, insulation between said casing and said shells, a rectaptacle in the food storage compartment, and communicating passageways interconnecting the freezing compartment and the space between the upper shell and the casing with the receptacle.

6. In a refrigerator a cabinet having outer walls defining a vertically elongated chamber, non-conducting separator members dividing said compartment into ice freezing and food storage chambers, the lower portion of the cabinet walls being contoured angularly to provide an angularly disposed dividing wall between the food compartment and a mechanism compartment, a motor-compressor in the mechanism compartment, a spaced flue secured to the back wall of the cabinet to induce a flow of convection cooling currents over the motor-compressor unit, refrigerant condenser tubes bonded to the outer walls of the cabinet, refrigerant evaporator tubes bonded to the walls of the shells forming walls of the food storage and ice freezing compartments, and an angularly movable bin in the food storage compartment having an angularly inclined back wall aligned with the angularly inclined wall of said food compartment and adjacent the evaporator tubes on the shell forming walls of the food compartment.

7. In a refrigerator, a cabinet having outer walls, spaced shells in the cabinet forming walls of vertically spaced ice freezing and food storage compartments, insulating material interposed between the cabinet and shells, the back wall of the cabinet and food storage compartment being angularly inclined to provide a mechanism compartment adjacent the bottom of the cabinet, refrigerant evaporator tubes in said back wall, and angularly movable bins positioned in the food storage compartment and having an angularly related back wall aligned with the wall of the food storage compartment adjacent said evaporator tubes.

8. A refrigerator comprising a cabinet having a vertically extending chamber, a separator dividing said chamber into freezing and storage compartments, insulation surrounding the freezing and storage compartments, and means having an inlet outside said chamber to receive condensate and said means also discharging liquid condensation to said separator from the exterior walls of said freezing compartment adjacent the insulation surrounding the freezing compartment and said separator having provisions for discharging condensate directly to said chamber.

9. Refrigerating apparatus comprising a cabinet having inner liner material forming walls of ice freezing and food storage compartments, a separator between said compartments having a channeled portion adjacent said liner material, a trough on the exterior of said liner material adjacent the lower portion of said ice freezing compartment and an opening in said trough leading to said channeled portion.

10. Refrigerating apparatus comprising a cabinet having inner liner material forming walls of ice freezing and food storage compartments, refrigerant evaporator tubes on the exterior of said liner material, a separator between said compartments having an opening leading to said food compartment, and a trough on the exterior of said liner material and being provided with an opening to conduct condensate to said food compartment.

11. Refrigerating apparatus comprising, liner means forming inner wall surfaces of a cabinet, a separator cooperating with said liner means to form an upper compartment and a lower compartment, a passage having an inlet outside said liner means in open communication with the exterior surface of said liner means above said separator and passing through said separator for discharging condensate into said lower chamber, and an opening in said passage in communication with the upper surface of said separator to receive condensate therefrom.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,051,733	Moore et al.	Aug. 18, 1936
2,166,791	Bixler	July 18, 1939
2,280,554	Steenstrup	Apr. 21, 1942
2,291,559	Philipp	July 28, 1942
2,318,984	Atchison	May 11, 1943
2,319,522	Schweller	May 18, 1943
2,425,021	Anderson et al.	Aug. 5, 1947