

May 9, 1939.

D. P. HEATH

2,157,127

EVAPORATOR

Filed Jan. 23, 1931

3 Sheets-Sheet 1

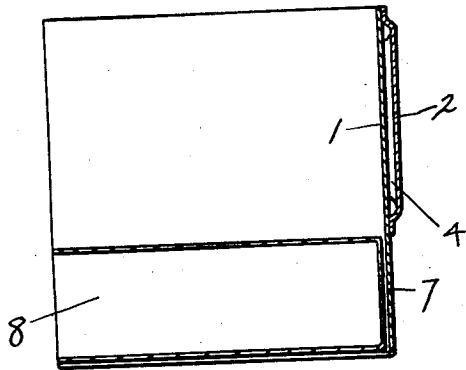


FIG. 1

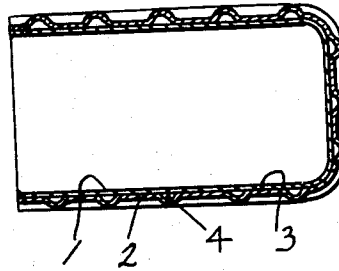


FIG. 2

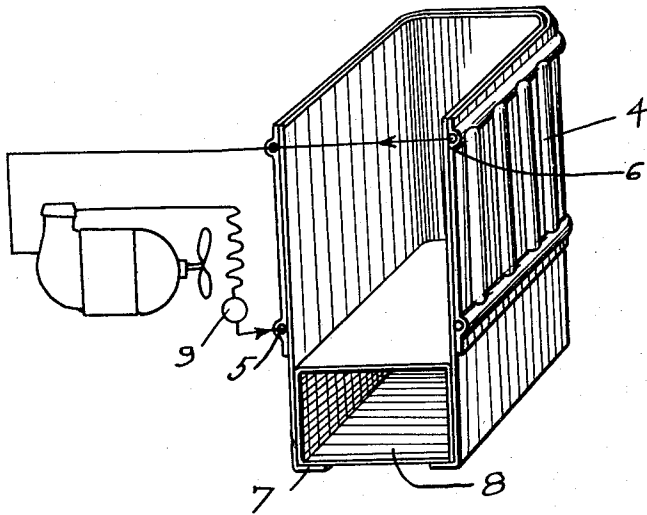


FIG. 3

WITNESS:

