Aug. 9, 1949. F. D. PELTIER 2,478,312

REFRIGERATOR INCLUDING AN EVAPORATOR AND ICE CUBE TRAY ARRANGEMENT FOR COOLING THE FOOD STORAGE COMPARTMENT

Filed May 30, 1944

Fig. 1.

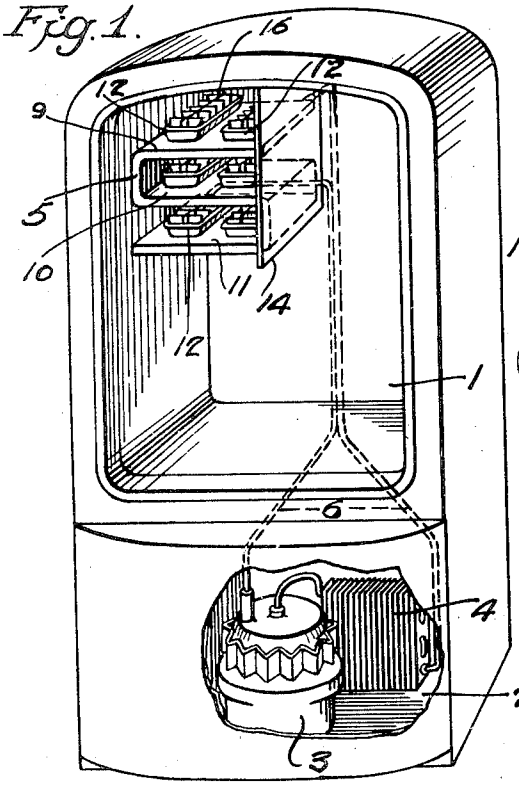
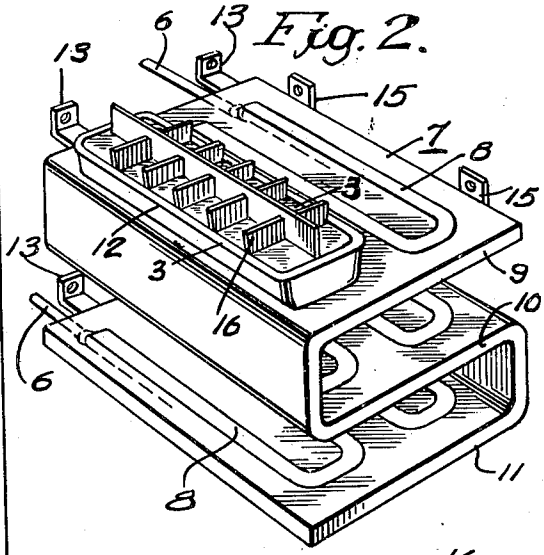


Fig. 2.



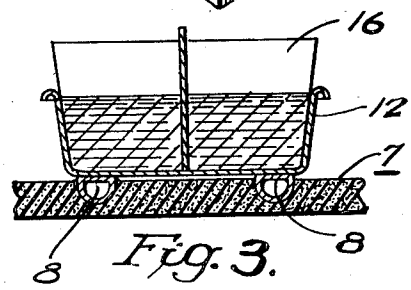


Fig. 3.

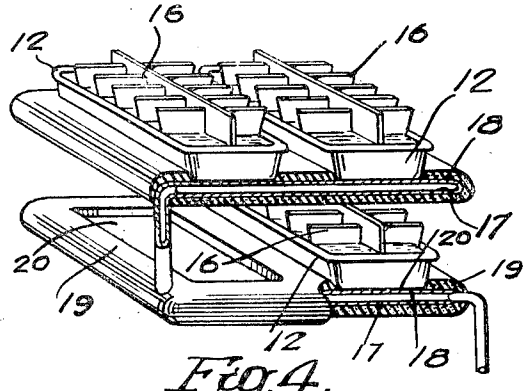


Fig. 4.

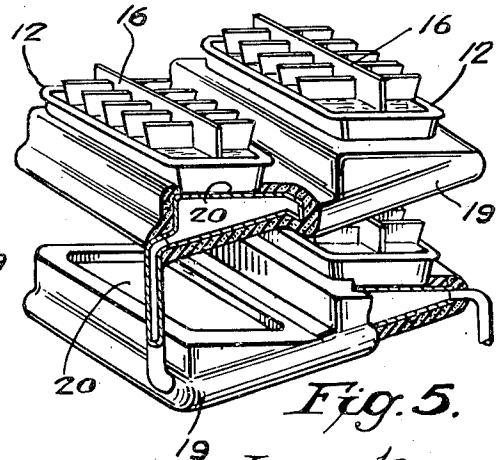


Fig. 5.

