Jan. 12, 1937. R. H. MONEY ET AL 2,067,643

FLAT TYPE EVAPORATOR STRUCTURE

Filed Aug. 23, 1934 2 Sheets-Sheet 1

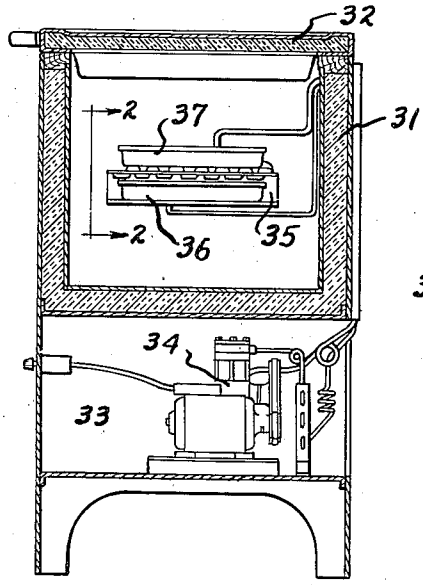


FIG. 1.

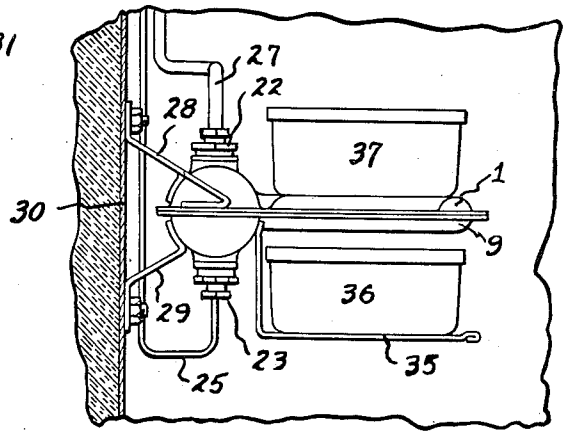


FIG. 2.

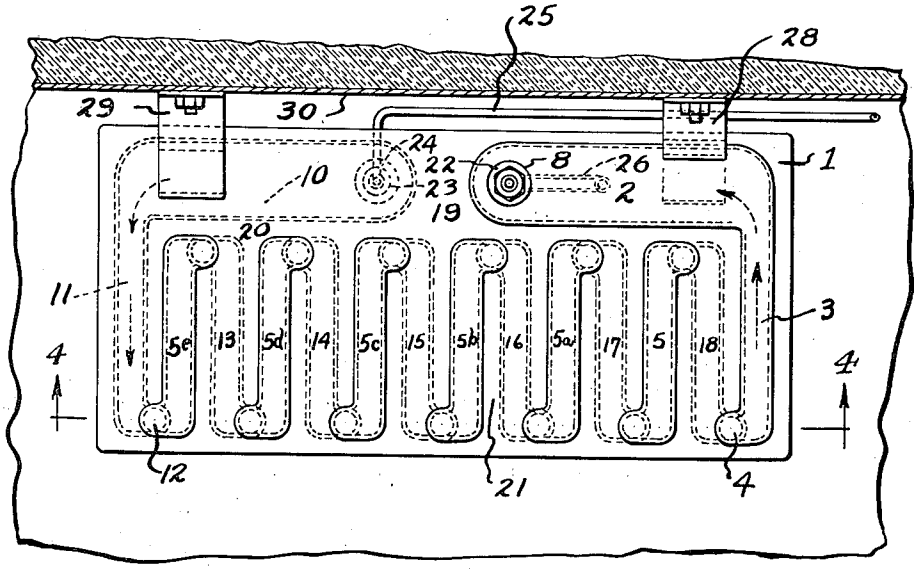


FIG. 3.

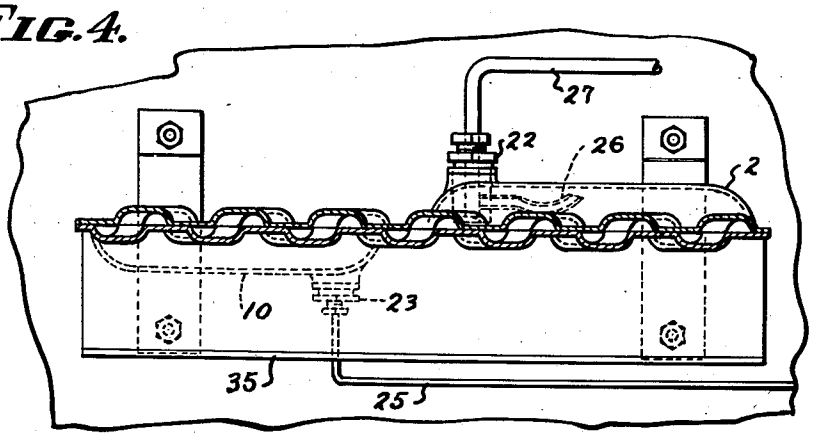
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FIG. 4.



