Sept. 5, 1939. W. W. HIGHAM ET AL 2,171,790

REFRIGERATOR EVAPORATOR

Filed July 2, 1938 2 Sheets-Sheet 1

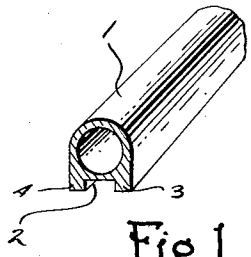


Fig. 1.

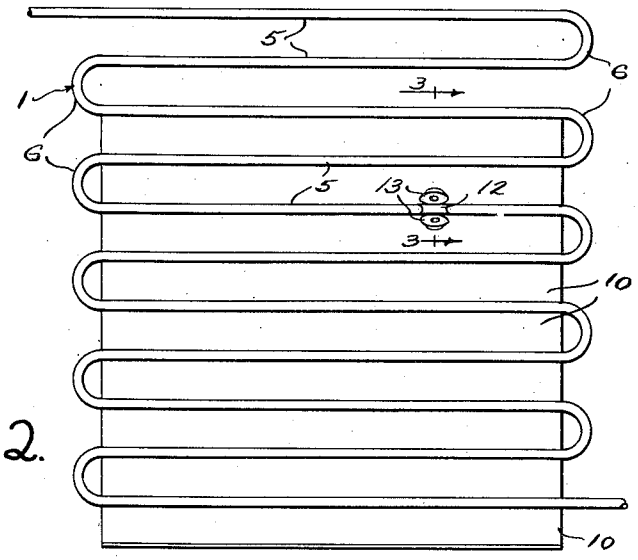


Fig. 2.

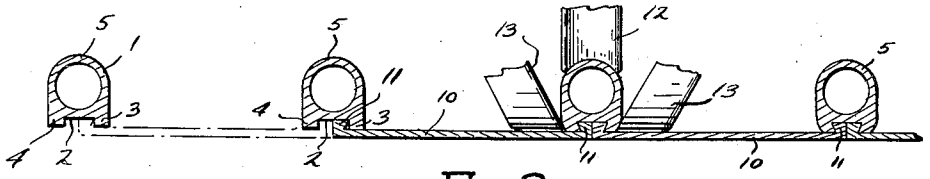


Fig. 3.

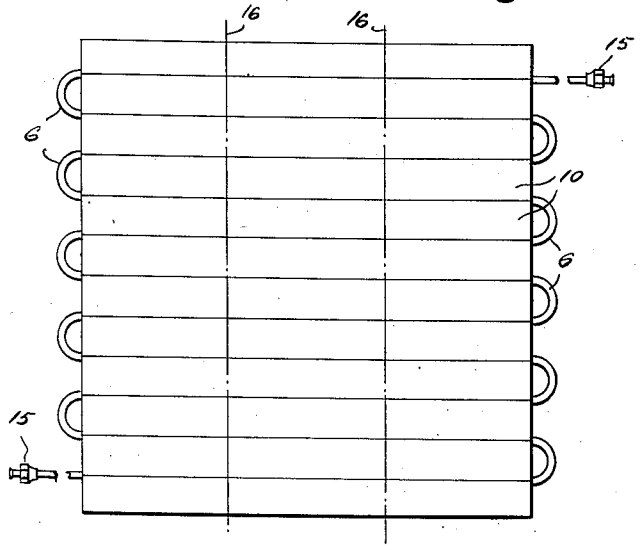


Fig. 4.

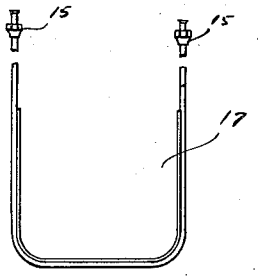


Fig. 5.

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REFRIGERATOR EVAPORATOR

Filed July 2, 1938 2 Sheets-Sheet 2

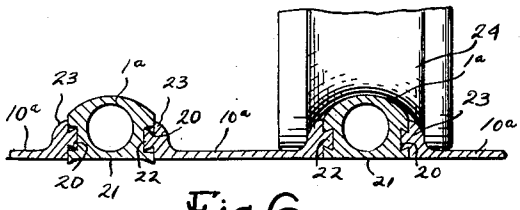


Fig. 6.

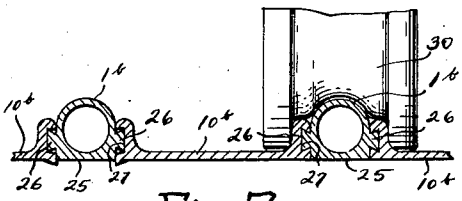


Fig. 7.

