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D. P. HEATH

2,161,293

REFRIGERATING APPARATUS

Filed March 30, 1938

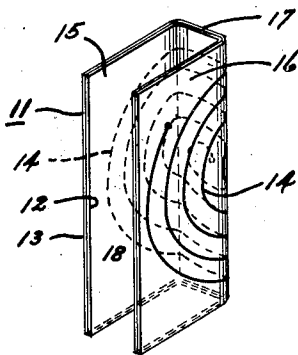


Fig. 2

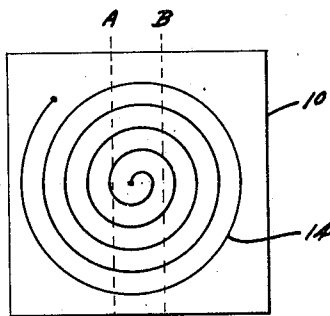


Fig. 1

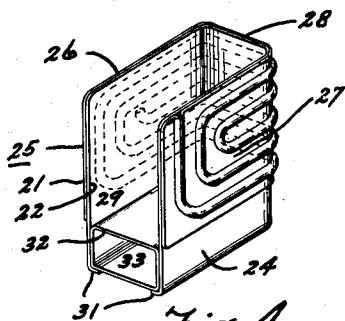


Fig. 4

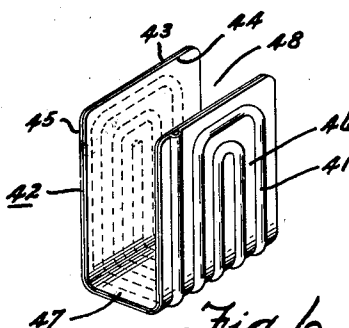


Fig. 6

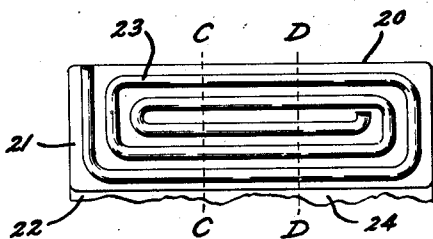


Fig. 3



Fig. 5



Fig. 7

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REFRIGERATING APPARATUS

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Application March 30, 1938, Serial No. 198,923

4 Claims. (Cl. 62—126)

My invention relates to improvements in evaporators for artificial refrigerating machinery and the present application is a continuation-in-part of my copending application Serial No. 510,688 filed January 23, 1931.

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

Another object of this invention is to provide a method of manufacturing a sheet metal evaporator by indenting or embossing a sheet of metal, then superimposing this preformed sheet of metal upon another sheet of metal and fixing or brazing the abutting surfaces of the sheets together to provide a double walled or sheath like structure and thereafter forming or bending the structure into a desired shape to embrace or provide a chamber for the reception of receptacles or trays adapted to contain a substance to be congealed or frozen.

Another object of importance to my invention is to provide a sheet metal evaporator with a chilling compartment which is not in direct contact with refrigerant in walls of the evaporator but which is arranged in good heat transfer relation with the refrigerant containing walls of the evaporator.

A further object of my invention is to provide an evaporator in the form of a metallic sheath bent to embrace or provide walls of a freezing space or chamber so as to partition the freezing space or chamber from a food storage compartment or a cooling space and which sheath is provided with a continuous voluted duct having its circumvolutions co-planar and arranged on the sheath to extend along or over at least a part of its adjacent and opposed walls on different sides of the freezing chamber.

A still further and more specific object of my invention is to provide a double walled metal structure or sheath having a continuous refrigerant passage provided between the walls thereof of an Archimedes spiral or an elongated voluted form and to bend or fabricate the sheath-like structure into a substantially U-shaped evaporator with the refrigerant duct extending over adjacent and opposed walls of a freezing chamber formed by the evaporator.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompany-

ing drawing, wherein a preferred form of the present invention is clearly shown.

In the drawing:

Fig. 1 is a view of a sheath like structure prior to bending same and having a refrigerant duct arranged in accordance with my invention associated therewith;

Fig. 2 is a view showing the metal sheath disclosed in Fig. 1 bent to form a substantially U-shaped evaporator;

Fig. 3 is a view similar to Fig. 1 showing a metal sheath having a modified form of refrigerant duct associated therewith;

Fig. 4 is a view showing the modified metal sheath disclosed in Fig. 3 bent to embrace a freezing space and having a chilling compartment associated with the evaporator;

Fig. 5 is a view similar to Figs. 1 and 3 showing a metal sheath having a modified form of refrigerant duct associated therewith;

Fig. 6 is a view showing the modified metal sheath disclosed in Fig. 5 bent to embrace or form walls of a freezing space; and

Fig. 7 is a view similar to Figs. 1, 3 and 5 showing a metal sheath having a still further modified form of refrigerant duct associated therewith.

