

Sept. 29, 1942.

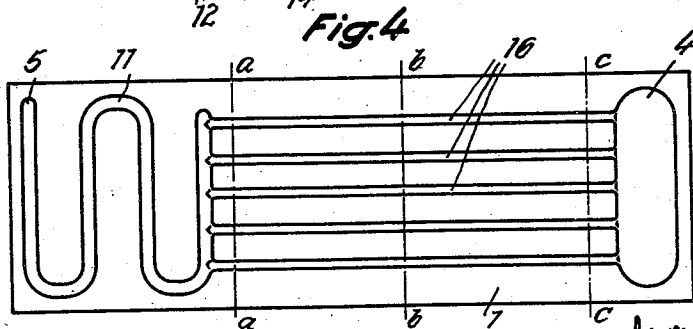
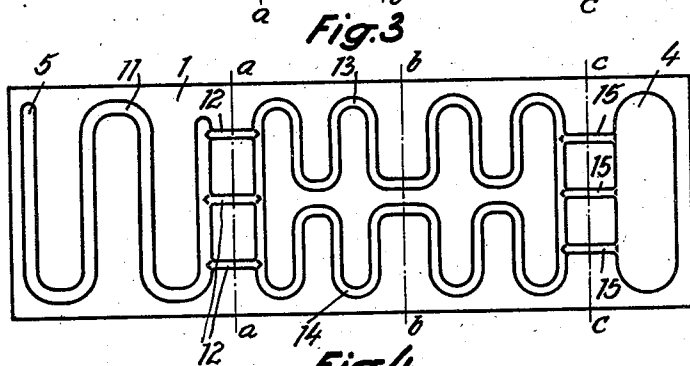
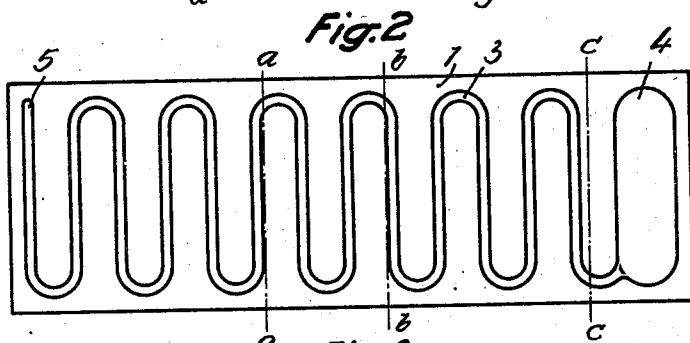
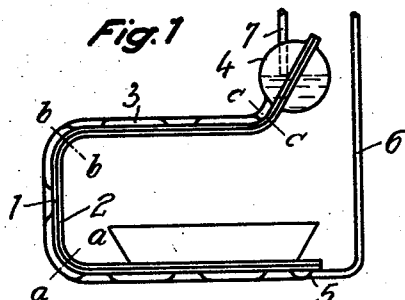
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2,297,219

