

July 19, 1938.

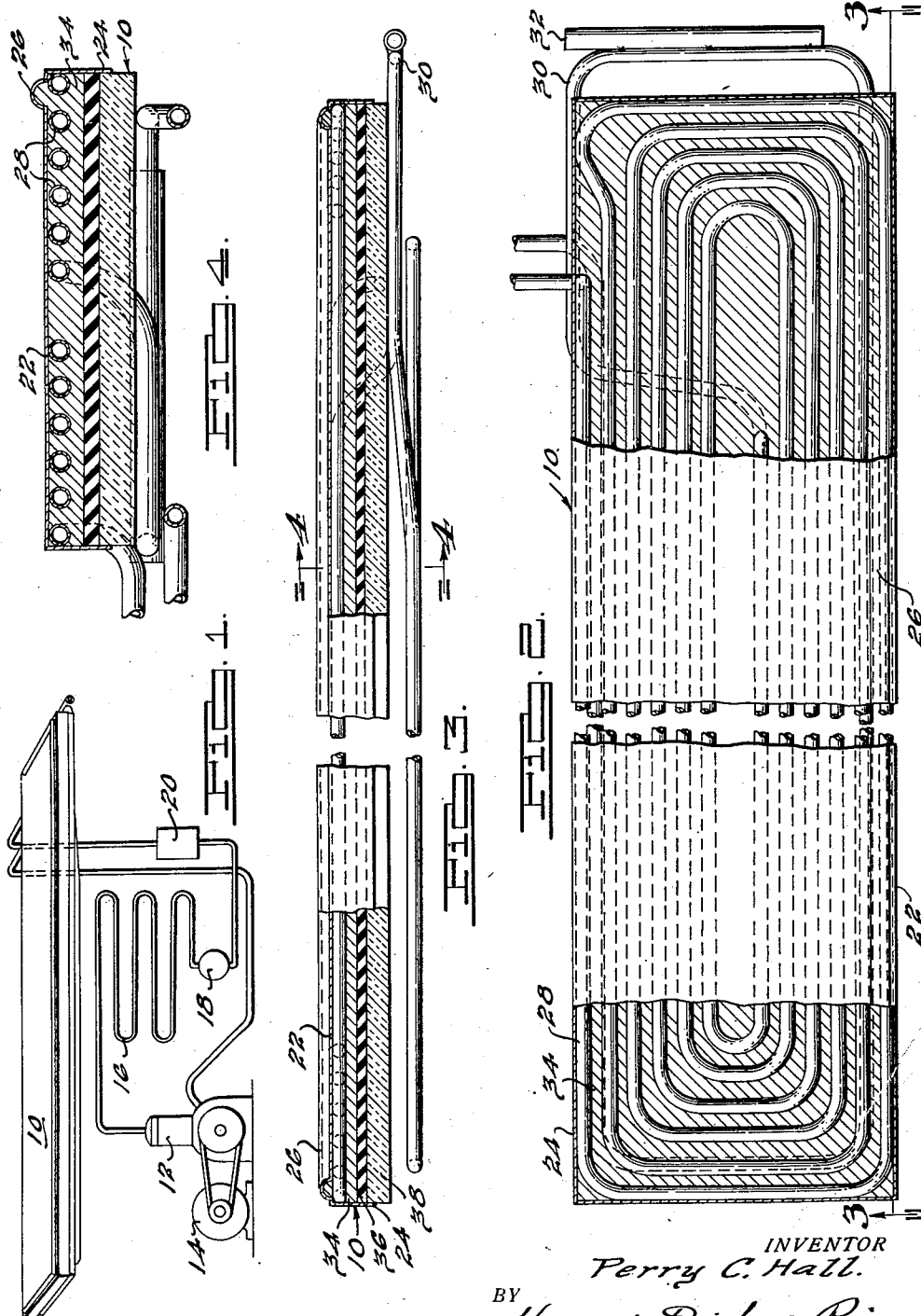
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2,124,110

