

Oct. 6, 1953

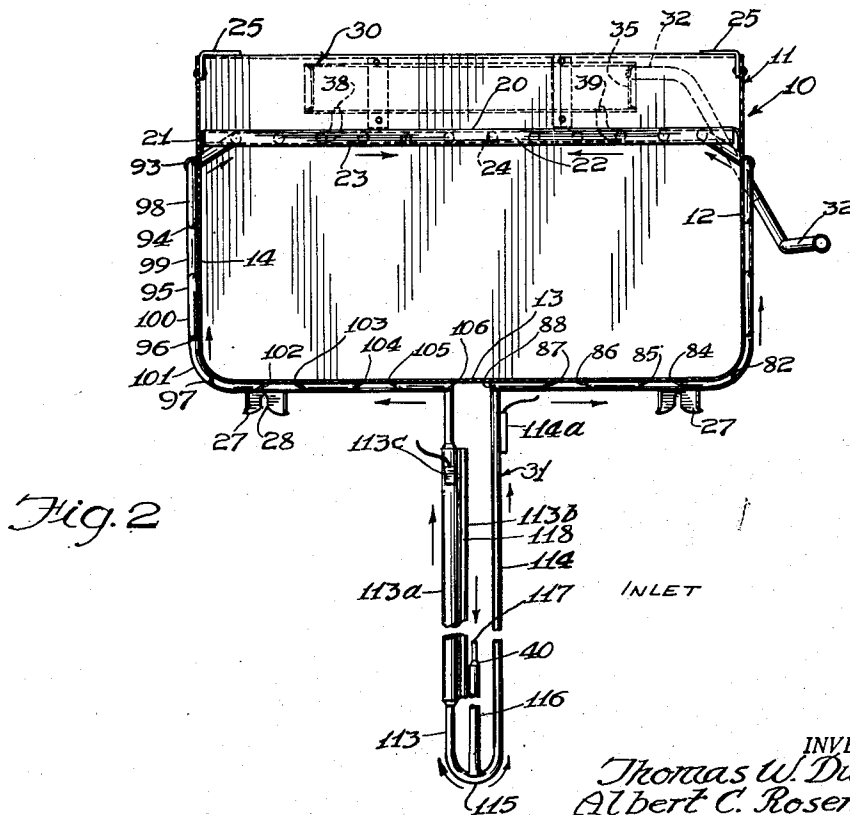
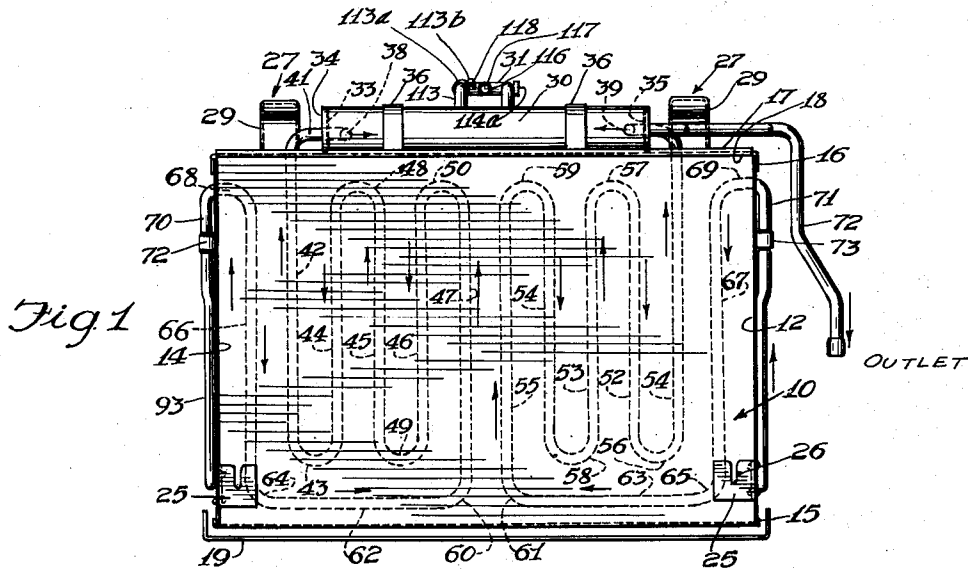
T. W. DUNCAN ET AL

