March 30, 1937. E. HEITMAN 2,075,438

REFRIGERATING APPARATUS

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Fig. 1.

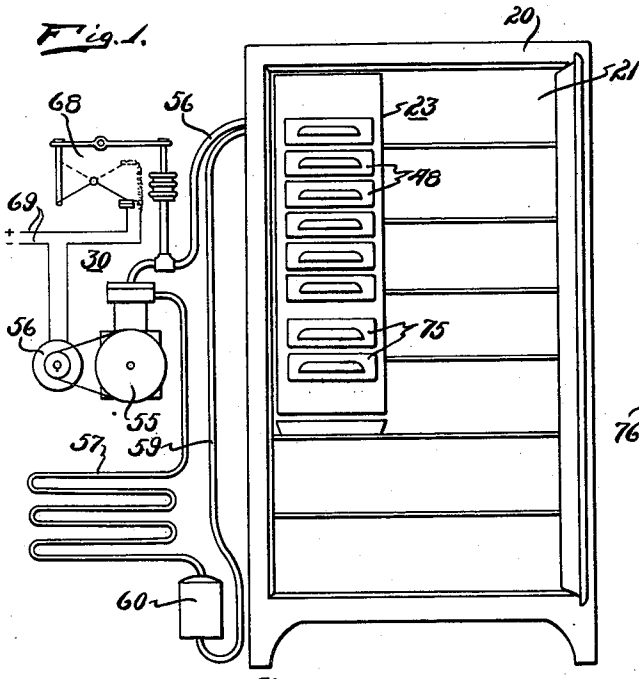


Fig. 4.

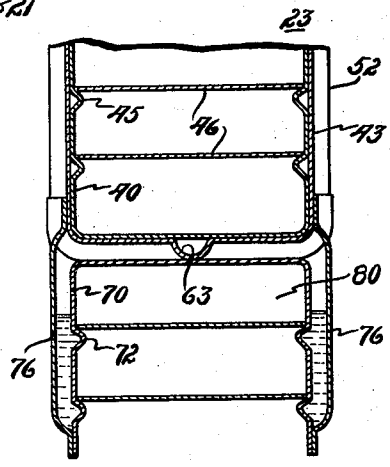


Fig. 3.

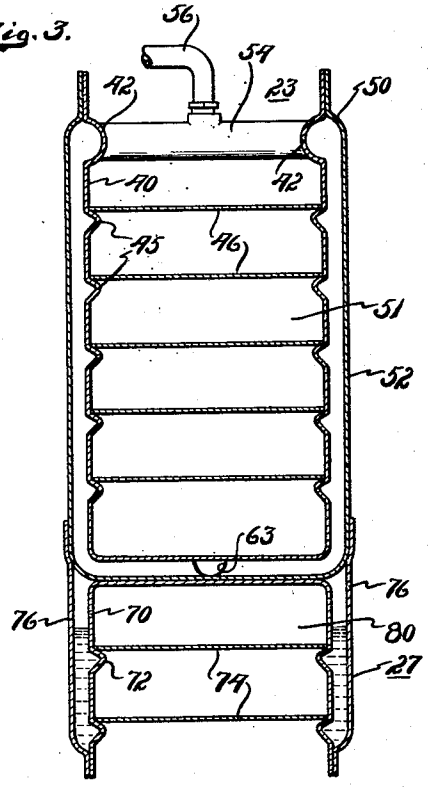
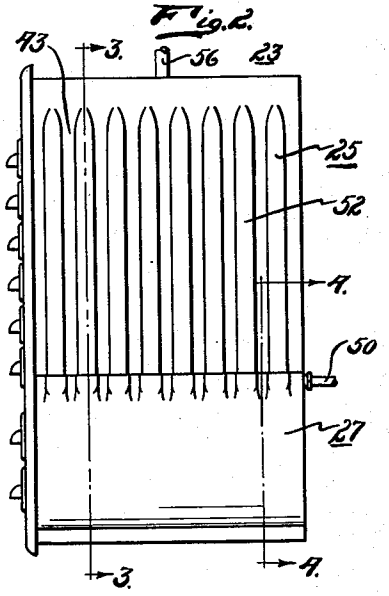


Fig. 2.



