

May 18, 1943

E. F. SCHWELLER
REFRIGERATING APPARATUS

2,319,522

Filed May 25, 1940

2 Sheets-Sheet 1

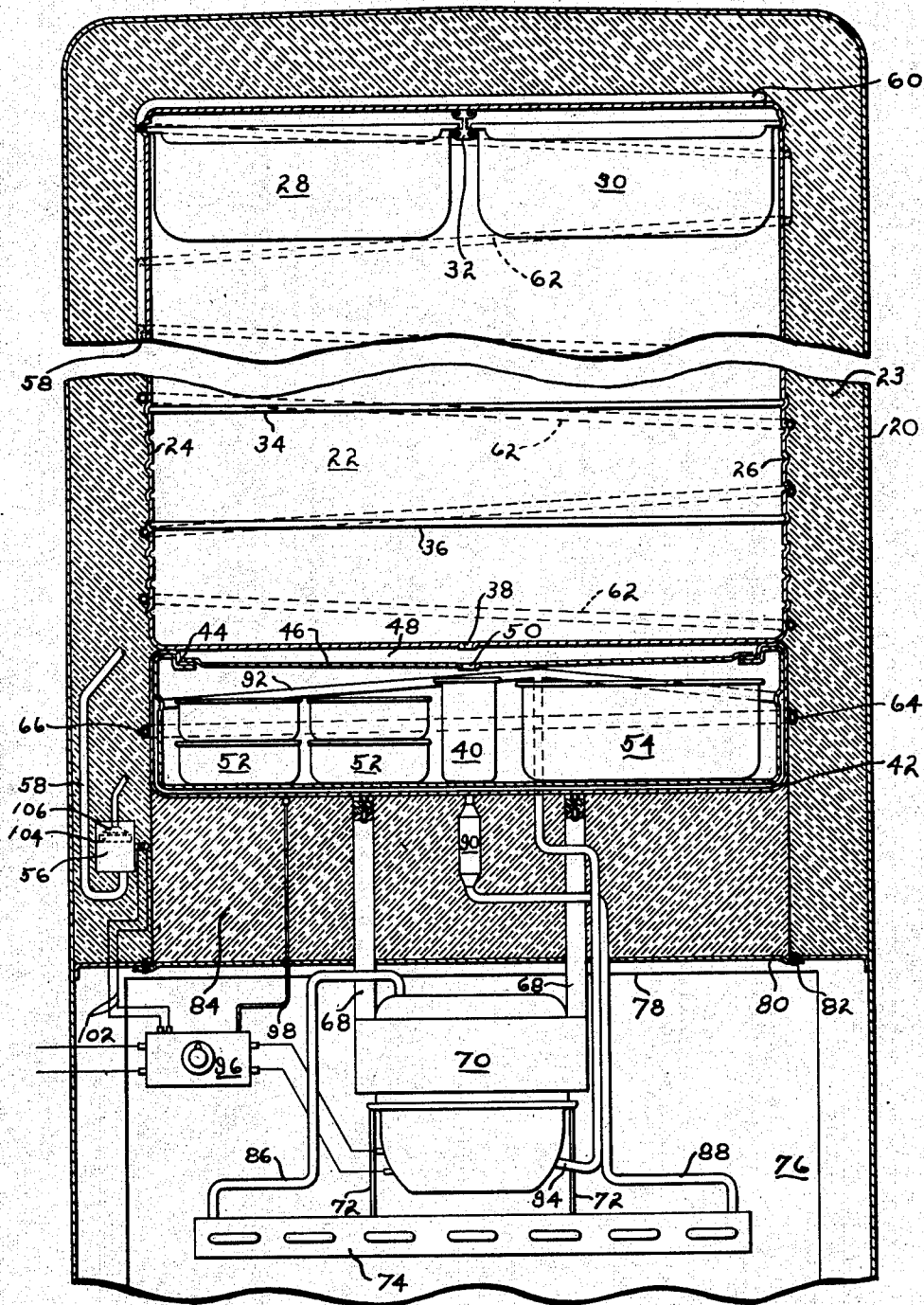


Fig. 1

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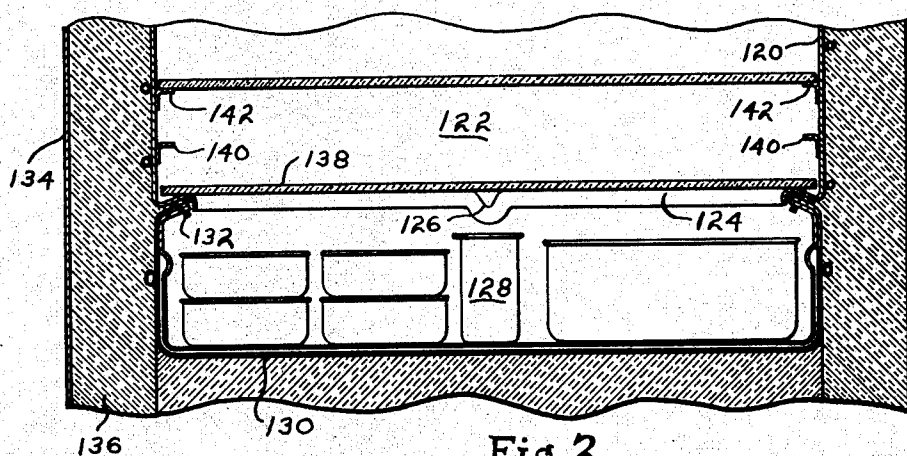


Fig. 2

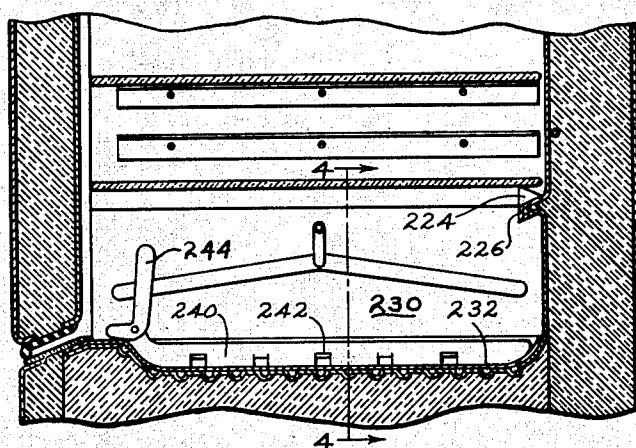


Fig. 3

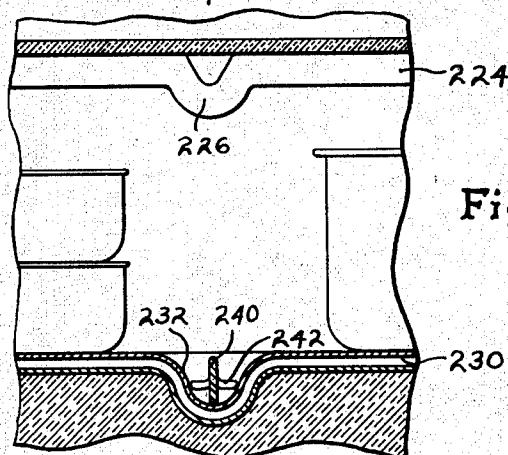


Fig. 4

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UNITED STATES PATENT OFFICE

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REFRIGERATING APPARATUS

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12 Claims. (Cl. 62—103)

This invention relates to refrigerating apparatus and more particularly to household refrigerators.

The removal of condensed moisture and spillage from refrigerator cabinets has been a vexing problem and various schemes of draining and disposing of this moisture and spillage have been proposed. All of these schemes appear to be objectionable in some way and, particularly, many are unsanitary and some cause undesirable odors.

It is an object of my invention to provide a refrigerating apparatus with an improved method and apparatus for the removal and disposal of the condensed moisture and spillage, in a simple, convenient, sanitary and odorless manner.

It is another object of my invention to provide an improved multi-temperature or multi-humidity refrigerator with means for collecting and freezing condensed moisture and spillage in a receptacle in such a way that the frozen moisture can be readily removed.

