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3,403,533

REFRIGERATOR WITH UPRIGHT DIVIDING WALL

Filed Oct. 7, 1966

4 Sheets-Sheet 1

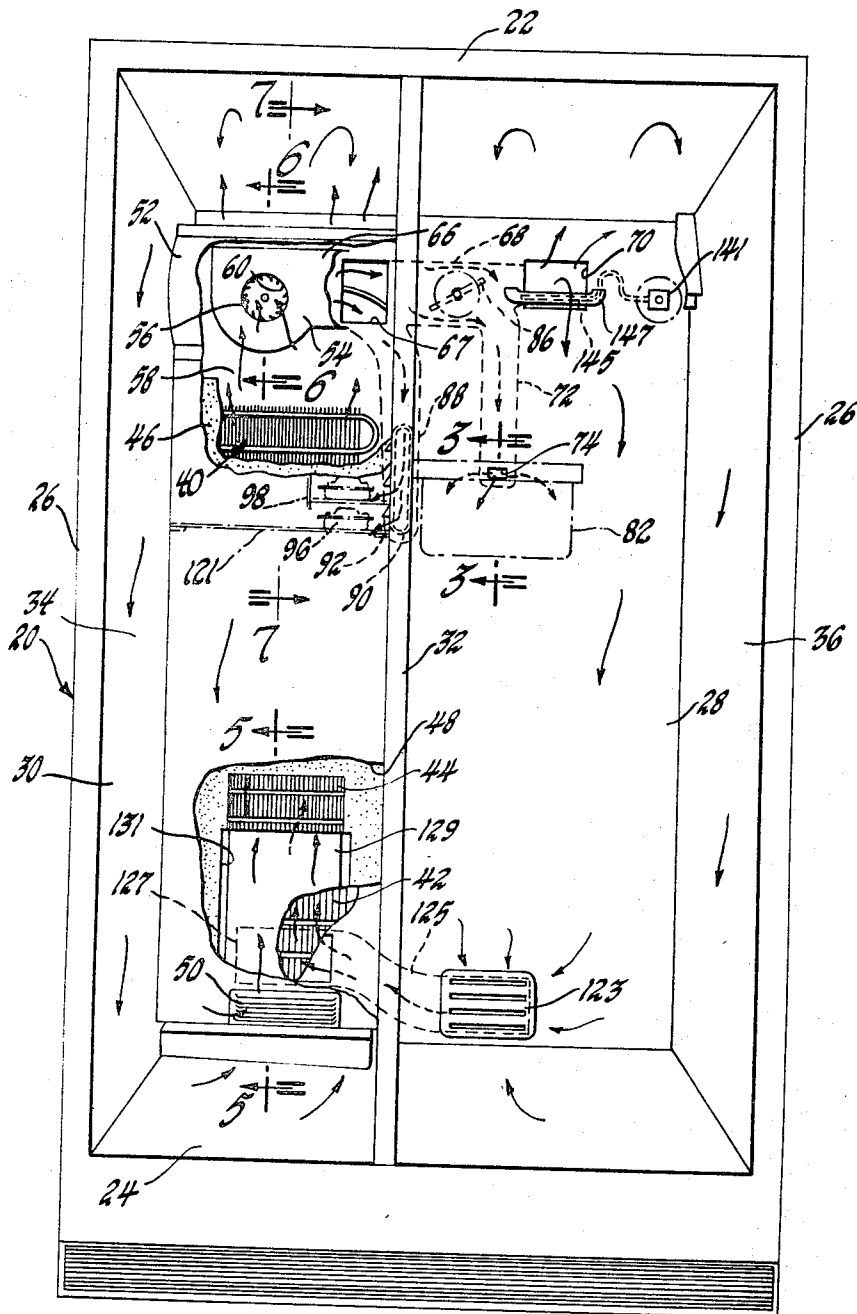


