

Jan. 30, 1962

L. J. MANN ETAL

3,018,637

REFRIGERATOR WITH DEFROST MEANS

Filed Feb. 17, 1960

2 Sheets-Sheet 1

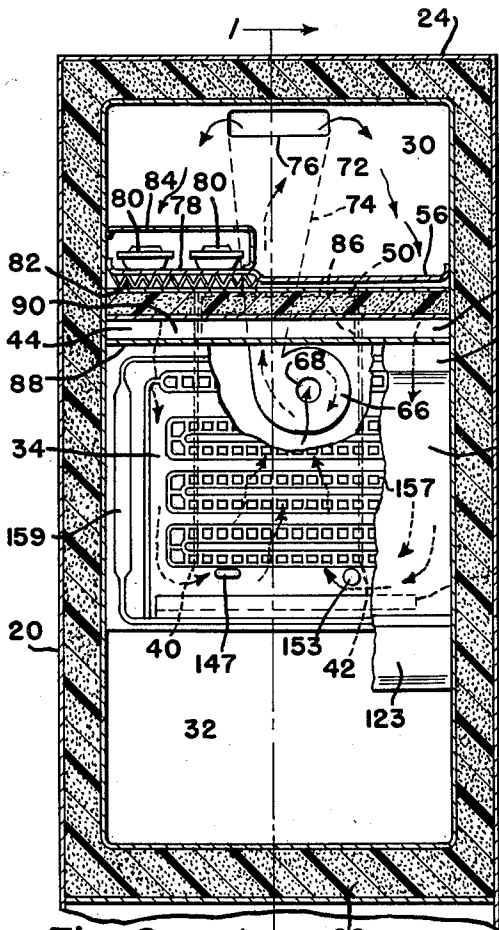


Fig. 2

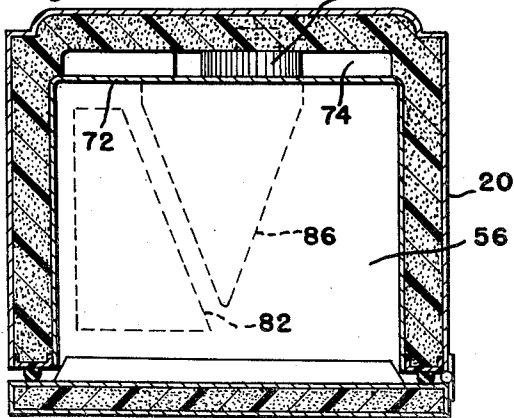


Fig. 3

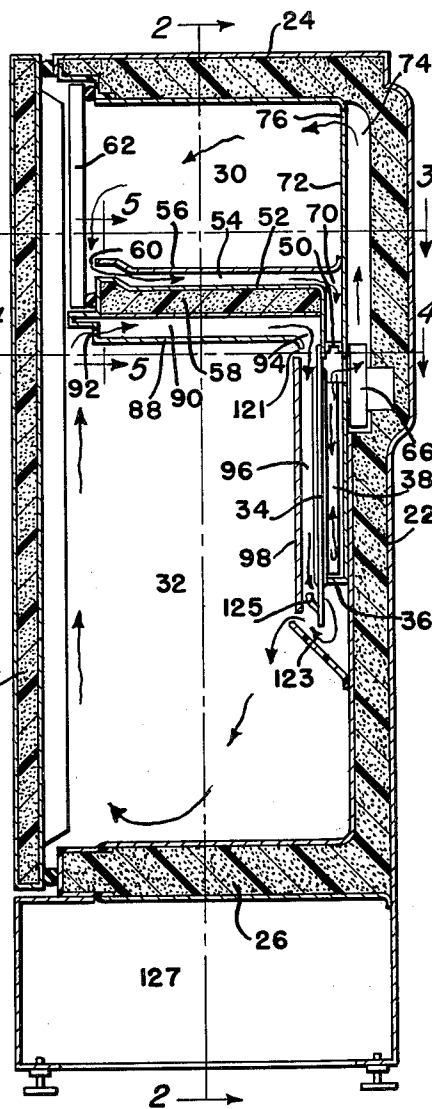


Fig. 1

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3,018,637

REFRIGERATOR WITH DEFROST MEANS

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Filed Feb. 17, 1960, Ser. No. 9,361

8 Claims. (Cl. 62-155)

This invention relates to refrigerating apparatus and more particularly to two-compartment household refrigerators in which frost will not collect and remain in either compartment.

Refrigerators which are free of frost have become popular; however, because of their relatively high price, their sale has been largely limited to those with larger incomes.

