Oct. 10, 1933. A. S. LIMPERT 1,929,952

COOLING UNITS FOR REFRIGERATION PURPOSES AND METHOD OF MAKING SAME

Original Filed Nov. 23, 1929

Fig. 1.

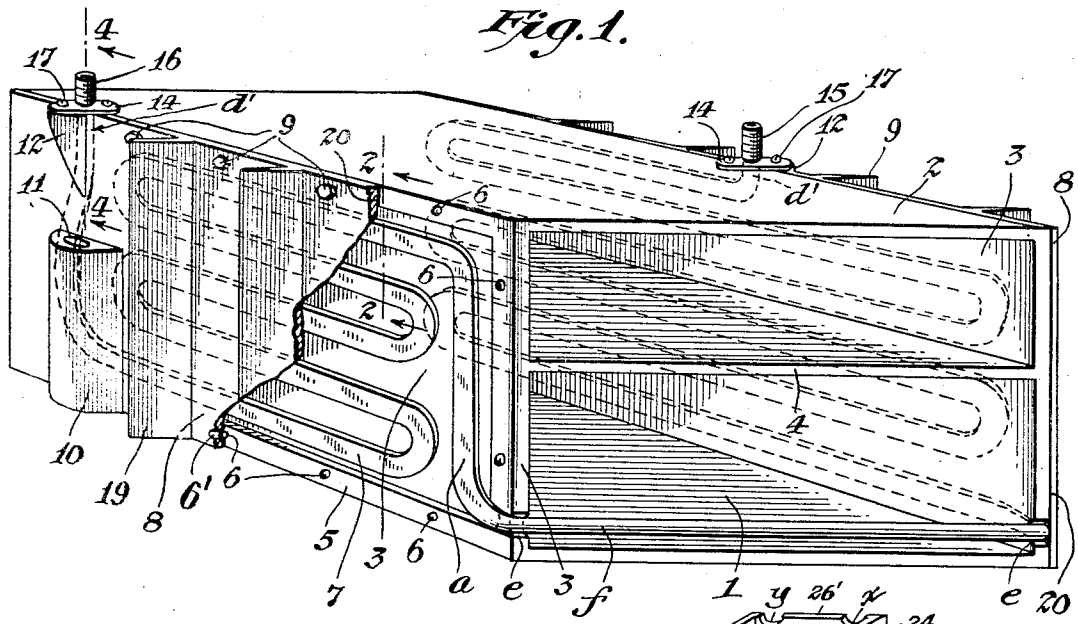


Fig. 7.

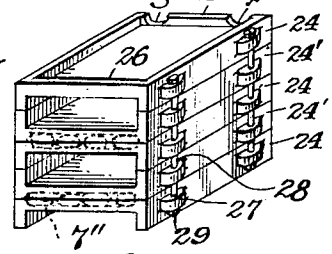


Fig. 2.

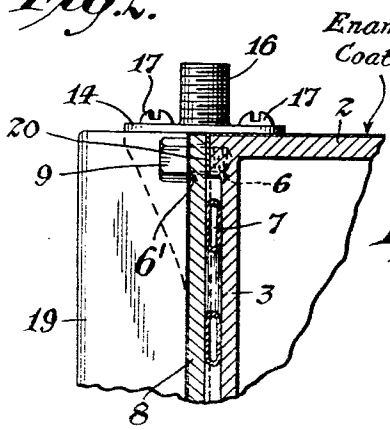


Fig. 3.

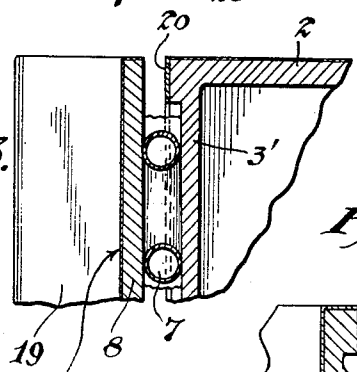


Fig. 6.

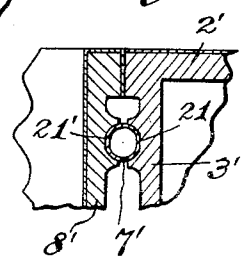


Fig. 4.