Fig. 1

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4 Sheets-Sheet 2

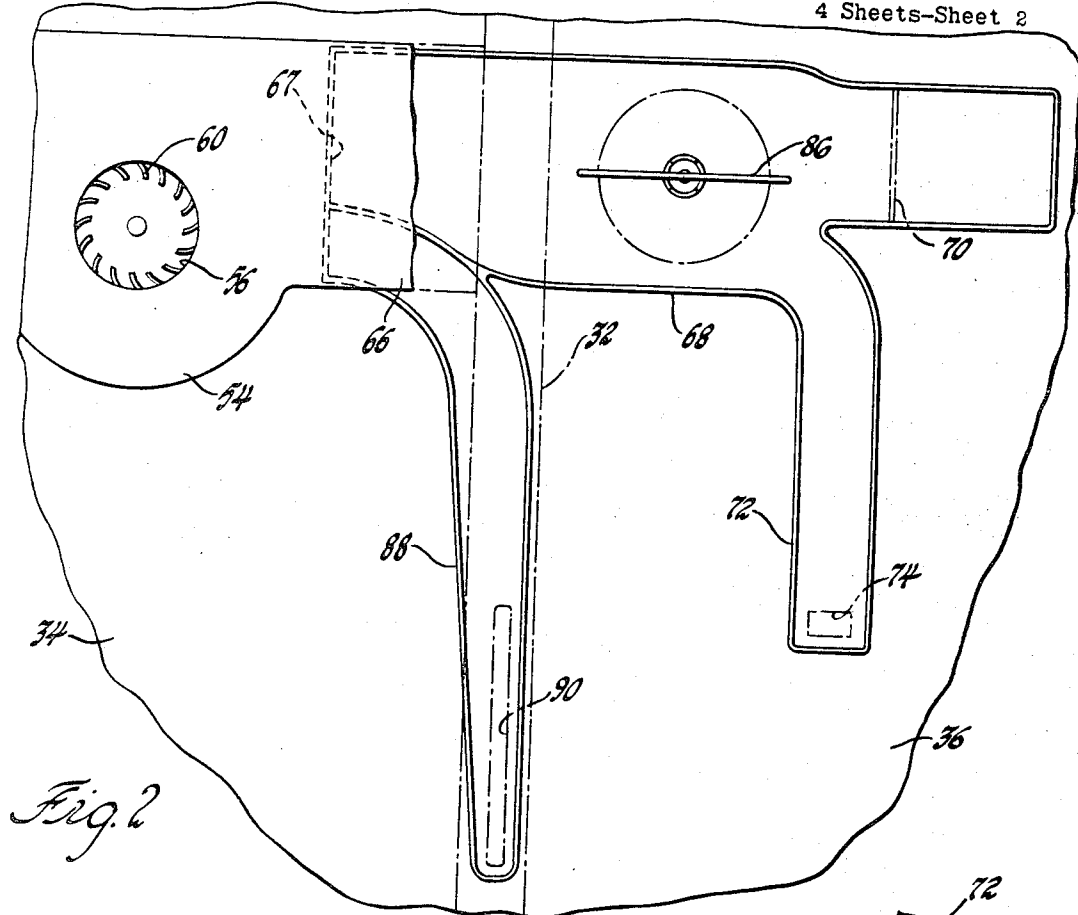


Fig. 2

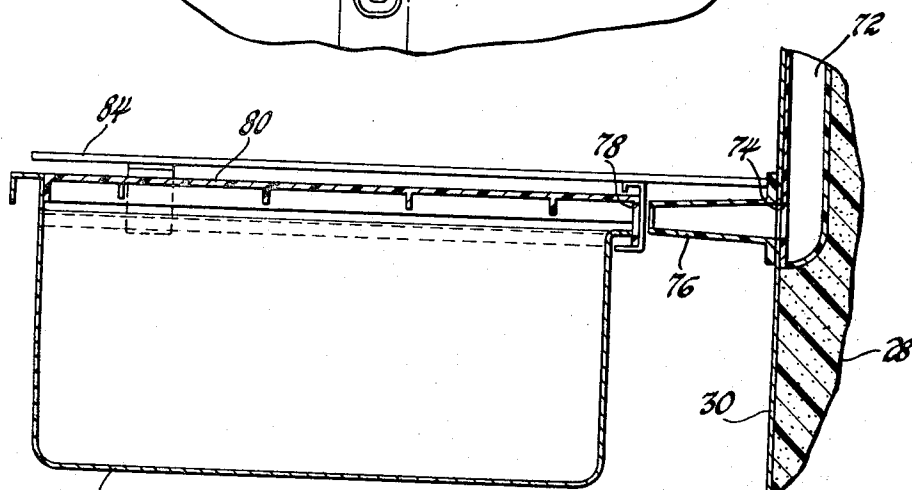


