July 9, 1963 C. E. REMBOLD 3,096,629

FROSTLESS FREEZER

Filed April 5, 1961 2 Sheets-Sheet 1

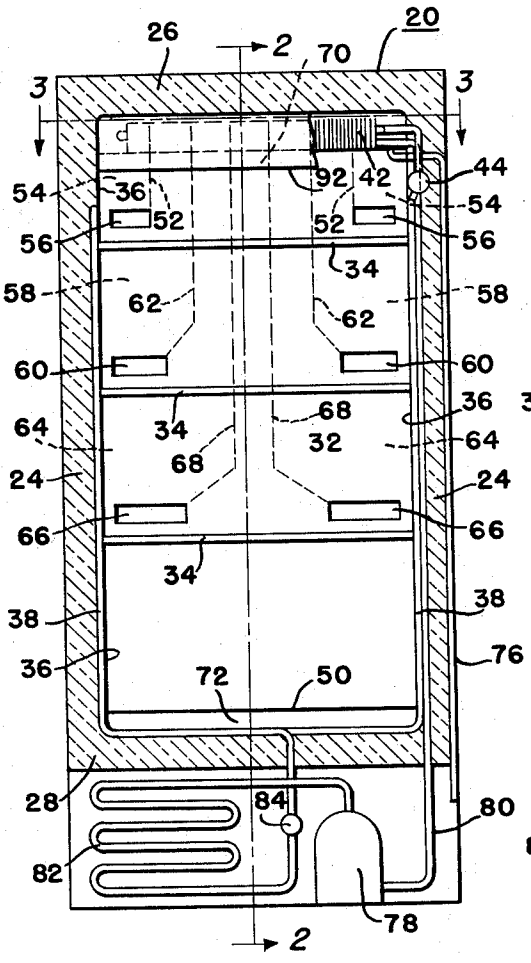

Fig. 1

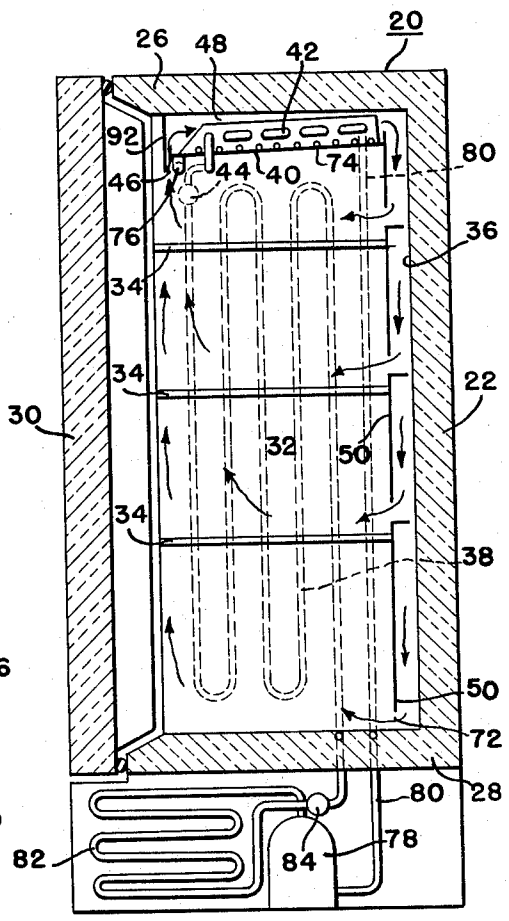

Fig. 2

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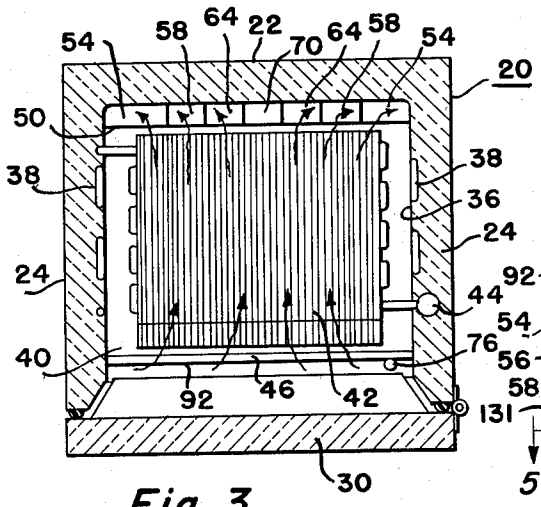