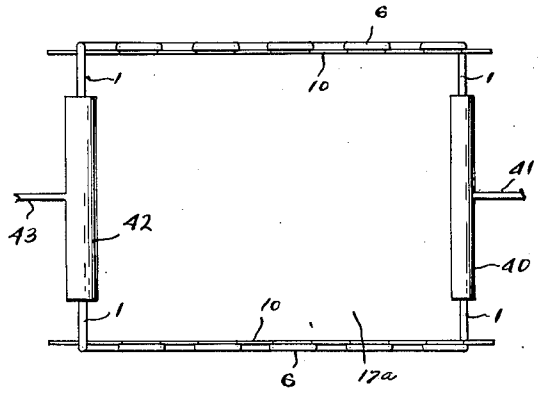


Fig. 8.

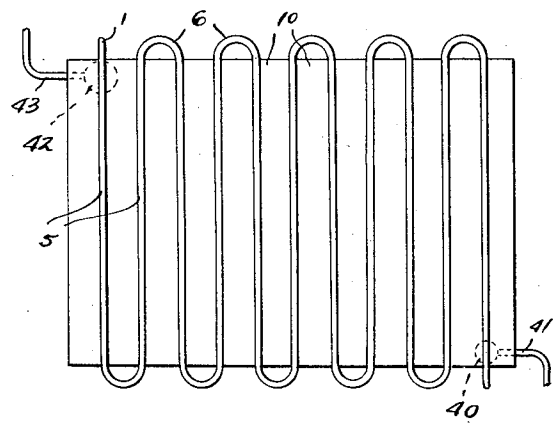


Fig. 9.

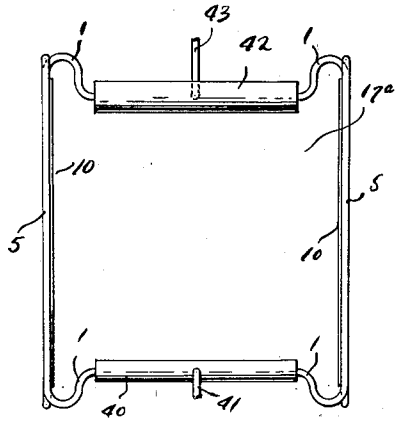


Fig. 10.

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Patented Sept. 5, 1939 2,171,790

UNITED STATES PATENT OFFICE

2,171,790

REFRIGERATOR EVAPORATOR

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Application July 2, 1938, Serial No. 217,150

10 Claims. (Cl. 62—126)

This invention relates to an evaporator structure for refrigerators.

The general objects of the invention are to provide an evaporator structure wherein one or more tubes are used for the refrigerant with the tubes fashioned into coils and wherein elements are employed with the tube to form or provide a wall structure of a solid nature. The wall structure may be employed as walls or defining parts for forming partially or entirely a sharp freezing chamber, or in some instances the wall may be such as to not define a sharp freezing chamber but may be left in substantially flat form and can be disposed vertically or horizontally or at any suitable angle. When disposed horizontally the wall structure may be employed as a shelf, and the temperature may be such as to freeze water or other substance retained on the shelf in a suitable receptacle.

To these ends the structure essentially comprises one or more lengths of tubing fashioned into coils with plate members assembled with and connected to the coils and closing the space between runs of the coils. The evaporator may be made in various sizes by selecting the desired length of tubing and the desired number of coils and plates.

The invention is exemplified by the illustrations in the accompanying drawings.

Fig. 1 is a perspective view of a tube which may be employed in carrying out the invention.

Fig. 2 is a plan view illustrating the tube fashioned into coils and showing one manner of assembling the wall-forming plates.

Fig. 3 is an enlarged cross sectional view taken on line 3—3 of Fig. 2 showing different stages of the assembling operation.

Fig. 4 is a plan view of a completed tube and plate assembly.

Fig. 5 is an end view of one form of evaporator which may be fashioned from the assembly shown in Fig. 4.

Fig. 6 is a view of a modified arrangement for connecting the plates and tube.

Fig. 7 is a view of a still further modified arrangement.

Fig. 8 is a top plan view of a different form of evaporator structure.

Fig. 9 is a side elevational view thereof.

Fig. 10 is an end view of an evaporator shown in Figs. 8 and 9.

The evaporator in its simplest form comprises essentially a tube and a plurality of similar plates. Preferably, the tube and plates are made of metal, and advantageously the tube may be formed of extruded metal. Aluminum or an aluminum alloy is admirably adapted for such purpose, although the tube may be fashioned from other metal such as copper, copper alloy, cuprous metals generally, or any other suitable metal. The plates may or may not be formed of extruded metal, and they may be made of any one of the above mentioned metals, particularly, an aluminum alloy.

