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B. C. JOHNSON

2,386,613

EVAPORATOR UNIT

Filed July 13, 1944

2 Sheets-Sheet 1

Fig-1

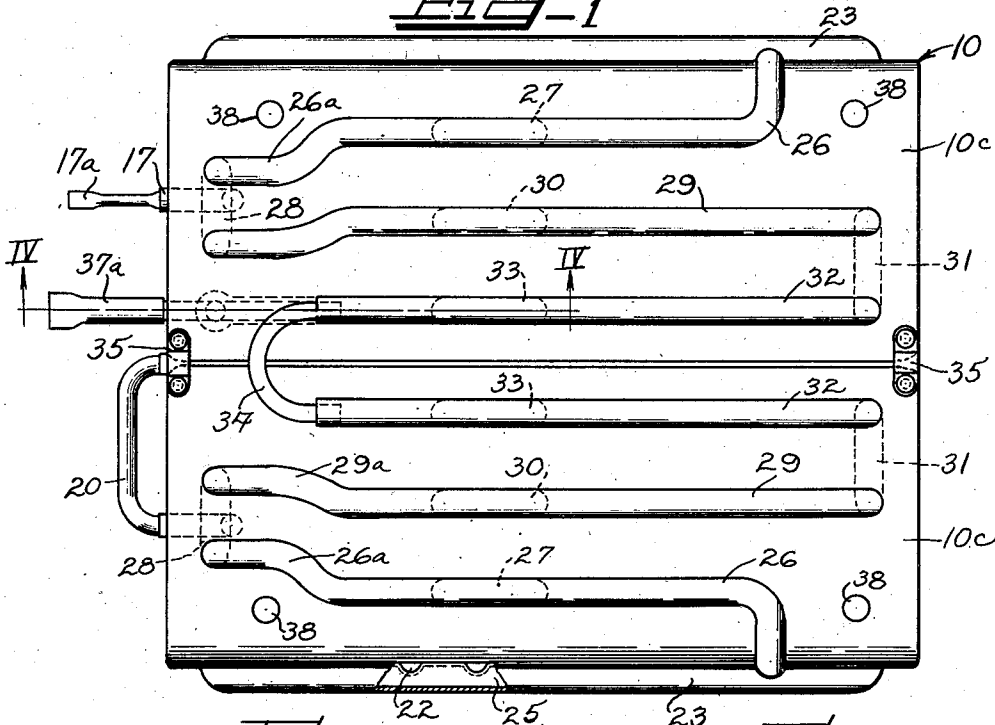


Fig-2

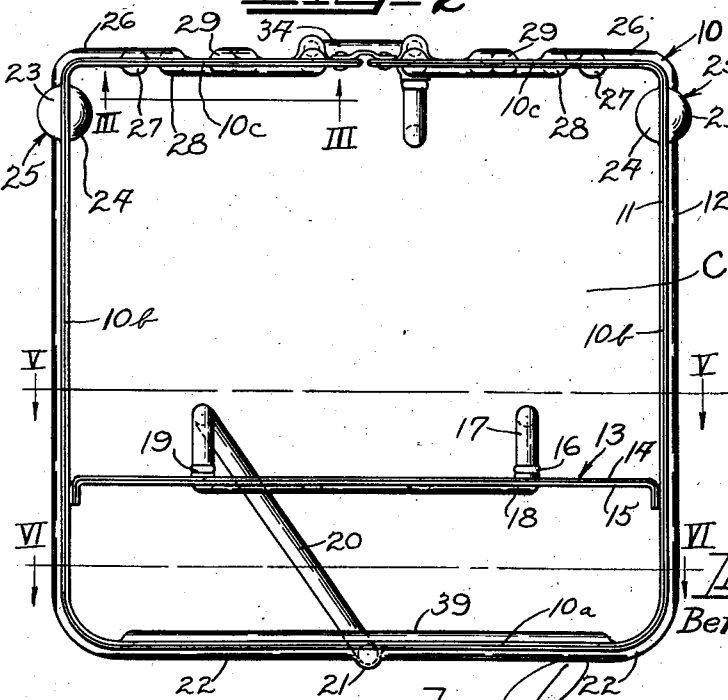
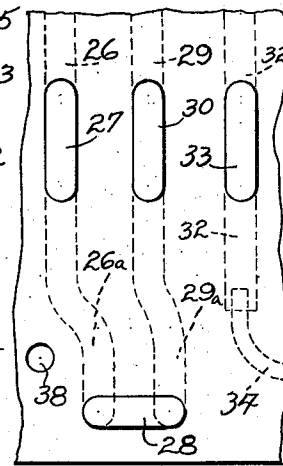