REFRIGERATING MECHANISM

Filed July 20, 1937

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

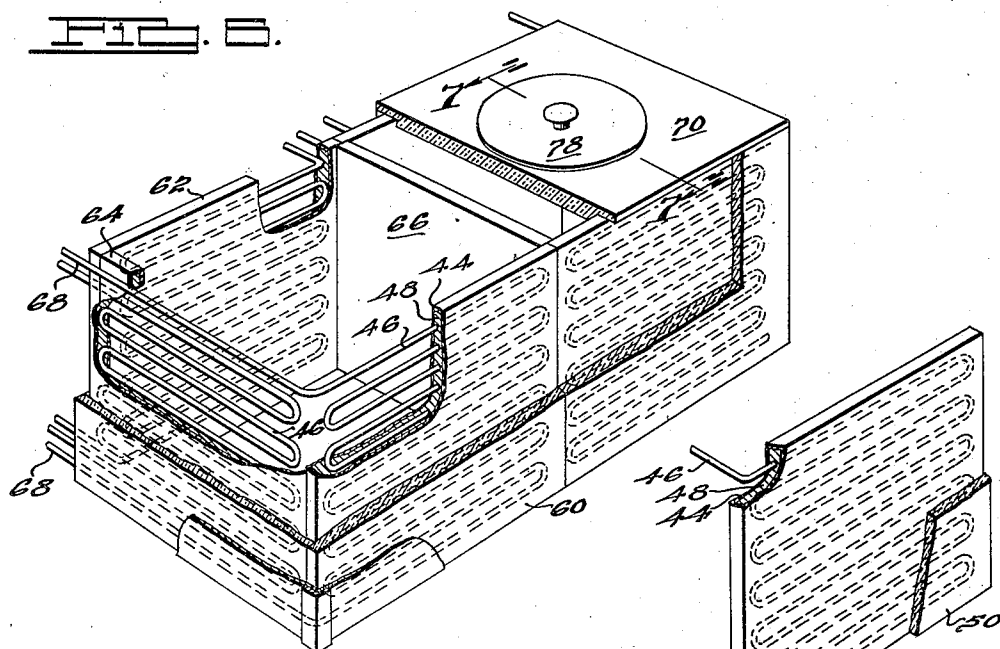
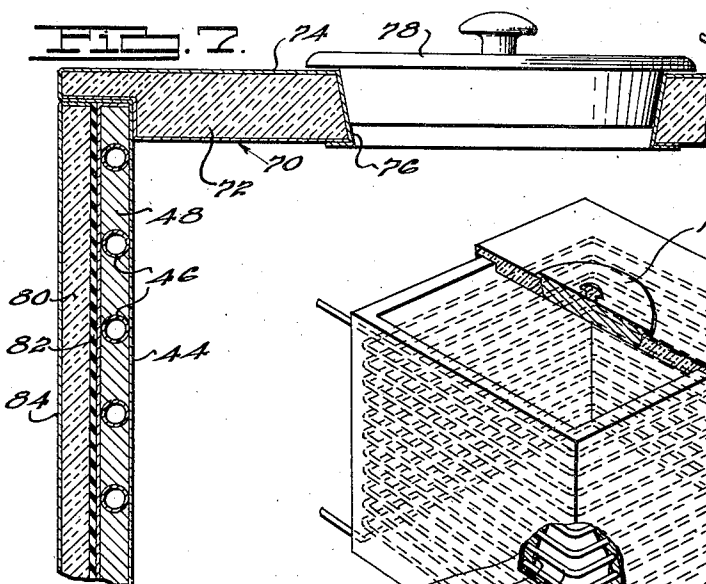
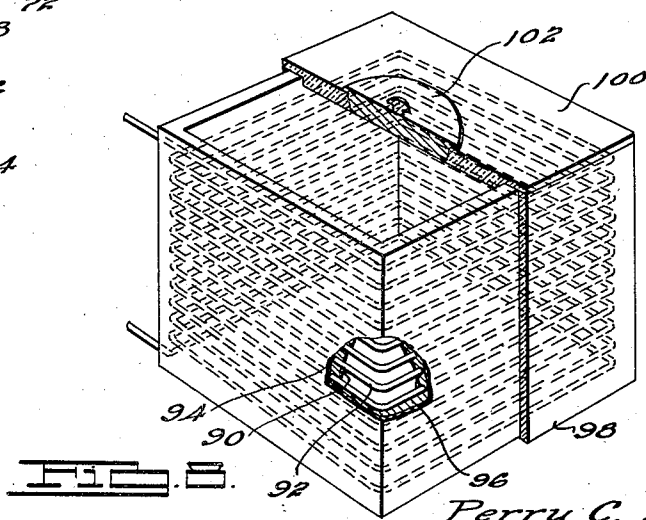


FIG. 2.



