Dec. 3, 1935. S. L. INGERSOLL 2,023,201

EVAPORATOR FOR REFRIGERATORS

Filed Sept. 29, 1932 2 Sheets-Sheet 1

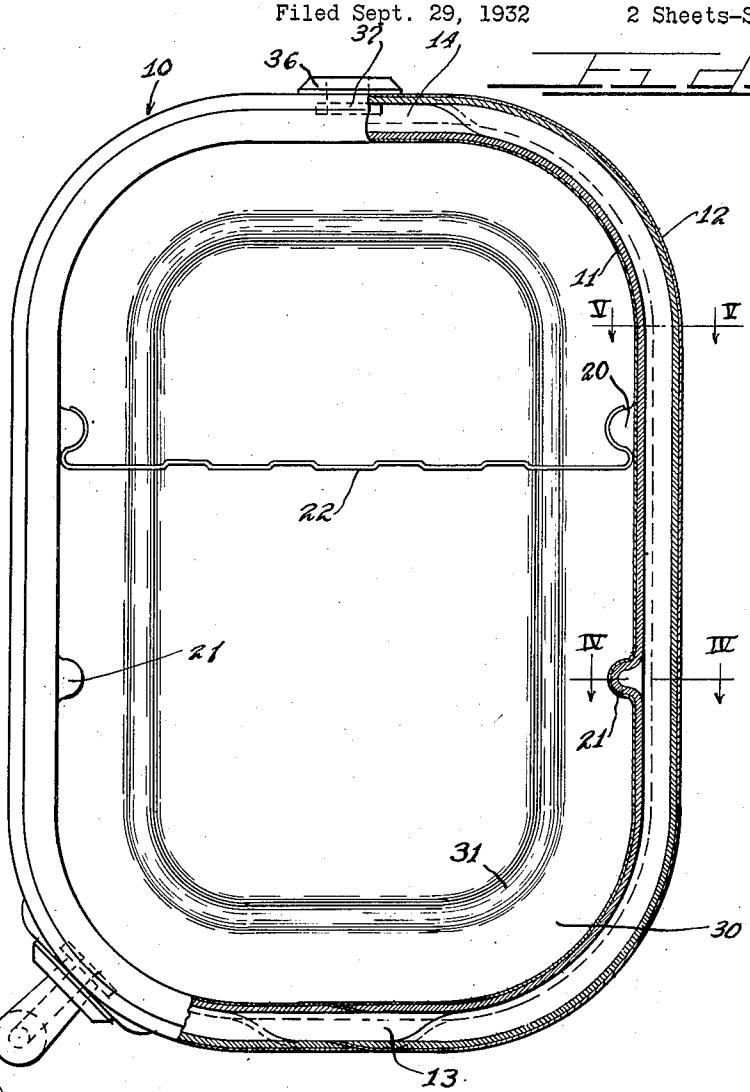


Fig. 1.

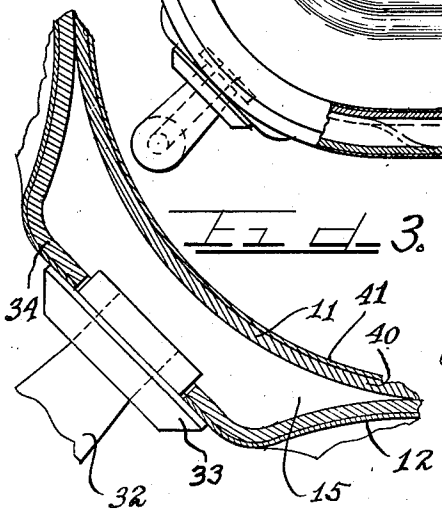


Fig. 3.

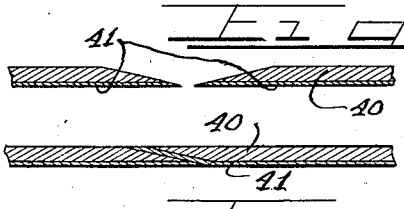


Fig. 2A

Fig. 2.