EVAPORATOR FOR REFRIGERATING APPARATUS OF THE COMPRESSION TYPE

Filed Feb. 3, 1939

3 Sheets-Sheet 1



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EVAPORATOR FOR REFRIGERATING APPARATUS OF THE COMPRESSION TYPE

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3 Sheets-Sheet 2

Fig. 5

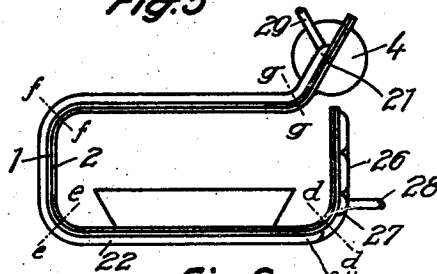


Fig. 6

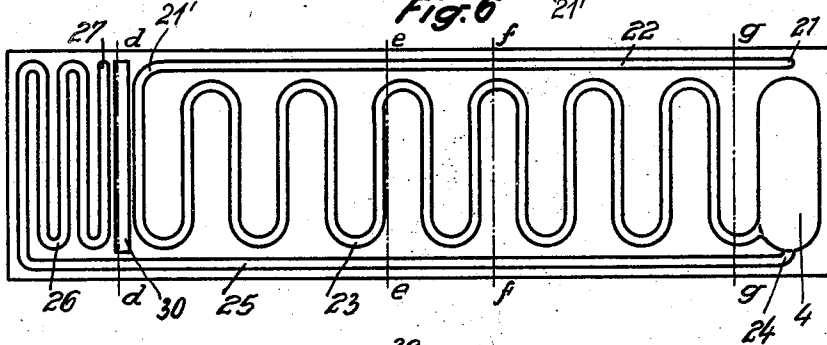


Fig. 7

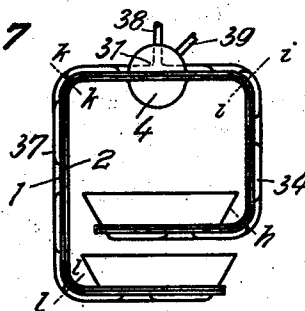
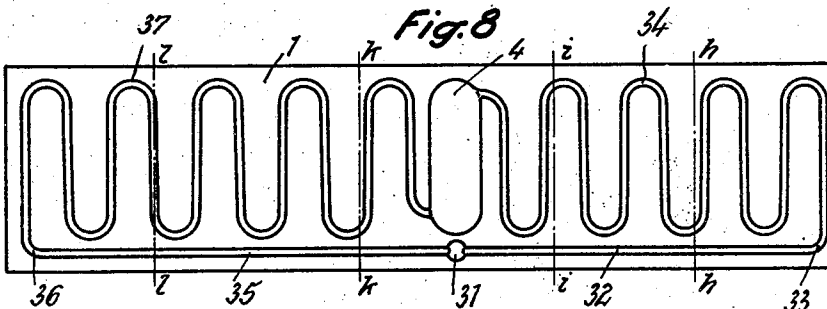


Fig. 8



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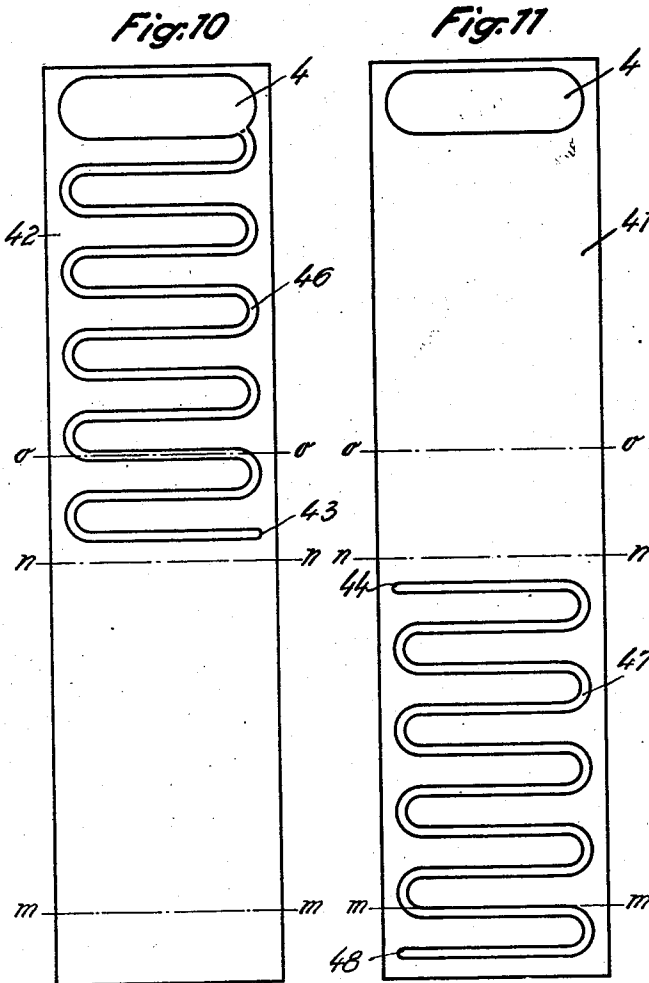
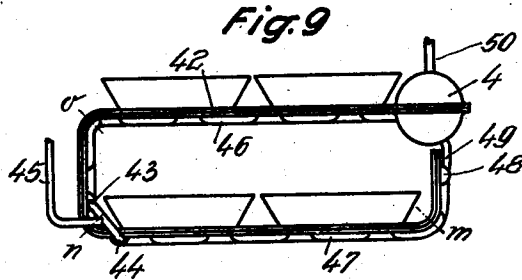
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EVAPORATOR FOR REFRIGERATING APPARATUS OF THE COMPRESSION TYPE

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3 Sheets-Sheet 3



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EVAPORATOR FOR REFRIGERATING APPARATUS OF THE COMPRESSION TYPE

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Application February 3, 1939, Serial No. 254,460
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7 Claims. (Cl. 62—126)

The present invention relates to improvements in evaporators for refrigerating apparatus of the compression type.