The tube structure in Fig. 1 illustrates one form of tube and the tube is generally illustrated at 1. One side of the tube is of a rather square formation fashioned with a groove 2 with opposite ribs 3 and 4. A suitable length of this tube is fashioned into coils as shown in Fig. 2, the particular coil shown having a series of runs 5 connected by bends of substantially 180° as shown at 6. The runs 5 are preferably parallel.

As shown in Fig. 3 there is a plate 10 between each run 5, and each plate has a rib 11 of dovetail formation, there being a rib on each edge of each plate. The coil, as shown in Fig. 2, may be placed upon a suitable support or work table, and then the several plates may be located substantially as shown in Fig. 3. The coil is disposed with the groove 2 lowermost, and then the plates positioned substantially as shown at the left hand side of Fig. 3, and then the ribs 3 and 4 are fashioned over so as to underlie the dovetail formation of the ribs 11. The two ribs 11 of adjacent plates meet each other to form a complete dovetail formation. The ribs 3 and 4 may be fashioned over in any suitable manner, as for example, by a tool having a roller 12 for engaging the top of the tube and rollers 13 for turning over the ribs. A plate for projecting beyond the endmost run of the coil may or may not be used. As shown in Fig. 2, one plate is used on one end but none at the other end.

The illustration in Fig. 4 shows an assembled evaporator unit in flat form, the Fig. 4 illustration being substantially that shown in Fig. 2 but in an inverted position. The ends of the tube may be rounded off and provided with fittings 15 for connection to other conduits or the like for the refrigerant. The evaporator may be thus used in flat form and may be disposed in a refrigerator cabinet so as to form a shelf. The plates meet together at closely fitted seams and provide a substantially smooth support upon which food stuffs may be disposed. A refrigerator may be set up to operate so that a tray of water or a tray of other food stuff may be rested upon the shelf and frozen. This structure may also be fashioned to define a hollow-like structure as

shown in Fig. 5. To this end the structure may be bent substantially on the bend lines 16 to form a U-shaped evaporator illustrated in Fig. 5 wherein the walls define an inner area generally shown at 17 which may be termed a sharp freezing area or zone.

Other ways of securing the plates and runs of coil are shown in Figs. 6 and 7. In Fig. 6 the tube 1a may be fashioned with undercut grooves on opposite sides, as shown at 20; while one side of the tube may be flat as illustrated at 21, the plates 10a are fashioned with opposite edges enlarged and provided with dovetail ribs 22. In this form the undercut grooves 20 may be originally of undercut shape, and after the tube is fashioned into coils, as shown in Fig. 2, plates 10a may be slipped into position by lengthwise movement between two adjacent runs. The edge portions of the plates may be enlarged, as shown at 23, for making a nice fit with the tube. To tighten down the joint pressure may be applied by means of a roller 24 to collapse the portions of the tube defining the undercut groove tightly against the dovetail ribs 22.

In Fig. 7 the tube 1b may be flat on one side, as shown at 25, and provided with dovetail ribs 26, while the plates 10b have enlarged edges with grooves 27. The grooves 27 may or may not be initially of undercut formation. If undercut initiallly the plates 10b will be assembled by shifting them lengthwise into position between runs, or if the grooves 27 are initially not undercut, then the plates may be positioned by snapping them into position between the runs. In any event, the groove formation may be closed or tightened against the dovetail ribs by a suitable roller 30.

The structure shown in Figs. 6 and 7 may be used in flat form, as illustrated in Fig. 4, or suitably shaped, one shape of which is shown in Fig. 5. The solid wall or flat surface is defined by the plates 10a and the flat surfaces 21 and 25 of the tube.

Another form of evaporator structure is illusttrated in Figs. 8, 9 and 10, and this evaporator may be fashioned from a tube and plate arrangement shown in Fig. 3, or Fig. 6 or Fig. 7. Whereas in Figs. 4 and 5 there is but a single tube, Figs. 8, 9 and 10 show an evaporator with parallel tube arrangements with headers. One portion of the evaporator, as for example, a side wall, may be defined by a plate-like arrangement in flat form. For convenience, the reference characters used in Figs. 8, 9 and 10 are the same as those used in Figs. 1 to 5, insofar as the characters are applied to the tube and plate structure, although, as mentioned above, the structures shown in Figs. 6 and 7 may be used. Another wall of this evaporator may be formed by a coil of tube and plates 10. In the arrangement shown two side walls of an evaporator are thus formed, and headers are used for connecting the two tubes of the two walls. One header is illustrated at 40 and the ends of the two tubes, both as illustrated at 1, are connected into the header 40, the header 40 having a tube 41 for the inlet of refrigerant. The opposite ends, also both indicated at 1 of each tube, are connected to a header 42 having an outlet for refrigerant 43. One header may be located in a relatively low position as illustrated, this advantageously being the inlet, and the other header, as at 42, may be located adjacent the top of the plates for the outlet of refrigerant. This arrangement defines a more or less confined area 17a which may be employed as a sharp freezing chamber.