Fig. 3

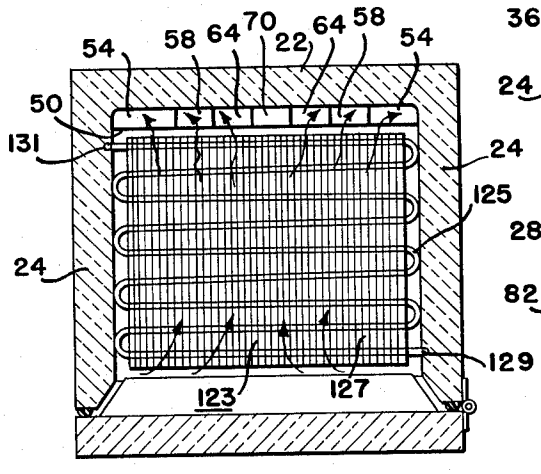

Fig. 5

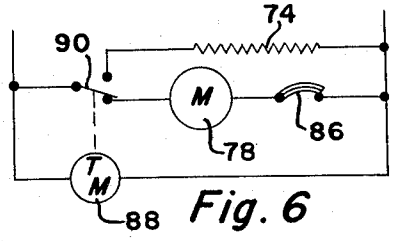

Fig. 6

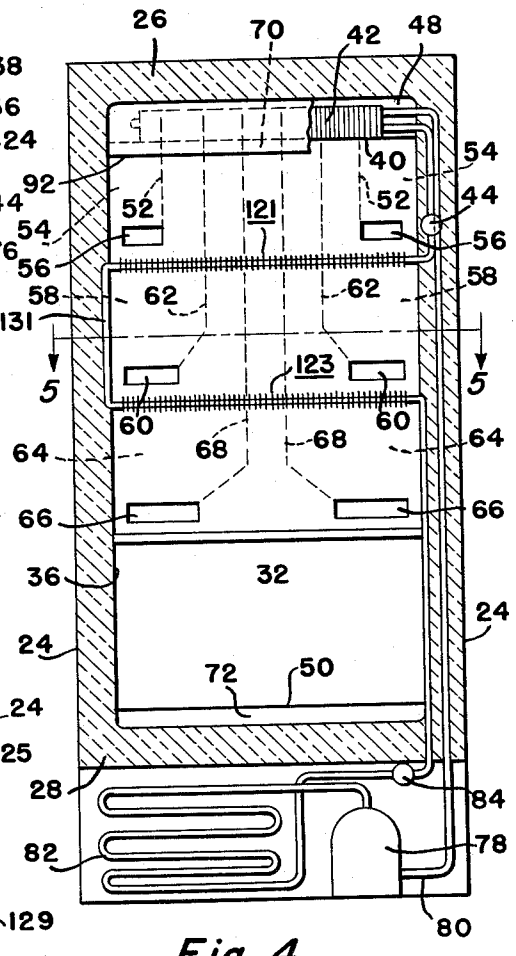

Fig. 4

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FROSTLESS FREEZER

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3 Claims. (Cl. 62—283)

This invention pertains to refrigerating apparatus and more particularly to frost-free freezers.

Frost-free freezers have become popular. However, the sale is limited by the higher price necessitated by the more elaborate construction and the fan system which has been required by these models. The operating cost is also increased by the current required by the fan as well as by the greater heat leak caused by the high velocity air circulation which increases the running time of the motor compressor unit.

It is an object of this invention to provide a frost-free freezer which does not require fan circulation and which will keep the storage compartment free of frost.

It is another object of this invention to provide a frost-free freezer which does not require fan circulation and has an evaporator upon which all frost accumulates which can be readily defrosted without substantially affecting the temperatures of the frozen storage compartment.

These and other objects are attained in the form shown in the drawing in which the first evaporating means is provided either in heat transfer with the outside walls of the storage compartment or made a part of the shelf structure of the storage compartment. To prevent the formation of frost in the storage compartment, there is provided above a false top wall a second evaporator which operates at a susbtantially lower temperature than the first evaporator. The chamber above the false top wall is connected at the front with the main storage compartment beneath and at the rear this upper chamber is connected with duct means of different lengths extending downwardly along the rear wall of the compartment at different levels to provide substantially uniform air flow throughout the compartment. Since the second evaporator operates at temperatures substantially below the temperature of the first evaporator, moisture vapor will migrate to it and all the frost will collect upon the second evaporator. This will prevent the deposit of frost within the main storage compartment. The second evaporator is defrosted frequently by the application of heat from an electric heater. This produces defrost water which is collected by the false top wall and conducted outside the refrigerator.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein preferred embodiments of the present invention are clearly shown.

In the drawings:

FIGURE 1 is a front vertical sectional view of a freezer embodying one form of my invention.

FIGURE 2 is an irregular side sectional view taken substantially along lines 2—2 of FIGURE 1.

FIGURE 3 is a horizontal sectional view taken along the lines 3—3 of FIGURE 1.

FIGURE 4 is a front vertical sectional view of another form of the invention.

