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2,863,303

REFRIGERATING APPARATUS

Filed Dec. 7, 1954

2 Sheets-Sheet 1

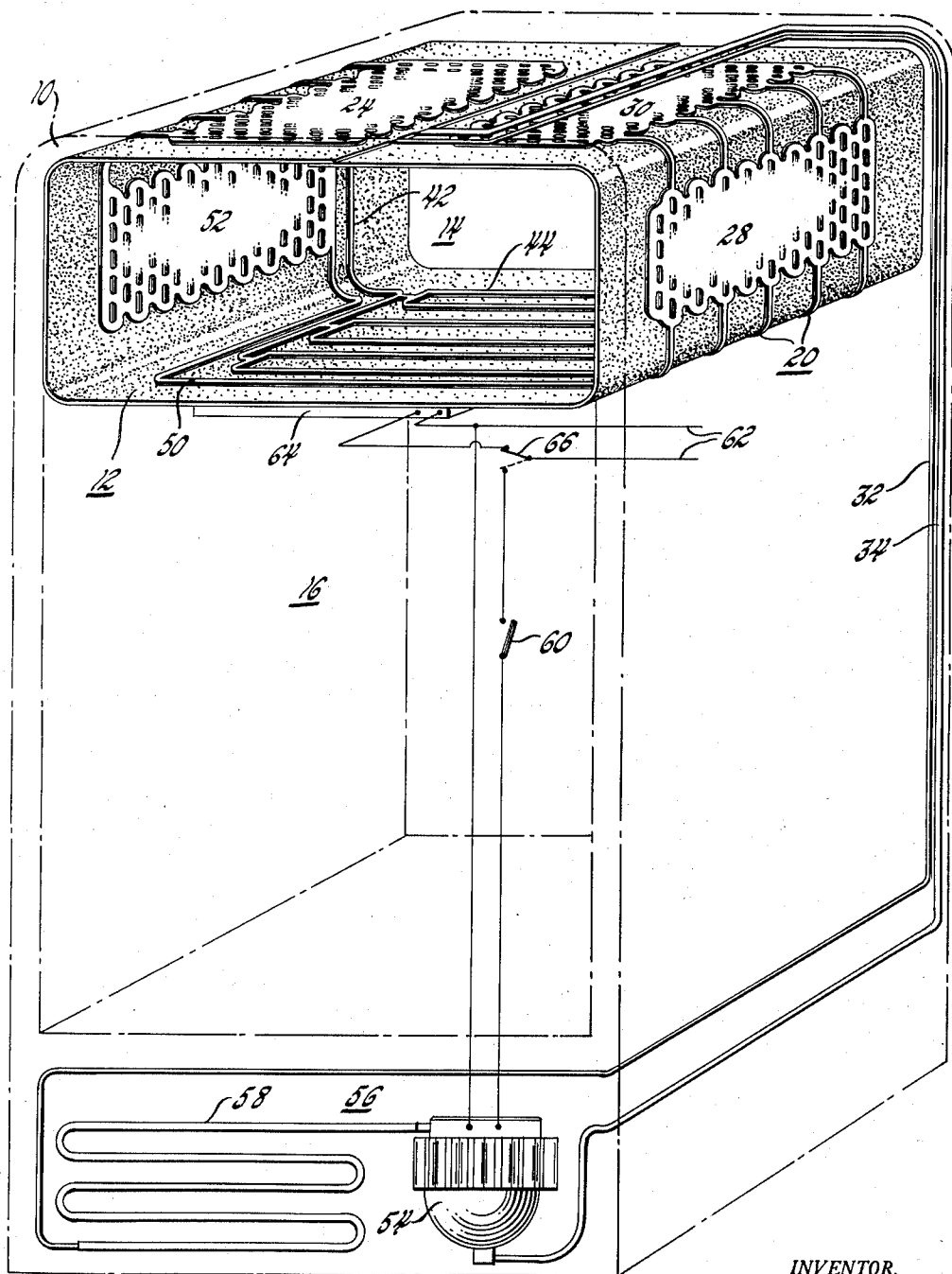


Fig. 1

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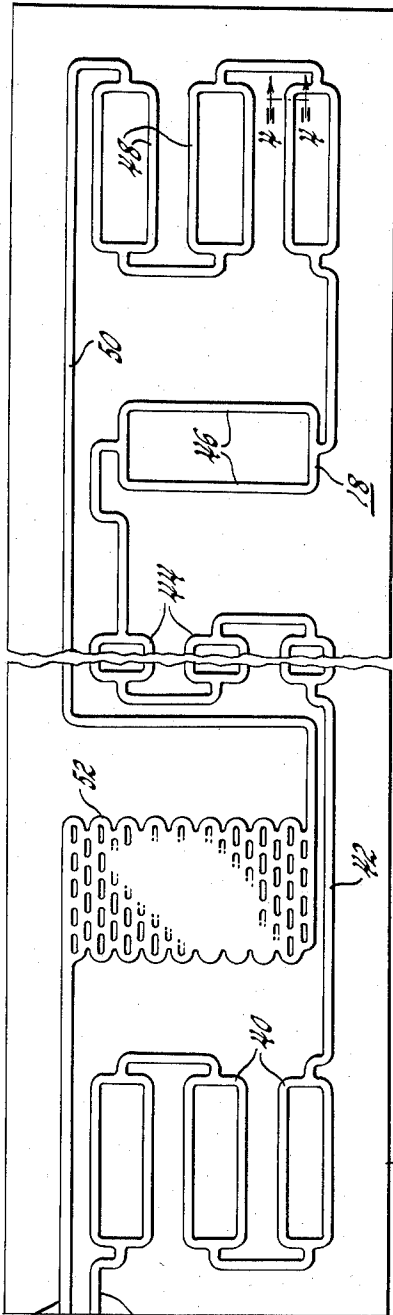


Fig. 2

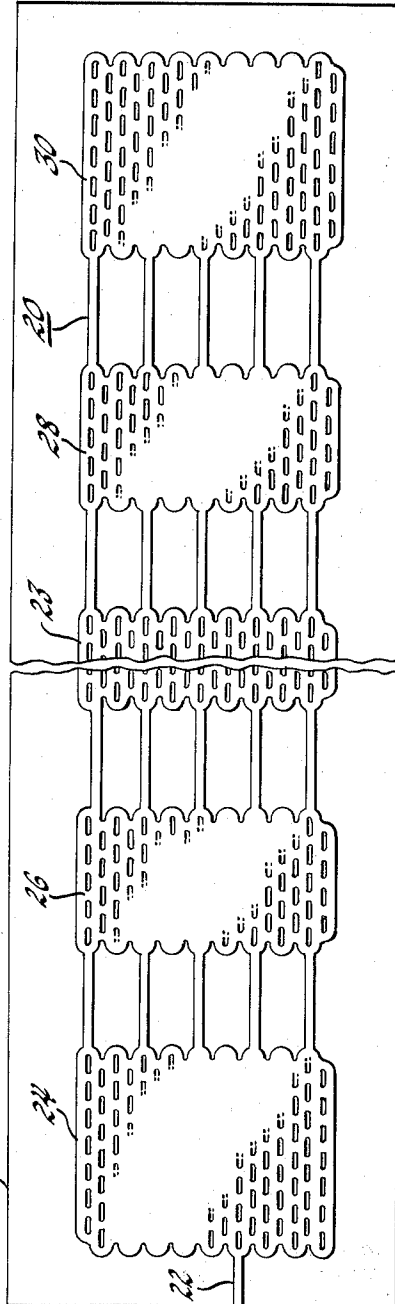


Fig. 3

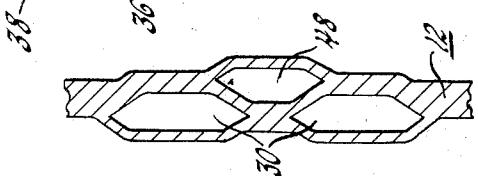


Fig. 4

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REFRIGERATING APPARATUS

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Application December 7, 1954, Serial No. 473,545

4 Claims. (Cl. 62—276)

This invention relates to refrigerating apparatus and more particularly to a household refrigerator having an improved arrangement for defrosting the evaporator.

It is an object of this invention to provide a simple and inexpensive plate type evaporator which includes an inbuilt sealed secondary refrigerant circuit for use in defrosting the evaporator.

More particularly, it is an object of this invention to utilize a roll forged evaporator having a first refrigerant passage for use in refrigerating the contents of the refrigerator and a second and independent refrigerant circuit superimposed on the first refrigerant circuit for use in defrosting the evaporator.

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:

Figure 1 is a perspective view, largely schematic, showing a preferred embodiment of the invention;

Figure 2 is a developed planned view showing the primary refrigerant circuit which is formed on the one surface of the evaporator plate;

Figure 3 is a view similar to Figure 2, but showing the refrigerant circuit on the other side of the evaporator; and

Figure 4 is a fragmentary sectional view taken substantially on line 4—4 of Figure 2.

