Oct. 29, 1946. L. A. PHILIPP 2,410,360

REFRIGERATING APPARATUS

Filed Jan. 25, 1945

Fig. 1

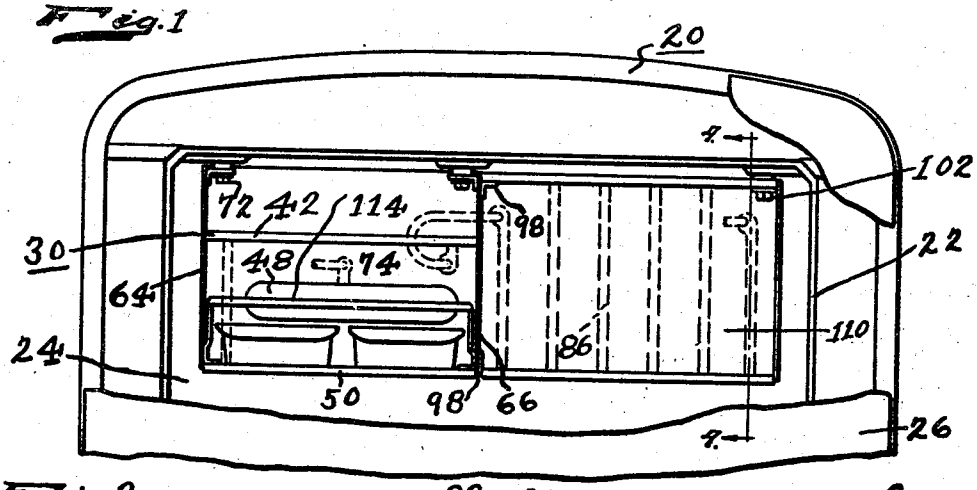


Fig. 2

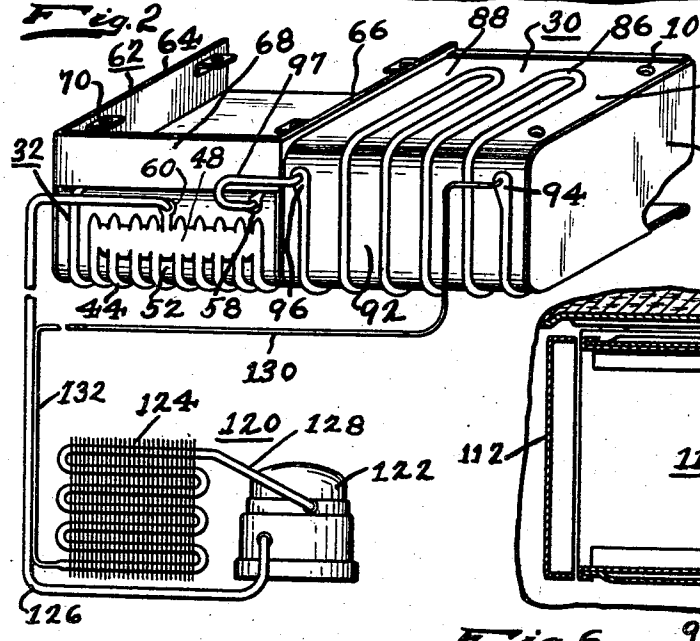


Fig. 3.

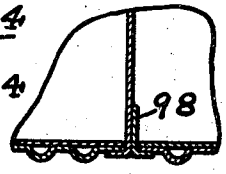


Fig. 4

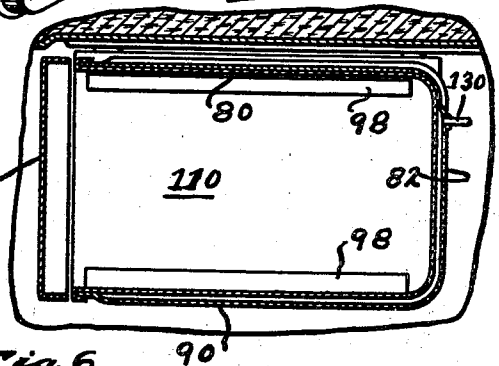
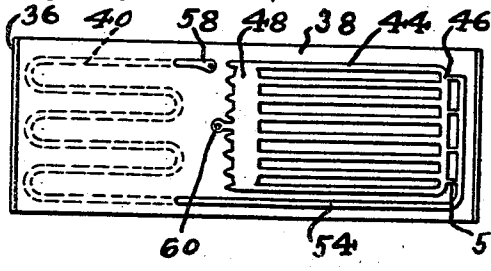


Fig. 6



Fig. 5.



