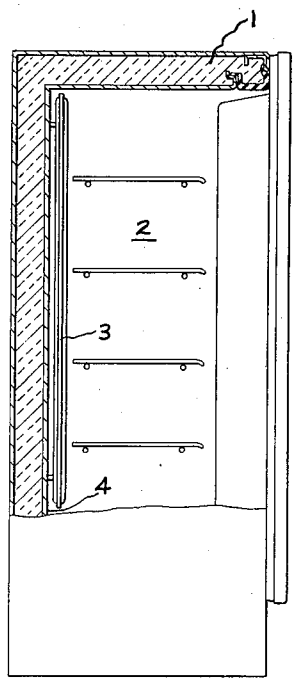
Aug. 25, 1959 D. A. SOLLEY, JR., ET AL 2,900,807

DEFROSTABLE EVAPORATOR STRUCTURE

Filed June 2, 1958

FIG. 1



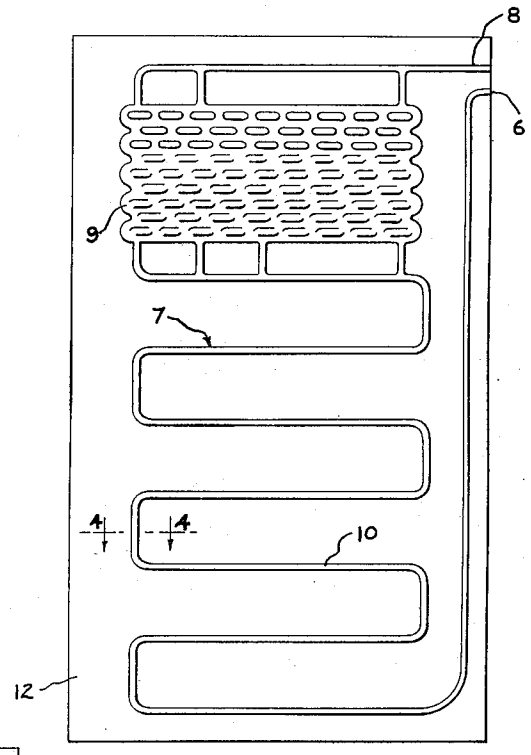


FIG. 2

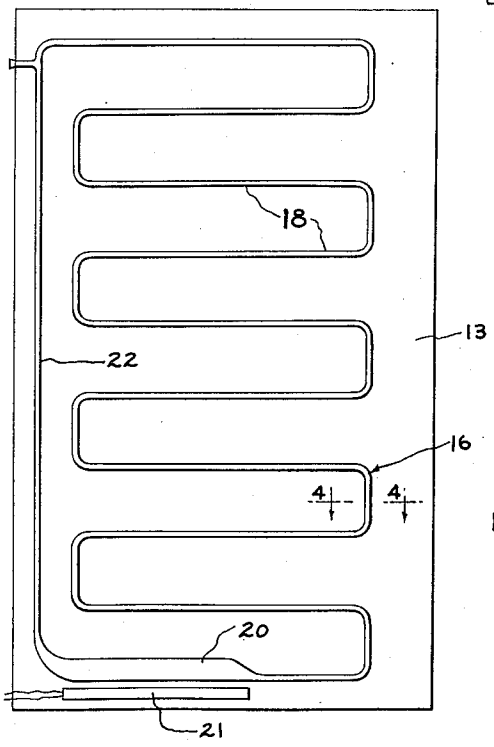


FIG. 3

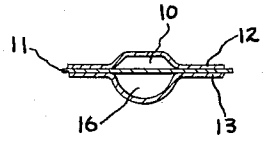


FIG. 4

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DEFROSTABLE EVAPORATOR STRUCTURE

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2 Claims. (Cl. 62—277)

The present invention relates to an evaporator structure and is more particularly concerned with an evaporator including both a refrigerant circuit and a defrost circuit.

For the purpose of defrosting refrigerant evaporators, there is sometimes provided, in addition to the normal refrigerant circuit, a defrost circuit, separate from the refrigerant circuit, through which warm refrigerant vapor or vapor of some other volatile liquid is circulated for the purpose of warming the evaporator structure to defrosting temperatures.