Referring now to the drawing wherein a preferred embodiment of the invention has been shown, reference numeral 10 generally designates an insulated household refrigerator cabinet in which there is mounted an evaporator assembly 12 which forms the walls of a frozen food storage compartment 14 and which also serves to refrigerate an unfrozen food storage compartment 16. The usual doors (not shown) would be provided for closing the front openings of the compartments 14 and 16.

The evaporator 12 is a roll forged evaporator which is made by superimposing three plates upon one another and by providing a pattern of stop weld material between the top plate and the center plate so as to form a first primary refrigerant circuit 18 such as that shown in Figure 2 of the drawing, and by placing a second pattern of stop weld material between the center plate and the lower plate, so as to form an independent secondary refrigerant circuit 20 of the type shown in Figure 3 of the drawing. The three plates are spot welded or otherwise secured together at their outer edges prior to the roll forging operation so as to prevent shifting of the plates during the subsequent roll forging operation. The plates are then passed between rollers which serve to reduce the overall thickness of the plates and to roll forge the three plates into one composite plate. Fluid under pressure is then forced in between the plates so as to dilate the primary and secondary refrigerant passages throughout the areas covered by the stop weld material.

For a more complete description of the materials and method used in manufacturing plate evaporators by the

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roll forging process, reference is hereby made to copending application, Serial No. 289,729, filed May 24, 1952, in name of Edward C. Simmons, now Patent No. 2,740,188 patented April 3, 1956. While the above mentioned copending application discloses the use of only two sheets to form a single refrigerant passage, this invention contemplates using three sheets so as to form two separate refrigerant circuits generally designated by the reference numeral 18 and 20.

After the refrigerant passages shown in Figures 2 and 3 have been properly dilated, a charge of secondary refrigerant is introduced into the refrigerant circuit 20 and the inlet connection 22 is then sealed off so as to provide a closed secondary refrigerant system. In this secondary system, the one central portion 23 forms the evaporator and secondary refrigerant storage section and the portions 24, 26, 28, and 30 form condensing portions. After the secondary circuit, generally designated by the reference numeral 20, has been charged with a suitable secondary refrigerant and the inlet passage 22 has been sealed off, the flat plate is bent into the box-like shape shown in Figure 1 of the drawing with the secondary refrigerant circuit arranged adjacent the outside surface of the evaporator.

The primary refrigerant circuit 18 is then connected to the usual liquid and suction lines 32 and 34, respectively, of a primary refrigerating system. The incoming liquid refrigerant which enters the primary evaporator passage at 36, first flows through a series of passages 40 which are located in that portion of the plate evaporator which forms a part of the ceiling of the freezing compartment 14. The refrigerant then flows through the passage 42 which leads to a series of refrigerant passages 44 which are provided in that portion of the plate evaporator which forms the bottom wall of the freezer compartment 14 and which also forms the ceiling of the unfrozen food storage compartment 16. The refrigerant leaving the passage 44 flows into passages 46 provided in the inner side wall of the freezer compartment and then flows into the passages 48 located in that portion of the plate evaporator which forms a part of the ceiling of the freezer compartment. By the time the primary refrigerant leaves the passages 48, some or all of it will be in vapor form and will then flow through the line 50 which leads to an accumulator section 52 provided in the one end wall of the freezer compartment as shown in Figure 1.

The accumulator 52 serves as a disengaging chamber for the mixture of liquid refrigerant and vaporized refrigerant entering the lower portion of the chamber. The refrigerant vapor then flows through the outlet line 38 into the suction line 34 which leads to the inlet of a conventional sealed motor compressor unit 54 located in the machinery compartment 56 of the cabinet. The outlet of the motor compressor unit 54 is connected to a conventional condenser 58 wherein the compressed refrigerant is condensed before being fed into the liquid line 32, which is in the form of a capillary tube restrictor. For purposes of illustrating the invention, a capillary tube type of restrictor has been shown for controlling the flow of refrigerant from the condenser to the evaporator whereas any type of pressure regulating means, such as an automatic expansion valve or a thermostatic expansion valve could be used.

