Sept. 17, 1963 E. K. HARLEY, JR 3,103,797

REFRIGERATORS

Filed March 30, 1961

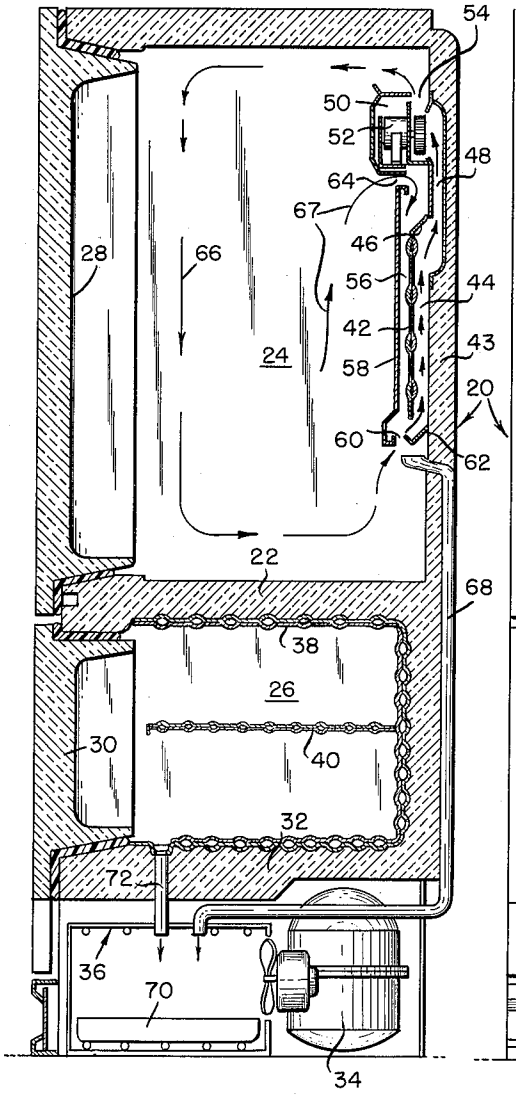


Fig. 2

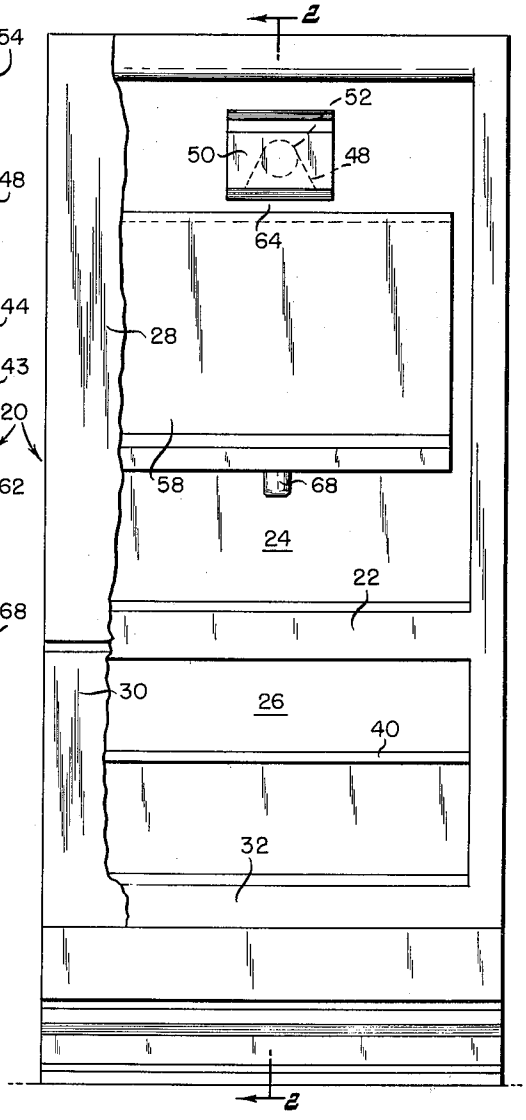


Fig. 1

INVENTOR
Earl K. Harley, Jr.