The application of this defrost scheme to an evaporator wherein the refrigerant passages are formed between two bonded sheets by expanding selected unbonded portions presents a number of problems. In the presently known evaporators of this type the refrigerant circuit generally comprises a serpentine portion covering part of the evaporator structure and an accumulator section or chamber of substantial area covering the remaining portion of the structure. For most effective defrosting, the defrost circuit must parallel or contact as closely as possible the refrigerant circuit so that it cannot conveniently be formed as part of a structure formed for example by the roll-bonded process if its path for proper operation requires any crossing of the refrigerant circuit. In addition, when the defrost circuit is in the form of a closed circuit charged with volatile liquid, which upon heating produces vapors for defrosting purposes, the closed or continuous passage for circulation of the defrosting vapors must be so constructed that the vapors formed in the vaporizing section will not interfere with the continuous circulation of vapor and liquid through the defrosting portion of the circuit.

It is the primary object of the present invention to provide a refrigerant evaporator structure including separate refrigerant and defrost circuits and so constructed that the defrost circuit may completely overlap or cross the refrigerant circuit.

Further objects and advantages of the present invention will become apparent as the following description proceeds and the features of novelty which characterize the invention will be pointed out with particularity in the claims annexed to and forming part of this specification.

In accordance with the present invention, there is provided an evaporator structure composed of three superimposed sheets of metal forge or roll bonded together at their interfaces except for those surfaces defining the refrigerant and defrost circuits. A refrigerant circuit is provided between the intermediate sheet and one of the outer sheets, this circuit including a serpentine passage and an accumulator portion composed of a plurality of closed spaced intersecting or interconnected passages each of which has about the same dimensions as the serpentine passage and which collectively form an accumulator chamber. The accumulator portion of the evaporator is generally the most difficult to defrost by means of any separate defrost circuit and in accordance with the present invention, the defrost circuit is provided

between the intermediate sheet and the other outer sheet so that the design or configuration of the refrigerant circuit will in no way interfere with the design of the defrost circuit. As a result, the defrost circuit can overlap or cross the refrigerant circuit and includes a plurality of passes of serpentine form on the opposite side of the intermediate sheet and in close heat exchange relationship with the parts of the accumulator portion.

For a better understanding of the invention reference may be had to the following description thereof when taken in connection with the accompanying drawing in which:

Fig. 1 is a side view partially in section of a refrigerator cabinet including an evaporator structure of the present invention;

Fig. 2 is an enlarged elevational view of one side of the evaporator structure;

Fig. 3 is a view similar to Fig. 2 of the other side of the evaporator structure; and

Fig. 4 is a sectional view generally along line 4—4 of both Figs. 2 and 3.

Referring now to Fig. 1 of the drawing there is shown a refrigerated cabinet 1 including a food storage compartment 2 in which there is disposed the evaporator structure 3 of the present invention, this evaporator structure being supported in a vertical position and preferably spaced slightly from the rear wall 4 of the food storage compartment 2.

With reference to Fig. 2, which shows the front side of the evaporator structure 3, the evaporator structure includes a refrigerant circuit comprising an accumulator 9 composed of a plurality of interconnected passages and a serpentine portion 10 and covering substantially all of the remaining front face portion of the evaporator structure. Although not shown, it will be understood that the refrigerator includes also a condensing unit comprising a compressor and a condenser, the condenser being connected to the inlet 6 of the refrigerant circuit 7 through a capillary tube while the compressor is connected to the outlet 8 from the accumulator 9 by means of a suction line.