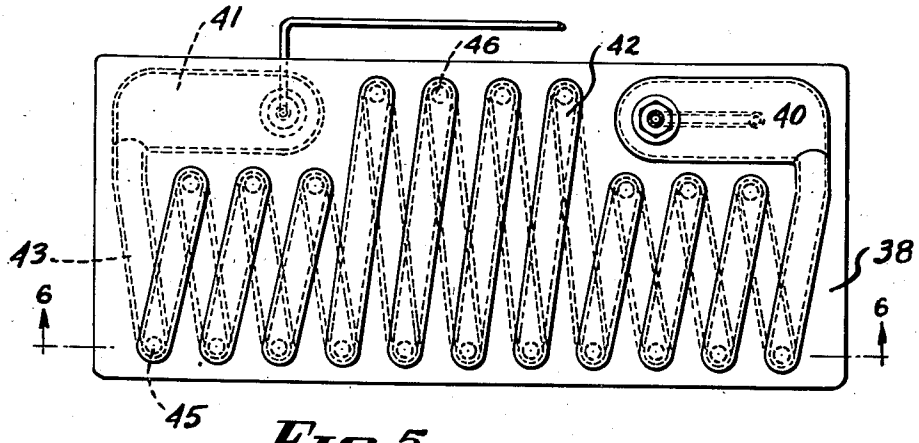


FIG. 5.

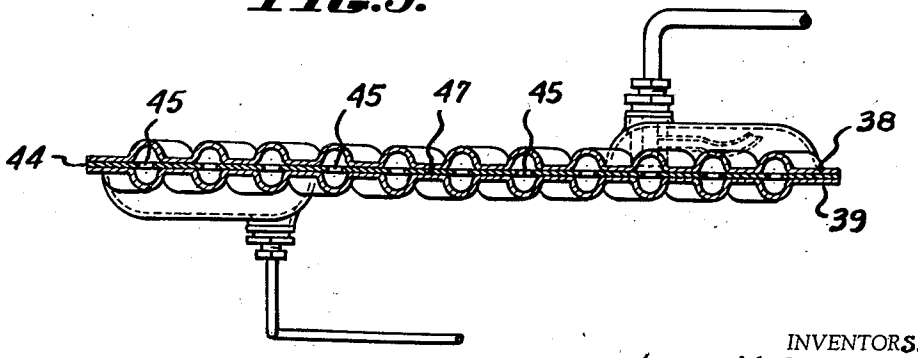


FIG. 6.

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2,067,643

FLAT TYPE EVAPORATOR STRUCTURE

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Application August 23, 1934, Serial No. 741,132

7 Claims. (Cl. 62—126)

Our invention relates to the manufacture of evaporators or expansion devices, such as are used in refrigerators or in other cooling devices. In particular our invention relates to the provision of evaporators which, in their position of use, are relatively broad and flat.

It is an object of our invention to construct evaporators of this type more cheaply than could otherwise be done, and especially to construct them of relatively simple and flat stampings of sheet metal, as will hereinafter be more fully described. It is an object of our invention to make evaporators from two main plates of metal which are stampings, with or without an intervening plate which acts as a diaphragm, and which need not be a stamping. It is an object of our invention to provide a type of evaporator having a continuous passageway from an entrance portion to an exit portion, which passageway insures the even circulation of refrigerant therethrough, and provides against the formation of so-called dead spots. It is an object of our invention to provide evaporators so constructed, in which a plurality of different kinds of stampings need not be used, but in which stampings which are reversible and are of a single type may be assembled in opposed relationship to form the completed evaporator.

These and other objects of our invention which will be set forth hereinafter or will be apparent to one skilled in the art upon reading these specifications, we accomplish by that certain construction and arrangement of parts of which we shall now describe certain preferred embodiments, it being understood that our invention is not limited thereto, but that modifications may be made therein without departing from the spirit thereof.