Fig. 5

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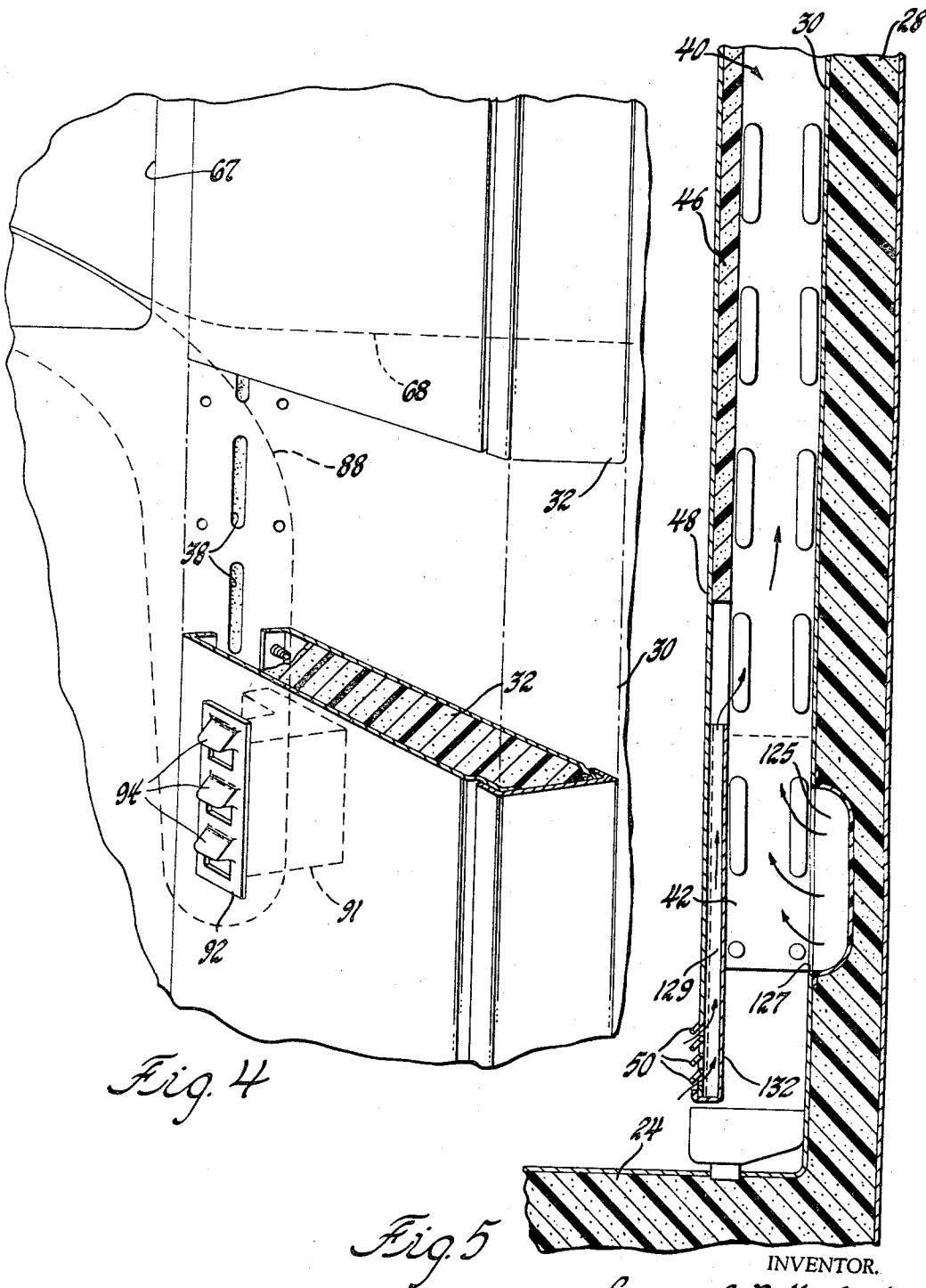
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4 Sheets-Sheet 3