15.5



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UNITED STATES PATENT OFFICE

2,124,110

REFRIGERATING MECHANISM

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Application July 20, 1937, Serial No. 154,643

4 Claims. (Cl. 62—126)

This invention relates to refrigerating mechanism and particularly to the evaporating units of such mechanism, the principal object being the provision of a refrigerant evaporating unit providing a material amount of heat absorbing hold-over capacity and that is simple in construction, economical to manufacture and efficient in use.

Further objects of the invention include the provision of a refrigerant evaporating unit including a solid composition of novel characteristics capable of building up a reserve of heat absorbing effect whereby to enable the associated refrigerating unit to operate through a relatively low number of cycles during a given unit of time; the provision of a refrigerant evaporating unit including refrigerant passages imbedded or otherwise so associated with a solid material as to be capable of storing up a material amount of heat absorbing effect during operative periods of the associated refrigerating unit; the provision of a novel non-aqueous substance which may be substituted for the brine conventionally employed in connection with refrigerating systems to store up a heat absorbing effect; and the provision of an evaporating unit for refrigerating mechanisms including refrigerant passages and a solid non-aqueous heat absorbing material arranged in heat absorbing relation thereto and which material is relatively economical to produce, which may be applied at a minimum cost and which is effective and long lived in use.

Further objects of the invention include the provision of a refrigerant evaporating unit including a heat conducting refrigerant conduit and a mass consisting principally of particles of metal suitably bonded together and to said conduit; the provision of a refrigerant evaporator unit including a refrigerant conduit and a mass of metal particles bonded together and to said conduit by silicate of soda; and the provision of a refrigerant evaporating unit including a refrigerant conduit of a material having a high coefficient of heat conductivity associated in direct heat exchange relation with respect to a metal wall and a mass of iron particles arranged in heat conducting relationship with respect to said conduit and wall and bonded together by silicate of soda.

The above being among the objects of the present invention the same consists in certain novel features of construction and combinations of parts to be hereinafter described with reference to the accompanying drawings, and then claimed, having the above and other objects in view.

In the accompanying drawings which illustrate suitable embodiments of the present invention

and in which like numerals refer to like parts throughout the several different views,

Figure 1 is a more or less diagrammatic view illustrating the application of the present invention to a chilling slab of the so-called salad chiller type and illustrating the same connected into a conventional refrigerating circuit;

Fig. 2 is an enlarged, partially broken, partially sectioned top plan view of the salad chiller illustrated in Fig. 1;

Fig. 3 is a partially broken, partially sectioned vertical sectional view of the salad chiller shown in Fig. 2 taken as on the line 3—3 thereof;

Fig. 4 is an enlarged vertical, transverse sectional view taken on the line 4—4 of Fig. 3;

Fig. 5 is a perspective view of an evaporator slab unit formed in accordance with the present invention and by means of which chilling and/or cooling devices of various types may be readily built up;

Fig. 6 is a broken perspective view of an ice cream cabinet which has been formed of units of the type illustrated in Fig. 5;

Fig. 7 is an enlarged fragmentary, vertical sectional view taken on the line 7—7 of Fig. 6;

Fig. 8 is a broken perspective view of another form of ice cream cabinet constructed in accordance with the present invention.

It will be understood by those skilled in the art that wherever possible it is desirable to so construct and arrange a refrigerating mechanism as to reduce the number of cyclic operations of the mechanism in a given time period to a reasonable extent in order to save wear and tear on the mechanism, decrease the amount of service required and other obvious reasons. A liquid brine solution is conventionally employed for this purpose although eutectic and other solutions have been proposed and have been employed to a limited extent to increase the hold-over capacity of an evaporator unit. In many instances it is impractical to employ a brine or other fluid hold-over means for the reason that provision must be made for expansion and contraction of the brine during variations in temperature thereof and such solutions are generally of a more or less corrosive type rendering their containers particularly open to leakage. For instance, the use of brine as a refrigerating effect hold-over medium for ice cream cabinet is objectionable for the reason that it tends to corrode the ice cream container positioned therein; in some constructions there is a liability of the brine contaminating the ice cream; and the insertion and removal of the ice cream containers from the cabinet causes

the brine to be dripped on the floor of the establishment in which it is located thereby effecting a disagreeable condition.