It is an object of this invention to simplify a two-compartment refrigerator which is free of frost in such a way that it can be made and sold at a low enough cost to appeal to the majority of people.

It is another object of this invention to provide a two-compartment frost-free refrigerator in which only a single temperature control and a single blower are required.

It is another object of this invention to provide a two-compartment frost-free refrigerator in which only a single evaporator is required and in which the frost accumulating thereon is minimized and substantially equalized by keeping the air of the above and below freezing compartments separated.

It is another object of this invention to provide a two-compartment frost-free refrigerator in which the amount of heat and time required for defrosting the evaporator is minimized by using heat from the air in the above freezing compartment in contact with the evaporator.

These and other objects are attained in the form shown in the drawings in which the below freezing compartment is located in the top of the insulated cabinet and provided with a false metal bottom wall having an entrance at the front and an exit at the rear. The air is drawn from this exit over the finned rear surface of the single plate-type evaporator by a blower which discharges the air up behind the rear wall of the below freezing compartment and through an opening at the upper rear into this compartment. In the above freezing compartment there are provided a false top wall and a false rear wall in front of the plate-type evaporator providing circulation by natural gravity substantially uniformly from various parts of the above freezing compartment into contact with the front face of the evaporator for cooling this compartment without the use of a fan. The plate-type evaporator separates and cools on its opposite faces both air circuits. It is provided with fins and an electric defrost heater upon its rear face so that it can be defrosted by this heater with the assistance of heat from the air in the above freezing compartment. The false bottom wall of the below freezing compartment has a raised portion on which the ice trays rest. This raised portion is provided with fins on its underside to provide greater air flow through this section to provide more rapid cooling of the ice trays. Partition walls are provided between the rear face of the evaporator and the rear wall so that the cold air drawn from beneath the false bottom wall of the below freezing compartment is circulated first down the sides and then up the center of the rear face of the evaporator.

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 embodiment of the present invention is clearly shown.

In the drawings:

FIGURE 1 is a vertical side sectional view of a refrig-

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erator embodying my invention taken along the line 1-1 of FIGURE 2;

FIGURE 2 is a front vertical section of the refrigerator shown in FIGURE 1 taken along the lines 2-2 of FIGURE 1;

FIGURE 3 is a horizontal sectional view taken along the line 3-3 of FIGURE 1;

FIGURE 4 is a horizontal sectional view taken on the line 4-4 of FIGURE 1;

FIGURE 5 is an enlarged fragmentary vertical section taken along the lines 5-5 of FIGURE 1;

FIGURE 6 is a wiring diagram; and

FIGURE 7 is a diagram of the refrigerating system.

Referring now to the drawings and more particularly to FIGURES 1 to 5 inclusive, there is shown a two-compartment household refrigerator having upright insulated side walls 20 and upright insulated rear wall 22, horizontal insulated top and bottom walls 24 and 26 and an insulated front door 28 which completes the enclosure of the below freezing compartment 30 and the above freezing compartment 32.

At the rear of the above freezing compartment 32 is a plate-type evaporator 34 which is impervious except at the bottom and extends substantially between the upright sides 20 and is substantially sealed thereto. This evaporator 34 is located in an upright position spaced from and parallel to the upright rear wall 22. This space is lined at the rear by a downward extension of the false rear wall 72 of the freezing compartment which is closed at the bottom by a horizontal wall portion 36. This space is provided with zigzag fins 38 as shown in FIGURE 3 which are bonded to the rear face of the plate evaporator 34. This space is provided with two vertical partition walls 40 and 42 which cooperate with the fins to provide partitions separating the space into two side portions 44 and 46 and a central portion 48. The central portion 48 is closed at the top by horizontal partition wall 50 extending between the tops of the vertical partition walls 40 and 42.

At the top of the evaporator 34, there extends a sheet metal wall 52 extending upwardly to the rear exit of the passageway 54 which is located beneath the false bottom wall 56 of the freezing compartment 30. This sheet metal wall extends forwardly to form the bottom of the passageway 56 and the true bottom of the compartment 30. It is supported upon the insulation 58 separating the below freezing compartment 30 from the above freezing compartment 32. The passageway 54 has an opening 60 at the front adjacent the inner door 62 which closes the below freezing compartment 30.