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EVAPORATOR FOR REFRIGERATORS

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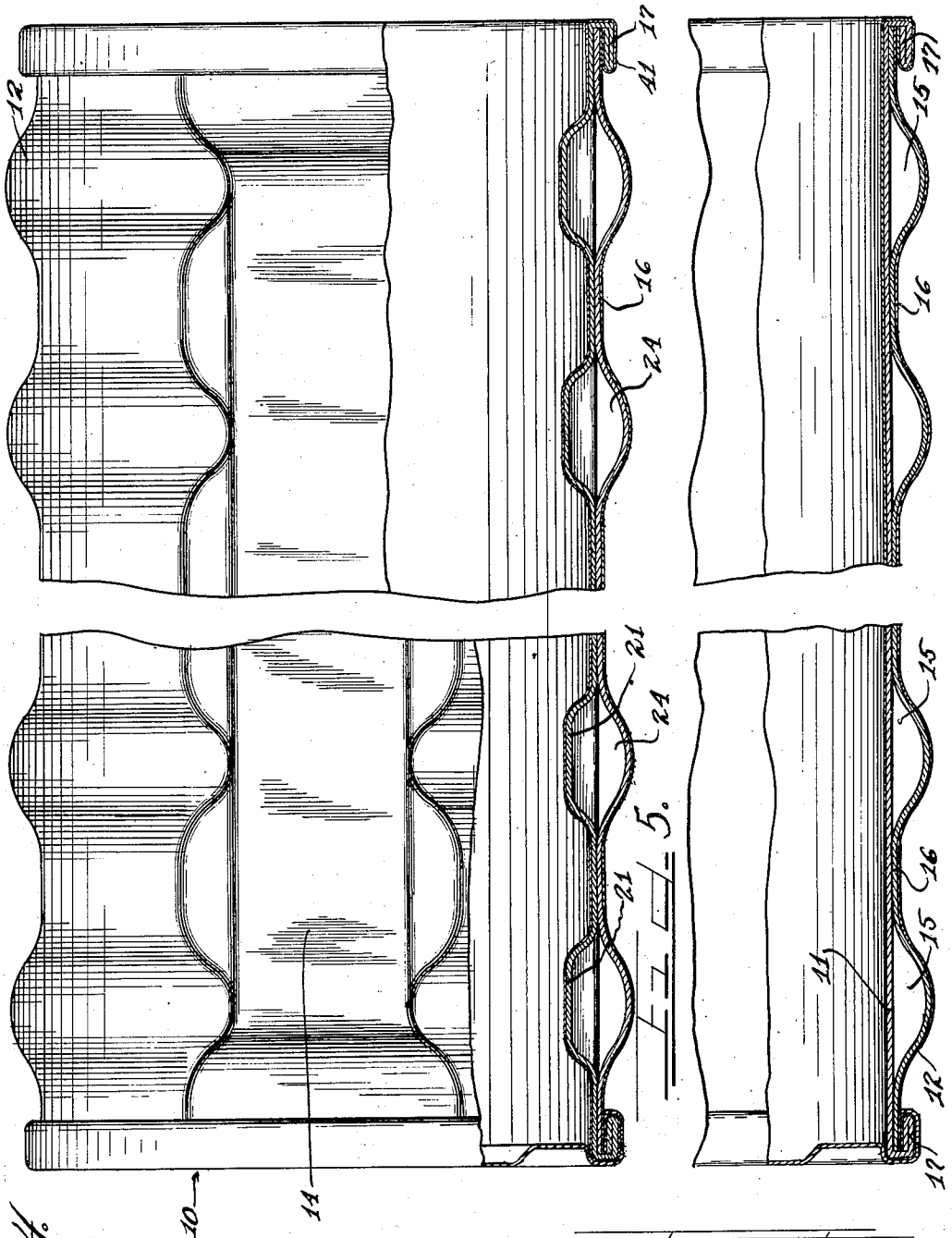


Fig. 4.

Fig. 5.

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2,023,201

UNITED STATES PATENT OFFICE

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EVAPORATOR FOR REFRIGERATORS

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Application September 29, 1932, Serial No. 635,386

9 Claims. (Cl. 62—126)

This invention relates to an evaporator or freezer unit for refrigerators of the type in which liquid or gas refrigerant is expanded with a decrease in temperature to absorb heat from the surrounding quarters.

More specifically, this invention relates to an evaporator unit for refrigerators composed of a two ply laminated metal having the unexposed and main body portion thereof composed of metal having a high coefficient of heat transfer while the exposed or outside surface ply is composed of a metal having a high resistance to corrosion.