INVENTOR.
EDWARD HEITMAN
BY Ralph E. Baker
ATTORNEY.

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Fig. 5.

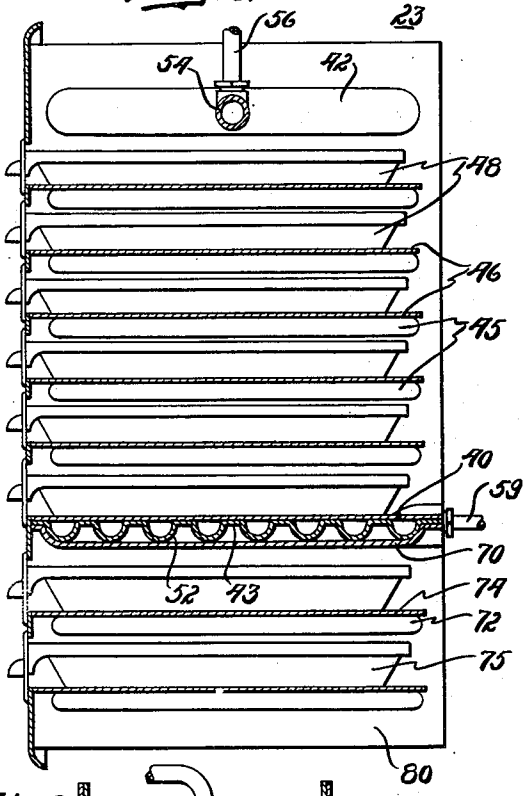


Fig. 8.

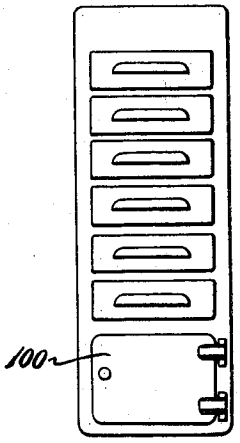


Fig. 6.

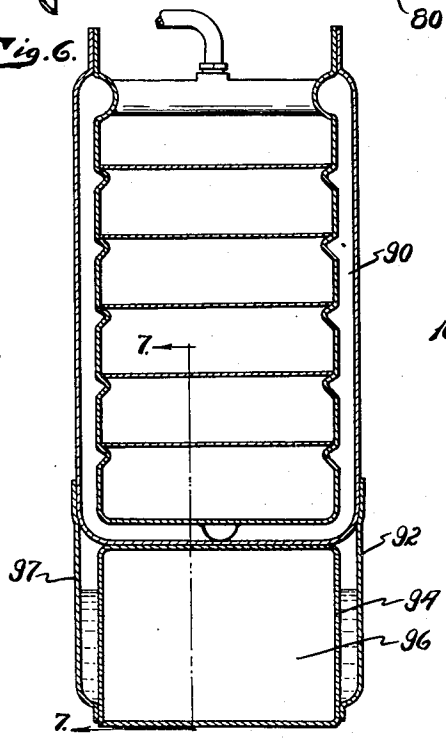
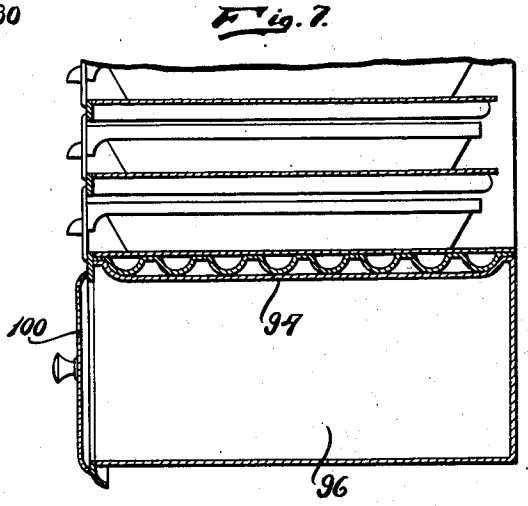


Fig. 7.