Fig-3



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EVAPORATOR UNIT

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Application July 13, 1944, Serial No. 544,748

6 Claims. (Cl. 62—126)

This invention relates to heat exchanger units having spent fluid conveying ducts equipped with pockets for acting as traps to retain unspent fluid in heat exchange relation in the unit until the fluid is spent.

More particularly the invention relates to an evaporator unit wherein refrigerant is first passed through a shelf of the unit and is then circulated to a manifold at the bottom of the unit which manifold distributes the refrigerant to a plurality of passageways extending along the bottom and up the sides of the unit to header chambers and wherein these header chambers discharge spent gaseous refrigerant through serpentine ducts extending over the top of the unit and having localized depending pockets along the lengths thereof to trap drops of liquid refrigerant from the spent gaseous refrigerant so that the refrigerant will be completely gasified and its heat absorption capacity fully spent before it is removed from the unit.

This application is a continuation-in-part of my copending application entitled "Evaporator unit" U. S. Serial 533,546, filed May 1, 1944.

In my copending application Serial No. 533,546 there is described and claimed an evaporator unit which has a top wall formed from inturned flanges on the sidewalls. Spent refrigerant ducts are embossed in these inturned flanges for conveying exhausted refrigerant from the tops of the headers in the sidewalls of the unit.

According to the present invention the spent refrigerant ducts leading from the headers in the sidewalls of an evaporator unit over the top of the unit are now equipped with depending localized pockets to act as traps for any liquid refrigerant that might be entrained in the gaseous refrigerant leaving the headers. These pockets will retain the liquid in full heat exchange relationship with the sharp freezing chamber provided by the evaporator unit until the liquid has been completely gasified whereupon the gases will commingle with the spent gases flowing through the ducts and be discharged with these gases.

It is then an object of the present invention to provide a sheet metal heat exchanger having a top wall equipped with spent refrigerant ducts containing localized pockets along the lengths thereof to trap liquids flowing through the ducts and retain these liquids until they are gasified.

Another object of the invention is to provide a sheet metal heat exchanger having a header chamber and a spent refrigerant duct leading

therefrom equipped with a trap for liquid refrigerants.

A further object of the invention is to provide an evaporator unit with a trap for liquid refrigerant about to leave the unit so that the liquid will be completely gasified before it is discharged from the unit.

A still further object of the invention is to provide an evaporator unit with serpentine spent refrigerant ducts leading from a header of the unit and equipped with depending pockets.

Another object of the invention is to provide a sheet metal evaporator unit having a bottom wall, upstanding sidewalls, inturned flanges on the sidewalls providing a top, header chambers embossed in the sidewalls, refrigerant ducts embossed in the side and bottom walls discharging into the header chambers, spent refrigerant ducts embossed in the inturned flanges for removing refrigerant from the header chambers, a plurality of depending localized pockets embossed in the inturned flanges in communication with the spent refrigerant ducts to receive liquid therefrom, and a refrigerated shelf supported on the sidewalls and supplying refrigerant to the refrigerant ducts.

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 preferred example only illustrate one embodiment of the invention.

On the drawings:

Figure 1 is a top plan view of an evaporator unit according to this invention illustrating, in dotted lines, pockets in the spent refrigerant ducts.