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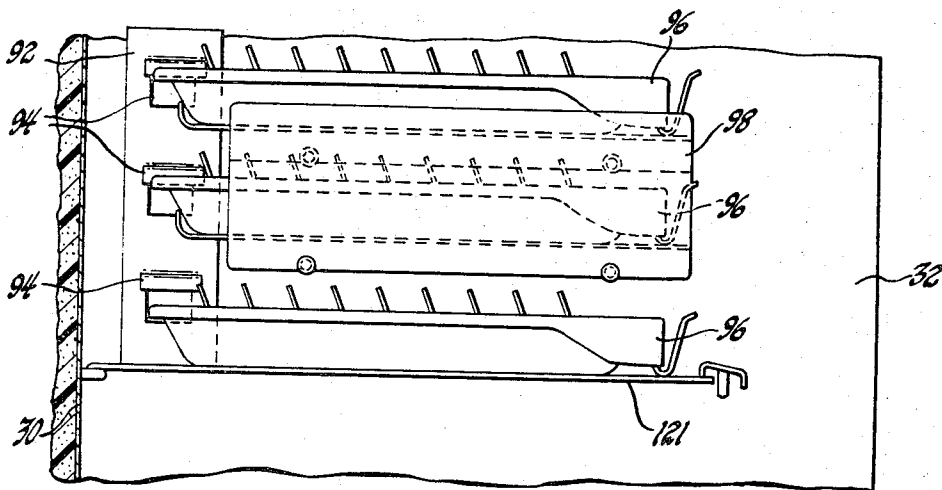
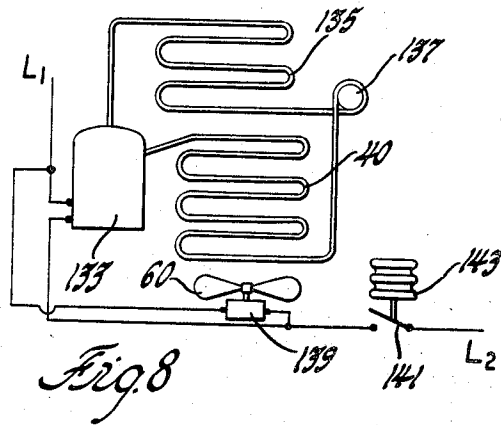
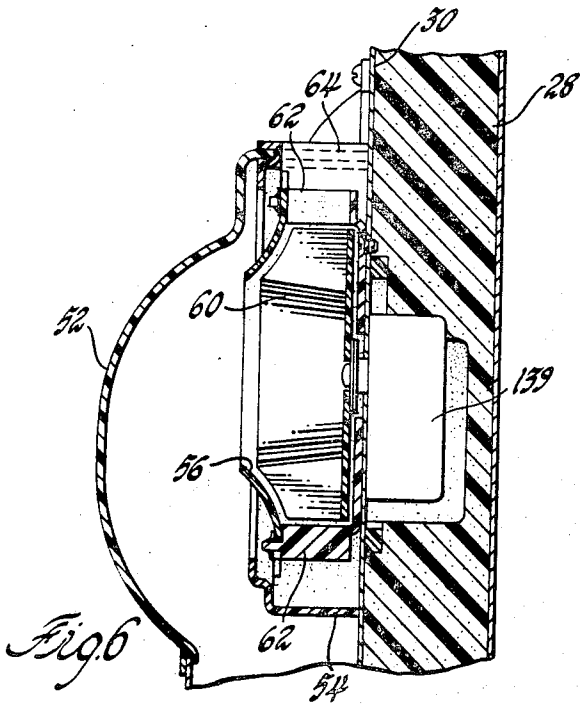
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REFRIGERATOR WITH UPRIGHT DIVIDING WALL

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4 Sheets-Sheet 4



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REFRIGERATOR WITH UPRIGHT DIVIDING WALL

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4 Claims. (Cl. 62—408)

