June 23, 1936. E. B. NEWILL 2,045,048

REFRIGERATING APPARATUS

Filed July 31, 1934 2 Sheets-Sheet 1

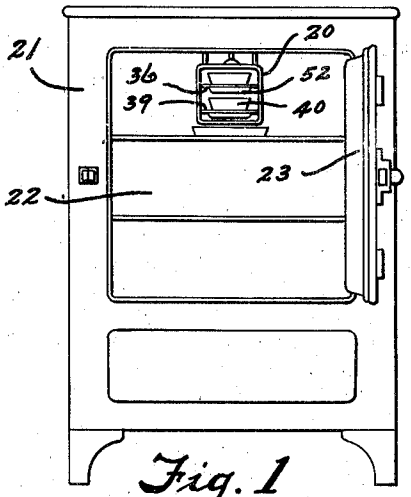


Fig. 1

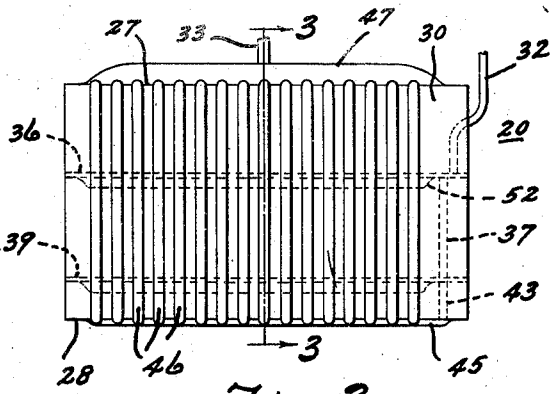


Fig. 2

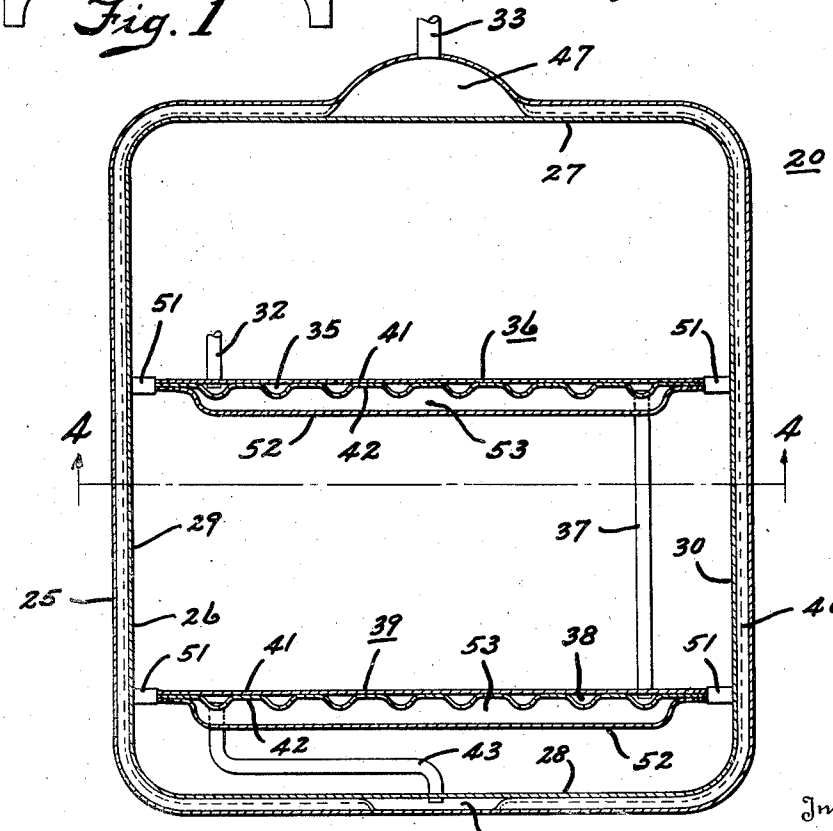


Fig. 3

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REFRIGERATING APPARATUS

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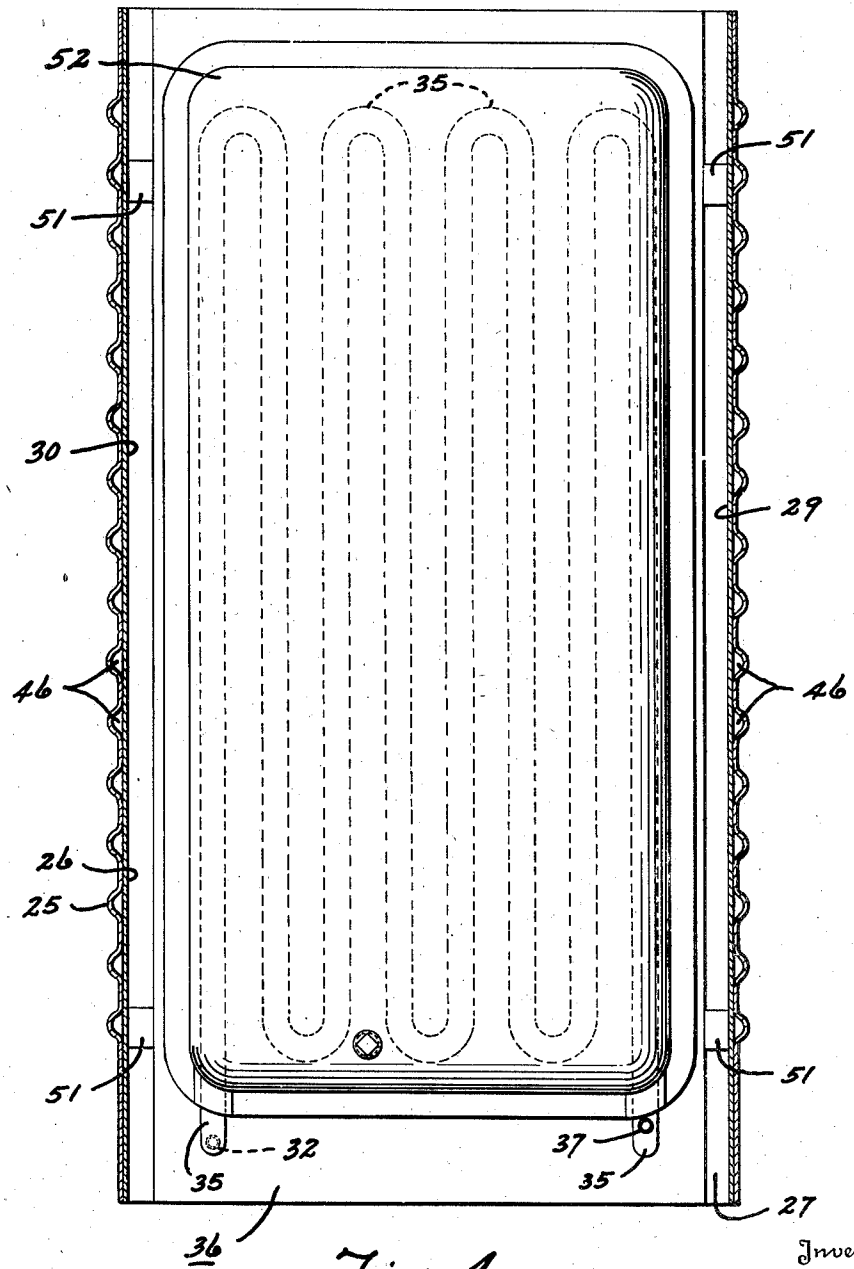


Fig. 4

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UNITED STATES PATENT OFFICE

2,045,048

REFRIGERATING APPARATUS

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Application July 31, 1934, Serial No. 737,787

8 Claims. (Cl. 62—95)

This invention relates to refrigerating apparatus and particularly to evaporators or cooling elements thereof.

Refrigerating apparatuses or systems of the present-day type usually have two major features embodied therein. The first of these features is the provision of an evaporator and a refrigerant flow circuit therethrough which will produce rapid freezing of substances placed in trays or receptacles and positioned on or in an evaporator while at the same time cooling the air within a refrigerator cabinet to the proper temperature for food preservation. The second of these major features is the provision of some sort of means for causing semi-automatic or automatic defrosting of the evaporator or in other words to cause a temporary higher temperature of the air cooling walls of the evaporator for melting frost or ice accumulated thereon therefrom. These two desirable features have resulted in extensive development of evaporators of special or unique design for refrigerating systems and the invention herein disclosed is an improvement in the art of evaporator design constructed especially to carry out the desirable features of a refrigerating system without loss of efficiency.