Reference is now made to the drawings, wherein

Figure 1 is a sectional elevation of an exemplary type of small refrigerator in which our evaporator finds utility.

Fig. 2 is an end elevational view of one type of our evaporator.

Fig. 3 is a plan view of the same type.

Fig. 4 is a sectional view of the evaporator taken along the lines 4, 4 in Fig. 3.

Fig. 5 is a plan view of another type of evaporator.

Fig. 6 is a sectional view thereof taken along the lines 6, 6 of Fig. 5.

Briefly, in the practice of our invention we provide a stamped metal plate having an embossed protuberance thereon adapted to act as a header, and a passageway communicating with said header and likewise embossed in said plate. The plate also bears throughout its length and breadth a plurality of other embossed passageways not directly communicating with the first. In forming up our evaporator two of such plates are placed together in opposed relationship, whereupon the header member of one of the plates forms an entrance way for the refrigerant, and the header member of the other of the plates forms a place for the withdrawal of gaseous refrigerant. When so assembled the various rudimentary passageways in the plates connect so as to form one continuous passageway from the entrance header to the exit header. Depending upon the shape of the rudimentary passageways referred to we use or omit a diaphragm member between the two plates.

Referring now to Figure 3, we have shown an evaporator comprising an upper plate shown in plan at 1. This plate is embossed as at 2 to form a header member, which extends along one side of the plate, but for less than its full extent. An embossed protuberance 3 forms a passageway communicating with the header 2 at one end, and at the opposite end in this type of evaporator we form a communicating embossed portion indicated at 4. At 5, 5a, and etc. we have shown embossed rudimentary passageways of generally Z-shape, having at each end oppositely directed communicating embossings indicated at 6 and 7. An orifice may be made in the header 2 as at 8. The plate 1 may be formed as a single stamping of metal.

A pair of these metal stampings are placed together in opposed relationship. This relationship is shown in Fig. 2, where 1 again indicates the upper plate, and 9 the lower plate. When the plates are so assembled it will be seen that the header 10 of the lower plate is offset from the header 2, and does not communicate directly therewith. The passageway 11 of the lower plate is closed at one side by a flat portion of the upper plate, but communicates as at 12 with the passageway 5e. Similarly, the rudimentary passageways 13 to 18, inclusive, of the lower plate form communicating passageways respectively between the members 3, 5 and 5e of the upper plate. Flat portions of the two plates make, as it were, closed tubes of the embossed passageways, so that there is between the header 10 and the header 2 in Fig. 3 a continuous tube-like passageway which can easily be traced on the drawings.

When the two plates are so assembled they may be welded together about their edges, and

afterwards tinned or otherwise treated to prevent corrosion. In order to resist internal pressure, it will be usual to spot weld the plates together where flat portions thereof are juxtaposed, as at places marked 19, 20, 21 and the like. A fitting 22 may be welded into the perforation 8 in the header 2, and another fitting 23 may be welded into the perforation 24 of the lower plate. A fitting 23 may serve as an entrance fitting for refrigerant delivered in any way desired, but preferably by means of a capillary tube 25. The fitting 22 may serve as an exit fitting for evaporated refrigerant and oil, and may be provided with an oil skimmer 26, such as that set forth in Patent No. 1,978,027, issued October 23, 1934. A tube 27 leads from the fitting 22 to the compressor of the refrigeration system.

In use the evaporator may be supported in a refrigerator cabinet by means of brackets 28 and 29, which are fastened against the wall 30 of a cabinet. In Figure 1 we have shown in section a general assembly comprising a small size refrigerator cabinet having an upper refrigerated compartment 31, and a hinged lid 32. A lower compartment 33 houses the usual motor, compressor and condenser assembly indicated broadly at 34.

In use a shelf member 35 may be provided beneath the evaporator so as to hold an ice cube tray 36 in close proximity thereto. Another ice cube tray 37 may be caused to rest upon the evaporator if desired.