ABSTRACT OF THE DISCLOSURE

In the preferred form, an upright removable dividing wall divides the interior of a single metal inner liner into above and below freezing compartments. A vertical finned evaporator extends up the rear wall of the below freezing compartment. An efficient centrifugal fan draws air from the top of the evaporator and delivers some of the air to the top of the below freezing compartment while the remaining air is fed through ducts in the rear wall to the top of the above freezing compartment with a branch feeding a set of passages in the dividing wall having outlets adjacent shelf supports thereon for freezing trays. Air is returned from the above freezing compartment through a duct in the rear wall to the bottom of the evaporator. A shield and duct are provided for carrying air from the bottom of the below freezing compartment to an intermediate point upon the evaporator.

This invention pertains to household refrigerators in which all the storage compartments are kept free of frost and the below and above freezing compartments are placed side by side and separated by an upright insulated dividing wall. Circulating branched air ducts are arranged therein to deliver air individually to the ice freezing apparatus and to closed containers as well as to the top of both types of compartments. This air is withdrawn at the bottom of both compartments to maintain more uniform desirable low refrigerating temperature throughout the compartments.

Because of a greater height to width ratio it has been difficult to properly cool and maintain uniform temperatures in household refrigerators having the above and below freezing compartments arranged side by side. It has also been difficult to provide fast ice freezing and adequate cooling of closed containers of such compartments.

It is an object of this invention to provide a household refrigerator having below and above freezing compartments located side by side and separated by a removable insulated wall and having an air circulating system with ducts along the walls for efficient transfer of heat from all parts of the compartments as well as the ice freezing apparatus and enclosed containers to the evaporating means.

It is another object of this invention to provide an improved control system for maintaining desirable refrigerating temperatures in an insulated cabinet having side by side below and above freezing frost-free compartments.

These and other objects are attained in the forms shown in the drawings in which an insulated cabinet is provided with a single sheet metal inner liner and an upright removable dividing wall which divides the interior of the liner into above the below freezing compartments. A vertical finned evaporator extends up the rear wall of the below freezing compartment. An efficient centrifugal fan located above this vertical finned evaporator delivers some air to the top of the below freezing compartment while the remaining air is fed through ducts in the walls with one branch feeding a set of ice freezing trays and another branch delivering air to the top of the above

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freezing compartment while a third branch delivers air into and/or around an enclosed container. Air is returned from the bottom of the above freezing compartment through a duct in the rear wall to the bottom of the evaporating means while air is drawn from the bottom of the below freezing compartment through a duct alongside the bottom of the evaporator to an intermediate point thereof since this air is relatively dry and at a lower temperature than the air drawn from the above freezing compartment.

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 front perspective view with the doors removed of a household refrigerator embodying one form of my invention;

FIGURE 2 is a view of the major portion of the fan and branched duct air circulating system illustrated in FIGURE 1;

FIGURE 3 is a fragmentary vertical sectional view taken along the lines 3—3 of FIGURE 1;

FIGURE 4 is a fragmentary perspective view illustrating a portion of the dividing wall and the inner liner and one of the branches of the duct system;

FIGURE 5 is a fragmentary vertical sectional view taken along the lines 5—5 of FIGURE 1;

FIGURE 6 is a fragmentary vertical sectional view taken along the lines 6—6 of FIGURE 1;

FIGURE 7 is a fragmentary side view of the dividing wall as indicated by the lines 7—7 in FIGURE 1; and

FIGURE 8 is a diagrammatical view of the refrigerant circuit and wiring for the refrigerator illustrated in FIGURE 1.

Referring now to the drawings and more particularly to FIGURE 1, there is illustrated a household refrigerator cabinet 20 having insulated horizontal top and bottom walls 22 and 24, insulated side walls 26, and an insulated rear wall 28. Within these insulated walls is a one piece box-shaped metal liner 30 which lines to top, bottom, side and rear walls. The interior of the liner 30 is divided by an upright insulated dividing wall 32 which divides the interior into a below freezing compartment 34 and an above freezing compartment 36. For minimizing heat transfer through the liner 30 from the above freezing compartment 36 to the below freezing compartment 34, the inner liner 30 is provided with a continuous series of upright slots 38 in the rear, top and bottom wall portions beneath the removable dividing wall 32. The dividing wall 32 fits within and extends between the top and bottom of the inner liner with a minimum of removable fastening so that it may be readily inserted and removed from the interior of the liner 30.