An object of the invention is to provide an evaporator or cooling element having an arrangement of passages therein which will permit effective circulation of refrigerant in the evaporator so as to cool certain surfaces thereof as desired and to provide an evaporator which can be readily fabricated from sheet metal shells or plates.

Another object of the invention is to provide an improved evaporator of the type having a plurality of walls forming an air cooling portion for the evaporator and a chamber therebetween with a refrigerated sharp freezing shelf or shelves, adapted to receive receptacles containing substances to be congealed or frozen, within the chamber and to construct and arrange the shelves in such manner that a difference in the temperature of the air cooling portion or walls of the evaporator relative to the temperature of the shelves will not materially affect the normal low temperature of the shelves.

In carrying out the foregoing object it is still a further object to provide temperature hold-over means in thermal contact with a refrigerated shelf within a freezing chamber or compartment defined by walls of an evaporator for maintaining the temperature of the shelf substantially constant during a temporary increase in the temperature of the evaporator walls.

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 form of the present invention is clearly shown.

In the drawings:—

Fig. 1 discloses a refrigerator cabinet of the household type having an evaporator constructed according to the present invention installed therein;

Fig. 2 is an enlarged side elevational view of my improved evaporator;

Fig. 3 is an enlarged vertical sectional view of my improved evaporator taken on the line 3—3 of Fig. 2 and showing the chamber formed by the evaporator walls as being divided into a plurality of compartments by refrigerated shelves; and—

Fig. 4 is a sectional view taken on the line 4—4 of Fig. 3 showing the bottom of one of the refrigerated shelves.

Referring to the drawings, for the purpose of illustrating the present invention, I have shown in Fig. 1 thereof an evaporator 20 constructed according to my invention mounted in the refrigerator cabinet 21 of any suitable construction or design. Preferably the cabinet 21 comprises an insulated food storage compartment 22 having a door 23 providing access thereto and a machine compartment (not shown) disposed below the food compartment. The refrigerant liquefying and circulating unit or machine of the refrigerating system, connected with the evaporator 20, may be of any suitable type and is adapted to be mounted in the machine compartment. Mechanical refrigerant liquefying and circulating units or machines of type mentioned are well known to those familiar with the art and need no detailed description.

The evaporator 20 is produced by uniting in any suitable manner superimposed sheet metal plates or telescoped sheet metal shells 25 and 26 (see Fig. 3) to provide a double walled structure having passages formed between the plates or shelves. The united plates or shells 25 and 26 are arranged to form a top wall 27, a bottom wall 28 and side walls 29 and 30 of an elongated horizontally extending freezing chamber or compartment. A liquid refrigerant inlet connection 32 and a gaseous refrigerant outlet connection 33 are connected with the evaporator 20. The refrigerant connection 32 may be connected with a refrigerant control device (not shown) of any well known type for governing or controlling the flow of liquid refrigerant to the evaporator. The refrigerant flow control device may be in the

form of a restriction expansion or float valve. The refrigerant connection 33 leads from the evaporator 20 to the crankcase or suction side of a compressor, ordinarily included as an element of the refrigerant liquefying and circulating unit, for withdrawing gaseous refrigerant from the evaporator. In order to provide the evaporator with a fast freezing portion and a relatively warmer portion for cooling air the refrigerant connection 32 leads to a serpentine refrigerant conduit 35 formed in the shelf 36. A pipe 37 conducts refrigerant from the conduit 35, in shelf 36, to a conduit 38 formed in a shelf 39. The shelves 36 and 39 provide the evaporator with fast freezing supports adapted to receive receptacles 40 containing a substance to be congealed or frozen. The shelves 36 and 39 divide the chamber or compartment, formed by the walls 27, 28, 29 and 30 of the evaporator, into a plurality of superimposed compartments. Shelves 36 and 39 each include superimposed sheet metal portions or members 41 and 42 (see Fig. 3) secured together in any suitable manner. The refrigerant conduits 35 and 38 provided in shelves 36 and 39 extend horizontally through the chamber or compartment formed by walls of the evaporator and are formed by depressions provided in the lower sheet metal portion 42 of the shelves. A pipe 43 conducts refrigerant from the conduit 38, in shelf 39, to a header or distributing manifold 45 formed by and located between the sheet metal plates or shells 25 and 26 in the bottom wall 28 of the evaporator. A plurality of refrigerant passages 46 formed by and located between the sheet metal plates or shells 25 and 26 extend outwardly from each side of the manifold 45 and upwardly along the walls 29 and 30 and along the top wall 27 and communicate with a gaseous refrigerant outlet header or chamber 47 to which the gaseous refrigerant return pipe 33 is connected.

