Oct. 19, 1948. B. C. JOHNSON 2,451,744

REFRIGERATOR LINER EVAPORATOR

Filed June 10, 1946 2 Sheets-Sheet 1

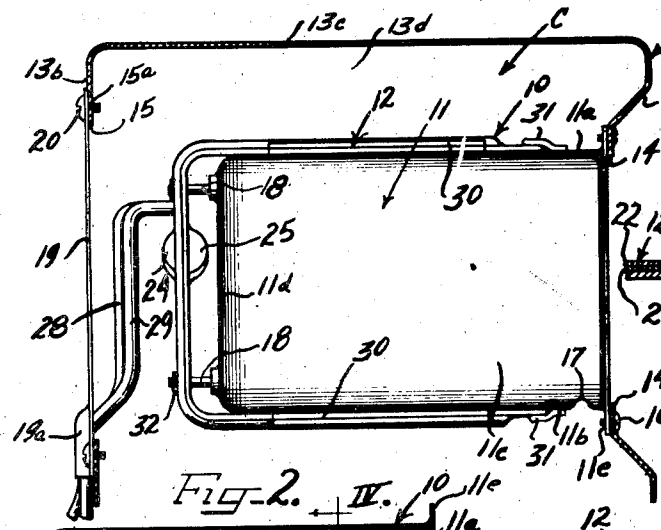


Fig-1.

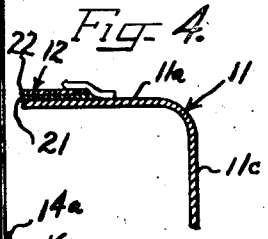
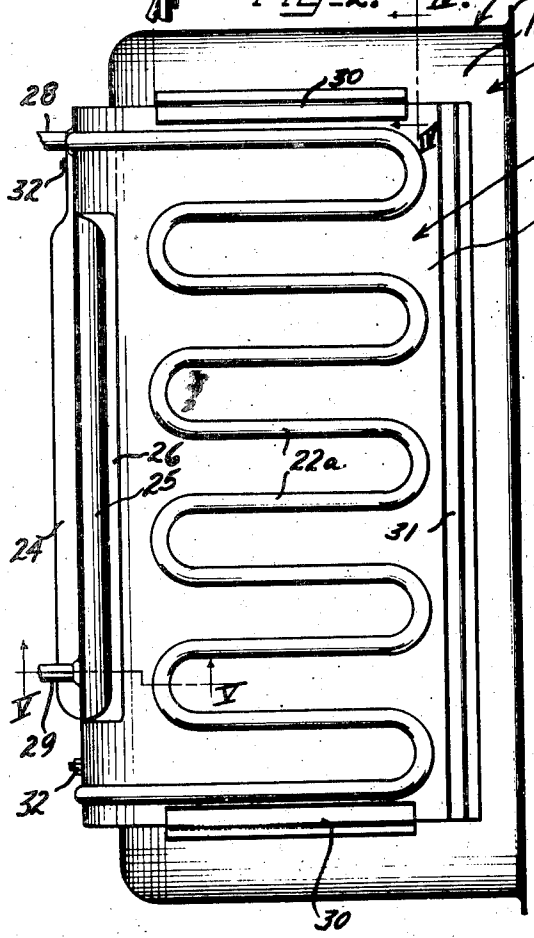


Fig-4.

Fig-2.



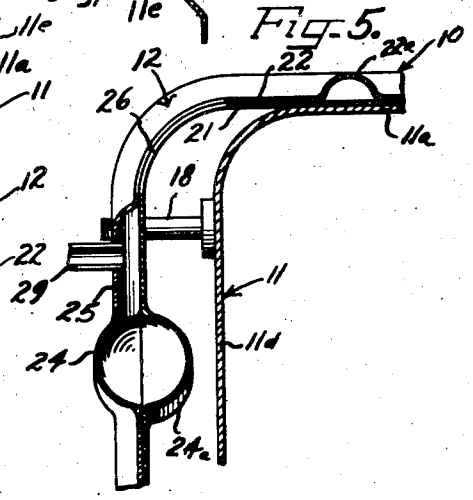
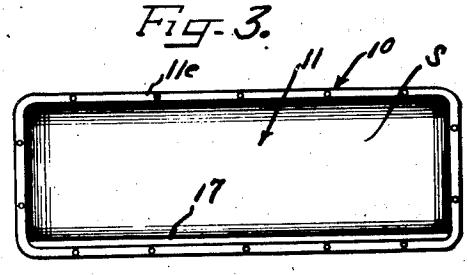


Fig-5.