The standard type of evaporator used in refrigerators operating on the principle of heat absorption by expanding liquids or gases has heretofore been made of various grades of iron or steel. The use of mild steels is generally desirable because of the high coefficient of heat transfer possessed by this type of steels. However mild steels are soft and do not stand up under corroding atmospheres which the evaporator may be exposed to in refrigerating machines. It was therefore necessary heretofore to enamel the outer surfaces of the evaporator units to protect the soft steel from corrosion. Enamel, however, being practically a non-conductor of heat greatly lowers the heat transfer through the walls of the evaporator unit and thus lowers the efficiency of the refrigerator.

The brittleness of an enamel or porcelain coating adds another disadvantage to the use of this type of protective cover since the enamel surface will chip off easily and expose the metal walls of the evaporator to the atmosphere.

It has been proposed to use stainless steels and other steels highly resistant to corrosion in the evaporator unit but such steels themselves have only low coefficients of heat transfer. Furthermore stainless steels and other corrosion resisting metals are expensive and not practical from an economic standpoint.

I have now devised an evaporator unit having a high coefficient of heat transfer and an exposed surface highly resistant to corrosion. The opposing factors of high heat transfer against corrosion resistance have been largely avoided by the use of a laminated metal such as is prepared in the process disclosed in my U. S. Patent No. 1,868,749. The preferred type of laminated metal used in my novel evaporator unit consists of a two ply sheet having an outside exposed surface of stainless steel and an inside surface, exposed to the refrigerant only, of mild steel having a high coefficient of heat transfer. The mild steel forms the greater portion of the evaporator walls, preferably about four-fifths of the thickness of the wall.

A steel containing 18% chromium and 8% nickel, which is known as 18—8 stainless steel, or a steel or iron containing chromium in varying proportions up to 30%, with or without any nickel, are good examples of the corrosion resisting metals that may be used for the outer layer or ply of the laminated metal evaporator wall. However, it is to be understood that other corrosion resisting metals may be used.

It is therefore an object of this invention to provide an evaporator for refrigerators comprising a unit composed of laminated metals one of which has a high coefficient of heat transfer while the other has a high degree of resistance to corrosion.

Another object of this invention is to provide an evaporator unit of novel design composed of different types of metal inseparably united together to form walls of the unit having a high coefficient of heat transfer and high resistance to corrosion.

Another object of this invention is to provide a freezer for mechanical refrigerators formed of a two ply laminated composite unit, the outer surface of which is composed of stainless steel, and the inner surface of which is a steel having a high coefficient of heat transfer.

A specific object of this invention is to provide a double walled evaporator unit defining a central chamber for ice trays and the like and chambers for refrigerating material between said walls, the inner surface of the walls being composed of a metal having a high coefficient of heat transfer while the outside exposed surfaces are made of stainless steel.

Other and further objects of this invention will be apparent from the disclosures in the specification and the accompanying drawings.

This invention (in a preferred form) is illustrated in the drawings and hereinafter more fully described.

Figure 1 is an end elevational view, partly in cross section, of the evaporator unit showing a shelf for ice pans and the like in the opening defined by the inside evaporator wall.

Figure 2 is an enlarged segmental cross sectional view showing the manner in which the laminated metal sheets forming the walls of the evaporator are welded together so that the soft steel is not exposed.

Figure 2A is a cross section segmental view showing the manner in which the laminated sheets are beveled before welding.

Figure 3 is a cross sectional segmental view of the inlet opening for refrigerating material entering the evaporator unit showing the pipe connection in elevation.

Figure 4 is a broken top view, partly in cross section along the line IV—IV of Figure 1 showing the manner in which the walls of the evaporator unit are crimped and welded together to form passageways along the sides of the unit for the refrigerating material and also to form supports for the shelves in the opening defined by the unit.

Figure 5 is a broken top view, partly in section taken along the line V—V of Figure 1.

In Figure 1, the reference numeral **10** indicates a preferred form of evaporator unit according to this invention having an inner wall **11** and an outer wall **12** composed of laminated material as will be hereinafter more fully described. Said walls **11** and **12** define an inlet chamber **13** extending the full length of the evaporator unit at the bottom thereof and an outlet chamber **14** extending the full length of the evaporator unit at the top thereof. As shown in Figure 5 the outer wall **12** is corrugated along the sides of the refrigerator unit forming passageways **15** between the chambers **13** and **14** at the bottom and top of the evaporator unit respectively. Said passageways **15** are sealed from each other by welded joints **16** located between the corrugations of the outer sheet and are sealed at the ends by a reversed flanged crimp **17** which will be hereinafter more fully described.