To cool the refrigerator there is provided an upright vertically finned refrigerant evaporator 40 having widely spaced fins 42 at the bottom thereof and closely spaced fins 44 extending upwardly above the widely spaced fins 42. The evaporator 40 rests against the rear wall of the inner liner 30 and on its front face is provided with a sheet 46 of heat insulating material. The face of the sheet 46 is provided with a sheet metal cover 48 having a set of entrance louvers 50 at the bottom.

At the top, the sheet 48 connects to a curved sheet 52 which is substantially sealed to the top of the sheet 48 as well as to the side wall 26 and the dividing wall 32 as well as to the fan housing 54 to provide a plenum chamber 58 between the top of the evaporator 40 and the fan housing. The fan housing 54 has an entrance opening 56 which draws air from the plenum chamber 58

above the evaporator 40 into the interior of the centrifugal fan 60 within the housing 54.

The centrifugal fan 60 cooperates with the stationary vanes 62 to efficiently discharge some of the air through an upper outlet opening 64 into the top of the compartment 34, while the remainder of the air is discharged through the laterally extending duct 66. This laterally extending duct 66 delivers air through an opening 67 in the liner 30 to a laterally extending duct 68 in the rear wall 28. This laterally extending duct 68 extends to an opening 70 in the rear wall of the liner 28 at the top of the above freezing compartment 36 for delivery of air to the top of this compartment in substantial volume. The duct 68 also connects with a downwardly extending branch duct 72 in the rear wall 28 extending to a third small opening 74 in the liner 30 at a location about a third of the distance down from the top wall 22. As shown in FIGURE 3, this opening 74 discharges into a nozzle 76 directing air through an aperture 78 in the side of the plastic cover 80 of the substantially closed meat keeping container 82. This meat keeping container 82 may be slideably mounted beneath the shelf 84. The duct 66 is provided with a manually controlled rotatable damper 86 which may be arranged to throttle the air flow therethrough to the openings 70 and 74.

The duct 66 has a downwardly extending branch duct 88 extending behind the dividing wall 32 connecting with a vertical slot 90 in the liner 30 directly behind the upright dividing wall 32. The dividing wall 32 is provided with passages 91 extending from the slot 90 to a cover 92 (see FIGURE 7), provided with three louvers 94 for directing a flow of air on to the three ice trays 96 mounted on three ice tray shelves 98 and 121 within the compartment 34 adjacent the dividing wall 32. This air rapidly cools the contents of the tray 96 so that rapid freezing results.

To assure circulation of the air to the bottoms of the compartments so as to maintain substantially uniform temperatures therein, the liner 30 at the bottom of the compartment 36 is provided with a cover 123 having a plurality of entrance louvers communicating with the duct 125 extending through the rear wall to an opening 127 in the liner behind the bottom portion of the evaporator 40 containing the widely spaced fins 42. This air is warmer and more moist than the air in the below freezing compartment 34. For this reason it is fed into the extreme bottom of the evaporator 40 provided with the widely spaced fins 42. The widely spaced fins 42 will not clog with ice as readily as the closely spaced fins since they provide more room for air flow between them and the accumulation of frost thereon will not substantially restrict the flow until an unusually thick layer accumulates. This air also flows through the full length of the evaporator 40 to provide a greater opportunity for cooling it.

The entrance louvers 50 at the bottom of the cover 48 are located near the bottom wall 24 so that adequate and uniform air circulation and cooling is provided for the bottom portion of the compartment 34. However, since this air is much cooler and dryer than the air flowing through the duct 125, it is desirable to delay the contact of this air with the evaporator 40 and to prevent it from coming into contact with the warmer and more moist air from the compartment 36 until it reaches the closely finned portion 44 of the evaporator. To accomplish this a duct 129 is provided behind the louvers 50 extending up to the closely finned portion 44. This duct 129 is formed within a cut-out portion 131 in the center bottom portion of the insulation sheet 46 and is separated from the widely finned lower portion 42 of the evaporator 40 by a shallow U-shaped member 132 extending down and closing the opening 131 in the insulation sheet 46. After the air flows through the duct 129 and passes the top of the metal sheet 132 it is free to flow into the closely finned portion 44 of the evaporator 40 through which it is drawn upwardly along with the air

flowing upwardly through the widely spaced portion 42 to the plenum chamber 58 beneath the fan housing 54.