Fig-3.



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REFRIGERATOR LINER EVAPORATOR

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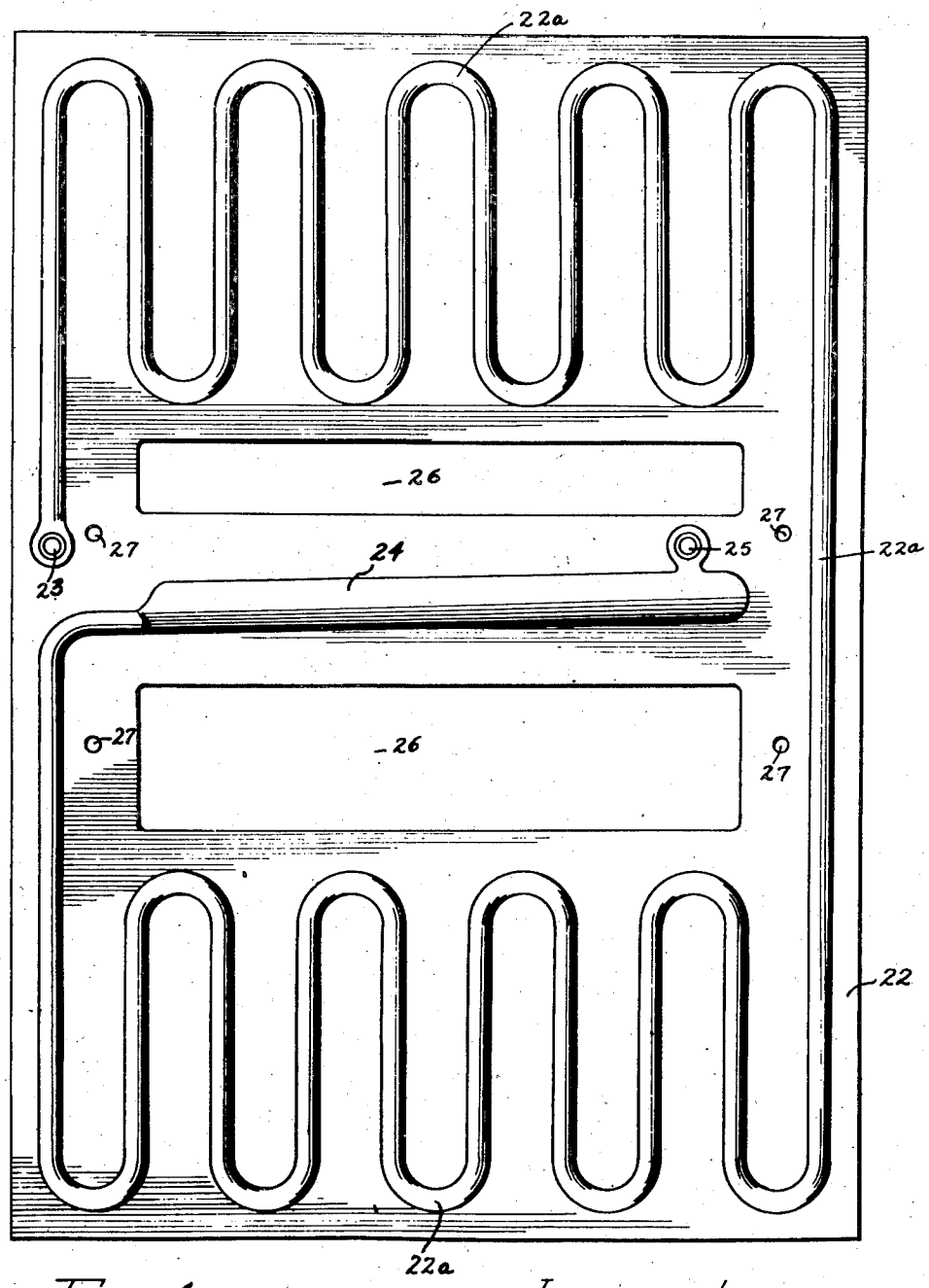


Fig. 6.