BY Strauch, Nolan & Neale

ATTORNEYS

United States Patent Office 3,103,797
Patented Sept. 17, 1963

3,103,797

REFRIGERATORS

Earl K. Harley, Jr., Greenville, Mich., assignor to Hupp Corporation, Cleveland, Ohio, a corporation of Virginia

Filed Mar. 30, 1961, Ser. No. 99,580
6 Claims. (Cl. 62—419)

This invention relates to domestic refrigerators and more particularly to refrigerators having separate compartments for the storage of fresh food and frozen food.

In units of this type, the refrigerator housing is divided by an insulated wall into two independent compartments each provided with a door and each provided with means for maintaining the compartment at the proper temperature for its intended purpose. In a typical case, the fresh food compartment is maintained at a temperature of about 37° and the frozen food compartment is held at a temperature of zero degrees.

The maintenance of these temperatures without loss of efficiency and without the use of complicated and expensive controls has continued to be a problem in the industry. The allied problem of preventing the formation of frost on the cooling coils in each of the compartments or the elimination of the frost once it has been formed has also at best been only partially solved.

With these considerations, in mind, it is the principal purpose and object of the present invention to provide improved refrigerator-freezer units including a novel construction for maintaining the respective food compartments and particularly the fresh food compartment at its preselected temperature and for maintaining this temperature at a uniform level throughout the compartment.

It is a further object of the present invention to provide an improved apparatus for maintaining a circulating supply of properly cooled air in the fresh food compartment, the apparatus being effective not only to provide for storage of food under optimum conditions but also to minimize the formation of frost on the cooling coil and to assure the prompt elimination of any frost automatically without additional heating apparatus often employed for this purpose.

Additional objects and advantages of the present invention will become apparent as the description proceeds in connection with the accompanying drawings in which:

FIGURE 1 is a front elevation of a refrigerator freezer unit constructed in accordance with the present invention with the doors removed to show interior details of construction; and

FIGURE 2 is a central vertical section of the unit of FIGURE 1 taken along line 2—2 of FIGURE 1.

Referring now more particularly to the drawings, the refrigerator-freezer unit of the present invention comprises an insulated housing indicated generally at **20**, the interior of which is divided by a horizontally extending insulating wall **22** into an upper fresh food compartment **24** and a lower frozen food compartment **26**. The compartments **24** and **26** are provided with separate doors indicated at **28** and **30**, respectively, to provide independent access to the fresh and frozen food compartments.

Beneath the bottom wall **32** of the insulated housing **20**, an insulated compartment is provided which houses the compressor **34** and the condenser assembly indicated generally at **36** which is disclosed in detail and claimed in application Serial No. 99,541, filed on March 30, 1961, by Earl K. Harley, Jr., et al., for Refrigerators and Components.

In accordance with the present invention, the frozen food compartment **26** is cooled by a plate type evaporator coil **38** built into the liner of the compartment and extending along the top, bottom and rear walls of the compartment. Connected in series with the evaporator coil **38** is a shelf **40** formed by an evaporator plate section which is provided for the storage of ice cubes or the quick freezing of foods.

The apparatus for cooling the fresh food compartment **24** which forms an important feature of the present invention includes an evaporator plate **42** which extends vertically closely adjacent the rear wall **43** of the fresh food compartment and extends from side to side thereof and occupies about the middle third of the vertical height of the compartment. Evaporator coil **42** is spaced from the rear wall of the compartment to provide a vertically extending relatively narrow channel **44**.

The upper end of the channel **44** is formed by a rearwardly turned portion **46** of the evaporator plate **42**. The central portion of the upper end of the channel **44** is connected by a short plastic conduit **48** embedded in the rear wall of the compartment **24** to a fan housing **50** in which a fan **52** is mounted. The fan housing is completely closed except for a restricted top opening **54** through which air is delivered to the top portion of the fresh food compartment **24**.