As is shown in Fig. 4 the evaporator structure is composed of three sheets, an intermediate sheet 11 and outer sheets 12 and 13. The inner sheet 11 and the one outer sheet 12 cooperate to form the refrigerant passage including the serpentine 10 while the intermediate sheet 11 and the other outer sheet 13 cooperate to form a defrost circuit 16 which as shown in Fig. 3 is of generally serpentine configuration and covers substantially the entire area of the evaporator structure. As is well known, the refrigerant and defrost circuits defined by the superimposed or laminated sheets 11, 12 and 13 can be made by any suitable process for forming such evaporators. One such process involves superimposing the three metal sheets on one another with predetermined patterns of a stop-weld material printed on appropriate surfaces of the sheets, roll-bonding the sheets together and finally expanding the areas covered by the stop-weld material by means of fluid pressure to develop the desired patterns for the refrigerant and defrost circuits. For example, in making the evaporator structure of the present invention the center or intermediate sheet 11 may have the defrost circuit pattern printed on the side facing sheet 13 and the refrigerant circuit on the other side so that when this sheet is placed between the sheets 12 and 13 and the laminate roll-forged or bonded, the resultant three-ply product, after expanding, will have the refrigerant circuit 10 expanded into the sheet 12 and the defrost circuit 16 expanded into the sheet 13. Alternatively, the structure may be made by laminating three metal sheets by means of a low melting point alloy, heating the laminated structure above the melting point of the alloy and

expanding selected areas using suitable dies to form the expansion patterns.

Preferably, as will be seen from a comparison of Figs. 2 and 3, the defrost circuit is in serpentine form and is made to parallel as closely as possible the serpentine portion of the refrigerant circuit and to criss-cross the area opposite the accumulator **9** by use of a plurality of closely spaced passes **18** which are formed between the sheets **11** and **13** opposite the accumulator **9**. These passes **18** effectively warm the entire accumulator area including the central portion thereof which would not be possible in any structure in which both circuits are formed between the same two sheets.

In accordance with the illustrated embodiment of the present invention, the defrost circuit **16** is of the type sometimes referred to as a secondary defrost circuit. It comprises a closed loop containing at the lower portion thereof, a chamber **20** charged with a quantity of vaporizable liquid such as any of the well known refrigerants and means in the form of an electric heater **21** for heating the liquid to effect vaporization thereof so that the circulation of the vapors and their subsequent condensation in the remaining portion of the defrost circuit warms the entire evaporator structure to defrosting temperatures. Thus in addition to the chamber **20** and the serpentine portions of the circuit, the circuit also includes a vertical riser **22** extending along one edge of the evaporator structure for conducting vapors of the liquid contained in the chamber **20** upwardly to the top of the serpentine portion. As these vapors condense in the serpentine portion during defrosting operation the condensed liquid flows downwardly through the serpentine passes of the defrost circuit and back to the vaporizing section **20**.

From the above description, it will be seen that by means of the present invention there is provided an evaporator structure of the type in which the refrigerant circuit and the defrost circuit can be formed simultaneously and of any configuration with as much overlapping or crossing of the two circuits as may be required for proper hot-gas defrost operation of the structure.

While there has been shown and described a particular embodiment of the present invention it will be understood that the invention is not limited thereto and it is

intended by the appended claims to cover all modifications thereof within the true spirit and scope of the invention.

What we claim as new and desire to secure by Letters Patent of the United States is:

1. A defrostable refrigerant evaporator structure comprising an evaporator composed of three sheets of metal bonded together, a refrigerant circuit between the intermediate sheet and one of the outer sheets including a serpentine passage and an accumulator portion composed of a plurality of closely spaced intersecting passages each having approximately the same dimensions as said serpentine passage, and a defrost circuit between said intermediate sheet and the other outer sheet, said defrost circuit being in the form of a closed loop and including a section of general serpentine configuration paralleling said refrigerant serpentine passage and another section including a plurality of passes disposed on the opposite side of said intermediate sheet from said accumulator portion.

2. A defrostable refrigerant evaporator structure comprising an evaporator composed of three sheets of metal bonded together, a refrigerant circuit between the intermediate sheet and one of the outer sheets including a serpentine passage and an accumulator portion composed of a plurality of closely spaced intersecting passages each having approximately the same dimensions as said serpentine passage and covering a substantial area to form an accumulator chamber in said refrigerant circuit, and a defrost circuit between said intermediate sheet and the other outer sheet, said defrost circuit being of general serpentine configuration and including one section generally paralleling said refrigerant serpentine passage and another section including a plurality of passes on the opposite side of said intermediate sheet from said accumulator portion.

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