A centrifugal motor fan unit 66 is located in the rear wall 22 and has its inlet opening 68 communicating with the upper portion of the central space 48 beneath the partition wall 50. This blower unit 66 draws air from the below freezing compartment beneath the false bottom wall 56 from the front entrance 60 through the passageway 54 to the rear exit 70 which communicates with the downwardly extending side passages 44 and 46 containing a portion of the fins 38 for presenting cool metal surfaces to the air. This circulating air passes downwardly along the rear face of the evaporator 34 to the bottom 36 and then travels upwardly through the central portion 48 contacting the center portion of the rear face of the evaporator 34 and the fins 38 until it is drawn into the inlet 68. The fins 38 are omitted in the area bounded by the dotted line 163 adjacent the inlet 68 to provide free air flow thereto. By its contact with the fins and the rear of the evaporator 34, the air is cooled and dried since the evaporator 34 is normally maintained at low temperatures, such as -5° to -15° F. The blower unit 66 discharges this cooled and dried air through a discharge duct 74 extending upwardly in the rear wall 22 behind the false

rear wall 72 of the above freezing compartment 30. This air is discharged through the openings 76 at the top center of the false rear wall 72 for substantial uniform distribution in the below freezing compartment. This cooling arrangement prevents the formation and accumulation of frost in the compartment 30.

The left side 78 of the false bottom wall 56 is raised to provide a platform for the ice trays 80 which rest thereon. This provides for a greater volume of air flow beneath the ice trays 80. The heat transfer properties are increased by a zigzag fin arrangement 82 beneath and bonded to the raised portion 78. A cover 84 extends over the ice trays. Beneath the false bottom wall 56, there is also provided a V-shaped deflector 86 having a pointed end extending toward the front and the spread rear portions extending substantially over the partitions 40 and 42. The lateral extent of the fins 82 is also shown in FIGURE 3.

The above freezing compartment 32 is also provided with a false top wall 88 above which is a passageway 90 having a front entrance 92 and a rear exit 94. Beneath the rear exit is a vertical duct 96 provided by a false rear wall 98 extending between the insulated side walls 20 in front of and spaced from the evaporator 34. A space 121 between the false top wall 88 and the false rear wall 98 improves the circulation in the air of the cabinet by permitting some of the air to be drawn through this opening. The main portion of the air, however, is drawn in through the front entrance 92 and passes rearwardly through the second passageway 90 where it will absorb any moisture which may occur on the bottom of the horizontal wall 58 and flows downwardly through the duct 96 having both its temperature and moisture content reduced by the cold surface of the evaporator 34. A drip collector 123 is provided beneath the evaporator 34. The bottom of the evaporator has an extended portion 125 permitting air from the duct 96 to flow through the opening to the rear wall 22 and through the drip collector 123. This arrangement provides a good air circulation and cooling for the compartment 32.

The customary machinery compartment 127 is located below the bottom wall 26. It contains the motor-compressor unit 129 and the condenser 131 which delivers liquid refrigerant through a capillary tube restrictor 133 to a plate-type evaporator 34. The evaporated refrigerant is returned to the motor-compressor unit 129. Since the evaporator 34 normally operates below ice freezing temperatures, frost will accumulate on both sides in substantially equal amounts. To periodically remove this frost, a serpentine electric heater 135 is located in the portion of the fins 38 nearest the evaporator 34 as is shown in FIGURE 3. As shown in FIGURE 5, a timing motor 137 is connected across the supply conductors 139 and 141. This timing motor normally keeps the double throw switch 143 in position to connect through the conductor 145 and the thermostat switch 147 with the blower unit 66 and the compressor motor 149.

At intervals, such as once a day, the timer motor 137 moves double throw switch 143 out of contact with the conductor 145 and into contact with the conductor 151 which connects through a thermostatic limiter switch 153 with the defrost heater 135 which in turn is connected to the supply conductor 141. The compressor motor 149 is deenergized at this time. Air circulation by natural gravity from the above freezing compartment 32 in its contact with the front face of evaporator 34 will heat the evaporator 34. At the same time, the electric heater 135 heats the rear face of the evaporator 34 to quickly raise its temperature above defrosting. The blower unit 66 is deenergized at this time so that no circulation is provided between the evaporator 34 and the below freezing compartment 30, thus preventing the compartment 30 from being warmed during the defrost period. The evaporator 34 will increase in temperature until all the frost melts therefrom and drains

into the drip collector 123. The partition 36 preferably has suitable drain hose to accomplish this. When a high enough temperature is reached to assure a complete defrosting, the thermostatic limiter switch 153 which is mounted on the evaporator 34 will open. This opening of the switch 153 will energize the solenoid 155 which returns the double throw switch 143 into contact with the conductor 145 to resume normal refrigerating operation. The evaporator 34 is preferably of the roll bonded plate type having dual serpentine refrigerant passages 157 which terminate in an enlarged accumulator chamber 159, the top of which connects to the suction inlet of the compressor 129.