We have shown in Fig. 4 a section through the evaporator thus far described, taken along the lines 4, 4 of Fig. 3. Like parts are indicated by like index numerals. It will be understood that by the particular construction of the embossed portions of the plates, there is provided a continuous tube-like passageway from the entrance header to the exit header. Other forms of embossed tube-like portions may be used, but if a diaphragm member is not to be employed, then the tube-like portions of one plate should be substantially offset from the tube-like embossed portions of the other plate, excepting where actual communication is to be made. This requirement, with plates of given size, is apt to cut down the possible volume capacity of the evaporator as such. Consequently we have shown in Figs. 5 and 6 another exemplary form of evaporator in which this requirement is not present, but in which a diaphragm member is relied upon to confine the flow of refrigerant. It will be seen that the evaporator is again formed of two main plates indicated at 38 and 39, each comprising a header indicated respectively at 40, and 41, and a series of embossed tube-like portions indicated at 42 for the upper plate, and 43 for the lower plate. It will be noticed that these tube-like portions are closer together in this evaporator than in the evaporator of Figs. 3 and 4, and that were the plates to be assembled without a diaphragm, the embossed tube-like portions would overlap for considerable portions of their length. Consequently, we have shown a diaphragm plate indicated at 44 interposed between the two embossed plates. This diaphragm plate has a series of perforations 45 where the lower tubes lead into the upper tubes, and a series of perforations 46 where the upper tubes lead into the lower tubes. The plates are assembled in the relationship most clearly seen in Fig. 6, and are welded together about their edges. They likewise may be spot welded together at intervals as shown at 47. In addition, if desired, the diaphragm plate may first be spot welded to one of the embossed plates prior to the assembly of the entire evaporator.

It will be understood that the particular form of the embossings which we have illustrated in our exemplary embodiments is not a limitation upon our invention. Other forms of tube-like embossings may be employed, and the arrangement of the headers may likewise be different. Instead of locating the headers along one side, they may be located along opposite ends or otherwise. Where a diaphragm member is used, the headers may, if desired, be located opposite each other, or may extend entirely along one side or edge. It will be understood that our evaporator is useful not only in refrigerators of ordinary type, but is useful to replace such refrigerating coils as are used, for example, in beverage or bottling coolers, in air conditioning systems and the like. For these uses the evaporators may be made of large dimensions flatwise. They likewise may be perforated between the tubing portions, and the perforated parts welded together between the perforations, if desired, for the circulation of fluid. A plurality of the evaporators may be connected together in series or in tandem. Being relatively broad and flat, they may be used horizontally, or they may also be used vertically, especially since the connection between the headers comprises in essence but a single tube. These evaporators are for this reason also not subject to the formation of dead spots.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent, is:—

1. An evaporator comprising a pair of plates, each of said plates being embossed to form a header, a tube-like portion communicating with said header, and a plurality of discontinuous and incomplete tube-like portions, said plates being assembled in opposed relationship so that said incomplete tube-like portions connect together to form a continuous tube extending from one header portion to the other.

2. An evaporator comprising a plurality of embossed metal plates, the embossings on said plates forming incomplete tube-like portions, said plates being assembled in such a way that said incomplete tube-like portions connect together to form a continuous single tube, an unembossed portion of each plate serving as a side of a tube otherwise formed by an embossing of the other plate.

3. An evaporator of broad, flat shape comprising a plurality of embossed metal sheets, embossings thereon forming tube-like portions open at one side, said plates being assembled together with a diaphragm member, said diaphragm member serving to complete said tube-like portions by closing the open side thereof, and said diaphragm member being perforated to provide an opening from one tube-like portion into another so as to form in effect a continuous tubing.

4. In an evaporator, a pair of metal plates embossed to form a header on each, and a plurality of incomplete and discontinuous tubes, said tubes having offset portions at their ends and said plates being assembled in opposed relationship so that each plate serves to complete said tube-like portions of the other plate excepting in said offset portions.

5. An evaporator of broad, flat shape and for horizontal use comprising headers, and a continuous tubing extending between said headers, said

evaporator consisting of a pair of identical embossed metal plates welded together in opposed relationship, each of said plates being embossed to form one header, said header being completed by an unembossed portion of the other plate.

6. An evaporator of broad, flat shape comprising headers, and a continuous tubing extending between said headers, said evaporator consisting of a pair of embossed metal plates welded together in opposed relationship, and an intermediate perforated diaphragm member, each of said plates being embossed to form a header and a plurality of incomplete and discontinuous tube-like portions, and said diaphragm serving to complete said tube-like portions, said perforations therein serving as connecting means between said tube-like portions.

7. An evaporator of broad, flat shape formed of opposed, identical, embossed metal plates, each embossed to provide a header and a plurality of incomplete tube-like portions, one of which is connected to the header, the embossings in said plates being so formed and disposed that when said plates are assembled and welded together in opposed relationship flat portions of each plate will complete said headers and said tubes excepting for end portions thereof which overlap, so that in the final structure one header is connected to the other header by a continuous tube-like passageway.

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