B.S. White

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3 Sheets-Sheet 2

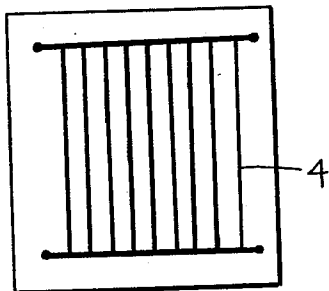


FIG. 4

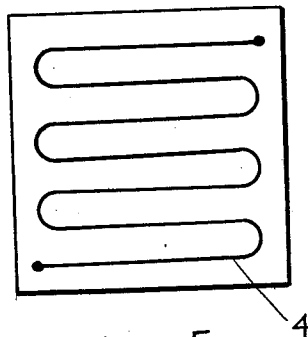


FIG. 5

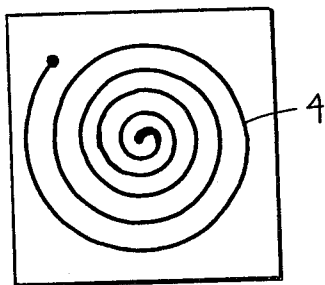


FIG. 6

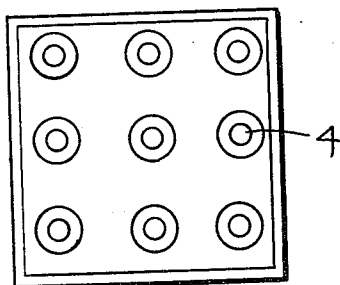


FIG. 7

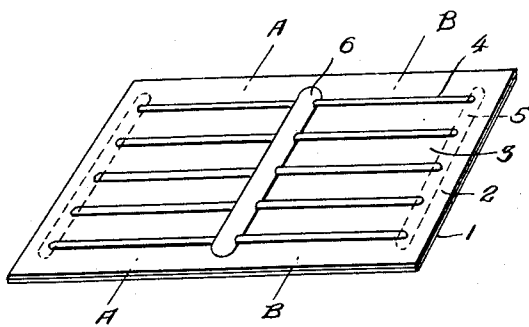


FIG. 15

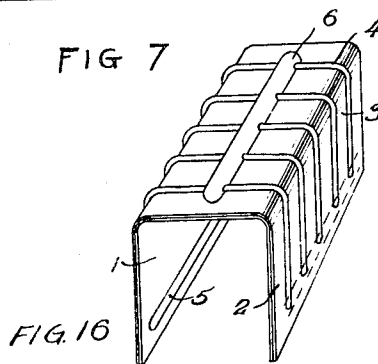


FIG. 16

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3 Sheets-Sheet 3

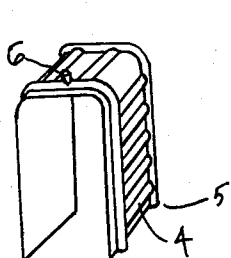


FIG. 8

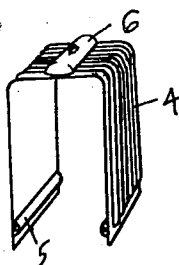


FIG. 11

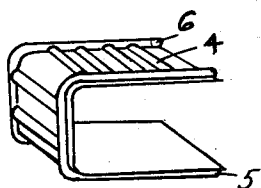


FIG. 9

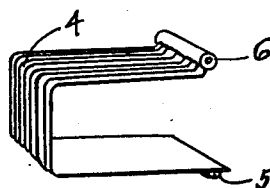


FIG. 12

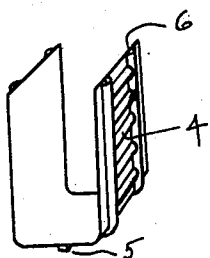


FIG. 10

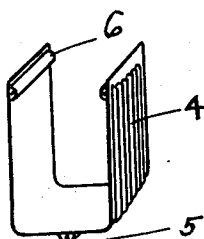


FIG. 13

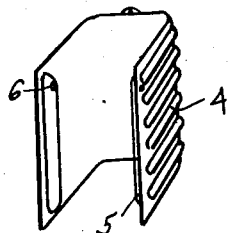


FIG. 14

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UNITED STATES PATENT OFFICE

2,157,127

EVAPORATOR

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idaire Corporation, Dayton, Ohio, a corpora-
tion of Delaware

Application January 23, 1931, Serial No. 510,688

14 Claims. (Cl. 62—126)

My invention relates to improvements in evap-
orators for artificial refrigerating machinery,
which usually employ a copper tube coil in which
to expand the refrigerant.

An object of this invention is to provide an
evaporator of sheet material for an artificial re-
frigerating machine that may be produced at a
low cost, in a compact form, and that may be
operated efficiently to cool domestic or commer-
cial refrigerators.

A further object is to provide a method of man-
ufacturing an evaporator of sheet material by
first indenting at least one of the sheets, then
fixing together walls to form a chamber, and
then forming the assembled wall structure to a
desired shape.

Another object of importance is to provide a
heat transferring compartment not touched by
refrigerant but in contact with the expansion
chamber containing the refrigerant.

I attain these objects by the devices illustrated
in the accompanying drawings, in which—

Figure 1 is a vertical side elevation in section
of one type of the evaporator; Fig. 2 is a plan view
of Figure 1; Figure 3 is a perspective of evapo-
rator shown in Figure 1 and here shown attached
to a refrigerating machine; Figures 4, 5, 6 and 7
illustrate various designs of indentations for
evaporators of this type; Figures 8, 9 and 10 show
alternate positions of the evaporator illustrated
in Figure 3; Figures 11, 12, 13 and 14 show various
positions of an evaporator indented as shown in
Figure 4, and bent so that the flues connecting
the headers form U shaped passage ways; Fig. 15
shows superimposed corrugated sheet metal por-
tions secured together and adapted to be bent
or formed to provide an evaporator; and Fig. 16
discloses an evaporator produced by bending or
forming the structure shown in Fig. 15 along the
dot-dash lines A—A and B—B.

Similar numerals refer to similar parts.