Evaporators for refrigerating apparatus of the compression type are frequently made of two metal sheets secured face on face together by welding and provided with indentations serving as conduits and as a collecting tank or header for the refrigerant. The welded sheets are as a rule so bent that they form a compartment for freezing purposes, for instance for the reception of ice trays. A suction conduit leading to the compressor of the refrigerator is connected to the refrigerant collecting tank or header formed by the metal sheets. An object of the present invention is to improve the operation and reliability of evaporators of the above-mentioned type without incurring difficulties or additional costs when manufacturing the evaporator structure. Other objects will become apparent from the following description.

According to the invention, the indentations and corrugations of the two welded metal sheets which form the main structure of the evaporator, are so arranged in the bent structure that the refrigerant supplied to the lower part of the evaporator is conveyed to the collecting header along a path not extending in the downward direction. This arrangement prevents the formation of vapor pockets in the refrigerant passages formed in the metal sheets. As compared with such known types of evaporators in which a single helical evaporator coil is employed, the evaporator according to the invention presents the advantage that the vaporous refrigerant developed in the evaporator can always easily rise to the collecting header unimpeded by vapor pockets which may occur in the said coil evaporators. Another known construction contains a manifold arranged at the lowest point of the evaporator, which is supplied with refrigerant and from whence it passes into a header through a number of conduits extending in parallel relation in the upward direction and forming the two side walls of the evaporator. This construction prevents the formation of vapor pockets. However, its parallel conduits are liable to clog up so that it may happen that only some of the parallel conduits are effective in producing cold. In contradistinction thereto, the evaporator structure according to the invention is so designed that the refrigerant passes from the lowest point of the evaporator to the collecting tank through only one or a few sinuous conduits so that a distribution of the refrigerant over a mul-

5 titude of parallel-arranged branches does not take place at the lowest point of the evaporator. Consequently, the refrigerant vapors developed to a relatively slight extent at the lowest point of the evaporator pass through all conduits of the evaporator, since, when using only two or a few parallel evaporator branches, the failure of one conduit reduces the effective evaporator surface to such an extent that the pressure of evaporation is considerably reduced, thus causing the non-effective evaporator branch to come again into operation. This effect does not occur in evaporators with a large number of parallel-arranged evaporator conduits, because the failure of one branch to operate does not influence the pressure of evaporation to such an extent as to re-establish the proper operation of the evaporator.

10 An evaporator according to the invention may contain a single sinuous conduit as above described as the only connection between the lowest point of the evaporator to the collecting tank. Another form of the invention is so designed that the refrigerant passes from the bottom portion of the evaporator at first through a single sinuous refrigerant conduit to a manifold and thence through two or more parallel conduits to the collecting header.

15 Another form of the invention employs two evaporator sections each having a horizontal surface for the reception of ice trays. Each of the two sections has a sinuous refrigerant conduit leading to a common header. The two surfaces serving for the reception of ice trays are preferably so arranged that they lie at different heights. The liquid refrigerant is supplied from a control valve, for instance a float valve, to the lower part of the evaporator preferably through a short conduit.

20 The vaporous refrigerant carried off from the header through a suction conduit may still contain liquid refrigerant together with the entrained lubricant. It therefore is preferable not to extend this conduit directly to the suction side of the compressor, but to interpose an additional evaporator in which the residual liquid refrigerant may evaporate. This additional evaporator is preferably designed according to the invention as a sinuous conduit formed by the above-mentioned corrugations of the sheet metal structure composing the evaporator.

25 In the accompanying drawings are shown several embodiments of the invention in diagrammatic form.

Fig. 1 represents a front view of an evaporator according to the invention, while

Figs. 2, 3 and 4 show three indented and corrugated sheet metal elements of different design which may be used for manufacturing evaporators of the type shown in Fig. 1.

Figs. 5 and 6 illustrate another evaporator construction in front view and one of the sheet metal elements used for its manufacture, respectively.

Figs. 7 and 8 show a front view of a third type of construction as well as one of its sheet metal elements, respectively.

Fig. 9 exemplifies a fourth way of embodying the invention, also by showing a front view of the complete evaporator structure, and

Figs. 10 and 11 show the two indented metal sheets used in this embodiment.

The evaporator shown in Fig. 1 is made of two metal sheets 1 and 2 secured, face on face together, by welding. In the metal sheet 1, shown developed in Fig. 2, are formed sinuous corrugations and indentations forming a conduit 3 and a collecting tank or header 4 for the refrigerant. A supply conduit 5 is connected to the lowest point 5 of the evaporator for supplying liquid refrigerant from the float valve (not shown). *a-a*, *b-b* and *c-c* denote the lines of the evaporator about which the two metal sheets are to be bent in order to form the box-like structure of Fig. 1. A conduit 7 leading to the suction side of the compressor is connected to the collecting tank 4. As will be readily apparent, the refrigerant conduit 3 forms a passage in which the vaporous refrigerant may at all times easily rise into the collecting tank 4 without permitting the formation of vapor pockets. In Fig. 1 the collecting tank 4 is, for instance, bent in the upward direction in such a manner, as indicated at *c-c*, that the liquid refrigerant entrained into the header 4 by the rising gas bubbles may completely flow back into the evaporator winding 3.