It is another object of my invention to provide a multi-temperature refrigerator with a freezing evaporator at the bottom and a storage compartment above cooled by an improved secondary means.

It is still another object of my invention to provide a multi-temperature refrigerator with removable means forming the bottom of the cabinet and the storage compartment and including a unitary primary refrigerating system.

It is still another object of my invention to provide an inner liner member of a refrigerator cabinet with an improved, simplified shelf supporting means.

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 a vertical staggered sectional view of a multi-temperature refrigerator cabinet embodying one form of my invention;

Fig. 2 is a fragmentary vertical sectional view of a refrigerator cabinet showing a modified form of my invention;

Fig. 3 is another fragmentary vertical sectional view of a refrigerator cabinet showing another modified form of my invention; and

Fig. 4 is a fragmentary sectional view taken along the lines 4—4 of Fig. 3.

Briefly, I have shown a refrigerator cabinet with a storage compartment at the top and hav-

ing a removable bottom structure which includes a primary freezing evaporator, an insulating means, a section of the bottom wall of the cabinet and the motor-compressor-condenser unit, all assembled together as a unitary removable part of the refrigerator. A secondary refrigerant circuit is wound about the upper storage compartment and is cooled by the primary freezing evaporator. An electrically-operated vapor lift pump is used to circulate liquid in the secondary circuit. The moisture condensed in the storage compartment is drained into a receptacle in the primary freezing evaporator compartment where it freezes; and thus this frozen moisture may be removed and disposed of while in a frozen condition so that odors and possibility of spilling the condensed moisture are thereby eliminated.

Referring now to the drawings and more particularly to Fig. 1, there is shown a household refrigerator cabinet having a sealed outer metal casing 20. In the upper portion of this outer metal casing there is provided a storage compartment 22 enclosed by a metal inner liner member 24. Between the sealed outer casing and the inner liner member is the insulation 23. The metal inner liner 24 is provided with inwardly facing grooves which are formed by bulging outwardly the side walls of the inner liner member along horizontal lines. These grooves are designated by the reference character 26 and are located at various levels in order to support the shelves in any desired spacing and to support at the top of the cabinet a pair of vegetable storage pans 28 and 30. A bracket 32 provides a center support for these pans. The grooves 26 provide a very simple sliding type support for the shelves 34 and 36 and the shelves may easily be slidably removed and relocated at various distances from the bottom of the compartment so that the spacing of the shelves may be readily adjusted to the size of the articles to be stored in the compartment. If desired one or both of these shelves may be made of glass so as to partly or wholly seal one part of the cabinet from another. Instead of glass or an open shelf a metal partition or an insulating board may be used to sub-divide this compartment. This is readily possible because the compartment is cooled through the walls without any substantial reliance upon air circulation from any one particular point.

The cooling of the air in a refrigerator cabinet always causes condensation of moisture from the air when there is sufficient moisture in the air. If the cooling surface is below freezing this

moisture freezes upon the cooling surface and must be removed by defrosting. If the cooling surface is above freezing the moisture may be readily drained away. In this cabinet, it is preferred to cool the walls of the inner liner member 24 at a temperature above freezing so that the moisture may be drained as it accumulates, otherwise the moisture would only drain away when the cabinet was being defrosted. Heretofore such moisture either from defrosting or from condensation has been collected either in a dish in the storage compartment or in a pan or reservoir in the machine compartment. When collected in the machinery compartment, the necessary connecting piping and trap would become covered with slime which would cause odors and which would sometimes become dried and be difficult to clean. Also, evaporation would take place in the machinery compartment and this would cause odors in the room where the refrigerator was kept. Where a dish was used in the storage compartment, it was necessary to frequently remove the contents of the dish to prevent contamination of the air in the compartment by this moisture which often provided undesirable odors.