2,654,226

AUTOMATIC DEFROSTING EVAPORATOR

Filed Aug. 18, 1951

4 Sheets-Sheet 1



INVENTORS;
Thomas W. Duncan
Albert C. Rosencranz
By Robert H. Wendt
Attorney

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4 Sheets-Sheet 2

Fig. 3

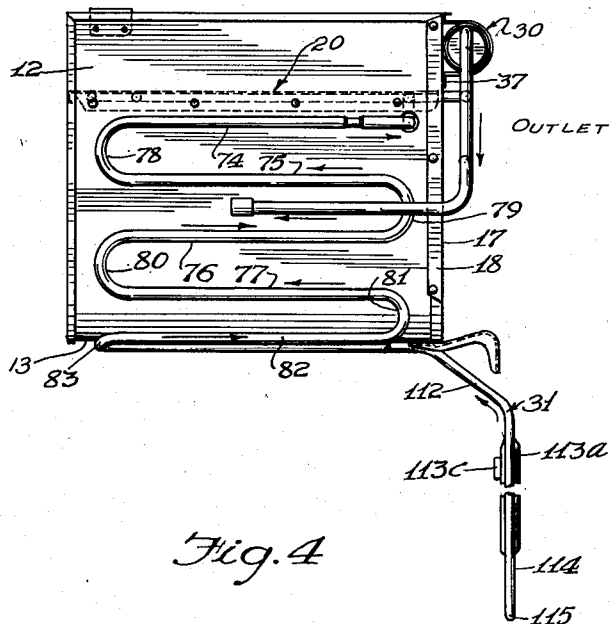
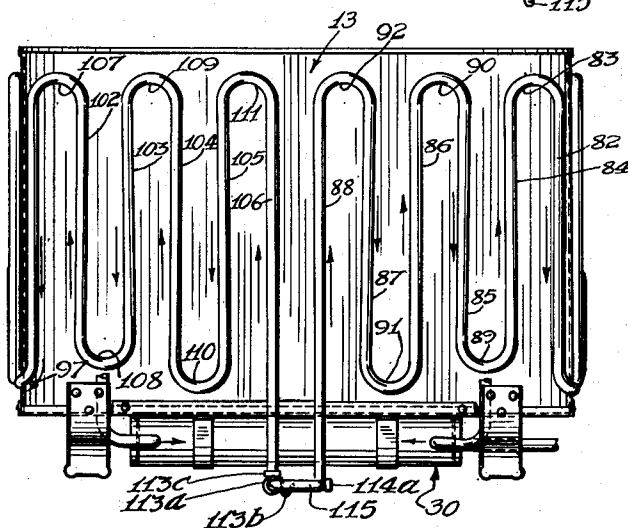


Fig. 4



INVENTORS;
Thomas W. Duncan
Albert C. Rosencranz
By Robert H. Wendt
Attorney

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Fig. 5

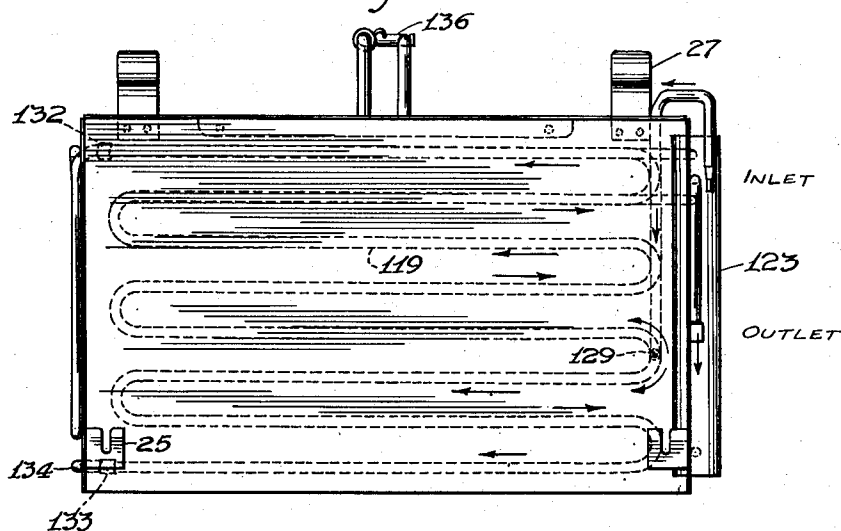
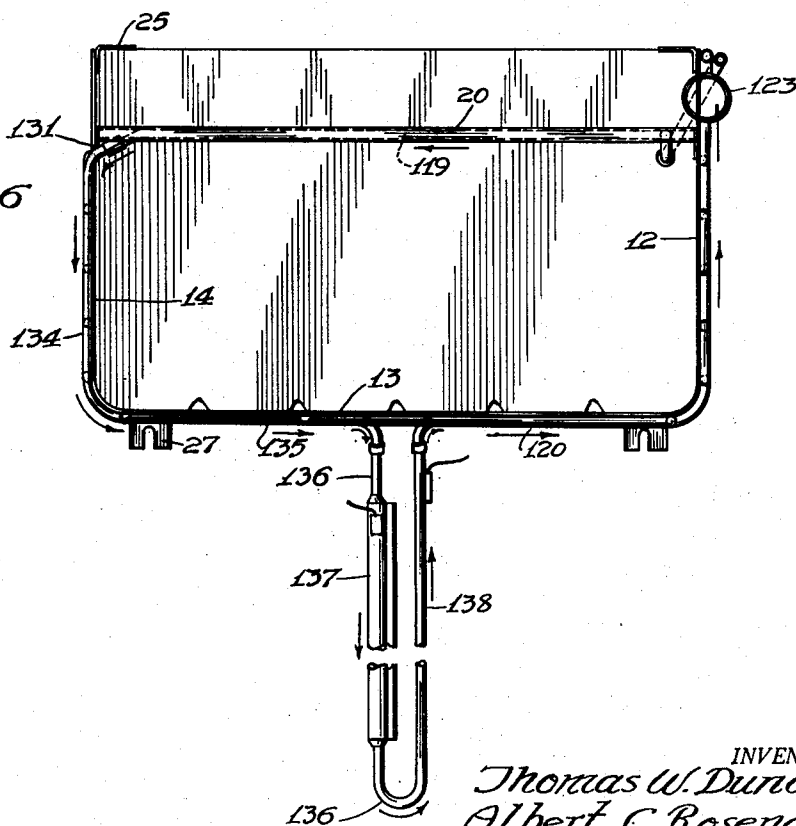


