Jan. 12, 1937. C. W. ALBERTSON 2,067,431

REFRIGERATING APPARATUS

Filed March 14, 1927 2 Sheets-Sheet 1

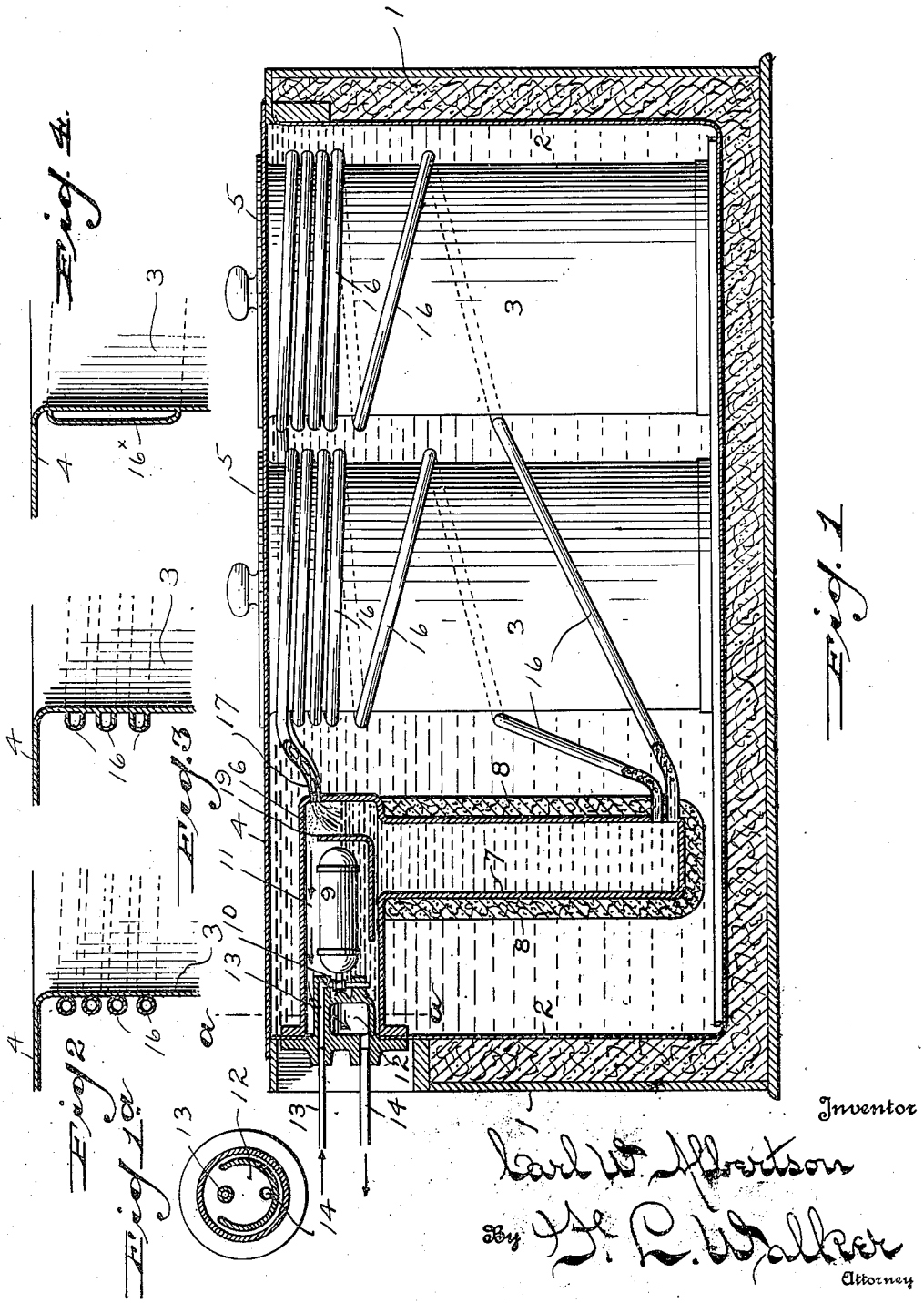


Fig. 1

Fig. 4.