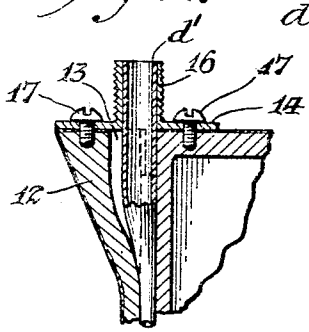
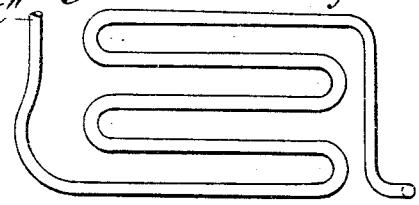


Fig. 5.



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COOLING UNITS FOR REFRIGERATION PURPOSES AND METHOD OF MAKING SAME

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7 Claims. (Cl. 62—95)

This invention relates to apparatus which is peculiarly suited for use as a cooling unit of an automatic refrigerator wherein an efficient, sturdy, compact, cheap and attractively designed unit is a matter of prime consideration. The further objects of the invention are the provision of a construction and a method of making same whereby such unit can be formed from ferrous or non-ferrous metals as a result of either a casting, a die-stamping or pressure, die-casting operation and which unit readily lends itself to being finished in enamel. Other objects of the invention are hereinafter set forth.

Heretofore it has been proposed to cast a coil of high conductivity, such as copper, for example, in a wall of metal of lower melting point, such for example as type metal, or other zinc alloys or even aluminum, but while tanks having such coils cast in the walls thereof are quite efficient as cooling units, nevertheless, there are many objections, such as the difficulties of casting, especially when a number of rejections are taken into consideration, the susceptibility of metal, such as copper, to form scale on the inside thereof during the casting operation, which scale tends to copper plate the valve-seats and bearings and other portions of a mechanical refrigerating machine and also the tendency to form air pockets between the coil and the metal wall in which the same is embedded due to the difference in the coefficients of expansion of the two metals. Also such cooling units cannot be enameled satisfactorily, since in the enamelling operations the temperatures are so high as to in many cases burn the coil besides forming scale as aforesaid, therein. Neither is it considered practicable at the present time to form such tanks of ferrous metal, such as steel or iron, as it is extremely difficult, if not impossible, to satisfactorily cast a coil therein unless the coil is of some expensive high melting point steel or other alloy and furthermore, the forming of such a coil is itself an extremely difficult and expensive operation.

My investigations have led to the discovery that the aforesaid objections can be effectively overcome and a cooling unit which is remarkably efficient can be constructed by following the method set forth in detail in the following description and drawing forming a part thereof.

Referring to the drawing wherein I have illustrated different embodiments of the invention

Figure 1 is a perspective view of an enameled cooling unit embodying my invention, the same being partly broken away to show the flattened coil enclosed between the walls thereof;

Fig. 2 is an enlarged detail fragmentary vertical section on the line 2—2 of Fig. 1;

Fig. 3 is a vertical section illustrating a stage of the operation prior to the compression or a flattening of the coil of circular cross section which is preferably employed in constructing my improved tank; and

Fig. 4 is a vertical section on the line 4—4 of Fig. 1 showing the construction of the coil terminals;

Fig. 5 is a side elevation; and Fig. 6 a fragmentary vertical section, both showing a modification in which a coil of circular cross section is employed;

Fig. 7 is a reduced scale isometric view of a still further modification.

Referring to Figs. 1 to 4 of the drawing and the construction shown therein, the reference numeral 1 designates a bottom, 2 the top and 3 the respective main side walls of the body proper of a cooling unit suitable for refrigeration machines, the body proper and attached side plates, hereinafter referred to, being preferably cast, although the same may be made by die-stamping. Said shell is preferably provided with one or more central partitions 4 which serve to sub-divide the same into a plurality of compartments and also serve as a support for ice trays and other receptacles placed therein. The side walls of the body proper are provided with raised rims 5 which are tapped, as designated by the numeral 6, to receive cap screws hereinafter referred to. The cooling coil 7, which is preferably of circular cross section originally, is first bent to form a series of loops of the desired outline and is then placed between the side walls 3 and the false walls 8, having apertures 6', are then tightly compressed against rims 5 of the side walls 3 and the tubing by turning down on cap screws 9 that are introduced into the aforesaid registered tapped apertures 6 and plain apertures 6' of said rims 5 and plate 8 respectively, whereupon the coil, which as stated, is preferably of circular cross section and is preferably of lead, or other highly impervious non-corrosive soft metal or metal alloy, will be flattened until it assumes the configuration shown in Figs. 1 and 2 with the result that considerably more than one half of its total perimeter will be in intimate metal-to-metal contact with the walls 3 and the false wall 8.