Fig. 6



INVENTORS;
Thomas W. Duncan
Albert C. Rosencranz
By Robert H. Wendt
Attorney

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4 Sheets-Sheet 4

Fig. 7

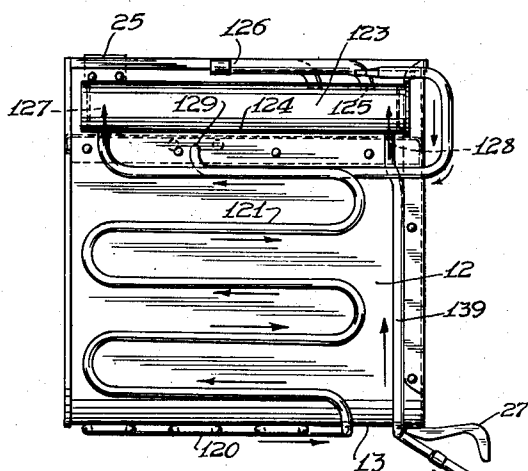
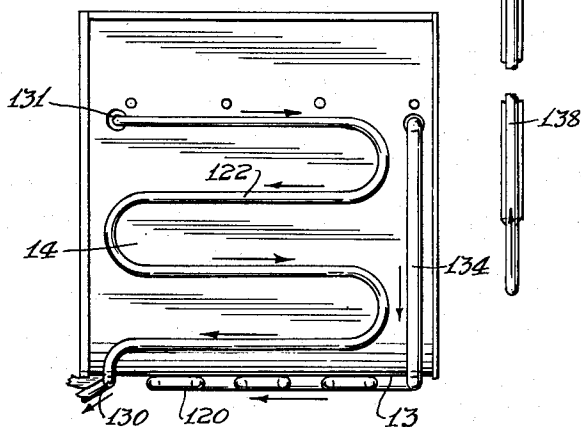


Fig. 8



INVENTORS;
Thomas W. Duncan
Albert C. Rosencranz
By *Robert H. Wendt*
Attorney

UNITED STATES PATENT OFFICE

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AUTOMATIC DEFROSTING EVAPORATOR

Thomas W. Duncan and Albert C. Rosencranz,
Evansville, Ind., assignors to Seeger Refrigerator Company, St. Paul, Minn., a corporation of Minnesota

Application August 18, 1951, Serial No. 242,462

7 Claims. (Cl. 62—2)

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The present invention relates to automatic defrosting evaporators, and is particularly concerned with evaporators of the type adapted to be used in household refrigerators.

The present invention relates also to an improved evaporator to be used in an automatic defrosting system of the type disclosed in the prior application of Thomas W. Duncan, Serial No. 144,641, filed February 17, 1950, for Automatic Defrosting Mechanism, which application is hereby incorporated herein by reference thereto.

One of the objects of the present invention is the provision of an improved evaporator in which the refrigerant can be caused to circulate during the defrost part of the cycle by the action of heat applied at a particular area of the evaporator, which heats the refrigerant that is circulated throughout the evaporator.

Another object of the invention is the provision of an improved evaporator fluid circuit, including a header for the suction tube in which the evaporator conduits are designed in the form of a complete loop connected at both ends to the header, and provided with portions of substantially equal resistance to flow so that by the application of a heater to an intermediate part the heated refrigerant can be caused to circulate throughout substantially the entire length of the evaporator conduits to heat the evaporator uniformly and melt the frost off all its areas within a short time.

Another object of the invention is the provision of an improved evaporator heating arrangement which heats the evaporator by heating the refrigerant, and which is adapted to effect a defrosting of the evaporator so quickly that the food which is stored in the evaporator or in the food storage space will remain substantially in its previously frozen state without being damaged by the introduction of heat into the evaporator.

Another object of the invention is the provision of an improved defrosting evaporator in which substantially equal static fluid pressure is maintained in both of the circuits of conduits, which are parallel to each other relative to the evaporator inlet and outlet, but which are also in series with each other from one header connection to the other header connection of the conduits.

Another object of the invention is the provision of an improved defrosting evaporator which provides a quick freeze shelf for freezing ice cubes and a relatively large frozen food

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storage space equally adaptable to the storage of frozen food, or the initial freezing of the food, which is simple in construction, capable of economical manufacture and adapted to perform its functions for a long period of time without necessity for repair.