The evaporator 40 has its outlet connected to the sealed motor compressor unit 133 which delivers the compressed refrigerant to a condenser 135 for delivering liquid refrigerant through the restrictor 137 to the entrance of the evaporator 40 as shown in FIGURE 8. The sealed motor compressor unit 133 as well as the electric motor 139 which drives the fan 60 are controlled by a temperature responsive switch 141 having its operating bellows 143 connected to a thermosensitive capillary tube 145 supported upon the inner face of a plastic bracket 147 extending across the air discharge opening 70. The thermosensitive capillary tube 145 is quickly responsive to the delivery of the cold air by the fan 60 so as to provide excellent temperature control of the evaporating means 40 and the circulating air. The difference between the temperatures of the compartments 34 and 36 is regulated by the manual adjustment of the damper 86. The manual adjustment of the damper 86 as well as the customer manual adjustment of the switch 141 will enable the customer to select the temperatures to be maintained in the compartments 34 and 36. Thus, through this system all air circulation and the control of the refrigerating system and also the selected below and above freezing temperatures will be maintained substantially uniform throughout both compartments.

While the embodiment of the 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 insulated top and bottom walls and side and rear upright walls enclosing a space, an insulated upright dividing wall extending within said space dividing said space into first and second insulated compartments located side by side, refrigerant evaporating means associated with said first compartment, wherein the improvement comprises a plurality of shelves mounted on said upright dividing wall in said first compartment adapted to support freezing trays, duct means extending from said evaporating means to said second compartment, said duct means having a branch for discharging air directly into heat transfer relation with said shelves and said trays, return duct means extending from said second to said first compartment, and fan means for circulating air from said first compartment and said return duct means into heat transfer relation with said evaporating means and through said duct means into said second compartment and said branch duct means and into contact with said shelves and trays.

2. A refrigerator including insulated top and bottom walls and side and rear upright walls enclosing a space, an insulated upright dividing wall extending within said space dividing said space into first and second insulated compartments located side by side, refrigerant evaporating means associated with said first compartment, wherein the improvement comprises a plurality of shelves mounted on said upright dividing wall in said first compartment adapted to support freezing trays, duct means extending from said evaporating means through said rear wall to said second compartment, said duct means having a branch extending through said upright dividing wall and having outlets adjacent said shelves and trays for discharging air directly into heat transfer relation with said shelves and said trays, return duct means extending from said second to said first compartment, and fan means for circulating air from said first compartment and said return duct means into heat transfer relation with said evaporating means and through said duct means into said second compartment and said branch duct means and into contact with said shelves and trays.

3. A refrigerator including insulated top and bottom walls and side and rear upright walls enclosing a space, wherein the improvement comprises an insulated upright dividing wall insertable into and removable from said

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space extending between said top and bottom walls dividing said space into first and second insulated compartments located side by side, refrigerant evaporating means associated with said first compartment, duct means extending through said rear wall from said second compartment to said evaporating means, said duct means having discharge means aligned with said upright dividing wall, said upright dividing wall having passages aligned and connected to said discharge means, said last named passages extending in said wall generally parallel to its surface and having discharge openings into one of said compartments, means for circulating air from said compartments into heat transfer relation with said evaporating means and through said duct means into said second compartment and through said passages and outlets in said upright dividing wall.

4. A refrigerator including insulated top and bottom walls and side and rear upright walls enclosing a space, wherein the improvement comprises an insulated upright dividing wall insertable into and removable from said space extending between said top and bottom walls dividing said space into first and second insulated compartments located side by side, refrigerant evaporating means

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associated with said first compartment, said top and bottom and side and rear walls being lined with a single metal liner, said liner being provided with substantially parallel elongated heat transfer reducing slots extending along the adjacent periphery of said upright dividing wall.

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