Figure 2 is a front end elevational view of the unit of Figure 1.

Figure 3 is a fragmentary plan view of a portion of the top wall of the unit of Figures 1 and 2 taken along the line III—III of Figure 2 and illustrating the pockets in several of the spent refrigerant ducts.

Figure 4 is an enlarged fragmentary vertical cross-sectional view, with parts in elevation, taken along the line IV—IV of Figure 1.

Figure 5 is a horizontal cross-sectional view, with parts in elevation, taken along the line V—V of Figure 2.

Figure 6 is a fragmentary horizontal cross-sectional view, with parts in elevation, taken along the line VI—VI of Figure 2.

As shown on the drawings:

The reference numeral 10 designates generally

the sheet metal evaporator unit of this invention. The unit 10 is composed of embossed, brazed or welded together metal sheets or plates including an inner sheet 11 and an outer sheet 12. The sheets 11 and 12 after being secured together are bent so as to provide a bottom 10a, spaced opposed vertical sidewalls 10b, 10b, and inturned top flanges 10c, 10c cooperating to enclose a sharp freezing chamber C as best shown in Figure 2.

A shelf 13 is secured to the sidewalls 10b, 10b of the unit 10 in spaced relation above the bottom 10a thereof. This shelf 13 is composed of embossed secured together metal sheets including a top sheet 14 and a bottom sheet 15.

The top sheet 14 of the shelf 13 has an embossed nipple 16 thereon near the rear end of the unit as best shown in Figures 2 and 5. The bottom sheet 15 of the shelf has a serpentine embossment 18 thereon leading from the nipple 16 to a second nipple 19 also formed on the top sheet 14. The nipples 16 and 19 are in transverse alignment near the rear end of the unit and a tube 20 is secured to the nipple 19.

The tube 20 discharges into a manifold duct provided by an embossment 21 on the sheet 12 along the central portion of the bottom 10a of the unit. As shown in Figures 2 and 6 the tube 20 extends into the duct provided by the embossment 21.

The outer sheet 12 of the unit 10 has embossments 22 therein which define refrigerant circulating ducts extending transversely outward from the manifold duct provided by the embossment 21. These embossments 22 extend along the bottom 10a of the unit and up along the sidewalls 10b of the unit in spaced parallel relation to end in transverse enlarged embossments 23, 23 formed in the sidewalls 10b, 10b near the top thereof. These embossments 23 are semi-cylindrical and are aligned with similar semi-cylindrical embossments 24, 24 on the inner sheet 11. The embossments 23 and 24 cooperate to provide header chambers 25, 25 for the unit.

Embossments 26 are formed on the outer sheet 12 and extend upwardly from near the front ends of the embossments 23 over the tops of the flanges 10c, 10c.

The embossments 26, 26, as best shown in Figure 1 extend rearwardly along the top of the unit 10 into spaced relation from the rear of the unit.

The inner sheet 11 of the unit has embossments 27, 27 thereon directly under the embossments 26 and about midway along the lengths of these embossments. The embossments 27 define pockets in the ducts provided by the embossments 26.

The front ends of the embossments 26 mate with embossments 28, 28 on the inner sheet 11 for defining passages and additional traps which connect the ducts of the embossments 26 with the ducts provided by additional embossments 29, 29 on the outer sheet 12. The embossments 29 are in spaced parallel relation inwardly from the embossments 26 and extend from the rear to the front of the unit about midway between the inner and outer ends of the flanges 10c. Localized embossments 30 in the inner sheet 11 provide pockets for the ducts created by the embossments 29.

The front ends of the embossments 29 are aligned with transverse embossments 31 on the inner sheet 11 near the front end of the unit. These embossments 31 provide connecting ducts and traps to ducts provided by additional embossments 32 formed in the outer sheet 12 near the inner edges of the flanges 10c, 10c. Emboss-

ments 33 are formed in the inner sheet 11 under the embossments 32 to define traps or pockets for the ducts provided by the embossments 32.