A solid mass of metal may be employed with an evaporator as a means for providing a hold-over capacity for the refrigerating effect thereof but in such case the resulting construction is unduly expensive, requires a considerable amount of machine work, is liable to develop leakage and while this last objection may be overcome by casting copper or other metal tubes within the solid mass of metal the cost of the unit is thereby further increased. By the use of the present invention the disadvantages of brine as a hold-over capacity for refrigerating effect is eliminated as well as the objectionable features of the use of a solid mass of metal for the same purpose and this is obtained by employing a mass of metal in the form of finely divided particles which as a whole may be readily formed to any shape desired and which are bonded together into heat conducting relationship with one or more associated refrigerant evaporator tubes by means of a suitable binding agent which itself serves as an added capacity for refrigerating effect.

In accordance with the present invention the particles of metal which are employed are preferably cuttings, shavings, or the like obtained from machine tools employed for turning, planing, milling or otherwise machining metallic parts; metallic filings or the like, all of which may be purchased for the lowest of scrap metal prices. These metal particles may be of any desired metal such as brass, copper or the like but preferably from the standpoint of cost are of iron or steel. Cast iron shavings or cuttings are preferred from the standpoint of usually being of smaller size than corresponding cuttings or shavings obtained in machining other materials. These metal particles are bonded together and formed into a solid mass by the use of silicate of soda, commonly known as water glass, which also serves to provide a hold-over capacity for refrigerating effect although not as efficiently as the particles of metal themselves. In carrying out the invention broadly it is preferable to arrange the refrigerant conducting tube or tubes in their desired relation and to provide a mold about the same to give a final article of the size, shape and contour desired. The metal particles and silicate of soda are then mixed together in suitable proportions preferably to produce a relatively heavy paste-like substance which is poured, cast or otherwise acted upon to fill the mold. Thereafter as soon as the silicate of soda has hardened the assembly, if and when required, may be removed from the mold whereupon it is ready for application.

In most cases it will be found to advantage in accordance with a further phase of the present invention to construct at least a portion of the mold from sheet metal and particularly that side thereof which is to be exposed to the medium from which it is desired to extract heat and to solder or otherwise secure the refrigerant conducting tubes in direct metallic heat conducting relationship with respect to such wall. Such wall or mold thereby also serves as a wall of the finished product and thereby provides the finished product with a wall impervious to moisture and generally to any ill effects that might otherwise be occasioned by contact of the medium or objects to be cooled thereagainst.

The proportions of iron particles to silicate of soda may, of course, be varied to a greater or

lesser extent and yet permit the advantages of the present invention to be obtained. It has been found, however, that a satisfactory mixture of these two materials consists of fifteen pounds of iron cuttings or shavings to approximately one gallon of silicate of soda, it being understood that foreign or other substances may be present to some extent. These proportions provide a heavy paste-like composition which will set in a reasonable time into a very hard composition particularly desirable for the use intended. The water content of water glass varies considerably in commercial practice so that the amount of water glass mixed with the metal particles may have to be varied from that stated to get a sufficiently heavy paste to render it properly workable. Where iron particles are used, however, and the mixture has fully set and dried out, the resulting composition will consist of approximately three to five parts of iron to one part of silicate of soda, by weight, and preferably about four parts of iron to one of silicate of soda.

One use to which the present invention is particularly applicable is so-called "chilling trays or slabs", a common use for which is found in restaurants and the like for the purpose of maintaining exposed food stuffs, such as salads, in suitably chilled condition. They are also found useful where it is desired to bring a material in temporary contact therewith for the purpose of chilling it and such use is found in connection with the sealing of wax paper wrapped around food stuffs such as bread, or the like. The application of the present invention to a chilling slab of the salad type is illustrated in Figs. 1 to 4, inclusive.

Referring now to Fig. 1 a salad chiller is indicated generally at 10 and as included in a refrigerating circuit including a compressor 12 driven by a motor 14 and delivering compressed gaseous refrigerant to a condenser 16 in which it is cooled and liquefied and delivered to a receiver 18 from which it flows through an expansion valve indicated diagrammatically at 20 to the chiller 10 and from which it is returned to the suction side of the compressor 12. As illustrated in Figs. 2, 3 and 4 the salad chiller 10 comprises an inverted pan-like metal part 22 having a continuous marginal side flange 24 of substantially equal depth throughout. Particularly where the device is to be employed as a salad chiller as assumed in the present case it may be preferable to provide one or more of the marginal edge portions of the top surface of the member 22 with an upstanding rib such as 26 pressed upwardly therein, this being particularly provided in a salad chiller for preventing the plates of salad from being pushed beyond the limit of the slab. The inverted pan-like member 22 may be formed of any suitable material capable of readily transmitting heat therethrough and preferably of some metal having a relatively high coefficient of heat conductivity. Copper and stainless steel are found to be particularly desirable as such material.