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REFRIGERATOR LINER EVAPORATOR

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6 Claims. (Cl. 62—126)

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This invention relates to a heat exchanger assembly composed of a receptacle and a removable cover arranged for circulating heat exchange fluid around the receptacle in intimate heat exchange relationship therewith. Specifically the invention deals with a refrigerator liner evaporator unit for mounting around the frost chest or liner of a refrigerator cabinet to control the temperature of the liner or frost chest.

Evaporator units for mechanical refrigerators are customarily suspended in the interior of the refrigerator cabinet, preferably from the top wall of the cabinet. In such refrigerators the evaporator unit itself is exposed to the storage space of the cabinet and rapidly becomes covered with frost from moisture in the storage cabinet. In addition, in such constructions, the evaporator unit must define the sharp freezing chamber or ice tray compartment in the food storage cabinet. If rapid freezing conditions are desired in the sharp freezing chamber, the outer exposed surfaces of the evaporator unit in the food storage cabinet also must become colder to drop the temperature of the cabinet more than is necessary or desired.

To avoid the above mentioned deficiencies of mechanical refrigerator units, it has been proposed to provide frost chests or liners in the refrigerator cabinet defining separate storage compartments or cabinets. These frost chests or liners take the form of canisters or containers closed around their entire periphery except at the front faces thereof to permit access to their interior. These chests or liners have been surrounded by serpentine coils of refrigerant conveying tubing. This tubing has been fastened to the liner or frost chest by means of spot welded clips, brazing, soldering, or the like. Further, in such arrangements, a separate refrigerant accumulator has been necessary. This accumulator was soldered to the coiled tubing. In order to increase heat transfer efficiency between the liner of frost chests and coils, a plastic compound was usually employed and the entire outside of the assembly was then usually coated with asphalt.

Frost chest or liner assemblies of the above described type are unsatisfactory in that they cannot be repaired without complete disassembly of the frost chest or liner from the cabinet. In addition, heat transfer efficiency is rather low even with the use of plastic material, asphalt, and the like, as described. The units are also difficult to make and are quite expensive.

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The present invention now provides evaporator units for refrigerator liners or frost chests which embrace the liner or frost chest in removable telescoping relation. The evaporator units are formed from secured together embossed contiguous metal sheets bent in the form of a U to embrace the top, bottom and back wall of the frost chest or liner. The evaporator units have embossments which provide a serpentine duct system for flowing refrigerant in intimate thermal relation with the liner. In addition the evaporator unit has an embossment which defines an accumulator chamber so that no separate accumulator need be used.

The refrigerator cabinet has a removable panel in the back wall thereof behind each frost chest or liner and evaporator units of this invention are readily inserted on and removed from the frost chest or liner through the openings afforded by these panels. No permanent connections between the frost chest or liner and the evaporator unit are used since the units have snug sliding-fit relationship with the liners or frost chests and are guided into the desired telescoping positions by means of guide strips fastened on the frost chests or liners.

It is then an object of this invention to provide a refrigerator liner evaporator unit composed of embossed contiguous secured together metal sheets having embossments defining refrigerant circulating ducts and an accumulator chamber and being bent to telescope a refrigerator liner in intimate heat exchange relation.

A further object of this invention is to provide a refrigerator cabinet construction wherein the cabinet body supports a canister type frost chest or heat conductive material in spaced relation from the walls of the cabinet and wherein a sheet metal evaporator unit is removably telescoped on the frost chest within the cabinet.

A further object of the invention is to provide a refrigerator cabinet structure including a cabinet body carrying a liner extending inwardly from the open front of the cabinet in spaced relation from the side, top and rear walls of the cabinet and wherein the rear wall has a removable panel defining an opening giving access to the cabinet, and wherein an evaporator unit is insertable through said opening in telescoped relation with the liner.