It will thus be seen that I have provided a refrigerant flow circuit through the sheet metal evaporator 20, between the refrigerant inlet and outlet connections thereof, which includes an extended portion comprising the shelves 36 and 39 connected in series with the inlet connection 32 and which portion is capable of producing very low temperatures and another portion connected in parallel circuit relation with the outlet connection 33 to provide refrigerated wall portions which are maintained at a higher temperature than the shelves for cooling and causing circulation of air within the food storage compartment 22 of cabinet 21.

The refrigerated shelves 36 and 39 have the major portion thereof spaced from the side walls 29 and 30 of the evaporator and are supported by these walls by members 51. The members 51 may be of any suitable material, preferably of a material of low heat conductivity and being separate from and independent of the material of the evaporator walls and of the shelves 36 and 39. Members 51 are secured to the shelves 36 and 39 and to the side walls 29 and 30 in any suitable manner. The feature of supporting the shelves 36 and 39 as disclosed will become apparent from the following description of the present invention. Each refrigerated shelf includes a sheet metal portion 52 having the portion thereof adjacent its edges secured in any suitable manner to the lower sheet metal portion 42 of the shelves. The portions of the sheet metal member 52 intermediate its secured portions is bulged outwardly so as to be spaced from the metal shelf portion 42 to provide a sealed chamber 53 along the bottom of the shelves. A non-freezing solution such as brine or the like is adapted to be placed in and sealed within the chamber 53.

The refrigerant flow circuit through the evaporator as hereinbefore described provides a portion adjacent the refrigerant inlet which is maintained at a very low temperature to produce fast freezing and a portion adjacent the outlet pipe 33 of the evaporator which produces a temperature sufficient to cool and cause circulation of air in the food storage compartment of the refrigerator cabinet. It is well known to those skilled in the art that the temperature of the air cooling walls of the evaporator is sufficiently low to cause moisture within the air in the food compartment, upon being chilled or cooled by flowing over the evaporator, to condense on the air cooling walls thereof. This moisture accumulates on the evaporator walls in the form of a layer of frost or ice. If this layer of frost or ice is permitted to build up or accumulate beyond a certain thickness it will render the refrigerant liquefying and circulating unit of the refrigerating system inefficient because each operating period thereof will be extended over a longer period of time than normal to cause the evaporator to produce the proper low temperature in the food compartment. This results in excessive wear on the operating parts of the unit and increases the cost of operating the refrigerating apparatus. It is to be understood that this fact has been generally recognized by those skilled in the art and by their provision of automatically or semi-automatically operated devices in conjunction with a refrigerating system to cause periodic intervals of non-operation of the refrigerant liquefying and circulating unit to permit the temperature of the evaporator to increase above the freezing point of water so that the frost or ice accumulated on walls of the evaporator will be melted or so that the air cooling walls will be defrosted.

According to my invention the brine solution contained in chamber 53 below each of the refrigerated shelves 36 and 39 serves as a temperature hold-over and prevents softening or melting of frozen substances contained in the trays or receptacles 40 supported on the shelves during a defrosting period of the air cooling walls of the evaporator. The refrigerated shelves 36 and 39 and the hold-over chambers 53 are substantially isolated or protected from the environment temperature surrounding the evaporator by the evaporator walls 27, 28, 29 and 30 and, if desired, by a rear and front cover plate or door (not shown) provided on the evaporator. Therefore the temperature of the air within the food compartment does not materially affect the temperature of the shelves. The brine hold-over solution in chambers 53, after having been reduced to the proper low temperature, serves to maintain the substance in trays 40 in a frozen condition during the period of time the evaporator is rendered ineffective temporarily to produce refrigeration, as for example, during defrosting of the walls thereof. The brine solution in chambers 53, after having been reduced to a low temperature, also aids in quickly reducing the temperature of an ice cube tray filled with water and placed upon either of the shelves 36 and 39 by absorbing heat therefrom and thereby decreases the maximum load on the refrigerating machine.

From the foregoing it will become apparent that I have provided an improved evaporator for refrigerating systems having all the desired characteristics of present-day refrigeration requirements. My improved evaporator provides for fast freezing of substances to be congealed or frozen in trays and at the same time prevents melting of the frozen substances during periods of defrosting of the air cooling walls of the evaporator.