Therefore, as an important feature of my invention, I have provided a drain aperture 38 in the bottom of the storage compartment which drains directly into a receptacle 40 in the primary refrigerant evaporator compartment. This construction eliminates piping which is difficult to clean and when the moisture drops into the receptacle 40 it freezes very rapidly so that it no longer gives off odors. The receptacle 40 rests directly upon the bottom of the U-shaped sheet metal primary evaporator 42 which has refrigerated bottom and side walls which extend upwardly into substantial contact with the lower edge of the inner liner member 24. However, if desired an insulating gasket may keep the upper extension of the primary evaporator 42 separated from the bottom of the inner liner member 24. The upper edge of the evaporator 42 is provided with a flange 44 which supports a removable shield 46 located beneath the bottom of the inner liner member 24 and spaced therefrom so as to provide substantially a dead air space 48 so as to prevent the bottom of the inner liner member 24 from reaching freezing temperatures. This shield 46 is provided with an aperture 50 which is slightly larger than the aperture 38 and registers directly with the aperture 38 so that moisture will not collect at this point upon the shield 46, but will drop directly from the aperture 38 into the receptacle 40.

From time to time, this receptacle 40 may be removed with the moisture therein in frozen condition and this frozen moisture after its removal from the refrigerator may be removed from the receptacle 40 and thrown into the drain where it can melt and be washed away. However, if desired, the frozen condensed moisture need not be removed from the receptacle but the receptacle itself may be left in the drain so that the moisture will melt directly out of the receptacle. In such case another receptacle should be placed in the refrigerator to catch the drip while the receptacle 40 is in the drain. If desired, the receptacle 40 may be made of paper or some other disposable material and disposed of with the condensed moisture, and the paper receptacle replaced after each usage. With this freezing method and arrangement there is no danger of spilling the contents of the receptacle 40 and the

contents of the receptacle 40 may be disposed of at such a place where the odors will not be objectionable. Normally these odors are only objectionable in the presence of certain foods which tend to acquire odors and taste from various sources.

The primary evaporator 42 is also provided with ice trays 52 and a frosting pan 54 for keeping frozen foods. The storage compartment 22 is cooled by a secondary refrigerant circuit which is filled with a considerable amount of volatile liquid. This secondary circuit extends from an electrically-operated vapor lift pump 56 and includes an upwardly extending tube portion 58 which extends upwardly along the front edge of the cabinet to a looped section 60 upon the top of the inner liner member 24. From this section 60 the secondary tubing includes portions 62 wrapped around the rear and side walls of the inner liner member 24 for cooling the walls of the inner liner member 24. The portion 62 slopes downwardly and works itself downwardly along the side and rear walls of the inner liner 24 until it reaches the bottom of these walls. From this point the secondary tubing connects to portions 64 and 66 which are in heat exchange relation with the side walls of the primary evaporator 42. These portions drain into the vapor lift pump 56.

The vapor lift pump 56 includes a float chamber containing a float 104 which is adapted to close the flared mouth of the tube 106 which connects to the condensed portion 66 of the secondary refrigerant tubing. When the float chamber is substantially filled, the float 104 closes the mouth of this tubing and a portion of the volatile liquid is heated in a small bulb provided in the side of the float chamber so that there is provided a vapor pressure sufficient to lift the volatile liquid out of the float chamber 56 to the top 60 of the secondary circuit from which point it will run by gravity through the portions 62 of the circuit wrapped around the inner liner member 24 where it can vaporize and cool the walls. The vapor pressure in the float chamber will also keep the float in its position closing the mouth of the tubing 106 until a substantial amount of the liquid collected therein has been forced to the top 60 of the circuit. For this reason, the float 104 should be made comparatively light in weight.

Preferably some form of volatile liquid is employed in this secondary circuit but if desired any sort of fluid and any sort of pump may be used to obtain the necessary circulation. If desired the pump may be provided with a temperature control controlled by the temperature in the storage compartment 22. The secondary refrigerant circuit tubing may be clamped at various points to the walls of the inner liner member 24 and the primary evaporator 42. If desired some sort of an adhesive may be used for further bonding the secondary circuit tubing to the inner liner member 24.

