Aug. 18, 1936. L. M. KEIGHLEY 2,051,769

REFRIGERATING APPARATUS

Filed May 24, 1935

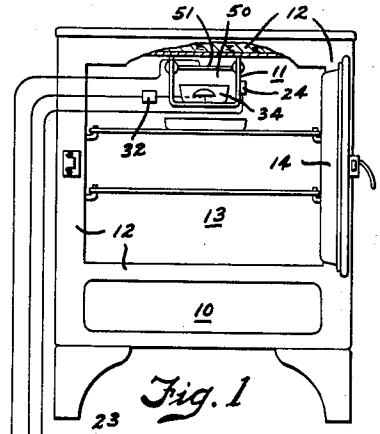


Fig. 1

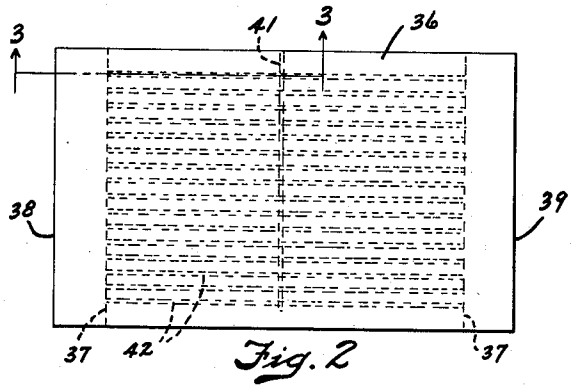
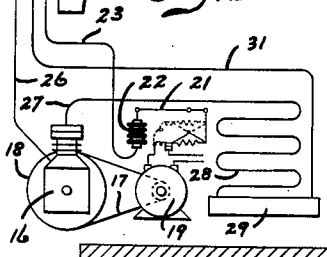


Fig. 2



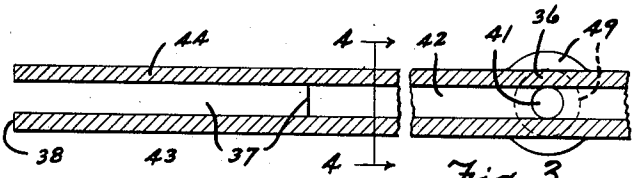


Fig. 3

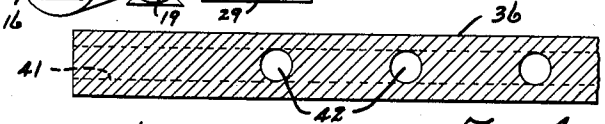


Fig. 4

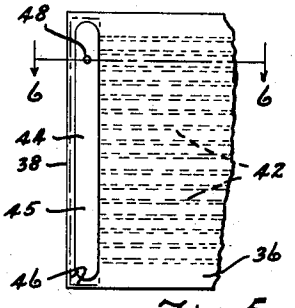


Fig. 5

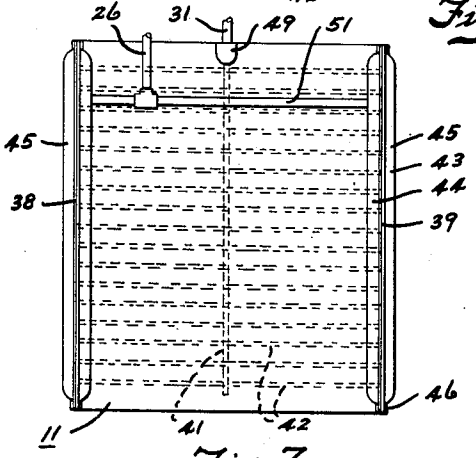


Fig. 7

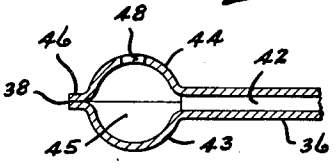


Fig. 6

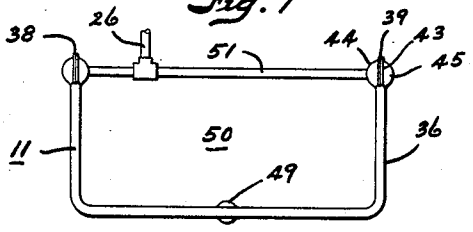


Fig. 8

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REFRIGERATING APPARATUS

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Application May 24, 1935, Serial No. 23,267

3 Claims. (Cl. 62—126)

This invention relates to refrigerating apparatus and particularly to cooling elements employed in such apparatus.