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REFRIGERATING APPARATUS

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Application January 25, 1945, Serial No. 574,479

8 Claims. (Cl. 62—126)

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This invention relates to refrigerating apparatus and, more particularly, to refrigerant evaporating units used in connection with such apparatus.

One of the objects of my invention is to provide an improved refrigerant evaporating unit which is adapted to maintain different temperatures in a plurality of zones.

Another object of my invention is to provide an improved refrigerant evaporating unit which includes a refrigerant evaporating section adapted to cool a zone to below freezing temperatures and a second refrigerant evaporating section adapted to maintain a second zone at fast freezing temperatures, said sections together being adapted to maintain a third zone at above freezing temperatures.

Another object of my invention is to provide an improved refrigerant evaporating unit which comprises a non-flooded section arranged to provide a below freezing zone and a flooded section arranged in conjunction with a second non-flooded section to provide a fast freezing zone.

Another object of my invention is to provide an improved refrigerant evaporating unit which comprises a C-shaped section having a single refrigerant passage and a second C-shaped section separated from the first section by a partition and having a single refrigerant passage connected in series to a plurality of parallel refrigerant passages joined at their outlet by a header.

Further object and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawing, wherein a preferred form of the present invention is clearly shown.

In the drawing:

Fig. 1 is a fragmentary vertical front view in elevation and partly broken away of a refrigerator showing my improved rerigerant evaporating unit;

Fig. 2 is a view shown partly in elevation and partly diagrammatically of my improved refrigerant evaporating unit and a refrigerating system associated therewith;

Fig. 3 is a view in cross-section of a portion of my improved refrigerant evaporating unit;

Fig. 4 is a view taken along the lines 4—4 of Fig. 1;

Fig. 5 is a plan view of the sheet metal portions of one section of my improved evaporating unit prior to bending; and

Fig. 6 is a plan view of the sheet metal portions of another section of my evaporating unit prior to bending.

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In the drawing, numeral 20 designates, in general, a refrigerator cabinet having an inner lining member 22 which forms the walls of a food compartment 24. A door 26 is provided for affording access to the food compartment. Disposed within the food compartment is my improved refrigerant evaporating unit designated, in general, by the numeral 30.

The refrigerant evaporating unit 30 comprises two C-shaped sections 32 and 34, respectively. The section 32 consists of an inner metal sheet 36 and an outer metal sheet 38 secured together in face to face relationship and formed to provide refrigerant passages therebetween. A serpentine corrugation is formed in the inner sheet 36 to provide a single refrigerant passage 40 which lies within the top wall, designated by the numeral 42, of the section 32. A plurality of parallel corrugations are formed in the outer metal sheet 38 to provide refrigerant passages 44 which are joined at their inlets by a manifold 46 formed in the outer sheet and at their outlets by a header 48 formed in both the inner and outer sheets. The parallel passages 44 are arranged on the bottom wall and rear wall, designated 50 and 52, respectively, of the C-shaped section 32. The serpentine passage 40 is connected to the inlet manifold 46 by means of a passage 54 and a number of restricted passages 56 which are all formed in the outer sheet 38. An inlet connection 58 is formed in the outer sheet 38 and arranged in open communication with the open end of the serpentine passage 40 while an outlet connection 60 is also formed in the outer sheet and arranged in open communication with the header 48. The two sheets 36 and 38 are preferably welded around their peripheral edges and between the corrugations formed therein to provide the refrigerant passages. The C-shaped section 32 is supported within a U-shaped metal sheet 62 having side walls 64 and 66 and a rear wall 68. The rear wall 68 is partially cut away in order to expose the rear wall 52 of section 32 to circulating air within the food compartment. Brackets 70 are attached to the top of the U-shaped sheet 62 for fastening same to the top wall of the inner lining member 22 with the aid of bolts 72. The walls of the U-shaped member 62 extend above the section 32 and enclose in conjunction with the rear wall 52 and bottom wall 50 of section 32 and the top wall of the inner liner 22 a fast freezing zone 74. The C-shaped section 34 consists of an inner and outer metal sheet designated by numerals 80 and 82, respectively, which are secured together in face to face relationship and formed to provide