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Patented Aug. 9, 1949

2,478,312

UNITED STATES PATENT OFFICE

2,478,312

REFRIGERATOR, INCLUDING AN EVAPORATOR AND ICE CUBE TRAY ARRANGEMENT FOR COOLING THE FOOD STORAGE COMPARTMENT

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Application May 30, 1944, Serial No. 538,059

3 Claims. (Cl. 62—95)

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This invention relates to evaporators of refrigerating machines and more particularly to that class of evaporator which is adapted to operate at temperatures below the freezing point of water.

Evaporators of this class are subject to frost accumulations from moisture in the ambient air, which accumulations adversely affect the efficiency of the evaporator and must be periodically removed if the efficiency is to be maintained at a desirable level. With a conventional evaporator such defrosting necessarily involves a substantial interruption in the refrigerating process.

A principal object of the present invention is to provide novel means for avoiding necessity for such interruption of the refrigerating process in order to effect defrosting of the evaporator.

Another object of the invention is to provide a novel evaporator of the stated type constructed so that the effective thermal transfer surfaces thereof exposed to the ambient air are constituted by readily detachable elements of the evaporator structure, said elements being readily removable from the said structure for the purpose of removing accumulated frost.

The invention further contemplates the provision of an evaporator of the stated character wherein the detachable elements may take the form of the conventional ice tray or other receptacle.

A further object is to provide a novel form of ice tray grid which, in addition to the normal function of dividing the interior of the tray into ice cube compartments, has the additional function of extending the useful heat transfer surface of the tray and of the evaporator with which the tray is associated, said grid having an application of particular importance to evaporators incorporating the present invention.

The invention resides further in certain structural details hereinafter described and illustrated in the attached drawings, wherein:

Figure 1 is a view in perspective of a refrigerator made in accordance with the invention.

Figure 2 is a detached view in perspective of one form of evaporator which may be used in the practice of the invention.

Figure 3 is a fragmentary sectional view on the line 3—3, Figure 2; and

Figures 4 and 5 are sectional views in perspective of other desirable forms of evaporator incorporating the invention.

With reference to the drawings, the refrigerator cabinet illustrated in Figure 1 comprises an upper insulated food storage compartment 1 and

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a lower machine compartment 2 which houses a motor compressor 3 and a condenser 4. The motor compressor unit 3 and condenser 4 constitute elements of a refrigerating system which also includes an evaporator 5, said evaporator being installed in the upper part of the compartment 1 and being connected in conventional manner to the compressor 3 and condenser 4 by means of suitable tubing 6. For the sake of clarity the conventional insulated door for the compartment 1 has not been illustrated.

Insofar as described, the construction is a conventional one for domestic refrigerators, the compartment 1 being adapted for storage of foodstuffs and being normally maintained at temperatures well above the freezing point of water. The compartment would, in practice, be provided with shelves, but since the shelves form no part of the present invention, they are not shown in the drawing.

The evaporator 5 departs from the conventional in certain respects described below. With reference to Figures 2 and 3 the evaporator consists of an S-shaped frame 7 which, in accordance with the present invention, is composed of material of low thermal conductivity. Any material of suitably low conductivity and having the required degree of inherent strength will answer the purpose. For example, the frame may suitably be composed of a moldable plastic. Within the frame 7 are embedded refrigerant conveying evaporator tubes 8, these tubes being composed of material of high thermal conductivity, preferably metal. As illustrated, the tubes 8 are of half-round form in the present instance, the rounded portions of the tubes being embedded and substantially surrounded by the material of the frame 7, and the flat surfaces of the tubes being exposed at the upper surfaces of the three horizontal portions of the frame 7 which have been designated in Figure 2 by the reference numerals 9, 10 and 11.

The coils of the tubing 8 are arranged in the frame so that their exposed flat surfaces may form seats for a plurality of ice trays 12, made preferably of metal in conventional manner, the arrangement of the coils being such as to afford seats for six of the trays, two upon each of the horizontal portions 9, 10 and 11 of the frame structure. The exposed tray-receiving portions of the tubes 8 are dimensioned so that the trays 12, when properly seated, will entirely cover the exposed flat surfaces of the tubes so that thermal transfer to the evaporator must be by way of the metallic walls of the trays.

It will be noted by reference to Figures 1 and 2 that the evaporator 5 is secured to the rear wall of the compartment 1 through the medium of brackets 13, 13, and that these brackets are extended beyond the rear edge of the frame 7 so that when the evaporator is mounted in the compartment a space will be provided between the rear wall of the compartment and the adjoining edge of the evaporator structure thereby providing for circulation of air between the wall and the evaporator. A corresponding spaced relation prevails between the adjoining side wall of the compartment 1 and the proximate side of the evaporator. At the other side, the evaporator may be attached to a panel 14, through the medium, for example, of brackets 15, 15.