FIGURE 5 is a horizontal sectional view taken along the line 5—5 in FIGURE 4.

FIGURE 6 is a simple wiring diagram applicable to both forms of the invention.

Referring now to the drawings and more particularly to FIGURES 1 to 3, there is shown an insulated refrigerator cabinet 20 having an insulated rear and side walls

22 and 24, an insulated top wall 26, an insulated bottom wall 28, and an insulated front door 30 for access to the storage compartment 32 enclosed by these walls. The storage compartment 32 is provided by three horizontal shelves 34 for supporting and storage of frozen foods therein. The storage compartment 32 is enclosed within a metal liner 36. A first evaporating means 38 in the form of a serpentine refrigerant tubing contacts the sides and the bottom of the metal inner liner 36. This evaporator 38 absorbs the heat leaking through the side and bottom walls 24 and 28 and also acts to cool the compartment 32 through the walls of the liner 36.

According to my invention, to prevent the formation of frost within a compartment 32 and particularly upon the walls of the inner liner 36, there is provided a false top wall 40 above the main portion of the storage compartment 32 forming the upper chamber 48. This wall 40 slopes slightly to the front and supports a second evaporator 42 of the fin and tube type within the chamber 48. This second evaporator 42 normally operates at temperatures at least 8° below the temperature of the first evaporator 38. For example, if the first evaporator 38 operates at a minus 20°, the second evaporator 42 operates at a temperature of minus 28° F. This difference in temperature may be attained in a number of different ways by different types of refrigerating systems. However, as shown in the figure, I have indicated diagrammatically between the first evaporating means 38 and the second evaporating means 42, a restrictor 44 of the tube or the weight type provided in the connection between the outlet of the first evaporating means 38 and the inlet of the second evaporating means 42. The restriction between the two evaporators causes the evaporating pressure in the second evaporator 42 to be a substantial amount lower than the evaporating pressure in the first evaporating means 38, thereby providing the 8° lower temperature of the evaporator 42. There is provided a space between the front of the false top wall 40 and the front door 30 providing an entrance 46 into the upper chamber 48 provided above the top wall 40 and containing the second evaporator 42.

The rear of the compartment 32 is provided with a false rear wall 50. The space behind the false rear wall 50 is arranged to provide a plurality of ducts extending from the upper chamber 48 downwardly for different distances. For example, two partition walls 52 on opposite sides form the ducts 54 extending downwardly to the upper openings 56 located above the top shelf 34. A second set of ducts 58 is formed beneath the partition 52 and the partitions 62 and extend down to the openings 60, and a fourth duct 70 extends from the center of the rear of the upper chamber 48 downwardly between the partitions 68 to the bottom of the false rear wall 50 which has an opening 72 extending across the bottom opening into the compartment 32. This provides a plurality of air circuits extending from the upper chamber 48 downwardly through the various ducts 54, 58, 64 and 70 and through their respective openings 56, 60, 66 and 72 into the compartment 32 where the air flows upwardly to the entrance 46. In these ducts, any heat leaking through the rear wall 22 is absorbed by the cold air. The heat leaking through the door 30 warms the air in the front part of the compartment 32 causing it to rise by natural convection and pass through the opening or entrance 46 into the upper chamber 48 where it is recooled by a second evaporator 42. To prevent the flow of air from the upper chamber 48 into the space surrounding the periphery of the door 30, there is provided a baffle 92 extending downwardly from the top wall 26 completely across the front of the compartment to a line which is below the bottom of the false top wall 40.

The second evaporator 42 cools and dries the air below

the temperature of the first evaporating means **38** and the moisture content which the air would otherwise have at this temperature, thereby preventing the formation of frost in the compartment **32** and also upon the metal liner **36** and thereby collects all the frost upon itself because of its substantially lower temperature. The frost upon the evaporator **42** is removed from time to time by the electric heater **74** under the control of the system shown in FIGURE 6. The false bottom wall **40** is arranged to serve as a drain pan for collecting the defrost water from the second evaporator **42** and conducting this defrost water out through the drain **76** extending down the outside of one of the side walls **24**.

A sealed motor compressor unit **78** withdraws evaporated refrigerant from the outlet of the second evaporator **42** through the suction conduit **80** and discharges this compressed refrigerant into a condenser **82** from which the liquid refrigerant is forwarded under the control of a suitable flow control device **84** such as a restrictor through a supply conduit to the inlet of the first evaporator **38**. The operation of the motor compressor unit **78** may be controlled by a thermostatic switch **86** connected in series therewith and responsive to the temperature of the storage compartment **32**. The operation of the defrost heater **74** is controlled by a timer motor **88** which operates at suitable intervals a single pole double-throw switch **90** from the connection with the compressor motor **78** into connection with the defrost heater **74**. At the termination of the defrost period, the timer motor restores the switch **90** to its normal position connecting with the compressor motor **78**.