refrigerant passages. A serpentine corrugation is formed in the outer sheet 82 to provide a refrigerant passage 86 which is arranged to extend substantially over the entire surface of the top, bottom and rear walls, designated by numerals 88, 90 and 92, respectively, of the section 34. An inlet connection 94 and an outlet connection 96 are formed in the outer sheet 82 at the extremities of the serpentine passage 86. A conduit 97 connects the outlet 96 of the serpentine passage 86 to the inlet 58 of the serpentine passage 40 of section 32. The section 34 is attached to the side wall 66 of the U-shaped sheet 62 by means of elongated L-shaped members 98. Holes 100 are provided in the top wall of section 34 to enable it to be suspended from the inner liner 22 by means of bolts 102. A sheet metal wall 104 is attached to the open side of section 34 to provide in conjunction with the walls of section 34 and the wall 66 a below freezing zone 110. Preferably, a door 112 is provided at the front of the evaporating unit for preventing air from the food compartment 24 from circulating into the interior of the zones 74 and 110. An inverted U-shaped shelf 114 is disposed intermediate the top and bottom walls of section 32 to provide a support for receptacles. This shelf is supported on the bottom wall of the section 32 and is preferably removable therefrom, as shown in my Patent No. 2,325,705 issued August 3, 1943.

Liquid refrigerant is supplied to the refrigerant evaporating unit 30 by means of a condensing unit 120 disposed in a machine compartment (not shown) provided in the cabinet 20. The condensing unit comprises a sealed motor compressor unit 122 and a condenser 124. Evaporated refrigerant is returned from the outlet 60 of the header 48 through a conduit 126 to the compressor 122. It is there compressed and delivered to the condenser 124 through a conduit 128. The condenser liquefies the compressed refrigerant and then delivers it to a small diameter tube 130 which conveys the liquefied refrigerant to the inlet 94 of the serpentine passage 86. This small diameter tube 130 serves to meter the flow of liquid refrigerant in a manner well understood in the art. Preferably, the small diameter tube 130 and the returned conduit 126 are arranged in heat exchange relation, as indicated at 132. The liquid refrigerant entering the serpentine passage 86 is circulated therethrough to the interconnecting conduit 97, some evaporation of the liquid refrigerant taking place in the serpentine passage. The mixture of evaporated and unevaporated refrigerant is then conducted through the serpentine passage 40 in the top wall 42 of section 32. It is then conveyed from this serpentine passage 40 through the conduit 54 and restricted passages 56 to the distributing manifold 46 of the parallel passages 44. These restricted passages 48 aid in promoting uniform circulation of refrigerant through the parallel passages 44. These parallel passages 44 are maintained in a flooded condition during normal operations of the system. Evaporated refrigerant is withdrawn from the header 48 connecting these parallel passages back to the compressor through the conduit 126 to repeat the cycle just described.

The system is preferably intermittently operated under the control of a thermostat (not shown) so as to maintain the C-shaped section 32 at a sufficiently low temperature during operation of the condensing unit to provide fast freezing temperatures within the zone 74. Then because of the improved construction of the evaporating unit 30, fast freezing temperatures will be maintained in zone 74 during the on-cycle and off-cycle periods of the condensing unit, below freezing but higher temperatures will be maintained in zone 110 by section 34 and above freezing temperatures will be maintained in the food compartment 24 by sections 32 and 34 together. Fast freezing temperatures are maintained by section 32 during both off and on cycles because the flooded portions contain enough liquid refrigerant at the expiration of the on-cycle to maintain the heat absorbing effectiveness of the section throughout the off-cycle. Section 34 is maintained at a below freezing temperature since it is supplied with the same low temperature refrigerant as section 32 during the on-cycle but its temperature is somewhat higher than that of section 32 since during the off-cycle any liquid refrigerant it contains passes into the flooded portion of section 32. The temperature maintained in compartment 24 is above freezing since substantially all the cooling of the circulating air is accomplished by only the refrigerated bottom and back walls of the evaporating unit, the side walls not being refrigerated. Accordingly, it will be clear from the foregoing that I have provided a refrigerant evaporating unit which is adapted to maintain different temperatures in a plurality of zones, and, more particularly, I have provided a refrigerant evaporating unit which is adapted to provide a frozen food storage zone, a fast freezing zone and an above freezing food storage zone.