A second channel **56** is formed between the forward face of the evaporator plate **42** and a thin sheet metal cover plate **58** which extends across the width of the fresh food compartment and above and below the top and bottom edges of the evaporator plate to completely cover the latter. A restricted opening **60** is formed at the bottom of channels **44** and **56** between a lip on the cover plate **58** and the forward edge of a drip trough **62**, the opening extending across the full width of the fresh food compartment. A somewhat larger opening **64** is formed between the fan housing **52** and a lip formed at the upper end of the cover plate **58**.

The refrigerator of the present invention is provided with the usual electrical controls, thermostats and the usual connections are provided to connect the evaporator plates **38**, **40** and **42** in series with the compressor. All of these controls and connections are essentially conventional and are omitted for clarity. For example, the operation of the compressor **34** is controlled by a thermostat sensing the temperature in the fresh food compartment and the system is properly balanced to provide zero zone temperatures in the freezer compartment when the fresh food compartment is at the proper temperature. The circuit for controlling the operation of the fan **52** is arranged to provide continuous operation of the fan except when the upper door **28** is opened so that warm, room air is not drawn over the evaporator.

Thus, when the system is in operation, the blower **52** will cause air to flow upwardly through the channel **44** over the plate and to circulate through the fresh food compartment in a pattern shown by the arrows **66** and **67**. A portion of the air flowing through channel **44** is supplied through the opening **60**, the remainder being supplied through the upper opening **64**, thus creating a substantially continuous flow of air over both sides of the evaporator plate **42**.

The air passing through the upper opening **64** is drawn from the warmest region of the fresh food compartment thus assuring a uniformity of temperature in the fresh food compartment not previously achieved.

Since the air is caused to traverse both faces of the evaporator plate, heat transfer between the evaporator coil and the moving air with a high degree of efficiency is assured. Also, since the exposed area of the evaporator plate is large and is all utilized effectively, the temperature of the evaporator plate can be kept relatively high as compared with many prior installations. This further increases the efficiency of the apparatus and decreases the tendency of the unit to accumulate frost. The continuous

movement of air over both sides of the evaporator further contributes to the substantially complete elimination of frost formation on the evaporator coil **42**. Any slight amount of frost which may be formed is quickly eliminated and melted during the compressor Off cycle at which time the temperature of the evaporator plate quickly rises above the freezing point, the frost is rapidly melted and the resulting water collects in the drain trough **62** and is delivered through a conduit **68** to the top of the condenser **36** and ultimately into a drip pan **70**. The frozen food compartment may be quickly defrosted in the conventional manner with the compressor turned off, the defrost water passing out of the drain **72** into the drip pan **68**.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

1. A refrigerator comprising an insulated housing divided by an insulated wall into an upper fresh food compartment and a lower frozen food compartment, an evaporator coil in said frozen food compartment, a second evaporator coil in said fresh food compartment, said second evaporator coil extending vertically of said compartment closely adjacent the rear wall thereof and forming with said rear wall a first air channel open at its lower end, a baffle mounted in parallel spaced relation with said second evaporator coil and forming therewith a second air channel, open at its upper and lower ends, the open lower ends of said first and second air channels being closely adjacent to permit air from said second channel to flow into said first channel, a fan mounted adjacent the upper end of the rear wall of said fresh food compartment and having an inlet in communication with the upper end of said first channel and an outlet in communication with the interior of said fresh food compartment at the top thereof, and means preventing flow of air from the upper end of said second channel to said fan inlet whereby air passes in series through said second channel and said first channel to said fan inlet.

2. A refrigerator comprising an insulated housing divided by an insulated wall into an upper fresh food compartment and a lower frozen food compartment, an evaporator coil in said frozen food compartment, a baffle mounted in parallel spaced relation with the rear wall of said fresh food compartment, a second evaporator coil mounted between said baffle and said rear wall in parallel spaced relation with said baffle to thereby provide first and second air channels between said baffle and said second evaporator coil and between said second evaporator coil and the rear wall of said fresh food compartment, respectively, said channels extending substantially across the entire width of said fresh food compartment, said channels having adjacent openings at the bottom thereof to permit the flow of air from said first air channel to said second air channel, a fan mounted adjacent the upper end of the rear wall of said fresh food compartment and having an inlet in communication with only said second channel and an outlet in communication with the interior of said fresh food compartment at the top thereof, and means preventing flow of air from the upper end of said first channel to said fan inlet whereby air passes in series through said first channel and said second channel to said fan inlet.