In making cooling elements or evaporators for refrigerating systems it has been customary to secure two sheets of metal together, such as by welding same between a plurality of corrugations provided in at least one of the sheets, to form refrigerant conveying passages between the sheets. The two sheets of metal forming a double walled evaporator structure have each been bent or arranged prior to securing them together to form a sharp freezing compartment. More recently, however, the sheets have been welded together in flat form and thereafter bent into the form desired to provide a freezing compartment. These prior methods of providing a cooling element or evaporator of a refrigerating system have not been entirely satisfactory because it has been very difficult to obtain a closed hollow wall structure due to the enormous amount of welding required. In addition the employment of two sheet metal members has rendered the cost of manufacturing evaporators very high. My invention is directed to simplifying and reducing the cost of manufacturing evaporators for refrigerating systems while at the same time eliminating as much as possible the amount of welding to be done.

An object of my invention is to provide an improved evaporator for a refrigerating system.

Another object of my invention is to form an evaporator for a refrigerating system from a single sheet of metal so as to provide smooth wall surfaces both internally and externally of a freezing compartment formed by the sheet of metal.

A further object of my invention is to provide a plurality of closed interconnected refrigerant conveying passages in a single sheet of metal to provide an evaporator for a refrigerating system and to thereafter bend the single sheet of metal into a form whereby the metal sheet provides a plurality of walls of a sharp freezing compartment adapted to receive and support ice trays.

In carrying out the foregoing objects it is a still further object of my invention to reduce the cost of producing an evaporator for a refrigerating system, of the type comprising a continuous metal wall having refrigerant passages therein, by reducing to a minimum the number of parts and the amount of welding necessary in providing a bendable hollow wall structure.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawing, wherein a preferred form of the present invention is clearly shown.

In the drawing:

Fig. 1 discloses a refrigerating apparatus having an evaporator constructed in accordance with my invention incorporated therein;

Fig. 2 shows a flat sheet of metal employed in the construction of the evaporator of my invention;

Fig. 3 is an enlarged fragmentary sectional view taken on the line 3—3 of Fig. 2;

Fig. 4 is a fragmentary sectional view taken on the line 4—4 of Fig. 3;

Fig. 5 is a fragmentary view showing a header formed in the end portion of the sheet of metal;

Fig. 6 is an enlarged sectional view taken on the line 6—6 of Fig. 5;

Fig. 7 is a top plan view of the sheet of metal after having been bent into the shape desired; and

Fig. 8 is a front elevational view of the evaporator formed from the single sheet of metal shown in Fig. 2.

Referring to the drawing, for the purpose of illustrating my invention, I have shown in Fig. 1 thereof a refrigerating apparatus including a small household refrigerator cabinet 10 having an evaporator or cooling element 11 of a refrigerating system mounted therein in any suitable or well-known manner. The cabinet 10 includes a plurality of insulated walls 12 surrounding and forming a food storage compartment 13 within the cabinet. The compartment has an access opening adapted to be closed by a door 14. The refrigerating system includes a refrigerant liquefying and circulating unit comprising a compressor 16 operated by being connected, through belt and pulley connections 17 and 18 respectively, to an electric motor 19. Operations of motor 19 are controlled by any suitable or well-known electric snap switch 21 which is actuated automatically by movement of a bellows 22 which bellows has a pipe connection 23 with a thermostat bulb 24 located in thermal contact with the evaporator 11 in compartment 13. Operation of motor 19 and consequently compressor 16 causes the compressor to withdraw vaporized refrigerant from the evaporator 11 through a gaseous refrigerant return pipe 26. The compressor 16 compresses the gaseous refrigerant and forces same under pressure, through a pipe 27, to a condenser 28 wherein it is cooled and liquefied in any suitable manner and caused to flow into a receiver 29. The liquefied refrigerant is stored in receiver 29 prior to its