A further object of the invention is to provide a refrigerator liner and evaporator unit assembly for refrigerator cabinets wherein the evaporator fits over and is detachably held on the liner by

clips or the like to permit easy replacement of the evaporator unit.

A still further object of the invention is to provide a sheet metal heat exchanger composed of a pair of contiguous secured together metal sheets which are embossed to provide circulating ducts for heat exchange fluid and which are apertured to eliminate extensive non-embossed areas.

A still further object of the invention is to provide a U-shaped evaporator unit having cut out portions at the corners thereof to render the unit easily bendable for conforming to a member received within the U.

Other and further objects of the invention will be apparent to those skilled in the art from the following detailed description of the annexed sheets of drawings which, by way of a preferred embodiment illustrates one example of the invention.

On the drawings:

Figure 1 is a side elevational view of a frost chest or liner and evaporator unit assembly of this invention mounted in a refrigerator cabinet shown in vertical cross section.

Figure 2 is a top plan view of the frost chest or liner and evaporator unit assembly of Fig. 1.

Figure 3 is a front elevational view of the assembly of Fig. 2.

Figure 4 is a fragmentary vertical cross sectional view taken along the line IV—IV of Fig. 2.

Figure 5 is an enlarged fragmentary vertical cross sectional view, with parts in side elevation, taken along the line V—V of Fig. 2.

Figure 6 is a top plan view of the evaporator unit before it is bent into U-shape and illustrating the embossments on the outer face of the unit.

As shown on the drawings:

In Figs. 1 to 3 and 5 the reference numeral 10 designates generally a frost chest or liner and evaporator unit assembly composed of a canister type metal chest 11 and a U-shape sheet metal evaporator unit 12 embracing the chest 11.

As best shown in Fig. 1, the assembly 10 is mounted in a refrigerator cabinet 13. The cabinet 13 has a front wall 13*a* with an opening 14 therein bounded by a marginal flange 14*a*. The cabinet 13 has a back wall 13*b* with an opening 15 that is aligned with the opening 14 and is preferably larger than the opening 14. The opening 15 is bounded by a marginal periphery 15*a*. The cabinet 13 also has a top wall 13*c* and side walls such as 13*d*. A chamber C is thereby provided by the cabinet 13.

The frost chest 11 is stamped or drawn from sheet metal and has a top wall 11*a*, a bottom wall 11*b*, side walls 11*c* and a back wall 11*d*. The front of the frost chest 11 is open and bounded by an outturned flange 11*e*. This flange is sized to fit against the marginal portion 14*a* of the opening 14 in the cabinet and screws or bolts 16 are passed through the flanges 14*a* and 11*e* to suspend the frost chest 11 in the chamber C of the cabinet 13 with the open front of the frost chest aligned with the opening 14 of the cabinet. A door (not shown) is hinged on the cabinet 13 to close the open front of the frost chest.

The bottom wall 11*b* of the frost chest 11 has a raised bead portion 17 extending transversely thereacross immediately behind the flange 11*e* thereof to provide a dam which will retain liquids or the like built in the storage compartment S of the frost chest.

The back wall 11*d* of the frost chest 11 is in spaced relation from the back of the cabinet 13 and has several studs 18 projecting horizontally

therefrom toward the back wall. These studs 18 are integrally affixed to the back wall 11*d* of the frost chest.

A cover panel 19 is provided to close the opening 15 in the rear wall 13*b* of the cabinet 13. This panel 19 has a marginal portion overlying the flange 15*a* of the opening 15 and screws or bolts 20 pass through the panel and marginal flange 15*a* to secure the panel in position on the cabinet. The panel 19 has an embossed portion 19*a* extending upwardly from the bottom edge thereof to define a passageway accommodating tubing therethrough as will be more fully hereinafter described.

The evaporator unit 12 is composed of brazed together contiguous metal sheets or plates including an inner sheet 21 and an outer sheet 22.