While the embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. A refrigerator including an insulated cabinet having upright and transverse insulated walls enclosing an above freezing compartment and a below freezing compartment above the above freezing compartment, said below freezing compartment being provided with a false bottom wall providing a first air passageway beneath and having openings adjacent the front thereof providing communication between said passageway and the below freezing compartment, an upright substantially imperforate plate type refrigerant evaporating means within said above freezing compartment substantially parallel to but spaced from an upright wall thereof, means cooperating with said evaporating means and said upright wall forming a first duct communicating with the rear of said first air passageway enclosing said below freezing compartment air and keeping said below freezing compartment air separated from the above freezing compartment air, fan means having an inlet communicating with said first duct and an outlet, a discharge duct extending from said outlet to the upper rear portion of said below freezing compartment for returning air cooled in said first duct by said evaporating means to said below freezing compartment, the front face of said evaporating means being exposed to the air in the above freezing compartment for cooling said above freezing compartment.

2. A refrigerator including an insulated cabinet having upright and transverse insulated walls enclosing an above freezing compartment and a below freezing compartment, said below freezing compartment being provided with a false bottom wall providing a first air passageway beneath and having openings adjacent the front thereof providing communication between said passageway and the below freezing compartment, an upright plate type refrigerant evaporating means within said above freezing compartment substantially parallel to but spaced from an upright wall thereof, means cooperating with said evaporating means and said upright wall forming a first duct communicating with the rear of said first air passageway, fan means having an inlet communicating with said first duct and an outlet, a discharge duct extending from said outlet to the upper rear portion of said below freezing compartment for returning air cooled in said first duct by said evaporating means to said below freezing compartment, the front face of said evaporating means being exposed to the air in the above freezing compartment for cooling said above freezing compartment, said false bottom wall having a raised portion for supporting ice trays providing a greater passage height beneath the raised portion for greater air flow than beneath other portions, said raised portion being provided with fins on its bottom face to provide more rapid heat transfer from the ice trays to the air in the first air passageway.

3. A refrigerator including an insulated cabinet having upright and transverse insulated walls enclosing an above freezing compartment and a below freezing compartment, said below freezing compartment being provided with a false bottom wall providing a first air pas-

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sageway beneath and having openings adjacent the front thereof providing communication between said passageway and the below freezing compartment, an upright plate type refrigerant evaporating means within said above freezing compartment substantially parallel to but spaced from an upright wall thereof, means cooperating with said evaporating means and said upright wall forming a first duct communicating with the rear of said first air passageway, fan means having an inlet communicating with said first duct and an outlet, a discharge duct extending from said outlet to the upper rear portion of said below freezing compartment for returning air cooled in said first duct by said evaporating means to said below freezing compartment, the front face of said evaporating means being exposed to the air in the above freezing compartment for cooling said above freezing compartment, said above freezing compartment being provided with a false wall in front of and spaced from the front face of said evaporating means open at the top and bottom to provide an upright duct for promoting the circulation of air from the above freezing compartment downwardly over the front face of said evaporating means.

4. A refrigerator including an insulated cabinet having upright and transverse insulated walls enclosing an above freezing compartment and a below freezing compartment, said below freezing compartment being provided with a false bottom wall providing a first air passageway beneath and having openings adjacent the front thereof providing communication between said passageway and the below freezing compartment, an upright plate type refrigerant evaporating means within said above freezing compartment substantially parallel to but spaced from an upright wall thereof, means cooperating with said evaporating means and said upright wall forming a first duct communicating with the rear of said first air passageway enclosing said below freezing compartment air and keeping said below freezing compartment air separated from the above freezing compartment air, fan means having an inlet communicating with said first duct and an outlet, a discharge duct extending from said outlet to the upper rear portion of said below freezing compartment for returning air cooled in said first duct by said evaporating means to said below freezing compartment, the front face of said evaporating means being exposed to the air in the above freezing compartment for cooling said above freezing compartment, said above freezing compartment being located below said below freezing compartment, insulating means separating said first air passageway and said above freezing compartment, and a false top wall in said above freezing compartment spaced from said insulating means to form a second air passageway, said false top wall being provided with a front entrance and a rear exit.