circulation, through a liquid refrigerant pipe line 31, to the evaporator 11. An expansion valve or device 32 interposed in the liquid refrigerant pipe 31 adjacent evaporator 11 controls the flow of refrigerant into the evaporator. The operation and function of a refrigerating system as herein disclosed is conventional and well-known to those skilled in the art for causing evaporator 11 to produce a refrigerating effect for withdrawing heat from compartment 13 and from a receptacle or ice tray 34 supported on the evaporator to cool the compartment and to cause freezing of the contents of tray 34.

Since my invention is directed to a novel evaporator or cooling element of a small low cost refrigerator cabinet of the type disclosed I will now proceed to describe, with the aid of the illustrations shown in the drawing, the method of making the improved evaporator. In accordance with the objects of my invention I cut a blank sheet 36, from a roll or long strip, of metal to a predetermined size as shown in Fig. 2 of the drawing. The single sheet of metal 36 is preferably of such thickness as to permit a plurality of passages or conduits to be formed between the exterior surfaces or faces thereof. It has been found that a sheet of bendable metal of from $\frac{3}{16}$ to $\frac{5}{16}$ of an inch is satisfactory in the production of my improved low cost evaporator. I cut or mill a slot 37 of a predetermined width and depth inwardly of each end 38 and 39 respectively of the blank single sheet 36 and this slot extends entirely across the sheet. I then drill or bore a hole 41 inwardly from one side edge of the sheet 36 to a point spaced from the opposite side edge of the sheet 36. A plurality of holes 42 are then drilled or bored inwardly from the opposite ends 38 and 39 of sheet 36. The holes 42 extend transversely to and register or communicate with hole 41 and slots 37 provided in the single sheet. After the sheet 36 has been milled and drilled or bored as described to provide the passages between the faces or intermediate the outer surfaces of the sheet the walls 43 and 44 of slots 37 are spread outwardly so as to open the slot to permit a forming tool, preferably of a collapsible type, to be placed between these walls. Walls 43 and 44 are forced back over the forming tool to cause the walls to be deformed or rounded inwardly of the ends 38 thereof to form a header chamber 45 substantially as shown for example, in Fig. 6 of the drawing. Walls 43 and 44 are then again spread apart a sufficient distance to permit the tool, after having been collapsed, to be removed from within the chamber 45. After the tool has been removed from chamber 45 the walls 43 and 44 are secured together about the ends 38 and 39 of sheet 36 and at the ends of the chambers 45 by welding same along the dot-dash line indicated by the reference character 46 in Fig. 5 to form a closed header which communicates with all of the passages 42. An opening 48 is then drilled through the wall 44 of each header 45 for a purpose to be hereinafter described. An expanding tool is forced into the open end of passage 41 to force the walls of the passage 41 outwardly and to enlarge the passage 41 at the edge of sheet 36, as indicated by the reference character 49 in Fig. 3 for the reception of the end of a refrigerant inlet pipe.