The inner laminated wall **11** is crimped to form upper and lower corrugations **20** and **21** respectively to act as supports for ice tray shelves one of which is shown at **22**. These corrugations of the inner wall as shown at **21** of Figure 4 are made to correspond with outer corrugations **24** of the outer wall **12** so as to form at these points enlarged passageways between the upper and lower chambers **14** and **13**. These enlarged passageways **24** exist only at the points where the shelf is suspended and beyond these portions the passages are reduced in size to the passageways **15** shown in Figure 5.

As shown in Figure 1 a back plate **30** is provided at the rear of the evaporator unit as a rear wall. This plate is provided with a convex rib **31** extending therearound, as shown, to act as a bumper for the ice trays and prevent them from freezing to the plate.

The refrigerating material in compressed gaseous or liquefied form is introduced through a pipe **32** coupled at **33** into the outer wall **12** of the refrigerator unit at a point near the bottom of the unit coinciding with a passageway **15**. At this point the outer wall **12** is provided with a flattened corrugation **34** to facilitate the fastening of the coupling **33** tightly against the metal wall to insure against leakage.

A coupling **36** is provided at the top of the evaporator unit preferably in the middle thereof for connecting with an exhaust pipe line (not shown) to the compressor. An opening **37** is provided at this point to allow the escape of expanded refrigerating material in the chamber **14**.

As best shown in Figures 2 and 3 the walls of the evaporator unit are composed of laminated metals inseparably united together such as by the method disclosed and claimed in my U. S. Patent No. 1,868,749. The walls **11** and **12** consist of a ply of high heat transfer metal such as mild steel **40** united to a ply of stainless or other steel of high corrosion resistance **41**. The mild steel or other metal having a high coefficient of heat transfer comprises the greater bulk of the wall and is exposed only to the refrigerating material inserted between the walls. The outer surfaces, of course, are exposed to the atmosphere in the refrigerator and are corrosion proof.

It is known that pure iron has a thermal conductivity of .146 calories per cubic centimeter per degree centigrade whereas the thermal conductivity of steel varies somewhat between .075 to .115. Mild steels generally have a thermal conductivity between .100 to .110 calories per cubic centimeter per degree centigrade. When this high rate of heat conductivity is compared with that of stainless steel which varies between .035 to .060 calories per cubic centimeter per degree centigrade it is readily apparent that the use of only a thin surface layer of stainless steel while the substantial portion of the wall is composed of mild steel greatly increases the heat transfer of the evaporators and likewise increases the efficiency of the refrigerating system.

In the preferred laminated sheet which is used to define the walls of the evaporator the mild steel forms about four-fifths the thickness of the wall. The combination of the high corrosion resistance stainless steel with the high heat transfer steel produces walls of unexcelled quality for evaporator units since the exposed surfaces of the unit are protected from corrosion while at the same time the high heat transfer properties of the softer steel are also utilized.

As shown in Figures 2 and 2A the laminated sheet forming the walls of the evaporator unit are preferably welded together so that the stainless steel layer is joined with the mild steel layer. This is accomplished by grinding the mild steel surface **40** of the sheet at the ends that are to be welded together to form a beveled surface. The stainless steel surface **41** which has not been ground is then placed on top of the beveled mild steel surface to which it is to be welded and compressed into the position shown in Figure 2. It is then welded. In this manner the stainless steel surface **41** exposed to the atmosphere is uninterrupted at the joint and the mild steel is at no point exposed to the atmosphere.

The seams or joints **17** (Figures 4 and 5) at the front and back ends of the evaporator unit are also carefully folded and seam welded so that the stainless steel surface **41** of the inner wall **11** is lapped around the soft steel inner surface of the outer wall **12** so that no part of the soft steel is exposed to the atmosphere.

It is evident that other details of construction may be used in the design of the evaporator unit. It is to be understood however that this invention includes in its broader form the use of laminated metals inseparately united together for evaporator walls. Such laminated metals are preferably of a two ply nature having the greater part thereof composed of a metal with high thermal conductivity while the other surface or ply is composed of a metal having high resistance to corrosion. A three ply sheet with stainless steel forming the outer plies and soft steel in the middle might be used in some cases where it is as desirable to have the wall surfaces exposed to the refrigerant corrosion proof also. This is ordinarily not necessary however.

I am aware that many changes may be made and numerous details of construction may be varied through a wide range without departing from the principles of this invention, and I, therefore, do not purpose limiting the patent

granted hereon otherwise than necessitated by the prior art.