The motor compressor unit 54 is adapted to be cycled by means of a conventional thermostatic switch 60 which when closed supplies power to the motor compressor unit from the main power lines 62. During normal operation of the refrigerator, frost will accumulate on the surfaces of the evaporator 12 and in order to remove the frost from the evaporator there is provided an electric heater

64 arranged directly beneath the bottom wall of the evaporator 12 in direct thermal exchange relationship with that portion 23 of the secondary refrigerant circuit which is located adjacent the bottom surface of the evaporator 12. For purposes of illustration there is shown a manually operated switch 66 for use in connecting the heater 64 to the main power line 62 whereas the switch 66 could be automatically controlled in response to operation of a timer clock or any other automatic means which would serve to defrost the evaporator at the desired intervals. It will be noted that the switch 66 is arranged so as to de-energize the compressor whenever the heater 64 is energized. This prevents operation of the refrigerating system during the defrosting period.

The heat supplied to the secondary refrigerant in the lower-most portion of the secondary circuit will cause the secondary refrigerant to boil so that the relatively hot secondary refrigerant vapor thus formed will travel upwardly into the secondary refrigerant passages 24, 26, 28, and 30 so as to distribute the heat to all portions of the evaporator with the result that the frost accumulated thereon will be melted in a short period of time. The secondary refrigerant vapor which flows upwardly into the condensing sections of the secondary circuit will be condensed and eventually drain by gravity down into the lower-most portion of the secondary system where it will be reheated and re-vaporized in accordance with well-known practice.

By virtue of the above described arrangement, it is obvious that the evaporator 12 may be manufactured at a very low cost, even though it includes a built-in secondary circuit for use in defrosting the evaporator. Furthermore, the evaporator and electric heater occupy a minimum amount of space and the time required for completely defrosting the entire evaporator is reduced as a result of the efficient arrangement for distributing the heat throughout the entire evaporator.

In accordance with the provisions of Rule 78a, reference is made to the following prior filed application: Serial Number 306,699, filed July 8, 1953, now Patent No. 2,712,736, patented July 12, 1955 to Wurtz et al.

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, as may come within the scope of the claims which follow.

What is claimed is as follows:

1. In a refrigerating system, an evaporator, a compressor, a condenser, said evaporator comprising a roll forged multiple plate unit forming the bottom and at least one side wall of a refrigerated compartment and having primary refrigerant passages formed between a first pair of said plates and having a secondary refrigerant circuit formed between another pair of said plates, refrigerant flow connections between said compressor, condenser, and primary refrigerant passages, and electric heater means for applying heat to the bottom portion of said secondary refrigerant circuit, said primary refrigerant passages including passages arranged adjacent the inner walls of said compartment; said secondary circuit including passages distributed throughout the major portion of the outer walls of said compartment and means for energizing said electric heater for defrosting said evaporator.

2. In a refrigerating system, an evaporator, a compressor, a condenser, said evaporator comprising a roll

forged multiple plate unit forming the bottom and at least one side wall of a refrigerated compartment and having primary refrigerant passages formed between a first pair of said plates and having a secondary refrigerant circuit formed between another pair of said plates, refrigerant flow connections between said compressor, condenser, and primary refrigerant passages, and electric heater means for applying heat to the bottom portion of said secondary refrigerant circuit, said primary refrigerant passages including passages arranged adjacent the inner walls of said compartment, said secondary circuit including passages distributed throughout the major portion of the outer walls of said compartment and means for energizing said electric heater for defrosting said evaporator, said last named means including means for preventing operation of said compressor when said heater is energized.

3. In a refrigerating system, an evaporator, a compressor, a condenser, said evaporator comprising a roll forged triple plate unit having primary refrigerant passage means formed between a first pair of said plates and having a closed secondary refrigerant circuit formed between another pair of said plates, refrigerant flow connections between said compressor, condenser, and primary refrigerant passage means, means for enclosing said evaporator in an insulated food compartment, and means for applying heat to a portion of said secondary refrigerant circuit, said primary refrigerant passage means including passages arranged on the side of said evaporator which is disposed to freeze the contents of said compartment, said secondary circuit including passages distributed throughout the major portion of the opposite side of said evaporator, and means for controlling said heat applying means, said last named means including means for preventing operation of said compressor while said heat is applied.

4. In a refrigerating system, an evaporator, a compressor, a condenser, said evaporator comprising a roll forged multiple plate unit forming the bottom and at least one side wall of a refrigerated compartment and having first refrigerant passages formed between a first pair of said plates and having a second refrigerant passage formed between another pair of said plates, refrigerant flow connections between said compressor, condenser, and first refrigerant passages, and means for applying heat to a portion of said refrigerant passage, said first refrigerant passages including passages arranged adjacent the inner walls of said compartment; said second passage including passages distributed throughout the major portion of the outer walls of said compartment and means for activating said heat applying means for defrosting said evaporator.

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