The evaporator shown in Figures 1, 2, and 3
comprises either one or two sheets of metal, at
least one of which has formed in a portion of its
area indentations 4. The two walls, 1 and 2 are
fixed together at or near their peripheries and
at certain other contiguous surfaces 3 by the
welding process, the brazing process, or by other
means so that the wall area subjected to pres-
sure, which is between adjacent wall joining
means, may be sufficiently small to withstand the
maximum pressure without the breaking of any
of the joints between the walls so that the struc-
ture as a whole may provide a practical vessel or
chamber for confining fluids. The joining of

the contacting portions of the two walls by
fusion is carried between the indentations 4 and
close up to the headers 5 and 6 to provide this
maximum strength. Communicating passage-
ways 4, provided by the indentations, allow free
flow from an inlet 5 to an outlet 6 opening.

The flat assembly of the two integral sheet walls
is then formed to the shape desired by pressing,
rolling, or by other processes. When bends are so
made, difficulty has been experienced because the
pressure of the press or roll, combined with the
difference in stresses set up in the two sheets, act
to flatten out the indentations. Also the welded
or brazed joints and joints of other kinds are
strained. However, I have found that when the
dies or rolls are built to safeguard these condi-
tions strong and efficient evaporators may be
manufactured by this method at a cost much less
than that of the present type of copper tube
evaporator.

In Figures 1, 2 and 3 there is shown a
sheet walled evaporator with horizontal inlet and
outlet headers at the bottom and top, respectively.
These headers are connected by a plurality of
substantially vertical passage-ways 4.

However, the indented wall or walls may be
arranged to afford communicating passage-ways
in a great variety of ways, and the bending of
the flat assembled sheets may provide many dif-
ferent shapes of tanks, also these tanks may be
placed in a number of positions and yet will serve
as efficient evaporators to convey heat to the
expanding refrigerant within their walls. For
instance, while Figure 4 shows the design em-
ployed in making the evaporator in Figure 1, the
die might be arranged to provide serpentine pas-
sageways as shown in Figure 5, or, the Archimedes
spiral, as shown in Figure 6, or the dimpled sheet
as shown in Figure 7, or, any other inden-
tation design. Obviously any of the various in-
dented or corrugated evaporator structures dis-
closed may be formed in accordance with the
showing in Figs. 15 and 16 and the description
relative thereto.

The Figure 1 tank is formed to have the head-
ers 5 form U bends and may be arranged in the
positions shown in Figures 1, 8, 9 and 10. How-
ever, the tank formed from the die of Figure 4
may also be bent in such a way that the con-
necting passage-ways, 4, between the headers form
U bends, as in Figures 11, 12, 13 and 14. These
few examples of the practical evaporator forms
that may take shape from the wall assembly of
Figure 4, and the various designs of indentations
illustrated, indicate the advantages of this meth-

od of manufacturing evaporators. Either or both the indented half cylindrical headers, 5 and 6 may be embossed in the inner sheet 1, as shown in Figures 11, 13 and 14.

5 The sheet type of evaporator may be successfully utilized with either the "dry" or the "flooded" system of refrigeration, and although a high pressure float valve 9 is shown in Figure 3, the evaporator may be efficiently operated with an expansion valve, or other type of refrigerant flow control.

The space 3 between the passage-ways 4 acts as a fin to absorb heat and conduct it to the refrigerant, but because of the integral construction, this type of evaporator is superior to the usual finned tubular evaporator. Refrigerant boiling and oil return are improved by locating 5 at bottom. Also the device is much easier to defrost than tubular evaporators. To provide evaporators requiring a minimum refrigerant content and a maximum heat absorbing surface, I have arranged the extension of at least one of the sheets beyond the refrigerant space. This sheet 7, Figure 1, picking up heat from the food chamber air, by convection, and from contacting trays, by conduction, rapidly transfers the heat by conduction to that portion of the walls 1 contacting the heat removing refrigerant. A cold compartment 8 is thus formed contiguous to the refrigerant chamber of the evaporator, which, because of the additional heat absorbing surface it adds to the evaporator without the joints required for surfaces contacting refrigerant, may be said to provide higher suction pressures and therefore more efficient operation at only a slight additional cost. The compartment 8 is made of thin walls in rectangular shaped sleeve-like form. The walls of this compartment may be a separate structure whose walls are of a material possessing a high rate of heat transmission and are arranged in close heat transferring contact with the walls of the refrigerant vessel. This removable construction permits the use of the "cold" box exterior of the refrigerator and also its temporary attachment to the refrigerant vessel for any desired cooling or freezing period. Also it permits a standardized refrigerant expansion vessel to be used with refrigerators of varying cubic content, as the auxiliary cooling surface attached to the refrigerant expansion chamber may be proportioned to give the increase of cooling surface required to maintain uniform box temperature conditions.