A boss 10, having a thermostatic well 11 cored therein, is cast integral with one of the side plates 8 of said unit, the same being preferably located adjacent the exit terminal of said coil, which latter is of cylindrical configuration adjacent both

of its respective ends, such cylindrical portions extending respectively through cored apertures in two bosses 12 that are also cast integral with each of the false walls on side plates 8, respectively. The aperture in each of the bosses 12 is adapted to receive and have a tight fit with each of the respective cylindrical ends *d'* of the coil 7. Pipe fittings 14, comprising a base plate 16 and a tubular extension, are secured by set screws 17 to the top 2 and to the top end of each of the bosses 12 respectively. Each of the ends *d'* of said coil after being inserted into said extensions 16 are then cut off flush therewith, following which the end faces of the said ends *d'* and the extensions 16 are brazed together.

The extensions 16 are then threaded to receive suitable unions or pipe couplings which serve to connect the respective ends of the coil 7 to the line containing the refrigerating medium of the machine with which said cooling unit is intended to be associated.

The false side walls or plates 8 are also preferably provided with integral fins or cooling vanes 19. A gasket 20, such as a lead or copper gasket or the like, is interposed between the marginal ribs or flanges 5 and margins of the sides 8 whereby, when the cap screws 9 are turned down in a manner previously described, a liquid tight joint is obtained.

In lieu of flattening the coil 7 in the manner previously described, the same may be previously flattened prior to being applied to the sides 3 of the main body of the unit, either by means of a hydraulic press or otherwise, and then the plates 8 are thereafter applied and the cap screws 9 are screwed down so as to intimately engage the flattened coil and the marginal ribs 5 as previously described. This latter procedure is particularly desirable in the event the tube is of relatively tough metal, such as copper, since unless the walls of a copper tube are quite thin, it would require considerable pressure to deform the same to the extent indicated in Fig. 2, whereas on the other hand, if a lead coil is employed, as is usually preferred, it is a comparatively simple matter to deform the same by simply turning down on the cap screws. As shown, the front edges of the side walls 3 are provided with grooves *e* which are adapted to receive the crossover pipe *f*.

In the construction shown in Figs. 5 and 6, the adjacent faces of the walls 3' and their associated cover plates 8' are grooved, either by a casting operation or by stamping up the same or forming the same in any other suitable manner, such grooves being respectively designated by the reference numerals 21, 21'. As shown, each groove is of arched cross-section and preferably the curvature of such arch is slightly flatter i. e. of greater radius than the curvature of the coil 7' which it is adapted to receive, and as shown, such grooves are of loop formation identical to the loop formation of the coil 7'. As a consequence, the coil 7' of circular cross-section and of any desired loop formation, can be first positioned in the grooves 21 and then the cover plates 8' are carefully fitted to the walls 3' in such a manner that the aforesaid recesses 6, 6' are brought into registry, which registration results in effecting registration of the grooves 21' with the grooves 21 and consequently when the cap screws 9 are screwed down, the inner surfaces of the grooves 21, 21' will be forced into intimate metal-to-metal engagement with the adjacent surfaces of the coil 7', which latter owing to the difference in curvature between its wall and the grooves 21, 21' will be slightly flattened as a result of such compression, thereby increasing the superficial area thereof which is in engagement with the inner surface of such grooves. When employing such grooves, side walls and plates, it is obviously unnecessary to cast bosses 12 on such plates as the projecting ends *d''* of the coil 7' will be of circular cross section and the pipe fittings can be anchored at their respective ends, by means of screws or otherwise, in the top 2' of the cooling unit in lieu of having one of its ends anchored in the top of the cooling unit 2 and the other in the top of the boss 12 in the manner previously described.