Other objects and advantages of the invention will be apparent from the following description and the accompanying drawings, in which similar characters of reference indicate similar parts throughout the several views.

Referring to the drawings, of which there are four sheets, accompanying the specification,

Fig. 1 is a top plan view of an evaporator embodying the invention;

Fig. 2 is a front elevational view;

Fig. 3 is a side elevational view taken from the right side of Fig. 2;

Fig. 4 is a bottom plan view;

Fig. 5 is a top plan view of a modification;

Fig. 6 is a front elevational view of the modification of Fig. 5;

Fig. 7 is a side elevational view taken from the right side of Fig. 6;

Fig. 8 is a side elevational view taken from the left side of Fig. 6.

The present evaporators may be embodied in the type of construction in which conduits are formed by grooves in one or both of two adjacent sheets, or they may be embodied in evaporators of the type in which a freezing chamber and shelf are formed by sheet metal, and the conduits for refrigerant comprise metal tubing secured to one or the other sides of the sheet metal.

For example, the evaporator shown in Figures 1 and 2 is indicated in its entirety by the numeral 10, and it comprises a box-like sheet metal housing 11, which has its side 12, its bottom 13, and opposite side 14 formed of a single sheet of suitable metal, such as aluminum.

This aluminum sheet is folded backwardly upon itself along the front edge to form a hairpin bend 15, which is rounded instead of sharp, and the same is true at a similar bend 16 at the rear edges of the evaporator.

The rear of the evaporator may be closed by means of a plane metal sheet 17, having a right angle attaching flange 18 along its two side edges and along its bottom edge for overlapping the sides 12 and 14 and the bottom 13, to which the rear wall may be secured by rivets or other suitable fastening means.

The front of the evaporator is preferably provided with a suitable door, such as the door

19, which may be pivoted at the bottom, top or either side of the evaporator, and which preferably effects a substantial closure of the front end.

The shelf 20 preferably comprises a plane sheet of aluminum having a downwardly turned flange 21 at each of its side edges engaging the walls 12 and 14, to which these flanges are secured respectively by rivets or other suitable fastening means.

The front and rear edges of the rectangular shelf 20 are also preferably provided with the depending border flange 22, which may also have a backwardly turned flange 23 underneath the tubing 24, carried by the shelf.

The width of the evaporator may be made as desired, depending upon the amount of food storage space desired below the shelf or the amount of shelf area desired. The evaporator illustrated is of such a width that it substantially fills the compartment of the refrigerator cabinet and occupies all of the inside liner space at the upper end of the cabinet, leaving only sufficient space between the liner and evaporator for air circulation.

The evaporator casing 11 is preferably provided with a plurality of brackets which are used for its support on the rear wall and the ceiling of the liner. For example, the two right angle brackets 25, which are secured to the top of the side walls 12 and 14 near the front of the evaporator, are provided with rearwardly open slots 26 for receiving headed securing members carried by the top of the liner.

The two right angle brackets 27, which are carried by the bottom wall 13 at its rear edge, are provided with downwardly open slots 28 for engagement with headed members carried by the rear liner wall.

As shown in Fig. 1, the horizontal flanges 29 of the brackets 27 are extended sufficiently so that they extend past the header 30; but they are forwardly of the loop 31 so that the loop 31 may be located in a recess in the rear wall of the liner, if desired, while the header 30 may be in front of the rear liner wall.

The rear liner wall may be provided with an elongated vertical depression formed therein for receiving the depending legs 113, 114, which are then disposed in front of the liner, outside the insulation, and covered with a suitable cover plate.

The header 30 may consist of a metal tube, such as aluminum, of uniform diameter and of a size sufficient to permit space for the bubbling and boiling refrigerant to discharge its bubbles, so that the suction tube 32 may carry off what is mainly vaporized refrigerant.

Each end of the header 30 is closed by a circular end wall member 33, having an outwardly directed cylindrical flange 34, which has a tight frictional fit in the end of the header tube 30, and which may be welded or otherwise suitably secured.

The suction tube 32 which leads to the inlet of the compressor may extend into the right end wall 35, preferably near its upper edge, as shown in Figure 2, to be located above any liquid level in the header.

The header is secured to the back wall 17 by a pair of half cylindrical sheet metal straps 36, having a pair of attaching flanges 37, which may be riveted or otherwise secured to the back wall 17 near its upper edge. Thus the header is at an elevation which is above all of the refrigerant

conduits except the suction tube 32, which itself is connected to a point adjacent the top of the header.

The header is preferably connected to the refrigerant conduits at a pair of symmetrical points, such as the header inlets 38 and 39, which are equally spaced from the ends of the header and located in the bottom of the header.