3. A refrigerator comprising an insulated housing divided by an insulated wall into an upper fresh food compartment and a lower frozen food compartment, an evaporator coil in said frozen food compartment, a second evaporator coil in said fresh food compartment, said second evaporator coil extending vertically of said compartment closely

adjacent the rear wall thereof and forming with said rear wall a first air channel open at its lower end, a baffle mounted in parallel spaced relation with said second evaporator coil and forming therewith a second air channel, means defining openings at the top and bottom ends of said second channel, the opening at the bottom of said second channel being adjacent the open lower end of said first air channel, a fan mounted adjacent the upper end of the rear wall of said fresh food compartment and having an inlet in communication with said opening at the top of said first air channel, and an outlet in communication with the interior of said fresh food compartment at the top thereof, and means preventing flow of air from the top end of said second channel to said inlet whereby air is drawn from said second channel into said first channel by said fan.

4. The refrigerator according to claim 3 together with a condensate trough positioned beneath said second evaporator coil at the bottom of said air channels, and a drain tube connected to said trough and leading to the exterior of said fresh food compartment.

5. A refrigerator comprising an insulated housing divided by an insulated wall into an upper fresh food compartment and a lower frozen food compartment, an evaporator coil in said frozen food compartment, an baffle mounted in parallel spaced relation with the rear wall of said fresh food compartment, a second evaporator coil mounted between said baffle and said rear wall in parallel spaced relation with said baffle to thereby provide first and second air channels between said baffle and said second evaporator coil and between said second evaporator coil and the rear wall of said fresh food compartment, respectively, said second evaporator coil having at its upper end an inclined portion extending to said rear wall across the full width of said second channel to form the upper end of said second air channel, a fan positioned in said fresh food compartment above said inturned portion of said second evaporator coil, and conduit means embedded in the rear wall of said fresh food compartment connecting the inlet side of said fan to said upper end of said second air channel, said fan having an outlet in communication with the interior of said fresh food compartment at the upper end thereof.

6. A refrigerator comprising an insulated housing divided by an insulated wall into an upper fresh food compartment and a lower frozen food compartment, an evaporator coil in said frozen food compartment, a substantially flat second evaporator coil in said fresh food compartment, said second evaporator coil extending vertically of said compartment closely adjacent the rear wall thereof and forming with said rear wall a first air channel, a baffle mounted in parallel spaced relation with said second evaporator coil and forming therewith a second air channel, said baffle extending beyond the top, bottom and end margins of said second evaporator coil, means defining a relatively restricted common opening at the bottom ends of said first and second channels in communication with the interior of said fresh food compartment adjacent the lower edge of said second evaporator coil, means defining a relatively enlarged opening at the upper end of said second air channel connecting the upper end of said second channel with the interior of said fresh food compartment, a fan mounted adjacent the upper end of the rear wall of said fresh food compartment above said second evaporator coil and having an inlet in communication with the upper end of said first air channel and an outlet in communication with the interior of said fresh food compartment adjacent the top thereof, whereby when said fan is in operation air is drawn into said second air channel at the upper end thereof and passes downwardly through said second air channel and joins air drawn in through said restricted opening for passage through said first air channel to said fan for return to the upper portion of said fresh food compartment.

(References on following page)

5

References Cited in the file of this patent

UNITED STATES PATENTS

2,085,346	Vretman	June 29, 1937
2,350,249	Osborn	May 30, 1944
2,875,595	Kleist	Mar. 3, 1959

6

2,900,806	Wurtz	Aug. 25, 1959
2,909,910	Saunders	Oct. 27, 1959
2,937,511	Mann	May 24, 1960
2,978,884	D'Aleandro	Apr. 11, 1961
2,994,209	Mann	Aug. 1, 1961