In order to produce an enameled cooling unit embodying my invention, it is merely necessary to first form a cooling unit proper of the desired size and shape, either with or without the grooved side walls above described, then the enamelling composition is applied to all of the surfaces of such unit except the outer surfaces of each of the walls 3 or 3'. Likewise, at the same time an enamelling composition is applied to all of the surfaces of the cover plates 8 or 8' with the exception of their respective inner faces. The said unit and the cover plate are then baked in the usual manner to form the desired enameled coating on all of the coated surfaces thereof to which the enamelling composition has been applied and then these enameled units and cover plates are utilized to assemble the complete cooling unit in the manner previously described, depending upon which type of cooling unit it is desired to produce.

As is apparent from the foregoing construction wherein I employ sectional walls between which I secure a coil in metal-to-metal contact with the adjacent faces of such walls, it is possible to die-cast the cooling unit proper and the cover plate, whereas were the coil embedded in such walls in the manner previously proposed, during the casting operation, the pressure usually required in such die-casting or pressure casting operation would objectionably distort, if not rupture, the embedded coil and likewise were such structure, having a coil cast therein, enameled, the temperature at which the enamelling was performed would deleteriously affect or even melt the embedded coil even were it possible to cast such a coil in a ferrous metal wall or a wall of other metal which was suitable for the reception of enamel.

It is particularly desirable to form a cooling unit in the manner herein described wherein the body proper is formed separately from the false side walls, as ready access is thereby afforded to the coils for testing purposes and thereby a defective coil could be readily repaired or renewed without discarding the entire unit as would otherwise be the case were the coil embedded in the side walls in the manner heretofore proposed, see in this connection Patent No. 1,706,621.

In the sectional cooling unit shown in Fig. 7, each section is of H-beam construction or channeled, all of which are of identical shape, but the sections 24 are inverted with respect to the position of the upright sections 24' whereby a series of narrow chambers are formed in between, within which the coils 7'' are positioned. The sections are each provided on one face thereof only with front and rear transverse marginal ribs 26, 26' which with the side flanges form a continuous rim. Bosses 27 are formed on each section, the same being so positioned that when the sections

are properly assembled the apertures in corresponding bosses on adjacent sections will be brought into registry and permit of the insertion therein of bolts 28 which when the nuts 29 are applied thereto and the said nuts screwed home will effect the flattening under compression of metallic lead coils of circular cross-section interposed between the transverse walls of adjacent sections in the same manner as previously described with reference to the flattening of the coils between the main side walls 3 and the false side walls 8 of the construction shown in Fig. 1.

The application of the coils to the construction shown in Fig. 7 may be readily effected by bending a length of lead pipe of circular cross-section into the desired series of loops, positioning the loops on the recessed top of one section, carrying a straight length of tubing to serve as a cross-over, out through an aperture x in the rear rib 26', then superimposing another section on the former section, carrying the cross-over length of tubing up over the rear end of the applied section and through the aperture y of the rib 26' at the rear end of the recess in the top thereof and again bending the tubing in situ in such recess to form the desired series of loops and so on. The bolts 28 are then inserted in the registering apertures of the adjacent bosses and the nuts 29 are screwed home until the rims of the inverted sections 24 are in contact with the adjacent rims of the upright sections 24' and thereby the flattening of the coil, if the same be of lead, will be effected and thereby substantially in excess of one-half of the perimeter of each coil in each chamber 25 will be in metal-to-metal contact with the adjacent transverse walls of the two adjoining sections which form the top and bottom walls respectively of such chambers. When forming the individual coils in the manner aforesaid, a terminal of round cross-section is allowed to project from the end of the top and bottom coils respectively for the reception of suitable fittings to afford means for connecting said series of coils to a refrigerant line similar to the manner in which the fittings are applied to the coil terminals in the other construction herein described. The cooling unit shown in Fig. 7 likewise lends itself readily to being made of aluminum or enameled iron or other suitable metals and the separate sections may be cast, formed by metal stamping or pressure die-casting, as desired.