The refrigerant conduits of the evaporator are preferably in the form of aluminum tubing secured to the sides of the aluminum shell or casing 11, and to the shelf 20, by welding or by means of a suitable heat conducting compound which adheres to both the tubing and the casing and increases the amount of heat conduction between the casing and tubing by intimate contact of the tubing and casing, and by passing through the compound which may have aluminum filings incorporated in it. The tubing is preferably so arranged that there is no possibility of a gas pocket forming which might prevent circulation of the refrigerant from the inlet 40 to the header 30.

Referring to Figure 1, the refrigerant tubing leads from the header inlet 38, with a laterally extending portion 41, and then extends forwardly at 42 underneath the shelf. Thereafter it has a U-bend at 43, and is provided with a succession of parallel portions 44-47, connected by U-bends 48-50, until half the shelf has been traversed.

In a similar way the other right half of the shelf in Figure 1 carries the sinuous tubing leading from the header inlet 39, and having the parallel portions 51-55 joined by the easy bends 56-59.

The shelf tubing is preferably applied to the lower side of the shelf and is concealed by the depending flange 22, leaving the top of the shelf smooth and plane for better heat conducting contact with the bottoms of the ice trays or other subjects to be frozen which may be placed on the shelf.

The forwardly extending parallel portions 47 and 55 are preferably bent laterally at 60 and 61, and have the laterally extending portions 62, 63 along the forward edge of the shelf.

Adjacent the side walls 12 and 14 these laterally extending portions 62 and 63 have a right angle bend 64 and 65, respectively, and backwardly extending parallel portions 66 and 67, terminating in U-bends at 68 and 69 near the rear wall and having projecting parallel portions 70 and 71 to be joined to the tubing which is carried by the side walls.

The side walls 12 and 14 are provided with suitable apertures for passing the tubing adjacent the U-bends 68 and 69. All of the parallel portions of the tubing carried by the shelf are preferably equally spaced so that the cooling effect may be as uniform as possible throughout the shelf area.

The side walls 12 and 14, and the bottom 13 are provided below the shelf with the sinuous coils extending in each case from the joints 72 and 73, backwardly and forwardly, with parallel portions and U-bends. Thus the right wall in Figure 1, as seen in Figure 3, has the parallel portions 74-77 and the U-bends 78-81, while the parallel portion 82 of the tubing is substantially at the corner.

The U-bends 81 and 83 extend about the corner and thereafter the bottom is provided with the parallel portions 84-88 and joined by the U-bends 89-92.

In a similar way the left side 14 of the casing, Figure 2, is provided with the parallel portions of the tubing indicated at 93-97, the last one being

substantially at the corner and with the U-bends 98-101.

The adjacent left side of the bottom 13 in Fig. 2 is provided with the parallel tubing portions 102-106 joined by the U bends 108-111. Like the shelf tubing arrangement, the parallel portions of the tubing on the casing walls 12, 13, and 14 are preferably equally spaced for uniform cooling effect. The last mentioned parallel tubing portions 88 and 106 on the bottom of the evaporator preferably extend to the rear edge; and they have diagonally extending portions 112 leading to a pair of depending tubular legs 113, 114, which are joined at the bottom of a U bend 115.

The depending loop 113-115 may be arranged inside the liner. The lower U bend 115 is preferably provided with a copper inlet tube 116 extending upwardly from the U bend and having a smaller end portion 117 of a size suitable to be joined to a capillary tube. Therefore 117 indicates the capillary inlet to the evaporator. Either leg 113 or 114 of the depending loop may be provided with one or more electric heating elements 118; and these are preferably clamped to the tube with aluminum jackets to facilitate heat exchange from the electric heating elements to the depending U-shaped tube, and thence to the refrigerant contained in the tube.

The heaters are preferably of the type in which the resistance wire is enclosed in a powdered insulating refractory, which in turn is enclosed in a metal tubular jacket so that the resistance wire cannot be short circuited by contact of its jacket with water or other materials.

The leg 113, which has the heater attached, is preferably provided with an enlargement comprising a tubular portion 113a of larger diameter, thereby increasing the volume of the refrigerant in that leg, which is subjected to heat. The leg 113 also carries an elongated clamp 113b welded thereto or extruded therewith, and shaped to engage and hold the heater 118. The leg 113 preferably carries a bulb 113c of a thermostat arranged to actuate a switch in the heater circuit to cut off the heat in case of overheating at that point by failure of the control mechanism to cut off the heater.

Leg 114 preferably carries a bulb 114a adjacent its upper end and actuating a switch for terminating the defrosting action by increase of temperature at that point. When the heated refrigerant has traversed the entire circuit of the evaporator it will reach and heat the bulb 114a, at which time the heating element should be cut out of circuit and the control of the evaporator restored to the usual thermostatic switch which controls the operation of the motor compressor.

The operation of this evaporator during cooling operations is as follows: The compressed and liquefied refrigerant comes in at the capillary inlet 117, being metered from the condenser by a suitable length of capillary tubing, and the liquid refrigerant under pressure from the compressor passes into the depending U-shaped loop 113-115, where its evaporation starts and the bubbles pass upward into the coils on the bottom of the evaporator and thence to the coils on the sides of the evaporator.