The primary evaporator 42 is connected structurally by vertical bars 68 with a sealed motor-compressor unit 70. This motor-compressor unit 70 is structurally connected by the rods 72 with a flat finned condenser 74 located beneath the sealed motor-compressor unit 70. The motor-compressor unit 70 and the condenser 74 are located in the machine compartment 76 which is provided with a ventilating opening in the bottom and a ventilating opening 78 in the rear wall.

The top of the machine compartment is provided with a removable metal section 80 which is fastened by screws 82 to the remaining portion of the top wall of this compartment. Preferably a sealing gasket is used to make this joint airtight. These screws may be removed in order to remove the entire primary refrigerating system from the cabinet through the bottom of the cabinet. In so doing any fastenings between the portions 64 and 66 of the secondary refrigerant circuit tubing and the primary evaporator 42 are disconnected. This makes it possible to remove the entire primary refrigerating system together with the wall section 80 and the insulation 84 between the wall section 80 and the primary evaporator as well as of the refrigerant connections in the primary refrigerant circuit.

These refrigerant connections include tubing 86 connecting the outlet side of the compressor with the inlet portion of the condenser 74, the tubing 88 connecting the outlet of the condenser 74 with the restrictor 90 which controls the supply of liquid refrigerant into the primary evaporator and the suction conduits 92 and 94 which connect the outlet of the primary evaporator 42 with the inlet of the motor-compressor unit 70. The restrictor 90 feeds the middle of the primary evaporator and the refrigerant divides and flows through passages to the side walls of the evaporator. The tubing 88 and the tubing 94 are in heat exchange relation so as to exchange heat between the cold suction gas and the warm liquid from the condenser. A thermostatically controlled switch means 96 may also be included in this assembly and provided with tubing 98 connected to a thermostat bulb mounted upon the bottom of the primary evaporator 42 or at some other suitable point thereon. This switch means 96 is electrically connected to the motor and the motor-compressor unit 70. This switch means 96 may also have a removable connection to the electrically operated vapor lift pump 56 through the conductor 102.

In Fig. 2 there is shown a modification in which a slightly different form is provided for the bottom of the food compartment and a different form of drain is provided. In this form the inner liner member 120 enclosing the food compartment 122 is provided with a flanged lower edge 124 which is curled upwardly to provide a drain trough extending around the bottom of the inner liner member 120. At some suitable point, such as the central portion of the rear wall, as shown, this trough 124 is bent downwardly as designated by the reference character 126 in order to form a spout so that the condensed moisture may drain directly therefrom into the freezing receptacle 128 which rests upon the bottom of the primary evaporator 130, like that shown and described in Fig. 1. The flange 124 is removably fastened to the upper flange of the primary evaporator 130 by the screws 132. An insulating gasket is provided between these flanges and serves to insulate the primary evaporator 130 from the inner liner member 120 so that the drain trough and contents will be maintained above freezing temperatures. This gasket also serves to seal the inner walls of the cabinet. The outer wall of the cabinet 134 is preferably hermetically sealed to protect the insulation 136 from the infiltration of moisture.

The top of the primary evaporator 130 and the compartment which it encloses is closed by a

movable insulating partition 138 which normally rests upon the flange 124 as shown in Fig. 2. However, if desired this partition 138 may be moved upwardly to the supports 140 or 142 in order to increase the size of the dry freezing compartment 130. Suitable gaps in the shelf supports may be provided in order to allow moisture to drain into the drip trough provided by the flange 124. The walls of the inner liner member 120 are cooled by a secondary refrigerant circuit means by contact with the primary evaporator 130 and by some suitable form of pump such as was described in connection with Fig. 1. The freezing evaporator 130 is provided with ice trays and a frosting pan like those shown in Fig. 1.

In Figs. 3 and 4 there is shown a modification somewhat similar to that shown in Fig. 2, but different in that the primary evaporator 230 is provided with a depression 232 in the bottom portion thereof located beneath the spout 226 of the drip trough and flange 224. This depression is provided with an ice removing means or grid comprising a longitudinal bar or partition 240 provided with laterally extending fingers or projections 242 and a combined handle and lever 244 which is provided for prying the bar or grid with the frozen condensed moisture attached thereto out of the depression so that it may be removed to a drain and the frozen condensed moisture there be allowed to melt from it. Preferably this depression is waxed in order to facilitate the removal of the frozen condensed moisture. Otherwise this form is constructed as shown and described in Figs. 1 and 2.