To the under-surface of the horizontal wall of the panlike member 22 is soldered or otherwise intimately secured, preferably in direct metallic heat conducting relation with respect thereto, a refrigerant evaporator tube or conduit 28. As indicated the tube 28 is preferably so formed as to provide a plurality of turns or loops so as to equally distribute the heat absorbing effects thereof equally over the entire horizontal wall of the member 22. Where it is desired to provide a thermostatic control for the refrigerating unit

controlled by the temperature of the slab 10 one end of the tubing 28 or one loop thereof, preferably at the discharge end of the tubing 28 or near the discharge end thereof, may be extended beyond the limits of the pan-like member 22 as at 30 and be provided with a receptacle such as 32 soldered or otherwise secured in direct metallic contact therewith for the purpose of receiving the usual thermostatic control bulb or feeler leg (not shown). The end portions of the tubing 28 may be led out from the side, back or bottom of the device in any desired relation to best suit the conditions of the installation met with in practice.

As illustrated in Figs. 2, 3 and 4 the bulk of the tubing 28 which constitutes that portion thereof which is soldered or otherwise secured in direct metallic contact to the under-face of the horizontal wall of the member 22 is imbedded in a layer 34 of a solid composition formed in accordance with the present invention. In other words the layer 34 comprises a mixture of metallic particles and silicate of soda in hardened form the proportions of which are preferably those already stated. It will be understood that this layer 34 is solid, of hard character, and is non-aqueous. The composition 34 is sealed within the inverted pan-like member 22 by means of a layer 36 of suitable plastic material of any suitable type commonly employed for sealing purposes, such as pitch or the like. The layer 36 is preferably of sufficient thickness as to positively prevent the passage of moisture there-through to the layer 34 and it is marginally sealed to the marginal flanges 24 of the member 22 so as to prevent the possibility of moisture finding its way to the layer 34 at such point. The layers 34 and 36 are preferably of such thickness in the construction shown as to stop short of the lower edge of the side flanges 24 so as to leave the projecting portions of such flanges to form a pocket for reception of at least the upper edges of a layer 38 of suitable heat insulating material which may be of a cork composition or any other suitable heat insulating composition commonly offered on the open market under various trade names. The layer of heat insulating material is preferably adhered in position by the plastic layer 36.

In manufacturing the chilling slab shown in Figs. 1 to 4, inclusive, the pan-like member 22 is first formed as by a pressing, rolling, or other suitable operation, the tubing 28 is then soldered or otherwise suitably secured in direct metallic contact to its inner face. The member 22 with the tubing 28 secured therein is placed in inverted position, that is with its open side facing upwardly, and a mixture of iron or other metal particles and liquid silicate of soda, preferably in the proportions previously stated and forming a preferably heavy paste, is poured into the member 22 and is worked into an even layer therein as by means of a trowel or the like so as to completely fill the lower portion thereof and intimately surround all of the tubing 28.

This assembly is then allowed to stand for a sufficient length of time to permit the silicate of soda to completely harden and dry out, thereby producing a composition of extreme hardness and predominantly composed of metallic particles. After the mixture of silicate of soda and metal particles has completely set and dried the layer 36 of plastic or the like is then applied while the assembly is still in the inverted position. Preferably the plastic 36 is applied in hot

condition so as to insure an intimate bond between it and the layer 34 as well as the inner surfaces of the flanges 24, and the slab of insulating material 38 is preferably applied while the plastic 36 is hot or in sufficiently fluid condition to cause the insulating material 38 to be adhered thereto, and it is preferably pressed down firmly upon the plastic so as to cause a small amount thereof to be extruded outwardly between the edge portions of the insulation 38 and the opposed wall of the flange 24 thereby insuring a complete and water-proof seal along this area. The assembly is then completed and may then be turned over to its normal position indicated. It will be understood that in practice such an assembly is usually set into a complementary opening formed in the upper face of the counter or the like and that when operating a relatively heavy layer of frost will form over the top surface thereof and the articles to be chilled, namely salads or the like, are seated directly upon the frosted surface.