After having performed the foregoing described operations the end portions of the single sheet 36 are bent upwardly to form a substantially U-shaped structure to provide the evaporator 11 shown in Figs. 1, 7 and 8. This bending of sheet 36 forms a plurality of refrigerated walls of a sharp freezing compartment 50 and the yoke or horizontal portion of the sheet 36 is adapted to receive and support the tray or receptacle 34 for congealing or freezing the contents of the tray. Each end of a pipe 51 is fitted in the opening or hole 48 provided in walls 44 of headers 45 and secured to these walls 44 for permitting equalization of a refrigerant level adapted to be maintained in the headers 45 of the evaporator 11. The gaseous refrigerant return pipe 26 of the refrigerating system may be connected into communication with either of the pair of headers 45 but this pipe is herein disclosed as being connected to the equalizing pipe 51. The end portion of the refrigerant inlet pipe 31 of the refrigerating system, extending from valve 32, is fitted in and secured to the enlarged or expanded portion 49 of passage 41. Obviously the passage 41 provides a manifold for distributing incoming liquid refrigerant to evaporator 11 to the plurality of passageways 42. The refrigerant upon flowing in both directions from manifold 41 flows through passages 42 and enters the headers 45 wherein a predetermined level of liquid refrigerant may, if desired, be maintained.

From the foregoing it will be seen that I have reduced the number of parts or sheets of metal ordinarily required to produce a sheet metal evaporator for a refrigerating system and that by reducing to a minimum the amount of welding also ordinarily required in the making of a sheet metal evaporator, I have thereby greatly reduced manufacturing costs. My improved construction has advantages over prior constructions in that it provides an evaporator which has smooth easily cleanable wall surfaces both internally and externally of the freezing compartment. The entire under surface of an ice tray is permitted, by the smooth walls of my construction, to be in intimate thermal contact with the evaporator thus affording faster freezing of the contents of the tray. The thick metal portions of the single sheet, employed in the making of the improved structure herein disclosed, provide an efficient temperature holdover for the evaporator between operating cycles of the refrigerant liquefying and circulating unit. My improved evaporator structure also has an advantage over older types of evaporators in that the refrigerant spaces in the evaporator are smaller thus a lesser amount of refrigerant is required to fill the evaporator and consequently a lesser amount of refrigerant is employed in the refrigerating system and better circulation of the refrigerant in and through the evaporator is obtained.

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. A cooling element for a refrigerating system comprising, a single sheet of substantially flexible metal having a refrigerant distributing manifold, a refrigerant header and a plurality of refrigerant passages interconnecting the manifold and header formed in the material of said single metal sheet intermediate the opposite faces thereof, said single sheet of metal being bent on a plurality of lines intermediate certain edges thereof to provide portions extending substantially at right angles to other portions of the sheet to form a plurality of walls of a freezing compartment adapted to receive a receptacle

containing a substance to be congealed or frozen, said manifold being located in the lower portion of said cooling element and said header being located in the upper portion of said element, means for controlling the flow of refrigerant to said manifold, and means for conveying refrigerant from said header.

2. A cooling element for a refrigerating system comprising, a single sheet of substantially flexible metal having a refrigerant distributing manifold, a header on each side of said manifold and a plurality of refrigerant passages interconnecting the manifold and the headers formed in the material of said single metal sheet intermediate the opposite faces thereof, said single sheet of metal being bent on two spaced apart parallel lines intermediate the ends thereof to provide a substantially U-shaped structure forming walls of a freezing compartment adapted to receive a receptacle containing a substance to be congealed or frozen, said manifold being located in the connecting yoke portion of the U-shaped structure and one of said headers being located in the upper portion of each of the legs of the U-shaped structure, means for controlling the flow of refrigerant to said manifold, and means for conveying refrigerant from said headers.

3. A cooling element for a refrigerating system comprising, a single relatively thin sheet of substantially flexible metal having a refrigerant passage or passages formed in the material of said single metal sheet intermediate the opposite faces thereof, said single sheet of metal being bent on a plurality of spaced apart straight lines intermediate certain edges thereof to provide substantially flat planular portions extending substantially at right angles to other substantially flat planular portions of the sheet to form a plurality of walls of a freezing compartment adapted to receive a receptacle containing a substance to be congealed or frozen, means for conducting a refrigerating medium to said passage or passages, and means for conveying the refrigerating medium from said passage or passages.

LLOYD M. KEIGHLEY.