While the form of embodiment of the invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. An evaporator for refrigerating systems comprising in combination, refrigerant conveying means arranged to define a plurality of walls of a sharp freezing compartment, a refrigerated shelf disposed horizontally within said freezing compartment for supporting a receptacle adapted to contain a substance to be congealed or frozen, a closed chamber containing a temperature hold-over substance adjacent to and in intimate thermal contact with said shelf, and means for supporting said refrigerated shelf and said chamber in spaced relation to the walls of said freezing compartment.

2. An evaporator for refrigerating systems comprising in combination, refrigerant conveying means arranged to define a plurality of walls of a sharp freezing compartment, a refrigerated shelf disposed horizontally within said freezing compartment for supporting a receptacle adapted to contain a substance to be congealed or frozen, a closed chamber containing a temperature hold-over substance adjacent to and in intimate thermal contact with said shelf, and means for supporting said refrigerated shelf and said chamber in spaced relation to the walls of said freezing compartment, said last named means being of a material separate from and independent of the walls of said compartment and of the hold-over chamber and shelf.

3. An evaporator for refrigerating systems comprising in combination, sheet metal portions having certain parts thereof secured together and certain other parts thereof spaced apart to provide refrigerant passages therebetween, said sheet metal portions being arranged to provide a plurality of walls of a freezing compartment, sheet metal portions having certain parts thereof secured together and certain other parts thereof spaced apart to provide a refrigerant passage therebetween and arranged horizontally within said freezing compartment to provide a shelf for supporting a receptacle adapted to contain a substance to be congealed or frozen, a sheet metal member secured to said shelf and forming a closed chamber containing a temperature hold-over substance in intimate thermal contact with said shelf, and means for supporting said shelf and said chamber from the walls of said freezing compartment, said supporting means comprising a plurality of members of low heat conductivity and formed of material separate from and independent of the material of said shelf and said evaporator walls.

4. An evaporator for refrigerating systems comprising in combination, sheet metal portions having certain parts thereof secured together and certain other parts thereof spaced apart to provide refrigerant passages therebetween, said sheet metal portions being arranged to provide a plurality of walls of a freezing compartment, sheet metal portions having certain parts thereof secured together and certain other parts thereof spaced apart to provide a refrigerant passage therebetween and arranged horizontally within said freezing compartment to provide a shelf for supporting a receptacle adapted to contain a substance to be congealed or frozen, a sheet metal member secured to the underside of said shelf and forming a closed chamber containing a temperature holdover substance in intimate thermal contact with said shelf, and means for supporting said shelf and said chamber in spaced relation to the walls of said freezing compartment.

5. An evaporator for refrigerating systems comprising in combination, refrigerant conveying means arranged to define a plurality of walls of a sharp freezing compartment, means forming a combined receptacle receiving shelf and closed container, said combined shelf and container being disposed horizontally within said freezing compartment and said container having a temperature holdover substance therein, and means for supporting said combined shelf and container in spaced relation to the walls of said freezing compartment.

6. An evaporator for refrigerating systems comprising in combination, refrigerant conveying means arranged to define a plurality of walls of a sharp freezing compartment, means forming a combined receptacle receiving refrigerated shelf and temperature holdover element, said combined shelf and element being disposed horizontally within said freezing compartment, and means for supporting said combined shelf and element in spaced relation to the walls of said freezing compartment.

7. An evaporator for refrigerating systems comprising in combination, refrigerant conveying means arranged to define a plurality of walls of a sharp freezing compartment, means forming a temperature holdover element, said element being disposed horizontally within said freezing compartment and providing a shelf for the reception of a receptacle adapted to contain a substance to be congealed or frozen, and means for supporting said element in spaced relation to the walls of said freezing compartment.

8. An evaporator for refrigerating systems comprising in combination, refrigerant conveying means arranged to define a plurality of walls of a sharp freezing compartment, means forming a combined receptacle receiving refrigerated shelf and temperature holdover element, said combined shelf and element being disposed horizontally within said freezing compartment, and means for supporting said combined shelf and element from the walls of said freezing compartment, said supporting means comprising a plurality of members of low heat conductivity formed of material separate from and independent of the material of said combined shelf and element and of said evaporator walls.

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