The refrigerant passes up the sides of the evaporator through the sinuous tubing to the central portion of the shelf, through the tube portions 62, 63, and thereafter it passes through the sinuous tubing carried by the shelf laterally toward both edges of the shelf, finally reaching the header 30 at the header inlets 38 and 39.

The compressor being connected to the suction outlet 32, of the header, maintains a suitable low pressure in the header during operating periods of the compressor and pumps off the evaporated refrigerant to be again compressed by the compressor and liquefied by removal of its heat in the condenser in the usual manner.

The course of the refrigerant through the tubing of the evaporator of Figs. 1 to 4 is through two parallel paths leading from the capillary tube 117 upward through both legs of the depending U-shaped loop 113-115 to the receiver 30, which has its suction outlet at 72, and these parallel paths are shown by the arrows applied to Figs. 1 to 4.

The operation of the evaporator during the defrosting part of the cycle is as follows: When the defrosting mechanism reaches the defrosting part of the cycle the compressor circuit is turned off by a switch in said mechanism, and the electric heater circuit of the heaters 118 is turned on and energized by the defrosting switch mechanism.

Since the heaters are applied only to one leg 113 of the depending loop, the refrigerant in that leg is heated, causing boiling and bubbling and vaporization, which produces an unbalance between the liquids, gases, and vapors contained in the two legs 113, 114.

Refrigerant tends to pass up the leg 113 and down the leg 114; and this refrigerant becomes heated and passes through all of the sinuous coils to the header, warming the left side of the evaporator of Fig. 2 first; and thereafter the heated refrigerant passes out of the header inlet 39 into the sinuous coils of the right hand of the shelf and the right-hand wall 12, and right portion of the bottom of the evaporator, until the entire system of sinuous tubing is filled with hot refrigerant. The refrigerant is constantly recirculated throughout the evaporator as long as the heater is energized.

The hot refrigerant heats the evaporator walls and melts the frost during a defrosting period, which may consume a certain number of minutes, and the time of which depends upon the size of the heater, size of the evaporator, and the amount of frost accumulated.

As soon as the frost has been melted off, the defrosting mechanism terminates the defrosting period by cutting off the electric heater circuit and turning on the compressor energization circuit. In a few more minutes the evaporator is again cooled to a freezing condition without any substantial amount of heat having been transmitted to the frozen food stored in the evaporator.

Referring to Figs. 5 to 8, these are similar views of a modification in which the evaporator is of similar shape, but of slightly different construction. In this embodiment of the invention the sheet metal casing of the evaporator is similar in shape and provided with the same side walls, 12, 14, and bottom 13.

This evaporator has similar top mounting brackets 25 and rear mounting brackets 27. The shelf 20 is similar in construction but has its sinuous tubing indicated by 119, passing backwardly and forwardly from side to side, with parallel portions joined by U-bends.

The sinuous coils 120 on the bottom 13 of this evaporator extend backwardly and forwardly with parallel portions that extend from side to side of the evaporator, as seen in Figures 7 and 8, and these are joined by U-bends.

The sinuous coils on the sides 12 and 14 of the evaporator are shown in Figures 7 and 8, and indicated by the numerals 121 and 122, and these extend backward and forward with parallel portions extending from the front to back of the evaporator.

The header 123 is preferably arranged adjacent the top of the right wall 12, which has a slot or rectangular aperture for receiving a part of the header which is welded, brazed or otherwise suitably secured in this rectangular aperture 124.

The header outlet is indicated at 125, leading to a suction tube 126, top, Figure 7, while the two header inlets are indicated at 127, 128.

The capillary tube inlet to the evaporator coils is preferably chosen at such a point 129, Figure 5, at one of the bends of the shelf tubing 119, so located that paths of substantially equal resistance to liquid flow are provided from the capillary inlet 129 to both of the header inlets 127, 128.

Header inlet 127 is preferably connected to the uppermost end of the sinuous coils 121 on the wall 12. The lowermost of these coils extends to and is connected to and forms an integral part of the bottom coils 120, which extend backward and forward laterally with respect to the evaporator.

The bottom coils 120 are continued up the left side 14 as tube 134. The side coils 122 pass through an aperture 131 in the side wall 14, below the shelf 20 in Fig. 8, and extend to the coils 119, which are located beneath the shelf 20.

The joint between the shelf coils and the side wall coils 122 is indicated at 132. The other end of the shelf coils 119 is connected at 133 (Fig. 5) to a depending tubular portion 134, which extends under the bottom wall 13 as a horizontal portion 135. The other end of the bottom coils 120 is connected to the side coils 121 (Fig. 7).

The depending U-shaped tube 136 has its legs 137, 138 connected at a suitable point in the circuit of the bottom tubes 120. One of the legs 138 is connected to the tube 139, leading to header inlet 128. The other leg 137 is connected to the tube which extends across the bottom of the evaporator parallel to tubes 120 and at the point 130 becomes coil 122.