As best shown in Fig. 6 the unit 12 is initially formed in the flat and the outer sheet 22 is embossed to define ducts 22*a* having two groups of serpentine coiled portions arranged to lie in the top and bottom walls of the unit 12. The ducts 22*a* have an inlet terminal end 23 arranged to be positioned in the back wall of the finished unit together with an exit terminal portion entering the lower end of an accumulator duct 24 also arranged to lie in the rear wall of the unit 12. The inner sheet 21 of the unit 12, as best shown in Fig. 5, is also embossed at 24*a* to cooperate with the embossed duct defining portion 24 of the outer sheet for providing an accumulator chamber of enhanced capacity. The embossment 24 slopes slightly upwardly as shown in Fig. 6 and has an upstanding terminal embossment 25 at its upper end providing an outlet.

Both of the sheets 21 and 22 have apertures 26 therethrough at portions thereof to define the corners of the U-shaped unit. The sheets, when in the flat, are substantially rectangular as shown in Fig. 6. After being embossed to define the above described ducts, the flat sheets are brazed together and are then bent into the U-shape of the finished evaporator unit. Top and bottom legs and a back wall are thereby provided with the serpentine groups of ducts 22*a* lying in the top and bottom legs and connected along one side edge by the connecting duct 22*a* shown in Fig. 6. The accumulator formed by the embossments 24 and 24*a* lies in the back wall of the finished unit. The apertures 26 lie in the corners between the back wall and the legs of the unit and since the legs are joined with the back wall only through fragmentary portions of the sheets, these legs are readily bent toward and away from each other to intimately hug the frost chest. In addition the cut out apertures 26 remove from the unit any large brazed together unembossed areas thereby facilitating the brazing operation in that gas pockets might be developed in large unrelieved contiguous areas.

The sheets 21 and 22 are further apertured at 27 to receive studs 18 therethrough.

A refrigerant supply tube 28 is secured in the inlet portion 23 of the duct 22*a* and a spent refrigerant outlet tube 29 is secured in the outlet terminal duct 25. Refrigerant is thus caused to flow first through serpentine ducts in the top leg of the unit, thence around the back of the unit into the serpentine ducts in the bottom of the unit and next upwardly into the back wall of the unit into the lower end of the accumulator defined by the embossments 24 and 24*a*. Spent refrigerant is exhausted from a level above the upper end of the accumulator out through the tube 29.

Elongated strips 30 are welded or brazed on the top wall 11a and bottom wall 11b of the frost chest 11 to extend longitudinally thereof adjacent the outer ends of the walls in spaced opposed parallel relation. These strips have raised portions cooperating with the walls to define grooves for snugly receiving the longitudinal edge portions of the top and bottom legs of the evaporator unit. Additional strips 31 extend transversely across the top and bottom walls of the frost chest 11 near the front end flange 11e thereof to cooperate with these walls for defining grooves which receive the front edges of the legs. The strips 30 and 31 thus provide clips which engage the ends and sides of the evaporator unit for retaining the unit in telescoped relation on the frost chest while causing the legs of the unit to have intimate contact with the top and bottom walls of the frost chest. It should be noted that the inner sheet 21 of the evaporator unit is not embossed along the top and bottom legs of the unit and has flat surfaces for intimate contact with the top and bottom walls of the frost chest.

The transverse strips 31 also function to provide stops for the evaporator unit 12 to hold the back wall of the unit in spaced relation from the back wall 11d of the frost chest and thereby prevent crushing of the embossment 24a against the back wall of the frost chest. The studs 18 are passed through the apertures 27 of the evaporator unit and nuts 32 are threaded on the studs to be bottomed against the back wall of the evaporator unit for drawing the unit tightly into the strips 31.

The tubes 28 and 29 connected to the unit 12 are passed through the chamber provided by the embossment 19a of the closure plate or panel 19 for the cabinet 13.

In order to remove the unit 12 from the frost chest 11, it is only necessary to remove the plate 19 from the cabinet 13, remove the nuts 32 from the studs 18, and slide the unit 12 rearwardly off of the frost chest 11 and out of the cabinet chamber C through the opening 15. The unit can thereby be easily repaired or replaced without disturbing any of the connections between the frost chest and cabinet. It should be noted that it is not even necessary to remove the tubes 28 and 29 from the unit 12 in order to permit removal of the unit from the cabinet chamber C since the tubes are flexible and when the closure plate or panel 19 is removed they have sufficient unrestrained length so that they can be deflected without kinking or collapsing.