5. A refrigerator including an insulated cabinet having upright and transverse insulated walls enclosing an above freezing compartment and a below freezing compartment, said below freezing compartment being provided with a false bottom wall providing a first air passageway beneath and having openings adjacent the front thereof providing communication between said passageway and the below freezing compartment, an upright plate type refrigerant evaporating means within said above freezing compartment substantially parallel to but spaced from an upright wall thereof, means cooperating with said evaporating means and said upright wall forming a first duct communicating with the rear of said first air passageway, fan means having an inlet communicating with said first duct and an outlet, a discharge duct extending from said outlet to the upper rear portion of said below freezing compartment for returning air cooled in said first duct by said evaporating means to said below freezing compartment, the front face of said evaporating means being exposed to the air in the above freezing compartment for cooling said above freezing compartment, said above freezing compartment being located

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below said below freezing compartment, insulating means separating said first air passageway and said above freezing compartment, and a false top wall in said above freezing compartment spaced from said insulating means to form a second air passageway, said false top wall being provided with a front entrance and a rear exit, said above freezing compartment being also provided with a second false wall in front of and spaced from the front face of said evaporating means to provide a third passageway and having a top entrance beneath the rear exit of said false top wall and having a bottom exit for promoting the circulation of air from said above freezing compartment through said second and third passageways.

6. A refrigerator including an insulated cabinet having upright and transverse insulated walls enclosing an above freezing compartment and a below freezing compartment above the above freezing compartment, said below freezing compartment being provided with a false bottom wall providing a first air passageway beneath and having openings adjacent the front thereof providing communication between said passageway and the below freezing compartment, an upright plate type refrigerant evaporating means within said above freezing compartment substantially parallel to but spaced from an upright wall thereof, means cooperating with said evaporating means and said upright wall forming a first duct communicating with the rear of said first air passageway enclosing said below freezing compartment air and keeping said below freezing compartment air separated from the above freezing compartment air, fan means having an inlet communicating with said first duct and an outlet, a discharge duct extending from said outlet to the upper rear portion of said below freezing compartment for returning air cooled in said first duct by said evaporating means to said below freezing compartment, the front face of said evaporating means being exposed to the air in the above freezing compartment for cooling said above freezing compartment, said evaporating means having fins on its rear face extending into said first duct.

7. A refrigerator including an insulated cabinet having upright and transverse insulated walls enclosing an above freezing compartment and a below freezing compartment above the above freezing compartment, said below freezing compartment being provided with a false bottom wall providing a first air passageway beneath and having openings adjacent the front thereof providing communication between said passageway and the below freezing compartment, an upright plate type refrigerant evaporating means within said above freezing compartment substantially parallel to but spaced from an upright wall thereof, means cooperating with said evaporating means and said upright wall forming a first duct communicating with the rear of said first air passageway enclosing said below freezing compartment air and keeping said below freezing compartment air separated from the above freezing compartment air, fan means having an inlet communicating with said first duct and an outlet, a discharge duct extending from said outlet to the upper rear portion of said below freezing compartment for returning air cooled in said first duct by said evaporating means to said below freezing compartment, the front face of said evaporating means being exposed to the air in the above freezing compartment for cooling said above freezing compartment, said evaporating means being substantially imperforate to separate the air in said first duct from the air in the above freezing compartment, said evaporating means having fins on its rear face extending into said first duct, means for normally maintaining said evaporating means continuously substantially below water freezing temperatures, a defroster heater located on the rear side of said evaporating means between said fins, and means for periodically energizing said defroster heater to periodically defrost said evaporating means.

8. A refrigerator including an insulated cabinet having upright and transverse insulated walls enclosing an

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above freezing compartment and a below freezing compartment, said below freezing compartment being provided with a false bottom wall providing a first air passageway beneath and having openings adjacent the front thereof providing communication between said passageway and the below freezing compartment, an upright plate type refrigerant evaporating means within said above freezing compartment substantially parallel to but spaced from an upright wall thereof, means cooperating with said evaporating means and said upright wall forming a first duct communicating with the rear of said first air passageway enclosing said below freezing compartment air and keeping said below freezing compartment air separated from the above freezing compartment air, fan means having an inlet communicating with the upper central portion of said first duct and an outlet, a discharge duct extending from said outlet to the upper rear portion of said below freezing compartment for return-

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ing air cooled in said first duct by said evaporating means to said below freezing compartment, the front face of said evaporating means being exposed to the air in the above freezing compartment for cooling said above freezing compartment, said first duct having a set of spaced upright partition walls extending between said evaporating means and said upright wall above said inlet and having two downwardly extending duct portions on the outer sides of said partition walls and an upwardly extending duct portion between the partition walls, said walls terminating above the bottom of the evaporating means causing the air to flow around them and between them before reaching the inlet.

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