In the form shown in FIGURES 4 and 5, the structure is identical and the parts bear similar reference characters with the exception of the first evaporator. Instead of the first evaporator being provided upon the bottom and sides of the inner liner as in FIGURES 1 to 3, the first evaporator is made up of two shelves **121** and **123** for supporting packages of frozen food. Each of these shelves, such as the shelf **23**, is made up of serpentine refrigerant tubing **125** arranged horizontally and having welded on the top and bottom parallel wire fins **127** extending from the front to the rear. This provides a suitable shelf support for frozen food packages and also provides adequate refrigeration for the interior of the storage compartment **32** without substantially interfering with air circulation. The inlet **129** of the shelf structure **123** is connected to the outlet of the motor compressor condenser unit while the outlet **131** of the shelf **123** is connected to the inlet of the shelf **121**. The outlet of the shelf **121** is connected to the restrictor **44** which connects to the inlet of the second evaporator **42** as before. As before, the second evaporator **42** is kept at a temperature substantially below the temperature of the first evaporator constituting the shelves **121** and **123** such as 8° F. This insures that the frost will collect only upon the second evaporator **42**, while the shelves **121** and **123** as well as the compartment **32** will be kept free of frost at all times. For example, the shelves **121** and **123** may be maintained at about minus 20° F. while the second evaporator **42** may be maintained at minus 28° F. This will maintain the compartment **32** at temperatures of zero or below. The circuit shown in FIGURE 6 may be used to control the system shown in FIGURES 4 and 5.

While the embodiments of the present invention as herein disclosed constitute preferred forms, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. A freezer including insulating walls and a front door completely enclosing a compartment generally in the shape of a rectangular parallelopiped to be kept below water freezing temperatures and containing a plurality of pervious shelves located at different heights, a false top wall located in the upper portion of said compartment providing an upper chamber, said insulating walls including an upright wall provided substantially from one edge of the compartment to the other with a plurality of independent duct means extending upwardly from locations a short distance above each shelf to and connecting with said upper chamber and each adjacent its bottom having a separate opening below said false top wall for communication with said compartment, a refrigerating system including first evaporating means in heat transfer relation with said compartment below said false top wall and second evaporating means located above said false top wall in heat transfer relation with said upper chamber, said false top wall being arranged to provide independent gravity air circulation between said upper chamber and each of said duct means and said compartment adjacent each shelf beneath said top wall, said refrigerating system including means normally maintaining both said evaporating means at below freezing temperatures and means normally maintaining said second evaporating means at temperatures substantially below the first evaporating means for collecting substantially all the frost thereon so as to prevent the deposit of frost in said compartment beneath said top wall.

2. A freezer including insulating walls and a front door completely enclosing a compartment generally in the shape of a rectangular parallelopiped to be kept below water freezing temperatures and containing a plurality of shelves located at different heights, a false top wall located in the upper portion of said compartment providing an upper chamber, said insulating walls including an upright wall provided substantially from one edge of the compartment to the other with a plurality of independent contiguous duct means extending upwardly from locations a short distance above each shelf to and connecting with said upper chamber and each having a separate opening below said false top wall for communication with said compartment, said openings in order from top to bottom being progressively larger, a refrigerating system including first evaporating means in heat transfer relation with said compartment below said false top wall and second evaporating means located above said false top wall in heat transfer relation with said upper chamber, said false top wall being arranged to provide independent gravity air circulation between said upper chamber and each of said duct means and said compartment adjacent each shelf beneath said top wall, said refrigerating system including means normally maintaining both said evaporating means at below freezing temperatures and means normally maintaining said second evaporating means at temperatures substantially below the first evaporating means for collecting substantially all the frost thereon so as to prevent the deposit of frost in said compartment beneath said top wall.

3. A freezer including insulating walls and a front door completely enclosing a compartment generally in the shape of a rectangular parallelepiped to be kept below water freezing temperatures, a false top wall located in the upper portion of said compartment providing an upper chamber, said insulating walls including an upright wall provided with a plurality of independent contiguous duct means extending from said upper chamber downwardly a plurality of different distances and having openings into said compartment a plurality of different distances down from said false top wall, a refrigerating system including first evaporating means in heat transfer relation with said compartment below said false top wall and second evaporating means located above said false top wall in heat transfer relation with said upper chamber, said false top wall being arranged to provide gravity air circulation between said upper chamber and each of said duct means and said compartment beneath said top wall, said refrigerating system including means normally maintaining both said evaporating means at below freezing temperatures and means normally maintaining said second evaporating means at temperatures substantially below the first evaporating means for collecting substan-

tially all the frost thereon so as to prevent the deposit of frost in said compartment beneath said top wall.

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