In the past it has been the common practice to form salad chillers of the type described simply by employing an inverted pan-like member such as the member 22 with the coils of tubing 28 soldered thereto and without any material whatever associated therewith for the purpose of providing a hold-over capacity for the refrigerating effect. Consequently the associated refrigerating mechanism was required to operate at intervals of very few minutes to maintain the chiller at the desired low temperature. Furthermore the lower surface thereof being more or less open to direct circulation of air in many cases fostered the formation of frost upon the lower surfaces with consequent dripping thereof on to objects positioned therebelow. It has been found that by the modification of such salad chillers in accordance with the present invention and as above described the cyclic periods of the refrigerating mechanism may be materially lengthened, in fact several fold, with all the attendant advantages. The resulting structure is solid and rigid and, accordingly, it does not require excessive care in its support, its character is such as to require no service, it is immune to the effects of moisture, and is such as to apply its heat absorbing effects only in the desired direction. Inasmuch as the metallic particles which are employed are preferably machine cuttings, and the like which may be bought at the lowest scrap prices as previously explained, the cost of providing this construction as compared to conventional constructions is only slightly more and yet a materially greater advantage is obtained.

As previously explained the present invention is capable of adaptation to any evaporator construction where it is desired to provide a greater hold-over of refrigerating effect than is possible by the bare evaporator coil. Evaporator units of this general character may be built up in slab-like formation and may be used either singly or a plurality of them may be associated together to provide larger evaporator units of various character and for various purposes. Such a unit is illustrated in Fig. 5 in which a generally rectangular slab is shown as comprising a hollow sheet metal container 44 within which is arranged tubing 46 preferably in the form of a plurality of turns, soldered or otherwise intimately bonded to one of the side walls of the container 44. That portion of the internal volume of the container 44 not occupied by the tubing 46 is filled with a material

48 which may be identical to the material 34 disclosed in connection with Figs. 1 to 4, inclusive. The sheet metal container 44 is preferably entirely imperforate and completely sealed at all points against the admission of moisture there-through to the material 48. Where a slab such as that shown in Fig. 5 is to be employed as a chilling plate, as one wall of a chamber to be cooled, or in a similar manner, it will generally be found preferable to cover that face thereof which is not to serve as an active heat absorbing surface with a layer of heat insulating material such as the layer 50, thereby preventing the absorption of a material amount of heat through such face.

In Figs. 6 and 7 an ice cream cabinet is illustrated primarily formed by assembling a plurality of units of the type shown in Fig. 5. The ice cream cabinet shown in Fig. 6 comprises front and back walls 60 and 62 respectively, opposite end walls 64 and a central wall 66 separating the interior of the cabinet into two separate chambers. The end wall 64 and intermediate wall 66 are each formed from a single unit such as illustrated in Fig. 5 except that in such case the ends of the tubing 46 are brought directly out from an end edge of the unit. The front wall 60 and rear wall 62 are each formed from a pair of units such as illustrated in Fig. 5 and it will be noted that these units overlap the end edges of the units forming the end and intermediate walls. The ends of the tubing for the front wall section are preferably extended along the outer faces of the end sections as illustrated at 68 in Fig. 6.

The metal coverings of adjacent sections are preferably soldered or otherwise secured and sealed together along their lines of junction, and a suitable bottom wall is provided and likewise soldered or otherwise suitably sealed and secured to the side and end wall sections so as to provide a fluid tight structure. The top wall 70 preferably comprises a thick slab of heat insulating material 72 enclosed in a metal sheathing 74. The top wall 70 centrally over each of the chambers is provided with a circular opening 76 in each of which is received an insulated plug closure 78 in accordance with conventional practice. The outer faces of the outer sections forming the side and end walls of the cabinet shown in Fig. 6 are covered by a relatively thick layer of insulation 80 equivalent to the insulation 50 illustrated in Fig. 5. Although the insulation layer 80 may be applied in any suitable manner it is preferably applied by the use of a layer of mastic 82 adhered to the outer face of the corresponding evaporator unit and to the inner face of the cooperating layer of insulation 80. Particularly where the exterior surface of the cabinet is to be exposed the outer face of the insulation material 80 is preferably provided with a metallic covering 84 suitably secured thereto and which may be finished in any desirable or suitable manner.