The rear ends of the embossments 32 terminate in spaced relation from the rear end of the unit 10 and receive therein the ends of a tube 34. The tube 34 connects the ducts provided by the embossments.

The embossments 26 and 29 have offset rear end portions 26a and 29a, respectively. These offset portions extend rearwardly beyond the rear ends of the embossments 32 and serve to center the connecting embossments 28 about midway between the inner and outer ends of the flanges 10c.

Brackets 35, 35 are riveted to the inner ends of the flanges 10b, 10b at the front and rear ends of the unit to hold these flanges in alignment and to provide a rigid top wall for the unit 10.

As shown in Figure 4, the rear ends of the embossments 32 have raised portions such as 32a to provide a larger opening for receiving the end of the connecting tube 34 so that the tube can have ample capacity. The raised portion 32a of one of the ducts 32 is directly above an embossment 36 on the inner sheet 11. This embossment 36 extends rearwardly and has a nipple defining portion 36a receiving the end of an exhaust tube 37.

Refrigerant is supplied to the unit through the inlet tube 17 and from this tube the refrigerant flows through the serpentine duct provided by the embossment 18 in the shelf 13. From the discharge end of the serpentine duct the refrigerant flows through the tube 20 into the manifold distributing duct provided by the embossment 21. From the manifold distributing duct the refrigerant flows along the bottom and sides of the unit through refrigerant distributing ducts provided by the spaced parallel embossments 22. The refrigerant is discharged from these refrigerant distributing ducts into the header chambers 25 where it is allowed to boil and gaseous or spent refrigerant is discharged from the tops ends of the header chambers 25 near the front end of the unit into the spent refrigerant ducts provided by the embossments 26.

Liquid refrigerant entrained in the spent refrigerant flowing through the ducts of embossments 26 is trapped in the traps provided by the embossments 27. The refrigerant next flows through the connecting ducts defined by the embossments 28 into other spent refrigerant ducts provided by the embossments 29 and these embossments 29 have pockets provided by embossments 30 for trapping remaining liquid in the spent refrigerant. Connecting ducts provided by the embossments 31 discharge into the innermost spent refrigerant ducts formed by the embossments 32. Pockets provided by embossments 33 serve to trap additional remaining liquid refrigerant.

The connecting ducts provided by the embossments 28 and 31 may also trap off some entrained liquid but the gaseous refrigerant may sweep the liquid through these ducts since the cross sectional area of the connecting ducts is about the same as the cross sectional area of the conveying ducts provided by embossments 26, 29 and 32.

The tube 34 connects one of the innermost ducts with the other innermost duct so that all of the spent refrigerant is discharged into the pocket provided by the embossment 36. This pocket of the embossment 36 drains to the spent refrigerant outlet tube 37.

From the above description it will be seen that the refrigerant is first circulated through a shelf and then through the bottom and sidewalls of the unit. Spent refrigerant which boils off from the header chambers of the unit is then led through serpentine paths provided in the top of the unit. These serpentine paths have a number of traps along the lengths thereof so that liquid entrapped with the gaseous refrigerant will be retained in heat exchange relationship with the sharp freezing chamber C until all of its refrigerating capacity has been exhausted and it turns into a gas for commingling with the gas being discharged.

The unit 10 can be readily suspended in a refrigerator cabinet from the top thereof and for this purpose the flanges 10c, 10c are provided with holes 38 at the four corners of the unit to receive suspension bolts or the like structure (not shown).

The refrigerant inlet tube 17 is closed with a cap 17a. Likewise the exhaust tube 37 is closed with a cap 37a. These caps 17a and 37a are used in shipping for sealing the interior of the unit.

The inner sheet 11 along the bottom wall 10a of the unit has a raised embossment 39 extending transversely across the rear end of the unit as shown in Figures 2 and 6. This embossment 39 serves as a tray stop for ice trays mounted on the bottom of the unit.