In Figs. 3 and 4, like reference numerals denote like parts as shown in Figs. 1 and 2. In Fig. 3 the refrigerant is supplied at 5 into the sinuous conduit 11 arranged in the lower horizontal portion of the evaporator. One end of this sinuous conduit 11 is designed in the form of a manifold. To the latter are connected three parallel ducts 12 which convey the refrigerant around the bending edge *a-a*, after which the refrigerant passes into the collecting tank 4 through two parallel sinuous passages 13 and 14, and ducts 15.

In the form of the invention shown in Fig. 4 a series of parallel extending conduits 16 which convey the refrigerant to the collecting tank 4 are connected to one end of the sinuous conduit 11.

Figs. 5 and 6 show a form of the invention in which an additional evaporator 25 is connected to the collecting tank 4. Here the refrigerant is supplied, from a pipe 20 ending at 21, through a straight supply duct 22 to the lowest point 21' of the sinuous evaporator conduit 23 which extends over the lower horizontal wall section of the evaporator chamber, the left-hand vertical wall section and the upper horizontal wall section of the evaporator structure to the header 4. The refrigerant leaves the collecting tank 4 at 24 and passes through the straight conduit 25 into a sinuous refrigerant conduit 26 serving as an additional evaporator. This conduit 26 forms the perpendicular right-hand wall section of the evaporator. To the end 27 of the conduit 26 is connected a conduit 28 leading to the suction side of the compressor. The bending edges of the evaporator plates are denoted by *d-d*, *e-e*, *f-f* and *g-g*. To reduce the direct heat exchange between the two sections of the structure con-

taining the additional evaporator 25 and the other evaporator parts 23, respectively, a recess 30 is provided in both metal sheets 1 and 2 of the evaporator.

The two embodiments shown in Figs. 7 to 11 are of a type in which two evaporator sections, each consisting of a sinuous refrigerant conduit, are connected to a common collecting tank 4, each of the evaporator sections having a horizontal surface serving for the reception of ice trays. In the case of the evaporator shown in Figs. 7 and 8, the refrigerant is conveyed through a conduit 38 to a manifold 31, and thence through a straight supply duct 32 to the lowest point 33 of the surface for the reception of the upper ice tray. The horizontal part of the surface is provided with a sinuous refrigerant conduit 34 which extends to the collecting tank 4 through the evaporator part shown at the right-hand side of Fig. 7. A corresponding refrigerant supply duct 35 leads to the lowest point 36 of the surface for the reception of the lower ice tray. The lower horizontal portion and the perpendicular wall portion of the sheet metal structure shown at the left-hand side of Fig. 7, are provided with a sinuous refrigerant conduit 37 which also extends to the collecting tank 4. 39 denotes the suction conduit connected to the collecting tank 4. *h-h*, *i-i*, *k-k*, *l-l* denote the bending edges of the evaporator.

The evaporator shown in Figs. 9 to 11 is formed of the two metal sheets 41 and 42. The liquid refrigerant is supplied to the evaporator through the conduit 45. The sinuous refrigerant conduit 46 formed in the metal sheet 42 begins at the junction 43. The conduit 47 formed in the plate 41 begins at the junction 44. A conduit 48 extending to the lower part of the collecting tank 4 is connected to the end 46 of the sinuous passage 47. 50 denotes the suction conduit and *m-m*, *n-n*, *o-o* denote the bending edges of the metal sheets 41 and 42.

The additional evaporator shown in Figs. 5 and 6 may also be employed in a corresponding manner in the forms of the invention shown in the other figures.

What is claimed is:

1. An evaporator structure for compression refrigerators, comprising two metal sheets sealed face to face together, one of said sheets having indentations and corrugations forming together with said second sheet a collecting header and a conduit system respectively, said sheets having two horizontal sections spaced vertically from each other so as to form two separate spaces for deep-cooling purposes, each of said horizontal sections containing an individual sinuous conduit forming part of said conduit system, separate conduits also forming part of said system and connecting said horizontal sections respectively with said collecting header, said latter conduits forming a refrigerant path nowhere extending in a downward direction, and conduit means also forming part of said system for supplying refrigerant to each of said horizontal sections.