While the form of embodiment of the invention as herein described, 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. The method which comprises removing heat from a storage compartment at temperatures above 32° F. and condensing moisture from the air in the compartment, transferring in liquid form the condensed moisture to a place of collection, freezing the condensed moisture at the place of collection, removing in frozen condition the frozen condensed moisture from the place of collection and disposing of the frozen condensed moisture.

2. Refrigerating apparatus including a cabinet provided with a freezing compartment and a storage compartment located above the freezing compartment, a receptacle in the freezing compartment maintained at freezing temperatures, and means for draining moisture from said storage compartment into said receptacle.

3. Refrigerating apparatus including a cabinet provided with a freezing compartment and a storage compartment located above the freezing compartment, a receptacle in the freezing compartment maintained at freezing temperatures, said storage compartment being provided with a trough adjacent the bottom of its walls, said trough being provided with discharge means discharging into said receptacle.

4. Refrigerating apparatus including an insulated cabinet provided with an inner liner member having top, rear and side walls, a unitary removable means forming the insulated bottom wall of said cabinet and a bottom for said inner liner member, and an evaporator below said liner member.

5. Refrigerating apparatus including an insu-

lated cabinet provided with an inner liner member having top, rear and side walls, a unitary removable means forming the bottom of said cabinet and a bottom for said inner liner member, said removable means including a primary refrigerating system, and a secondary refrigerant circuit means removably connected to said primary refrigerating system for cooling the interior of said inner liner member.

6. Refrigerating apparatus including an insulated cabinet provided with an inner liner member, a primary refrigerating means adjacent the bottom of the inner liner member, secondary circuit means in heat exchange relation with the primary refrigerating means and the inner liner member, and pumping means for circulating fluid through said secondary circuit means.

7. Refrigerating apparatus including an insulated cabinet provided with an inner liner member, a primary refrigerating means adjacent the bottom of the inner liner member, secondary circuit means including a condenser in heat exchange relation with the primary refrigerating means and an evaporator in contact with the inner liner member, and pumping means for circulating fluid through said secondary circuit means.

8. The method which comprises condensing moisture from the air in a compartment by surfaces employed to cool the air, conveying the condensed moisture away from the cooling surfaces, collecting and freezing the collected moisture, and thereafter removing the frozen condensed moisture in frozen condition from the place of freezing.

9. Refrigerating apparatus including a cabinet having insulated walls adjacent an inner liner member forming a food storage compartment therein, a unitary removable means located below

said liner member, said removable means including an insulated portion forming a part of the insulated cabinet walls and having a primary refrigerating system associated therewith, said primary refrigerating system comprising an evaporator above the insulated portion of said means and a refrigerant compressing and liquefying unit therebelow, and a secondary refrigerant circuit means removably connected to the evaporator of said primary refrigerating system for cooling the interior of said food storage compartment.

10. Refrigerating apparatus including a cabinet provided with a food storage zone and a freezing zone beyond the storage zone, means for conveying moisture out of said storage zone and into said freezing zone, means for receiving and freezing the moisture in said freezing zone, and means for removing the moisture in frozen condition from said freezing zone.

11. Refrigerating apparatus including a cabinet provided with a food storage zone and a freezing zone beyond the storage zone, means for conveying moisture out of said storage zone and into said freezing zone, means for receiving and freezing the moisture in said freezing zone, and said receiving means being removable from said freezing zone for removing the moisture therefrom in frozen condition.

12. Refrigerating apparatus including a cabinet provided with a food storage zone and a freezing zone beyond the storage zone, means for conveying moisture out of said storage zone and into said freezing zone, means for receiving and freezing the moisture in said freezing zone, and means for mechanically releasing the frozen moisture from said receiving means to permit removal thereof from said freezing zone.

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