As shown in Figures 2 and 5 the nipples 16 and 19 extend upwardly from the shelf 13 near the rear end of the unit and the inlet tube 17 as well as the connecting tube 20 have upstanding vertical legs secured in these nipples. The nipples and upstanding legs of the tube also act as tray stops for ice trays mounted on the shelf 13.

From the above description it will be understood that the invention now provides a sheet metal heat exchanger or evaporator unit which utilizes all of the capacity of a fluid flowing there-through by retaining the fluid until it is completely spent. In evaporator units employing volatile liquid refrigerants, the refrigerant is of necessity retained in the unit in heat exchange relationship with the sharp freezing space defined by the unit until it is completely gasified. Serpentine spent refrigerant ducts are equipped with traps to receive any droplets of liquid refrigerant entrained in the spent gases and to retain these droplets until they are completely gasified.

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. An evaporator unit comprising contiguous secured-together metal sheets bent to form the bottom, side walls and top of a sharp freezing chamber, embossments in said sheets forming header chambers in each side wall of the unit together with refrigerant circulating ducts around the bottom and side walls of the unit discharging at their upper ends into the header chambers and an inlet duct communicating with the bottom portions of the circulating ducts to supply refrigerant thereto, said outer sheet having embossments therein extending from the tops of the header chamber defining embossments over the

top of the unit to define spent refrigerant ducts, and said inner sheets having localized embossments communicating with spaced portions of the spent refrigerant ducts to trap liquid in the refrigerant flowing therethrough.

2. A sheet metal evaporator unit having opposed side walls with header chambers therein, inturned flanges on the upper ends of the side walls providing a top for the unit, embossments on said flanges providing serpentine spent refrigerant ducts communicating with the tops of the headers, a spent refrigerating tube communicating with said ducts, and localized pockets at spaced intervals along the lengths of the ducts for trapping liquid refrigerant entrained with the spent refrigerant.

3. In a sheet metal evaporator unit having a bottom, sides, inturned flanges on the sides cooperating to form a top, and spent refrigerant ducts embossed in said flanges, the improvement of localized embossments in said flanges communicating with said spent refrigerant ducts at spaced intervals along the lengths thereof to trap liquid entrained with the spent refrigerant.

4. An evaporator unit comprising secured together contiguous metal sheets embossed to provide refrigerant circulating ducts, header chambers, and spent refrigerant removal ducts, said sheets being bent to form the bottom, sides and top of a sharp freezing chamber with a header chamber in each side and with refrigerant circulating ducts extending around the bottom and sides to discharge into the header chambers, said sheets being further embossed to define spent refrigerant ducts extending from the tops of the header chambers over the top of the unit, and additional embossments in the top of the unit in one of said sheets forming localized pockets to trap liquid refrigerant in said spent refrigerant ducts.

5. A sheet metal evaporator unit comprising inner and outer secured-together contiguous metal sheets bent to form the bottom, side walls and top of a sharp freezing chamber, said outer sheets having embossments therein defining a header chamber at the upper end of each side wall together with U-shaped refrigerant circulating ducts extending around the bottom and side walls and terminating at their upper ends in said header chamber, said outer sheet being further embossed to define an inlet manifold communicating with the bottoms of the refrigerant circulating ducts, said outer sheet being still further embossed to provide serpentine ducts in the top of the unit, and said inner sheets being embossed along the top of the unit to define localized pockets for said spent refrigerant circulating ducts to trap liquid material entrained in the spent refrigerant.

6. A sheet metal evaporator unit comprising contiguous secured-together metal sheets bent to form a bottom wall, upstanding side walls and inturned flanges extending from the upper ends of the side walls, said inturned flanges being in closely spaced aligned relationship to form a top for the unit, embossments in said flanges defining spent refrigerant circulating chambers, and additional embossments in said flanges defining depended localized wells for said ducts to trap liquid entrained with the spent refrigerant.

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