2. In an evaporator for compression refrigerators composed of two metal sheets welded face to face together, at least one of said sheets having indentations and corrugations so as to form together with said other sheet a collecting header and a conduit system communicating with said header, said header being arranged in the central portion of said composite sheet structure whereby said structure forms two evaporator sections at either side of said header, each of said

sections having a lower horizontal portion serving as carrier for ice trays and an upper and mainly vertical portion, each of said horizontal portions containing a single sinuous conduit forming part of said conduit system, said upper portions containing conduits also forming part of said system so as to connect said horizontal sections with said header by passages nowhere extending in a downward direction, and conduit means also forming part of said system for supplying refrigerant to each of said horizontal portions.

3. In an evaporator for compression refrigerators composed of two metal sheets welded face to face together, at least one of said sheets having indentations and corrugations so as to form together with said other sheet a collecting header and a conduit system communicating with said header, said welded sheets being bent to a box-shaped structure forming a storage space for deep-cooling purposes and having a horizontal bottom section, said horizontal section containing a single sinuous conduit forming part of said conduit system and communicating with said header through other parts of said conduit system so as to form a continuous passage from the lowest section of said structure to said header nowhere extending in a downward direction, inlet means arranged near said header for supplying refrigerant, and a straight supply duct connecting said inlet means with said sinuous conduit, said duct being also formed by corrugations of said metal sheets.

4. An evaporator structure for compression refrigerators, comprising two metal sheets sealed face to face together and having indentations and corrugations forming a collecting header and a conduit system respectively, said sheets being bent so as to form horizontal and vertical wall sections of a storage space for deep-cooling purposes, said conduit system formed by said corrugations having two separate branches, one of said branches having a portion confined to one section of the evaporator structure and the other branch having a portion located in another section of said structure, said metal sheets having a recess separating said two sections, one of said branches of said conduit system consisting of a sinuous winding extending from the lowest section of the evaporator structure to the bottom portion of said header along a path nowhere extending in a downward direction, said other branch consisting of a sinuous conduit connected with the top portion of said header and having an outlet to be connected with the compressor of the refrigerator, and a supply duct also formed by said corrugations, said duct having an inlet opening near said header and being connected with said sinuous winding in order to supply refrigerant to the lowest section of said evaporator structure.

5. In an evaporator structure for compression refrigerators comprising an evaporator conduit system proper and a short supply conduit connected with the lowest portion of said system, a pair of metal sheets sealed face-to-face together and bent so as to have horizontal and vertical wall sections, respectively, forming a storage chamber for deep-cooling purposes, at

least one of said sheets having corrugations forming said evaporator conduit system and at least one of said sheets having an indentation forming a collecting header arranged above and communicating with said system, said corrugations forming said conduit system extending consequently over said horizontal and vertical wall sections along a path nowhere extending in a downward direction and including a single sinuous passage forming the only connection between said supply conduit and said header and extending over the horizontal wall section forming the bottom of said chamber.

6. In an evaporator structure for compression refrigerators comprising an evaporator conduit system proper and a short supply conduit connected with the lowest portion of said system, a pair of metal sheets sealed face-to-face together and bent so as to form horizontal and vertical wall sections of a storage chamber for deep-cooling purposes, said sheets having corrugations and indentations forming said evaporator conduit system and a collecting header arranged above and communicating with said system, said corrugations forming said conduit system extending consecutively and continuously over said horizontal and vertical wall sections and forming a composite passage for the refrigerant, said passage being composed of a single sinuous winding extending over the bottom wall section of said storage space and having one end forming the only connection with said supply conduit, and a group of conduits arranged in parallel relation as regards the flow of refrigerant and extending substantially only over the vertical and upper wall sections of said chamber, said conduits of said group having one end connected with said header and the other end connected with the other end of said single winding so as to form a manifold connection, said composite passage forming a path nowhere extending in a downward direction.

7. In an evaporator structure for compression refrigerators comprising an evaporator conduit system proper and a short supply conduit connected with the lowest portion of said system, a pair of metal sheets sealed face-to-face together and bent so as to have horizontal and vertical sections forming the walls of a storage chamber for deep-cooling purposes, said sheets having corrugations and indentations forming said evaporator conduit system and a collecting header arranged above and communicating with said system, said corrugations forming said conduit system extending consecutively and continuously over said horizontal and vertical sections along a path nowhere extending in a downward direction and including a single sinuous passage forming the only connection between said supply conduit and said header and extending over substantially the entire wall section forming the bottom of said chamber, said pair of metal sheets having further corrugations forming an additional evaporator conduit of sinuous shape having one end connected with the top portion of said header and the other end forming the outlet of the evaporator structure.

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