The ends of the tubing 46 in each of the units including the extended end portion 68 are preferably all extended through the rear face of the cabinet as indicated in Fig. 6 where the inlet ends thereof may be connected with singly or in multiple to any suitable type of refrigerant supply controlling device and which may be either of dry or expansion valve type, or a float controlled flooded type.

Particularly where it is desired to form smaller refrigerated containers such for instance as a single chamber ice cream cabinet as illustrated in Fig. 8, it is not necessary to employ a plurality

of individual sections such as illustrated in Fig. 5 and as explained in connection with Figs. 6 and 7 to form the same, but it may be formed as an integral structure such as illustrated in Fig. 8.

Referring to Fig. 8 a cabinet is shown including side and end walls and a bottom wall. The side and end walls in Fig. 8 are of the same general construction as previously illustrated in that they each include a metallic inner sheathing 90 to which the evaporator tubing 92 is preferably soldered or otherwise secured in direct metallic contact therewith, an outer sheathing 94, and an enclosed mass 96 of a composition comprising metal particles and sodium silicate as previously described. The inner lining 90 including the floor of the cabinet is preferably soldered or otherwise secured together to form an integral imperforate and fluid tight structure and in this case instead of having separate tubing in each of the side and end walls of the device a single length of tubing 20 continuously bent around the inner sheathing 90 is preferably employed as illustrated. This construction is suitable for smaller and more easily handled units, whereas if a refrigerating unit is of a large size it is usually preferable to construct it of section such as illustrated in Fig. 5, transported in sections to the place of delivery and there set up and secured together into the desired structure previously explained. Where a construction as illustrated in Fig. 8 is to be employed as an ice cream cabinet or the like it will, of course, usually be considered necessary to provide its exterior surface with a suitable covering 98 of suitable heat insulating material and a top wall 100 of heat insulating material is provided with the usual central aperture closed by an insulated closure plug such as 102.

It will be understood that the illustrations of the chilling slab and of the ice cream cabinet in the accompanying drawings serve primarily as illustrations of the wide uses to which the present invention may be applied and that wherever applied the evaporator unit provides a construction free of any liquid hold-over agent for the refrigerating effect while still providing such hold-over capacity for the refrigerating effect in a rigid, solid non-leakable structure efficient in use and relatively economical to produce.

Formal changes may be made in the specific embodiment of the invention described without departing from the spirit or substance of the broad invention, the scope of which is commensurate with the appended claims.

What I claim is:

1. A refrigerant evaporator unit comprising an inverted pan-like member formed from sheet metal, a refrigerant conduit secured in direct metallic heat conducting relation with respect to the lower face of said pan-like member, a layer of material substantially enclosing said refrigerant conduit and underlying the lower face of said member, said layer of material terminating above the lower edges of the side walls of said pan-like member, a sealing material sealing the lower face of the first mentioned material and marginally sealed to the inner side walls of said pan-like member, and a layer of heat insulating material disposed below said sealing material and overlapped at least in part by the side walls of said pan-like member.

2. A chilling slab for salads and the like comprising an inverted sheet metal pan-like member of relatively great length as compared to its width, a plurality of loops of metallic refrigerant conduit secured in direct heat conducting rela-

tionship with respect to the lower face of said pan-like member, a layer of rigid material providing a heat absorbing capacity for said conduit substantially enclosing said conduit and covering the lower face of said pan-like member, means sealing the lower face of said layer against the penetration of moisture thereinto, and further means insulating the lower face of said material against the transfer of heat thereto.

3. In the manufacture of a refrigerant evaporator unit, the steps of forming a sheet metal pan-like structure, securing a refrigerant conduit in direct metallic contact with the inner surface of the bottom wall of said pan-like member, inverting said structure, applying a mass of finely divided metallic particles and a liquid binder in said pan and working it into a layer of substantially equal thickness over the bottom surface

thereof, and then allowing said binder to harden.

4. A chilling slab for salads and the like comprising an inverted sheet metal pan-like member of relatively great length as compared to its width, a plurality of loops of metallic refrigerant conduit secured in direct heat conducting relationship with respect to the lower face of said pan-like member, a layer of rigid material surrounding said loops and covering the lower face of said pan-like member including a mixture of metal particles bonded together by sodium silicate, means sealing the lower face of said layer against the penetration of moisture thereinto, and further means insulating the lower face of said material against the transfer of heat thereto.

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