In the operation of this device the six trays 12 installed in the evaporator, as illustrated in Figure 5, will seat upon the tubes 8 and will cover the latter so that no portion of the tubes will be exposed directly to the ambient air within the compartment. The trays 12, however, being of metal or other material of high thermal conductivity and being in direct and intimate heat transfer relation with the refrigerant tubes 8, will be maintained at or near the sub-freezing temperature of the said tubes and will thereby provide adequate effective heat transfer surface for the evaporator in the chamber. Since the exposed surfaces of the trays are maintained normally at temperatures below the freezing point of water, these surfaces will tend to collect frost from the air within the chamber. The frost deposit will thus be restricted to the tray surfaces, and defrosting may readily be effected by withdrawal of the trays without interruption of the refrigerating process.

Attention is directed to the character of the grid element 16 which, while essentially of conventional form insofar as their normal function of dividing the interior of the trays 12 into a number of ice cube compartments is concerned, depart from the conventional in that they are extended at the top well above the upper edges of the walls of the tray. By means of this device the effective heat transfer surface of the trays is augmented to a material extent. This extended surface of the ice tray grid also aids the operation of removing the ice cubes from the trays by providing paths for rapid conduction of heat to the sides of the ice cube compartments thereby to free the grid from the cubes.

As previously set forth, the only active portion of the evaporator exposed to the atmosphere within the chamber 1, which portion is maintained at a temperature below the freezing point of water, is constituted by the exposed surfaces of the trays 12 and grids 16. Accordingly, any deposition of frost within the chamber will of necessity be upon the surfaces of the trays and grids so that complete defrosting of the evaporator may be effected by freeing the frost from said surfaces after removal of the trays from the chamber.

It is to be noted that the material of the frame 7 which functions to insulate in part the active evaporator elements or tubes 8 would in course of time tend to approach the temperature of the active evaporator elements. There exists, however, a continuous transfer of heat through the cabinet walls to the relatively cool air within the compartment, so that the surface temperature of the frame 7 will eventually reach a mean value between the temperature of the tubing 8 and that of the ambient air. It is thus possible to maintain the mean temperature at a nonfrosting level.

A modification of the aforedescribed evaporator is illustrated in Figure 4. In this case the evaporator comprises metal plates 17 and 18 having passages for the circulating refrigerant. In accordance with the invention, these plates are covered with suitable insulating medium, indicated by the reference numeral 19, said insulating envelope being interrupted so as to expose portions 20 of the upper surfaces of the plates.

These exposed portions 20 are shaped and dimensioned to conform to the bottoms of the trays 12, so that when the trays are seated upon the said exposed portions the plates are protected against direct contact with the ambient air within the compartment and transfer of heat must therefore be by way of the walls of the trays 12 and the extended surfaces of the grids 16. The device functions in essentially the same manner as that described above in connection with the evaporator 5.

Figure 5 illustrates an evaporator structure corresponding essentially with that shown in Figure 4 with the exception that the plates or their equivalent are constructed and arranged in a manner to afford inclined tiers tending to promote a free circulation of air through the evaporator.

While it has not been deemed necessary to illustrate certain constructional details which, per se, form no part of the present invention; it might be mentioned that some suitable tray-release mechanism would be employed to facilitate removal thereof. Various mechanisms of this type are available, and the selection of one thereof involves design alone.

I claim:

1. In a refrigerator, a refrigerated compartment, an evaporator unit mounted in and constituting the major cooling means for said compartment and comprising a hollow metallic member and an envelope of thermal insulating material, said envelope being discontinuous so as to expose a localized area of said member, a metallic ice tray removably seated upon and effectively covering said exposed area, and an ice cube grid in said tray comprising partitioning elements of high thermal conductivity and of substantially greater height than the walls of said tray.

2. In a refrigerator, a normally closed refrigerated compartment, an evaporator unit mounted bodily within said compartment and operating normally at temperatures below the freezing point of water, said evaporator consisting of a metallic structure having exposed areas constituting seats for ice trays whereon said trays and structure are brought into intimate thermal transfer relation, metallic ice trays freely supported on said seats and forming in effect highly heat-conductive extensions of the evaporator in said compartment, and an envelope of thermal insulating material embracing the remaining surface area of the structure whereby transfer of heat from the ambient air to the structure may be confined substantially to paths extending through the ice trays.

3. An evaporator unit of a type adapted to be mounted bodily within a chamber to be refrigerated and to operate normally at temperatures below the freezing point of water, said evaporator consisting of a metallic structure having exposed areas constituting seats for ice trays whereon said trays and structure are brought into intimate

thermal transfer relation, said seats being arranged in superimposed tiers inclined to the horizontal, and an envelope of thermal insulated material embracing the remaining surface area of the structure whereby transfer of heat from the ambient air to the structure may be confined substantially to paths extending through the ice trays.

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