Although only a preferred form of the invention has been illustrated, and that form described in detail, it will be apparent to those skilled in the art that various modifications may be made therein without departing from the spirit of the invention or from the scope of the appended claims.

I claim:

1. A refrigerant evaporating unit comprising a C-shaped section having a single refrigerant flow passage and a second C-shaped section having a plurality of parallel passages and a single refrigerant flow passage communicating at one end with said parallel passages and at the other end with said first mentioned single refrigerant flow passage.

2. A refrigerant evaporating unit comprising a non-flooded refrigerant evaporating element having parallel refrigerated walls arranged to provide a low temperature zone therebetween, a second non-flooded refrigerant evaporating element and a flooded refrigerant evaporating element arranged to provide a fast freezing zone therebetween, said first mentioned non-flooded evaporating element and said flooded evaporating element being arranged to cool circulating air in a third zone.

3. A refrigerant evaporating unit comprising a non-flooded refrigerant evaporating element having parallel refrigerated walls arranged to provide a low temperature zone therebetween, a second non-flooded refrigerant evaporating element and a flooded refrigerant evaporating element having a portion arranged in parallel with said second non-flooded evaporating element to provide a fast freezing zone therebetween, said first mentioned non-flooded evaporating element and said flooded evaporating element being arranged to cool circulating air in a third zone.

4. A refrigerant evaporating unit comprising a non-flooded refrigerant evaporating element having parallel refrigerated walls arranged to provide

a low temperature zone therebetween, a second non-flooded refrigerant evaporating element and a flooded refrigerant evaporating element having a portion arranged in parallel with said second non-flooded evaporating element to provide a fast freezing zone therebetween, said refrigerant evaporating elements being connected in refrigerant flow relationship in the order named.

5. A refrigerant evaporating unit comprising sheet material arranged to provide two compartments, a serpentine refrigerant passage associated with one of said compartments only, a second serpentine refrigerant passage associated in heat exchange relation with a wall of the other compartment only and a plurality of parallel refrigerant passages associated in heat exchange relation with the opposite wall of said other compartment, said refrigerant passages being connected in refrigerant flow relationship in sequence in the order named.

6. A refrigerant evaporating unit comprising sheet material arranged to provide two adjacent compartments, non-flooded refrigerant evaporating means associated with the walls of one of said compartments only, non-flooded refrigerant evaporating means associated in heat exchange relation with a wall of the other compartment only and flooded evaporating means associated in heat exchange relation with an opposite wall of

said other compartment, said evaporating means being connected in refrigerant flow relationship in sequence in the order named.

7. Heat absorbing means comprising three vertically extending single ply sheets of metal in spaced apart relationship, refrigerant conveying means extending between the uppermost edges of only two of said sheets, refrigerant conveying means extending between one of said two sheets and the third substantially midway between the upper and lower portions thereof, and refrigerant conveying means extending across the spaces between the lower portions of all three of said sheets.

8. Heat absorbing means comprising three vertically extending single ply sheets of metal in spaced apart relationship, refrigerant conveying means extending between the uppermost edges of only two of said sheets, refrigerant conveying means extending between one of said two sheets and the third substantially midway between the upper and lower portions thereof, vertically extending refrigerant conveying means extending between the vertical edges at one end of each of said three sheets, and refrigerant conveying means extending across the spaces between the lower portions of all three of said sheets.

LAWRENCE A. PHILIPP.