One of the legs, such as leg 137 of the depending loop 136, is provided with one or more electric heating elements clamped to the tube with aluminum jackets to facilitate heat exchange. Thus the heaters are again located to heat only one leg of the depending loop, causing an upward circulation in that leg, which eventually carries hot refrigerant to every part of the evaporator tubing.

This modified evaporator is also preferably provided with an enlargement, a clamp carried thereby, and a heater, and with the two controlling thermostatic bulbs previously described with respect to legs 113, 114.

The defrosting evaporator of this modification operates in substantially the same manner as that previously described. In this case, however, the refrigerant is carried first to the shelf where the capillary inlet is located at 129, and there the refrigerant goes in both directions through two paths of substantially equal resistance to the header 123, passing from the shelf to the sinuous coils on the sides and bottom of the evaporator before reaching the header.

The course of the refrigerant through the tubing of the evaporator of Figs. 5 to 8 is shown as

extending in two parallel paths beginning at the capillary tube inlet which communicates with the shelf tubing at the point 129, Fig. 5, where it separates into two parallel paths which are indicated by arrows. One of these paths includes the sinuous tubing 119, which is above the point 129 in Fig. 5, and which extends backwardly on the shelf 20 to the point 132.

From this point the course of refrigerant extends down the sinuous tubing 131, 122 on the side 14 of the evaporator to the point 130, where the tubing makes a straight pass 135 over to the leg 136 of the U-shape formation down which it passes. The course of the refrigerant is then upward through the leg 138, which extends laterally on the bottom of the evaporator to the tube 139, which extends upwardly on the side 12 to the receiver 123.

The other parallel path in the course of the refrigerant extends from the point 129, Fig. 5, sinuously across the front part of the shelf 20 and downwardly on the side 14, Fig. 8, through the tubing 134. Thereafter the tubing of this path extends sinuously from left to right across the bottom and backwardly on the bottom until it communicates, in Fig. 7, with the sinuous tubing 121, on the side 12 through which the refrigerant passes upward to the discharge end 127 into the receiver 123. The suction tube is again indicated at 126, extending from the upper part of the header.

It will thus be observed that we have invented improved evaporator structures and a circulating system for refrigerant which permits the application of electric heaters to such a point that a positive circulation is induced in the conduits of the evaporator.

The electric heater being placed low and below every part of the evaporator, except the connecting bend of the depending loop, refrigerant which is heated tends to bubble upward from the electric heater. This causes a corresponding downward current in the other leg of the depending loop, feeding new refrigerant to be heated.

The present evaporator and its heating arrangements permit the defrosting of a large evaporator with a light amount of frost in a matter of a few minutes. The amount of time required depends upon the amount of frost deposit, size of the evaporator, size of tubes and size of heaters, but a positive circulation of heated refrigerant is assured with these arrangements. The enlargement 113a and the clamp carried thereby may be part of an integral extruded metal member, the ends of the tube being spun after the adjacent clamp portions have been cut off.

While we have illustrated a preferred embodiment of our invention, many modifications may be made without departing from the spirit of the invention, and we do not wish to be limited to the precise details of construction set forth, but desire to avail ourselves of all changes within the scope of the appended claims.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent of the United States, is:

1. A defrosting evaporator comprising a metal housing having a pair of side walls joined by a bottom wall and provided with a shelf extending from side wall to side wall, a rear wall closing the rear space between said side walls, a suction header carried by an upper part of one wall and having a suction tube extending into the header with the tube inlet adjacent the top of said header,

sinuous tubing carried by the bottom of said shelf and extending sinuously down both side walls and across the bottom of said bottom wall, an inlet tube communicating with the sinuous tubing at a point remote from said header to cause the refrigerant to be supplied through two paths in parallel leading to said header, and outlets from said sinuous tubing communicating with both ends of the lower part of said header, said tubing also including a depending U-shaped portion having a pair of legs extending downward from said bottom wall, and an elongated metal enclosed electric heater engaging one of said legs and causing the heating and upward boiling of refrigerant in said latter leg, to circulate heated refrigerant through said tubing and header to defrost said evaporator.

2. A defrosting evaporator comprising a metal housing having a pair of side walls joined by a bottom wall and provided with a shelf extending from side wall to side wall, a rear wall closing the rear space between said side walls, a suction header carried by an upper part of one wall and having a suction tube extending into the header with the tube inlet adjacent the top of said header, sinuous tubing carried by the bottom of said shelf and extending sinuously down both side walls and across the bottom of said bottom wall, an inlet tube communicating with the sinuous tubing at a point remote from said header to cause the refrigerant to be supplied through two paths in parallel leading to said header, and outlets from said sinuous tubing communicating with both ends of the lower part of said header, said tubing also including a depending U-shaped portion having a pair of legs extending downward from said bottom wall, and an elongated metal enclosed electric heater engaging one of said legs and causing the heating and upward boiling of refrigerant in said latter leg, to circulate heated refrigerant through said tubing and header to defrost said evaporator, said U-shaped portion being symmetrically located with respect to the housing side walls and at the rear of the bottom wall.