I claim as my invention:

1. An evaporator for refrigerators comprising a double walled receptacle providing a central compartment for quick refrigeration, the double walls of said receptacle defining a refrigerant chamber, the outer surfaces of said chamber being composed of a layer of metal highly resistant to corrosion and the inner surfaces being composed of a layer of metal having a high coefficient of heat transfer, said inner metal layer being relatively much thicker than said outer layer and said layers being inseparately united together.

2. An evaporator for refrigerators comprising a laminated metal unit providing a compartment for ice trays and the like, chambers for refrigerating material at the top and bottom of said unit, passageways around the sides of said unit connecting said top and bottom chambers, said chambers and passageways being composed of mild steel on their inner surfaces and stainless steel on their outer surfaces.

3. An expansion unit for mechanical refrigerators comprising a double walled structure outlining a central opening for ice trays and the like and defining between said walls inlet and outlet chambers for refrigerating material connected with each other through parallel passages along the sides of the unit, said walls being composed of two-ply laminated metal, the inner ply of which is a steel having a high heat transfer coefficient while the outer ply is a stainless steel.

4. An evaporator for refrigerators comprising a unit having double walls spaced from each other to form an expansion chamber for refrigerants, said walls being composed of composite multi-ply laminated metal sheets having a thick ply of a high heat transfer metal unexposed to the atmosphere and a relatively thin ply of a non-corrosive metal exposed to the atmosphere.

5. An evaporator unit comprising a pair of spaced interfitting shells having inside surfaces of mild steel possessing a high coefficient of heat transfer and outside surfaces integrally united thereto possessing high resistance to corrosion, each of said shells being formed from a laminated metal sheet having the adjoining edges thereof beveled toward the corrosion resistant surface and having said surface below one of said bevels welded to the mild steel bevel on the adjoining edge of the sheet so that the mild steel cannot be exposed to the outside atmosphere, said shells being joined at their ends for defining a refrigerant chamber.

6. An evaporator unit comprising a pair of spaced interfitting shells formed from laminated metal sheets having a surface layer of stainless steel backed with a layer of mild steel possessing a high coefficient of heat transfer, the stainless steel surfaces being exposed to the outside and the mild steel surfaces defining a refrigerant compartment between the shells, said shells having their adjoining edges beveled toward the stainless surface and having the stainless steel surface below one of said bevels superimposed over and welded to the mild steel bevel of the adjoining edge of the sheet so that the mild steel cannot be exposed to the outside, corrugations formed in said outside shell for defining a plurality of passageways along the sides of the shells, said shells being spaced from each other at the top and bottom thereof for forming header compartments joining each of the passageways.

7. An evaporator for refrigerators comprising spaced inner and outer shells of laminated metal sheets welded together, each sheet comprising a ply of corrosion resistant metal integrally united to a ply of metal having a high coefficient of heat transfer and having their ends sealed to form a refrigerant expansion chamber between said shells with the metal having high heat transfer defining the walls of said chamber and the corrosion resistant metal defining the outside surfaces of the evaporator, corrugated portions on the sides of said evaporator for forming separated passageways for the refrigerant between the shells of said evaporator, said passageways opening into common chambers at the top and bottom of said evaporator and inlet and outlet means for allowing the refrigerant to pass through said chambers.

8. An evaporator for refrigerators comprising a sheet of laminated metal welded together to form a shell, crimped portions extending toward the inside of said shell at regulated intervals forming shelf supports, a second shell of laminated metal fitted around said inner shell, said shells having a ply of metal of high heat transfer on the inside defining chambers at the top and bottom thereof for a refrigerant and a ply of corrosion resistant metal united thereto defining the outside surfaces of the evaporator, and corrugations in the outer shell forming between the shells individual passageways between said top and bottom chambers.

9. An evaporator unit comprising a pair of spaced interfitting shells having inside surfaces of mild steel possessing a high coefficient of heat transfer and outside surfaces integrally united thereto possessing high resistance to corrosion, each of said shells being formed from a laminated metal sheet having the adjoining edges thereof bevelled toward the corrosion resistant surface and overlapping with the bevelled mild steel surface of one edge abutting and welded to the corrosion resistant surface of the other edge so that the mild steel cannot be exposed to the outside atmosphere, said shells also being joined at their ends for defining a refrigerant chamber therebetween with the mild steel defining the walls of said chamber.

STEPHEN L. INGERSOLL.