INVENTOR.
EDWARD HEITMAN

BY
Ralph E. Baker
ATTORNEY.

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UNITED STATES PATENT OFFICE

2,075,438

REFRIGERATING APPARATUS

Edward Heitman, Detroit, Mich., assignor to Kelvinator Corporation, Detroit, Mich., a corporation of Michigan

Application October 10, 1932, Serial No. 636,993

2 Claims. (Cl. 62—126)

This invention relates to refrigerating apparatus, and more particularly to refrigerant evaporators for use in such apparatus.

One of the objects of my invention is to provide an improved refrigerant evaporator having a vertical dimension exceeding the permissive depth of the refrigerant to provide a large freezing capacity for freezing large quantities of substances, such as water.

Another object of the invention is to provide a new and improved refrigerating apparatus of the type including primary and secondary refrigerating systems arranged in heat exchange relation to provide a large cooling zone and a large ice making capacity.

Another object of the invention is to provide a cooling element of the type described which is efficient in operation and which may be economically constructed of sheet metal.

Other objects and advantages will be apparent from the following description and accompanying drawings, wherein a preferred form of the present invention is clearly shown.

In the drawings:

Fig. 1 is a diagrammatic illustration of a refrigerating apparatus embodying features of my invention;

Fig. 2 is a side view in elevation of the cooling element shown removed from the cabinet;

Fig. 3 is an enlarged view in cross section of the cooling element taken along the line 3—3 of Fig. 2;

Fig. 4 is an enlarged fragmentary view of the cooling element in cross section, taken along the line 4—4 of Fig. 2;

Fig. 5 is a side view of the cooling element in cross section;

Fig. 6 is a view in cross section of a modified form of cooling element;

Fig. 7 is a fragmentary side view in cross section, taken in the direction of the arrows 7—7 of Fig. 6; and

Fig. 8 is a front view in elevation of the cooling element shown in Fig. 6.

In household refrigerators, it has been found desirable to make provisions for the freezing of ice cubes for table use or the like. Evaporators of the so-called flooded type have been found satisfactory in the smaller food capacity refrigerators in which the capacity of the freezing chamber and its ice making capacity are usually small. However, it has been found that the use of evaporators of this type are not entirely satisfactory in the larger refrigerators, having large food storage compartments to be refrigerated and in which there is a need for a large freezing compartment having a capacity for rapidly freezing large quantities of desserts and ice cubes. In such evaporators, it has been found that the depth to which the refrigerant containing chambers may be designed to extend is limited since refrigerant will not boil at proper times below a certain depth and, consequently, will not properly refrigerate below a certain depth. For any refrigerant this maximum depth may be designated as the "permissive depth." This condition consequently limits the depth to which the freezing compartment may be designed to extend and consequently its capacity for freezing substances and for cooling circulating air in the food compartment.

In my invention, the above difficulties have been obviated so that a large and efficient freezing chamber is provided in which large quantities of food articles may be stored to be rapidly frozen and large quantities of ice may be made. I accomplish this by utilizing primary and secondary refrigerating systems, which I have arranged in heat transfer relation so that the primary system condenses evaporated refrigerant in the secondary system. The primary system includes a sheet metal evaporator having a large freezing chamber, which may be made as deep as the efficiency of rapid freezing will permit. The secondary system comprises a sheet metal evaporator arranged immediately below the primary evaporator and in good thermal contact therewith thus effectively extending the total vertical dimension below the permissive depth. The secondary evaporator is also provided with a freezing chamber which adds to the ice making capacity of the cooling element, and a cooling zone which adds to the area of the heat exchange surface for cooling circulating air.

Referring now to the drawings for a detailed description of the invention, the numeral 20 designates, in general, a refrigerator cabinet having a food storage compartment 21. Within the compartment 21 there is disposed heat absorbing means or a refrigerant evaporator 23 for cooling the circulating air within the compartment and for freezing large quantities of ice cubes.