3. A defrosting evaporator comprising a metal housing having a pair of side walls joined by a bottom wall and provided with a shelf extending from side wall to side wall, a rear wall closing the rear space between said side walls, a suction header carried by an upper part of one wall and having a suction tube extending into the header with the tube inlet adjacent the top of said header, sinuous tubing carried by the bottom of said shelf and extending sinuously down both side walls and across the bottom of said bottom wall, an inlet tube communicating with the sinuous tubing at a point remote from said header to cause the refrigerant to be supplied through two paths in parallel leading to said header, and outlets from said sinuous tubing communicating with both ends of the lower part of said header, said tubing also including a depending U-shaped portion having a pair of legs extending downward from said bottom wall, and an elongated metal enclosed electric heater engaging one of said legs and causing the heating and upward boiling of refrigerant in said latter leg, to circulate heated refrigerant through said tubing and header to defrost said evaporator, and a thermally responsive member having its bulb located to be heated by the upper part of said latter leg, to control said electric heater and prevent overheating of the evaporator.

4. A defrosting evaporator comprising a metal

housing having a pair of side walls joined by a bottom wall and provided with a shelf extending from side wall to side wall, a rear wall closing the rear space between said side walls, a suction header carried by an upper part of one wall and having a suction tube extending into the header with the tube inlet adjacent the top of said header, sinuous tubing carried by the bottom of said shelf and extending sinuously down both side walls and across the bottom of said bottom wall, an inlet tube communicating with the sinuous tubing at a point remote from said header to cause the refrigerant to be supplied through two paths in parallel leading to said headers and outlets from said sinuous tubing communicating with both ends of the lower part of said header, said tubing also including a depending U-shaped portion having a pair of legs extending downward from said bottom wall, and an elongated metal enclosed electric heater engaging one of said legs and causing the heating and upward boiling of refrigerant in said latter leg, to circulate heated refrigerant through said tubing and header to defrost said evaporator, said heater having a pair of elongated partially cylindrical clamping flanges engaging said latter leg.

5. A defrosting evaporator comprising a metal housing having a pair of side walls joined by a bottom wall and provided with a shelf extending from side wall to side wall, a rear wall closing the rear space between said side walls, a suction header carried by an upper part of one wall and having a suction tube extending into the header with the tube inlet adjacent the top of said header, sinuous tubing carried by the bottom of said shelf and extending sinuously down both side walls and across the bottom of said bottom wall, an inlet tube communicating with the sinuous tubing at a point remote from said header to cause the refrigerant to be supplied through two paths in parallel leading to said header, and outlets from said sinuous tubing communicating with both ends of the lower part of said header, said tubing also including a depending U-shaped portion having a pair of legs extending downward from said bottom wall, and an elongated metal enclosed electric heater engaging one of said legs and causing the heating and upward boiling of refrigerant in said latter leg, to circulate heated refrigerant through said tubing and header to defrost said evaporator, said latter leg having a cylindrical enlargement extending over the major portion of its length, increasing the heat conduction from said heater to a larger amount of refrigerant.

6. A defrosting evaporator comprising a metal housing having a pair of side walls joined by a bottom wall and provided with a shelf extending from side wall to side wall, a rear wall closing the rear space between said side walls, a suction header carried by an upper part of one wall and having a suction tube extending into the header with the tube inlet adjacent the top of said header, sinuous tubing carried by the bottom of said shelf and extending sinuously down both side walls and across the bottom of said bottom wall, an inlet tube communicating with the sinuous tubing at a point remote from said header to cause the refrigerant to be supplied through two paths in parallel leading to said header, and outlets from said sinuous tubing communicating with both ends of the lower part of said header, said tubing also including a depending U-shaped portion having a pair of legs extending downward from said bottom wall, and an elon-

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gated metal enclosed electric heater engaging one of said legs and causing the heating and upward boiling of refrigerant in said latter leg, to circulate heated refrigerant through said tubing and header to defrost said evaporator, said header being located on the rear wall and effecting a heating and defrosting of said rear wall.

7. A defrosting evaporator comprising a metal housing having a pair of side walls joined by a bottom wall and provided with a shelf extending from side wall to side wall, a rear wall closing the rear space between said side walls, a suction header carried by an upper part of one wall and having a suction tube extending into the header with the tube inlet adjacent the top of said header, sinuous tubing carried by the bottom of said shelf and extending sinuously down both side walls and across the bottom of said bottom wall, an inlet tube communicating with the sinuous tubing at a point remote from said header to cause the refrigerant to be supplied through two paths in parallel leading to said header, and

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outlets from said sinuous tubing communicating with both ends of the lower part of said header, said tubing also including a depending U-shaped portion having a pair of legs extending downward from said bottom wall, for the purpose of establishing a refrigerant liquid circuit to cause circulation through said pair of legs by the application of heat to one of said legs, causing the upward boiling in said latter leg and a downward circulation in the other leg due to the head differential in said refrigerant between said legs.

THOMAS W. DUNCAN.
ALBERT C. ROSENCRAZ.

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