55 I am aware that prior to my invention evaporators have been made with sheet metal walls. I therefore do not claim such a combination broadly; but I claim:

1. The process of making an evaporator from two sheets of metal, which consists in first stamping the sheets of metal to form embossed portions at predetermined points in each sheet, an embossed portion in one sheet consisting of a substantially half-cylindrical depression adapted to cooperate with the other sheet to form a header portion, forming laterally, extending parallel embossed portions in one sheet, said embossed portions opening at one end into said header portion and terminating near the opposite edge of said sheet, superimposing said sheets so that the header portion and flat walls extending therefrom of the one sheet register with portions of the other of said sheets, welding the sheets together around the edges and between the embossed portions for structural strength, and then bending the sheets

thus secured together to form a plurality of walls of a sharp freezing chamber.

2. The process of making an evaporator from two sheets of metal, which consists in first stamping the sheets of metal to form embossed portions at predetermined points in each sheet, an embossed portion in one sheet consisting of a substantially half-cylindrical depression adapted to cooperate with the other sheet to form a header portion, forming laterally extending parallel embossed portions in one sheet, said embossed portions opening at one end into said header portion and terminating near the opposite edge of said sheet, superimposing said sheets so that the header portion and flat walls extending therefrom of the one sheet register with portions of the other of said sheets, welding the sheets together around the edges and between the embossed portions for structural strength, and then bending the sheets thus secured together intermediate their ends on at least two or more lines to form a least three walls of a sharp freezing chamber.

3. A sheet metal evaporator comprising, vertically disposed and contiguously extending sheet metal portions, a header portion formed in at least one of said sheet metal portions, corrugations formed in at least one of said sheet metal portions communicating with said header portion, one of said sheet metal portions being secured to the other thereof along said corrugations and sealed at its peripheries to form a chamber therebetween for the expansion of refrigerant, and said sheet metal portions thus secured together being bent to provide two vertical side walls and the vertical back wall of a sharp freezing compartment for receiving a receptacle adapted to contain a substance to be congealed or frozen.

4. A sheet metal evaporator comprising, vertically disposed and contiguously extending sheet metal portions, a part of one of said sheet metal portions being extended outwardly away from the other of said portions to form a chamber therebetween, one of said sheet metal portions being corrugated to form substantially parallel passageways communicating with said chamber, contiguous parts of said sheet metal portions adjacent said chamber and said passageways being secured together to form a closed refrigerant expansion unit, and said unit being bent to provide the vertical side walls and the vertical back wall of a sharp freezing compartment for receiving a receptacle adapted to contain a substance to be congealed or frozen.

5. A sheet metal evaporator comprising, vertically disposed and contiguously extending sheet metal portions, a part of one of said sheet metal portions being extended outwardly away from the other of said portions to form a vertically disposed chamber therebetween, one of said sheet metal portions being corrugated to form a plurality of horizontally disposed substantially parallel passageways communicating with said chamber, contiguous parts of said sheet metal portions adjacent said chamber and said passageways being secured together to form a closed refrigerant expansion unit, and said unit being bent to provide the vertical side walls and the vertical back wall of a sharp freezing compartment for receiving a receptacle adapted to contain a substance to be congealed or frozen.

6. A sheet metal evaporator comprising, vertically disposed and contiguously extending sheet metal portions, a part of one of said sheet metal portions being extended outwardly away from the

other of said portions to form a vertically disposed chamber therebetween, one of said sheet metal portions being corrugated to form a vertically disposed header spaced from said chamber and a plurality of horizontally disposed substantially parallel passageways communicating with said header and said chamber, contiguous parts of said sheet metal portions adjacent said chamber, said header and said passageways being secured together to form a closed refrigerant expansion unit, and said unit being bent to provide the vertical side walls and the vertical back wall of a sharp freezing compartment for receiving a receptacle adapted to contain a substance to be congealed or frozen.