Referring to the drawing, for illustrating my invention, I have shown in Fig. 1 thereof a sheath or flat double walled structure 10 comprising two sheets of metal superimposed upon one another and secured together by welding or brazing contiguous portions thereof in any well-known manner and adapted to be bent on the lines indicated at A—A and B—B to form a substantially U-shaped evaporator. The evaporator 11 disclosed in Fig. 2 is of a form which is the result of bending the assembled sheath like structure 10 on the spaced apart parallel lines shown in Fig. 1 of the drawing. The sheath structure 10 or evaporator 11 comprises metal plates or sheets 12 and 13 at least one of which is corrugated or embossed, as at 14, to form a refrigerant expansion duct between the metal sheets of an Archimedes spiral form as disclosed in my copending application above referred to. This spiral comprises a continuous voluted refrigerant duct having its circumvolutions co-planar and extending to points adjacent the edges of the sheath structure 10. The U-shaped form of the evaporator 11 provides integral walls 15, 16 and 17 which embrace or provide the upright side walls and a back wall respectively of a sharp freezing space or chamber 18. The space or chamber 18 may be provided with suitable supports or shelves for receiving

ing and supporting therein receptacles adapted to contain substances to be congealed or frozen, such as ice making trays as is conventional in the art. Walls 15, 16 and 17 of evaporator 11 partition the freezing space or chamber 18 from a cooling space such as the food storage compartment of a refrigerator cabinet and prevent the air cooled by the evaporator and circulating in the food compartment from entering the sharp freezing space to thereby protect the substance being congealed or frozen.

In Fig. 3 of the drawing I have disclosed a flat double walled structure or sheath 20 which comprises superimposed and secured together metal sheets or plates 21 and 22. At least one of these metal plates 21 or 22 is corrugated or embossed, as at 23, to provide a refrigerant conveying or expansion duct between the plates which is of an elongated form. It will be noted that metal sheet 22 of structure 20 extends beyond the one edge of metal sheet 21, as at 24, and the purpose of this extending portion 24 of sheet 22 will soon become apparent. The elongated refrigerant duct 23 associated with the plates or sheets 21 and 22 of the sheath like structure 20 comprises a continuous voluted passage having its circumvolutions co-planar with the end of the outer circumvolution thereof extending to one edge of the structure. The sheath like structure 20 is adapted to be bent on the spaced apart parallel lines indicated at C—C and D—D to form the U-shaped sheath or evaporator 25 disclosed in Fig. 4 of the drawing. Upright walls 26, 27 and 28 of the U-shaped evaporator 25 form or embrace a sharp freezing space or chamber 29 which may be provided with suitable supports or shelves for supporting within chamber 29 receptacles adapted to contain a substance to be congealed or frozen. The extension 24 of metal sheet or plate 22 has its edge portion 31 bent inwardly of the freezing space or chamber 29 to form a support for a cold box or sleeve 32 which forms a chilling compartment 33. The chilling compartment is out of direct heat exchange contact with refrigerant contained in the refrigerant duct 23 but is in good heat exchange relation with walls of evaporator 25. Compartment 33 may, therefore, be utilized for the storage of food products not necessarily to be frozen but desired to be maintained at a lower temperature than the temperature maintained in the food storage compartment general of a refrigerator cabinet.

In Fig. 5 of the drawing I have disclosed a flat double walled structure or sheath 40 which comprises two superimposed and brazed together metal sheets or plates. One of the sheets or plates of the structure 40 is corrugated or embossed, as at 41, to provide a continuous refrigerant conveying or expansion duct between the plates which is of an elongated form similar to that shown in Fig. 3 of the drawing but which has its one end extending to a different edge of the sheath structure. This elongated refrigerant duct 41 associated with the structure 40 comprises a continuous voluted passage having its circumvolutions co-planar. The flat two-plate sheath structure 40 is adapted to be bent on the spaced apart parallel lines E—E and F—F to form the U-shaped sheath or evaporator 42 disclosed in Fig. 6 of the drawing. It is to be noted that the bonded together plates 43 and 44 of evaporator 42 form side walls 45 and 46 and a bottom wall 47 to thereby embrace a freezing space or chamber 48. This freezing space or

chamber may be provided with suitable supports or shelves for the reception and support of receptacles adapted to contain a substance to be congealed or frozen such as ice trays.