The heat absorbing means 23 comprises, in general, a primary refrigerant evaporator 25 and an evaporator 27 for a secondary refrigerant which constitutes the secondary refrigerating system. Refrigeration is supplied to the primary refrigerant evaporator 25 by a refrigerant circulating or condensing unit 30. The unit 30, together with the evaporator 25, constitutes the primary refrigerating system. The evaporators

25 and 27 are connected together in the same vertical plane and in heat transfer relation so that the evaporated refrigerant in the secondary evaporator 27 is condensed by the cooling action of the primary evaporator 25.

In practice, it has been found that in evaporators of the flooded type which use but a single refrigerant, the accommodation of about six standard ice trays, one above the other, is the greatest depth to which the side walls may be extended without the possibility of superheating the refrigerant in the lower portion of the evaporator. Thus, rapid or any freezing of ice cubes is prevented in the lowermost tray or trays should the evaporator be extended to too great a depth.

By the use of the primary and secondary refrigerant evaporators arranged in heat transfer relation, the freezing of ice cubes in excess of six standard trays is provided for and the total vertical dimension of the heat absorbing means may exceed the permissive depth of the refrigerant without the superheating of the refrigerant in the lower part of the primary evaporator.

In Figs. 1 to 3, I have disclosed a primary refrigerant evaporator having provisions for the accommodation of six standard size ice making receptacles, one above the other. Preferably, the primary evaporator 25 is constructed of sheet metal of uniform thickness so that it may be successfully coated with vitreous enamel, such as porcelain, on its exterior surface. The primary refrigerant evaporator comprises, in general, an inner U-shaped sheet metal member 40, which is provided with indented portions 42 adjacent each end thereof which serve as refrigerant manifolds for gaseous refrigerant, and a plurality of indented portions 45 which provide supports for shelves 46 for supporting ice making receptacles 48. An outer U-shaped sheet metal member 50 cooperates with the inner sheet metal member to provide a chamber for refrigerant. The outer sheet metal member is corrugated as at 52 for providing passages for the refrigerant. Preferably, the inner and outer sheet metal members are welded together at their ends and spot welded between the corrugation at the contacting points of said members. The sheet metal members 40 and 50 also cooperate to provide at least three sides of a freezing zone or chamber 51.

The manifolds 42 are interconnected by a conduit 54. Gaseous refrigerant is withdrawn from the evaporator 25 through a vapor conduit 56 by the condensing unit 30. The condensing unit comprises, in general, a compressor 55, a motor 56 for operating the compressor, and a condenser 57. The compressor withdraws the gaseous refrigerant, compresses it and delivers it to the condenser wherein it is liquefied and from which it is delivered to the evaporator 25 through a liquid supply conduit 59 under the control of high side float mechanism 60. The vapor conduit 56 is connected to the conduit 54 and the liquid supply conduit 59 is connected to manifold 63, which extends along the bottom wall of the evaporator 25 and communicates with each of the passageways between the inner and outer sheet metal members.

Preferably, the primary system is intermittently operated and for the purpose of controlling the operation of the motor 56, I have provided an automatic switch 69. The switch 68 is adapted to connect and disconnect the motor to and from the power mains 69 in response to predetermined changes in pressures in conduit 56.

In order to provide additional ice making capacity and air cooling surface, the secondary refrigerant evaporator has been provided. This evaporator is arranged immediately below the primary evaporator in the same vertical plane therewith and thermally connected thereto so that the evaporator 25 serves to condense evaporated refrigerant in the secondary evaporator. The secondary refrigerant evaporator comprises, in general, an inner sheet metal member 70 which is in the form of an inverted U. The top wall of the sheet metal member 70 is arranged so that it abuts the bottom wall of the primary refrigerant evaporator 25. The sheet metal member 70 is provided with indented portions 72 which provide supports for shelves 74 for supporting ice making receptacles 75. A pair of sheet metal members 76 are joined at one end to the sheet metal member 70, and on the upper ends thereof are joined to the outer sheet metal member 50 of the primary evaporator. These joints are preferably made by welding. As will be noted in the drawings, the sheet metal parts 70 and 76 cooperate to form a chamber for a secondary liquid refrigerant and a freezing zone or chamber 80. By this arrangement, evaporated refrigerant in the secondary refrigerant evaporator moves upwardly where it comes in contact with the bottom wall of the primary refrigerant evaporator where it is condensed by the cooling action of the primary refrigerant evaporator.