7. In a sheet metal evaporator, two vertically disposed metallic shells having a header formed therebetween, one of said shells being corrugated with a plurality of substantially parallel passageways communicating with said header, said shells being welded together along lines defining said corrugations at contiguous portions extending parallel to said corrugations, and said shells being sealed together at or near their edges to form a refrigerant expansion chamber bent to provide the vertical side walls and the vertical back wall of a sharp freezing compartment.

8. A sheet metal evaporator comprising, vertically disposed and contiguously extending sheet metal portions, one of said sheet metal portions being corrugated to form a plurality of horizontally disposed substantially parallel headers, one of said sheet metal portions being corrugated to form a plurality of vertically disposed substantially parallel passageways communicating with said headers, contiguous parts of said sheet metal portions adjacent said headers and said passageways being secured together to form a closed refrigerant expansion unit, and said unit being bent to provide the vertical side walls and the vertical back wall of a sharp freezing compartment for receiving a receptacle adapted to contain a substance to be congealed or frozen.

9. A sheet metal evaporator adapted to be installed in a food storage chamber of a refrigerator cabinet in spaced relation to the walls thereof for cooling and causing circulation of air between the evaporator and walls of the chamber comprising, vertically disposed contiguously extending sheet metal portions, said sheet metal portions having certain parts thereof spaced apart and certain other contiguous parts thereof secured together to form a refrigerant expansion passage or chamber therebetween, and said sheet metal portions thus secured together being bent to provide two substantially straight vertical side walls and a substantially straight vertical back wall of a sharp freezing compartment for receiving a receptacle adapted to contain a substance to be congealed or frozen.

10. A sheet metal evaporator adapted to be installed in a food storage chamber of a refrigerator cabinet in spaced relation to the walls thereof for cooling and causing circulation of air between the evaporator and walls of the chamber comprising, vertically disposed contiguously extending sheet metal portions, said sheet metal portions having certain parts thereof spaced apart

and certain other contiguous parts thereof secured together to form a refrigerant expansion passage or chamber therebetween, and said sheet metal portions thus secured together being bent to provide three substantially straight vertical walls of a sharp freezing compartment for receiving a receptacle adapted to contain a substance to be congealed or frozen.

11. A sheet metal evaporator adapted to be installed in a food storage chamber of a refrigerator cabinet in spaced relation to the walls thereof for cooling and causing circulation of air between the evaporator and walls of the chamber comprising, contiguously extending sheet metal portions having certain parts thereof spaced apart and certain other contiguous parts thereof secured together to form a refrigerant expansion passage or chamber therebetween, and said sheet metal portions thus secured together being arranged to provide at least three substantially straight upright walls of a sharp freezing compartment for receiving a receptacle adapted to contain a substance to be congealed or frozen.

12. A sheet metal evaporator adapted to be installed in a food storage chamber of a refrigerator cabinet in spaced relation to the walls thereof for cooling and causing circulation of air between the evaporator and walls of the chamber comprising, vertically disposed contiguously extending sheet metal portions, one of said sheet metal portions being corrugated and being secured to the other sheet metal portion at its periphery and between the corrugations to form a plurality of refrigerant expansion passages between the sheet metal portions, and said sheet metal portions thus secured together being arranged to provide at least three upright walls of a sharp freezing compartment for receiving a receptacle adapted to contain a substance to be congealed or frozen.

13. In a sheet metal evaporator, two substantially vertically disposed shells having a central header portion and spaced apart walls formed by a continuation of the material of said header walls, one of said shells having a plurality of substantially vertical corrugations parallel with said header and a plurality of horizontally disposed passages connecting said vertical corrugations with said central header, and said shells being secured together at contiguous portions between said corrugations and sealed at their peripheries to form a chamber for the expansion of refrigerant.

14. An evaporator for a refrigerating system comprising, superimposed sheet metal portions forming a double walled structure, the sheet metal portions of the double walled structure having certain parts thereof secured together and certain other parts thereof spaced apart to provide a refrigerant passage or passages therebetween, said double walled structure being arranged to form three upright sides of a sharp freezing compartment, said refrigerant passage or passages extending over portions of all of said sides of said freezing compartment, and inlet and outlet means for conveying refrigerant to and for withdrawing refrigerant from said passage or passages.

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