By the term "intimate contact" as used in certain of the claims, I contemplate such contact as would be obtained between the coil and the adjacent walls were the metal absolutely bare or were it to be covered with a film, as distinguished from a coating of metal oxide scale naturally formed thereon or an applied protective film of enamel or the like, not exceeding 1/100 of an inch, as distinguished from a substantial insulating coating of enamel or other material of the order of thickness commonly employed in enamelling which substantially exceed 2/100 of an inch in thickness.

The term "line contact" as used in the claims, refers to the contact in a plane corresponding to a cross-section through the coil and the walls adjacent thereto, as distinguished from the substantially "point contact" in the same plane of a tube of circular cross section with a flat surface brought into intimate contact therewith.

Various modifications within the scope of the appended claims may be made without departing from the spirit of my invention.

The term "sharp" as employed in the claims denotes a unit which is keenly cold or biting cold, in the sense that the same is commonly used with reference to sharp frost or sharp weather.

Having thus described my invention, what I claim and desire to obtain by United States Letters Patent is:

1. A sharp cooling unit, comprising a shell having sectional side walls and a sharp cooling chamber therein, and a cooling coil interposed between the adjacent faces of the sectional side walls, the major portion of the perimeter of such coil throughout substantially the entire length thereof, being in metal-to-metal contact with the adjacent faces of the sectional side walls between which it is located.

2. An enameled cooling unit, comprising a main body having a sharp cooling chamber therein and certain of its walls being sectional, the adjacent inner faces of a sectional wall being bare of enamel and being in intimate metal-to-metal contact with a looped metallic tube, such tube, throughout the greater portion of its length, within such unit, having the major portion of its perimeter in such metal-to-metal contact with such adjacent walls.

3. In a cooling unit, the combination comprising a main body having a sharp cooling chamber therein, and certain of its walls being formed in sections which are held in spaced relation with respect to each other, and a flattened tube of metal interposed between the adjacent faces of certain of said sectional walls, the major portion of the perimeter of said tube throughout the greater portion of its length within said walls, being in metal-to-metal contact with the adjacent surfaces of said walls.

4. The method of making a refrigerating unit, comprising separately forming a chambered main body, applying a looped tubular member, adapted to conduct a temperature-regulating medium therethrough, to an external wall of said main body and subsequently applying a cover plate to such wall in such a position and while applying sufficient pressure to said plate to effect the substantial flattening deformation of said looped tubular member so as to effect intimate metal-to-metal contact between said cover plate and the major portion of the perimeter of such tube throughout the major portion of its length thereof.

5. The method of making a refrigerating unit, comprising separately forming a chambered main body, applying a looped tubular member, adapted to conduct a temperature-regulating medium therethrough, to one of the surfaces of such main body, such tube being of substantially circular cross-section when originally applied to such wall and subsequently effecting the flattening of such tube and applying thereover a cover plate in such a manner that such tube, such cover plate and the surface of the main body to which the tube is applied are in intimate metal-to-metal contact.

6. The method of making an enameled cooling unit for refrigeration purposes, which comprises first enamelling portions only of such cooling unit, then applying a tube of looped formation to one of the bare unenameled surfaces of the main body of such cooling unit and then covering such tube with a cover plate having a bare metal face on the side adjacent such tube and having its other face opposite thereto enamelled, while applying sufficient pressure to said plate to effect the substantial flattening

deformation of said tube so as to insure intimate metal-to-metal contact of said plate and body with the major portion of the perimeter of such tube throughout the major portion of its length and then securing the parts tightly together in their assembled position.

7. The method of making a refrigerating unit, comprising separately forming a main body, a looped tubular member of predetermined looped formation and a false wall plate, then assembling the parts together so that the said tubular member is interposed between adjacent faces of a wall of such main body and such false wall plate and then forcing such false wall plate under pressure against such tubular member and effecting the deformation of the latter so as to increase the contact area between the wall of the main body and the tubular member on the one hand, and the tubular member and the adjacent face of the false wall plate on the other hand and securing the parts in their assembled relation.

ALEXANDER S. LIMPERT.