Referring now to Fig. 7 of the drawing, there is disclosed a flat double walled structure or sheath 50 adapted to be bent on the lines G—G and H—H to provide a substantially U-shaped sheath or evaporator. In this form of my invention at least one of the sheets or plates of the sheath structure 50 is corrugated or embossed, as at 51, to form a double coil or meander type of continuous refrigerant conveying or expansion duct between the plates. In this form of continuous refrigerant duct both ends thereof are adjacent one another instead of one end being at the middle of the coil and the other end at the outside thereof. The ends of the voluted refrigerant duct 51 extend to the same edge of the sheath like structure 50 and the double circumvolutions of this duct extend around a looped inner portion of the duct to provide a continuous passage.

In each form of the invention disclosed one end of the voluted duct serves as a refrigerant inlet connection for refrigerant adapted to be circulated around the freezing space embraced by the walls of the evaporators, while the other end of the duct serves as an outlet connection for conveying refrigerant from the evaporator. Thus, the ends of the voluted refrigerant duct in the present disclosures may be connected with a refrigerant translating device comprising, for example, a compressor-condenser unit of any suitable or conventional construction wherein refrigerant is compressed and liquefied and circulated to an evaporator for expansion therein to cause the evaporator to absorb heat from the medium to be cooled thereby. The metallic sheath evaporators 11, 25 and 42 herein disclosed may be mounted in any desired position within a food compartment of a refrigerator cabinet. For example, an evaporator may be mounted to provide three upright walls of a sharp freezing space or chamber, or it may be turned and mounted so as to provide two side walls and a bottom wall of a chamber. In either event, the continuous voluted refrigerant duct has its circumvolutions extending over a portion of an adjacent and an opposed wall of the sheath like evaporator which embraces the freezing space. The circumvolutions of the continuous or elongated voluted refrigerant expansion duct extending over different walls embracing a freezing space is a feature of importance to the present invention because this arrangement provides for substantially uniform cooling of portions of a plurality of walls of the evaporator. This feature reduces the temperature gradient between portions of the evaporator walls to thereby maintain all walls thereof at substantially the same temperature. The uniform temperature of the various walls of the metal sheath evaporator prevents undue accumulation of frost on certain portions of the walls relative to other portions thereof to thereby render the walls more efficient for absorbing or withdrawing heat from the freezing space which they embrace.

From the foregoing, it will be apparent that I have provided an improved sheath like or sheet metal evaporator for use in refrigerating systems. The sheath like evaporator structure can be manufactured at low cost, is neat in appearance and efficient in producing refrigeration. The continuous voluted refrigerant expansion duct

associated with the sheath and having its co-planar circumvolutions disposed on the sheath to pass over adjacent and opposed walls of the evaporator provides an improved refrigerant duct arrangement which maintains all walls of the evaporator at substantially the same temperature and also maintains various portions of each wall at a uniform temperature.

While the form of embodiment of the invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. An evaporator for a refrigerating system comprising, a double walled structure including superimposed sheet metal members secured together and bent into a substantially U shape to provide a plurality of walls embracing a freezing space, at least one of said sheet metal members having a corrugation therein cooperating with another of said sheet metal members to provide a continuous refrigerant conveying duct formed between said double walled structure, and said refrigerant duct being in the form of an Archimedes spiral with its circumvolutions co-planar and arranged to extend over said walls on adjacent sides of the U-shaped evaporator.

2. An evaporator for a refrigerating system comprising, a double walled structure including superimposed sheet metal members secured together and bent into a substantially U shape to provide a plurality of walls embracing a freezing space, at least one of said sheet metal members having a corrugation therein cooperating with

another of said sheet metal members to provide a continuous refrigerant conveying duct formed between said double walled structure, and said refrigerant duct having its convolutions wound around one another with its circumvolutions co-planar and arranged to extend over said walls on three sides of the U-shaped evaporator.

3. An air cooling and ice freezing evaporator of a refrigerating system adapted to be located in a food storage compartment of a refrigerator cabinet comprising, a substantially imperforate metallic sheath exposed to the air to be cooled and formed to provide a plurality of walls embracing a freezing space, said walls forming a partition between the freezing space and the compartment in which the air is to be cooled, means on the sheath forming walls of a continuous voluted duct, and said continuous duct having its circumvolutions co-planar and passing over said walls on juxtaposed sides of the evaporator.

4. An air cooling and ice freezing evaporator of a refrigerating system adapted to be located in a food storage compartment of a refrigerator cabinet comprising, a substantially imperforate metallic sheath exposed to the air to be cooled and formed to provide at least three walls embracing a freezing space, said walls forming a partition between the freezing space and the compartment in which the air is to be cooled, means on the sheath forming walls of a continuous voluted duct, and said continuous duct having its circumvolutions co-planar and passing over said walls on three sides of the evaporator.

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