From the above descriptions it should therefore be understood that this invention provides a chest or liner and heat exchanger assembly especially adapted for refrigerator cabinets wherein the heat exchanger can be easily separated from the liner or frost chest without disturbing the liner or frost chest and its connection with the cabinet. It will also be understood that the heat exchanger itself is arranged so that it will always have intimate heat exchange relation with the liner or frost chest without being permanently connected therewith.

It will, of course, be understood that various details of construction may be varied through a wide range without departing from the principles of this invention and it is, therefore, not the purpose to limit the patent granted hereon otherwise than necessitated by the scope of the appended claims.

I claim as my invention:

1. In combination, a cabinet having front and rear walls with openings bounded by marginal flanges, a canister type liner in said cabinet having an open front with an outturned mounting flange therearound mating with the marginal flange around the opening in the front wall of the cabinet, means securing the mounting flange of the liner with said marginal flange around the opening in the front wall of the cabinet, a heat exchange unit insertable through the opening in the rear wall of the cabinet in telescoped snug engagement on said liner, tubes secured to said unit for circulating fluid therethrough, and an embossed removable cover overlying the marginal flange on the rear wall of the cabinet for closing the opening in said rear wall and receiving said tubes through the embossed portion thereof.

2. In combination, a refrigerator cabinet having aligned openings in the front and rear walls thereof, a frost chest in said cabinet having an open front aligned with the opening in the front wall of the cabinet and secured to said front wall, said frost chest having top, bottom, side and rear walls in said cabinet in spaced relation from the cabinet walls, a U-shaped sheet metal evaporator unit having top and bottom legs snugly engaging the top and bottom walls of the frost chest and a rear wall portion connecting said legs behind the rear wall of the frost chest, said evaporator unit having embossments in the top and bottom legs defining refrigerant circulating ducts together with embossments in the back wall defining an accumulator chamber, tubes communicating with said ducts and chamber respectively for circulating refrigerant through the unit, said tubes being connected to the rear wall of the unit and extending through the opening in the rear of the cabinet, and a closure plate for said opening in the rear wall of the cabinet having an embossed portion providing a passageway for receiving said tubes.

3. A frost chest construction for a refrigerator comprising a metal container defining a storage space, a separate sheet metal evaporator unit embracing said container in intimate heat transfer relationship, said evaporator unit being embossed to define refrigerant circulating ducts and an accumulator chamber receiving refrigerant from said ducts, and means carried by the container releasably holding the evaporator unit snugly thereon.

4. In combination a frost chest, clips secured on the outside of said chest cooperating therewith to define grooves, and a U-shaped sheet metal evaporator unit embracing said chest and seated in said grooves in intimate thermal relation with the chest.

5. A frost chest and evaporator unit assembly for refrigerator cabinets which comprises a container with one open end, studs extending rearwardly from the closed end of said container opposite said open end, an evaporator unit having legs embracing the top and bottom walls of the container and a rear wall receiving said studs therethrough, stops on the top and bottom walls of the container arranged for abutting the front end of the face of the evaporator unit, and nuts on said studs pressing against the rear wall of the evaporator unit to draw the unit against said stops.

6. In combination, a frost chest having top, bottom, and rear walls together with an open front defining a storage chamber, a U-shaped sheet metal evaporator unit having top and bottom legs in intimate contact with the top and bottom walls of the frost chest and a bight portion ad-

jacent the rear end wall of the frost chest, said evaporator unit having refrigerant circulating ducts in intimate thermal relationship with the frost chest, and means releasably retaining the evaporator unit in position on the frost chest.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,049,708	Lieb	Aug. 4, 1936
2,309,533	Philipp	Jan. 26, 1943
2,325,705	Philipp	Aug. 3, 1943

FOREIGN PATENTS

Number	Country	Date
589,389	Germany	Dec. 4, 1933