The structures shown and described constitute the basic evaporator structure, although it is to be appreciated that the completed evaporator may be finished and embellished as desired by suitable coverings or plates, or for example, an instrument panel or plate at the front or the like, and the sharp freezing chambers 17 and 17a may be completely or partially closed by the use of other sheet metal plates. The device has been described as a refrigerant evaporator, but the structure may be used in refrigerators for condensers or the like, although the plate structure has been particularly designed and is particularly useful in evaporators.

We claim:

1. An evaporator comprising a tube fashioned into a coil having a plurality of spaced substantially parallel runs connected together by bends in the tube, a plurality of plates separate from the tube tnd bridging the space between adjacent runs, and formations on the runs of tube and the edges of the plates fashioned into interengaging relationship for securing the edges of the plates to the runs of tube.

2. An evaporator comprising a tube fashioned into a coil having spaced substantially parallel runs connected together by bends in the tube, a plurality of plates separate from the tube, each bridging the space between two adjacent runs and tongue and groove formations on the tube and plates serving to connect the edges of the plates to the runs of tube.

3. An evaporator comprising a tube having ribs running along one side thereof and defining therebetween a groove, said tube being fashioned into a coil having a plurality of runs connected together by bends in the tube, and a plurality of plates each having a rib along one edge, said plates being disposed so that a plate bridges the space between adjacent runs with the ribs on the adjacent edges of two plates disposed in the groove in a run, the ribs on the tube being fashioned into interlocking relationship with the ribs on the plates.

4. An evaporator comprising a tube having ribs running along one side thereof and defining therebetween a groove, said tube being fashioned into a coil having a plurality of runs connected together by bends in the tube, and a plurality of plates each having a dovetail shaped rib along one edge, said plates being disposed so that a plate bridges the space between adjacent runs with the ribs on the adjacent edges of two plates disposed in the groove in a run, the ribs on the tube being fashioned into interlocking relationship with the dovetail shaped ribs on the plates.

5. An evaporator comprising a tube having a groove formation substantially on opposite sides, said tube being fashioned into a coil having a plurality of spaced runs connected by bends in the tube, said tube being disposed so that the grooved formations on successive runs face each other, and a plurality of plates, one disposed between each two adjacent runs and having dovetail shaped ribs fitting in the groove formation on the runs, the material of the tube being fashioned so that the groove formation interlocks with the dovetail ribs on the plates.

6. An evaporator comprising a tube fashioned into a coil having a plurality of spaced runs connected by bends in the tube, said tube having a dovetail shaped rib on opposite sides with the

tube disposed so that the ribs on successive runs project toward each other, and a plurality of plates, one disposed between each two adjacent runs, each plate having a groove formation on its edges for receiving the ribs on the runs and the groove formation being fashioned into interlocking relationship with the dovetail shaped ribs.

7. An evaporator comprising a tube having a flat surface on one side, said tube being fashioned into a coil having a plurality of spaced runs connected together by bends in the tube, a plurality of plates, one disposed between each two adjacent runs and bridging the space therebetween, interlocking tongue and groove formations on the tube and on the edges of the plates for uniting the plates and the runs, and one surface of each of the plates being disposed substantially in the same plane with the flat surfaces of the tube to provide a substantially smooth solid wall.

8. An evaporator comprising a tube fashioned into a coil having spaced runs connected together by bends in the tube, a plurality of plates disposed in edge to edge relationship, with each plate bridging the distance between adjacent runs, the meeting edges of the plates substantially underlying a run of the coil, said meeting edges of the plates and the tube having interengaging tongue and groove formations for securing the edges of the plates to the runs of the tube.

9. An evaporator comprising, two sections each formed of a tube fashioned into a coil having a plurality of spaced runs connected by bends in the tube, said sections being disposed in spaced relationship, a plurality of plates each substantially bridging the space between successive runs of the coil, the plates and tube having interfitting tongue and groove formations, a header having an inlet for refrigerant, one end of the coil in each section being connected to said header so that the header connects the two sections, a second header having an outlet for refrigerant, and the other end of the coil in each section being connected to the second named header so that the second header connects the two sections.

10. An evaporator comprising, two sections, each formed of a tube fashioned into a coil having a plurality of spaced runs connected by bends in the tube, said section being disposed in spaced relationship, means closing the space between successive runs of the coil and defining a substantially closed wall, the said means and tube having interfitting tongue and groove formations, a header for connecting the two sections and having an inlet for refrigerant, one end of the coil in each section being connected to said header, a second header for connecting the two sections and having an outlet for refrigerant and the other end of the coil in each section being connected to the second named header.

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