From the foregoing, it will be noted that I have provided a refrigerant evaporator which is capable of refrigerating a large food storage compartment and which is also capable of rapidly freezing large quantities of ice cubes. It will also be noted that I have provided a primary refrigerant evaporator, the side walls of which extend to such a depth that the maximum number of ice making receptacles may be placed therein without the possibility of superheating the refrigerant in the lowermost part thereof. In addition, I have joined to the primary refrigerant evaporator a secondary refrigerant evaporator which has accommodation for additional ice making receptacles, and I have arranged this secondary evaporator so that the heat absorbed thereby is conducted to the refrigerant contained in the primary evaporator and also the evaporated refrigerant is conducted to the primary evaporator for condensing evaporated refrigerant in the secondary evaporator. By this arrangement, the freezing of additional ice cubes in no way causes superheating of refrigerant in the primary evaporator and at the same time these additional ice cubes are rapidly frozen.

In Figs. 6, 7 and 8 of the drawings, I have disclosed a slightly modified type of heat absorbing means which comprises, in general, a primary refrigerant evaporator 90 which corresponds in all respects to the primary refrigerant evaporator 25, and a secondary refrigerant evaporator 92 which functionally corresponds to the secondary refrigerant evaporator 76 of the first embodiment. The secondary refrigerant evaporator comprises an inner sheet metal boxlike member 94 which completely encloses and forms a refrigerating compartment 96 for the storage of frozen food articles or the like. The evaporator 92 also includes additional sheet metal material 97 which is joined to the primary refrigerant evaporator at the upper ends thereof and which is joined to the said sheet member 94 at the lower part thereof, preferably by welding. The sheet metal parts 94 and 97 cooperate to form a chamber for a secondary liquid refrigerant for refrigerating the compartment 96. In this em-

bodiment of the invention, the compartment 96 is so arranged as to accommodate large quantities of food articles stored therein to be maintained in the frozen condition or for storing frozen ice cubes therein. If desired, the compartment 96 may be employed for freezing desserts and the like. Also, if desired, a large receptacle (not shown) may be placed in said compartment for receiving the stored food articles. The front of the compartment 96 is closed by a hinged door 100.

Although only a preferred form of the invention has been illustrated, and that form described in detail, it will be apparent to those skilled in the art that various modifications may be made therein without departing from the spirit of the invention or from the scope of the appended claims.

I claim:

1. A sheet metal evaporator for refrigerating apparatus comprising an inner sheet metal member, an outer sheet metal member cooperating with said inner member for providing at least three sides of a freezing compartment, said members being spaced apart for the circulation of refrigerant therebetween, a sheet metal member providing inner walls for a refrigerating compartment and being arranged so that the top wall thereof abuts the bottom wall of said freezing compartment and sheet metal material cooperating with the last named sheet metal member for providing a space for refrigerant on the sides of said refrigerating compartment.

2. A sheet metal evaporator for refrigerating apparatus comprising an inner U-shaped sheet metal member, an outer corrugated U-shaped member cooperating with said inner member for providing at least three sides of a freezing compartment and being adapted to contain a quantity of liquid refrigerant, an inverted U-shaped sheet metal member abutting the lowermost portion of said outer sheet metal member and arranged to provide inner walls of a refrigerating compartment and sheet metal side walls cooperating with said inverted U-shaped member for providing a space for liquid refrigerant.

EDWARD HEITMAN.