Fig. 3

Fig. 2

Fig. 2a

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REFRIGERATING APPARATUS

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Fig. 5

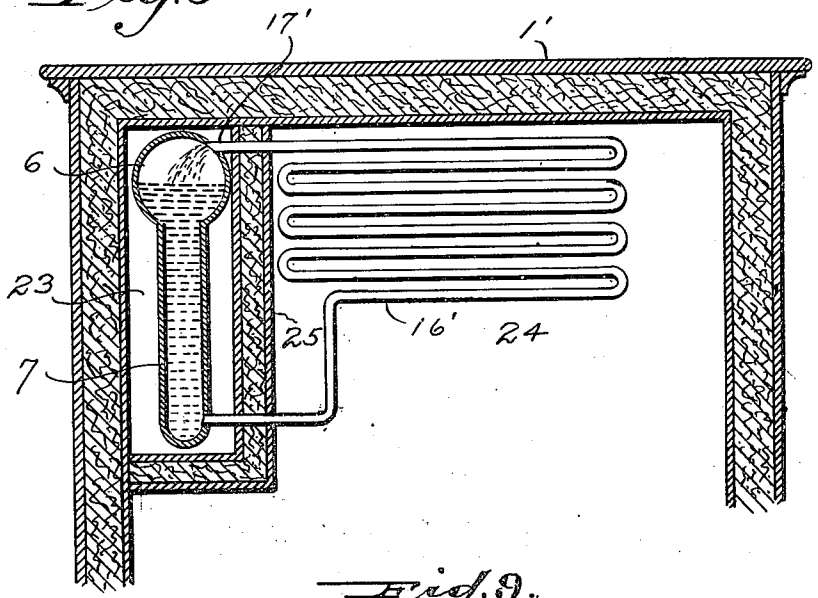


Fig. 7.

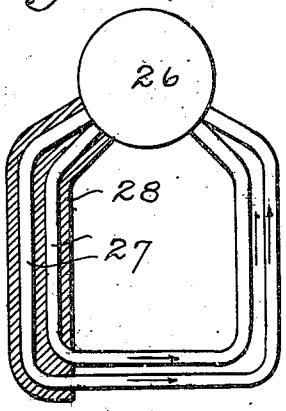


Fig. 9.

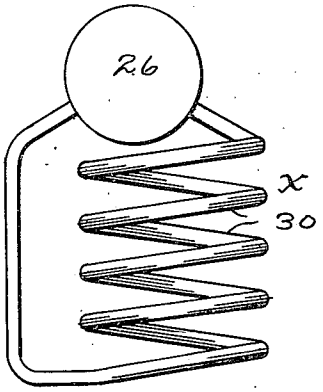
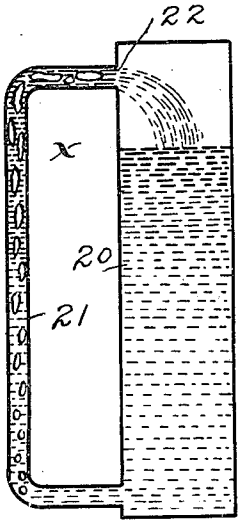


Fig. 6



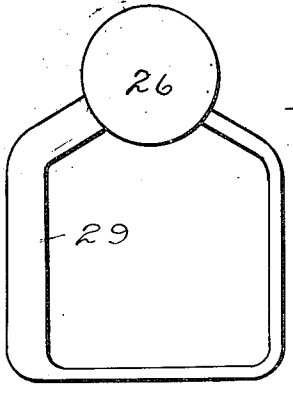


Fig. 8

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REFRIGERATING APPARATUS

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Application March 14, 1927, Serial No. 175,021

35 Claims. (Cl. 62—126)

My invention relates to refrigeration apparatus of the flooded type, and more particularly to means for inducing a circulation of the refrigerant medium within the expansion or absorption coils and for equalizing the temperature throughout the height of a refrigeration compartment. While the invention is applicable to those systems employing a brine tank, or the like, in which the refrigeration unit is submerged, it will be understood that it may be utilized with equal facility in a direct expansion system wherein the brine tank or other body of liquid is omitted and air is circulated in direct contact with expansion coils. The invention will be illustrated and described more particularly as applied to a commercial refrigerating cabinet or a cooler for ice cream and the like, but it is not limited to such application, but may be generally applied to household and other refrigerators.

The conventional type of cooler or refrigeration cabinet for commercial usage consists of a rectangular brine tank having therein compartments or pockets open at their tops to receive cans of ice cream or other commodities. These compartments or pockets are surrounded by the brine which is refrigerated by a unit comprising a series of coils submerged therein, into which liquid refrigerant is introduced and allowed to expand. Inasmuch as most of the refrigeration is produced below the liquid level within such expansion coils, this level is maintained considerably below the level of the brine within the tank surrounding such expansion coils and the compartments or pockets of the cooler or cabinet. This leaves a stratum of several inches of warm brine at the top of the tank, which warm brine being lighter than the cold brine beneath, remains there continually. As the principal heat leakage is through the side walls of the cabinet the adjoining portion of the brine becomes heated and rises to the top of the tank. This top stratum of warm brine may be cooled only by conduction from the brine at lower levels.

In the commercial refrigeration cabinets or coolers at the present time the refrigerating unit or expansion coils are usually located centrally within the brine tank and the containers or pockets to receive cans of ice cream or other commodities are located at opposite sides of the unit and at different distances therefrom. The result is that those containers or pockets more remote from the refrigeration unit obtain refrigeration only by convection of the surrounding brine, and there is therefore considerable temperature variations between the different compartments or commodity pockets.

Most refrigerating apparatus employing the flooded system utilize the gas pressure in the evaporator or boiler as a means of control for starting and stopping the compressor. The pressure or vapor tension of the refrigerant fluctuates with the temperature of the brine immediately surrounding the unit. As some of the pockets or compartments in the commercial type of refrigerator or cabinet are quite remote from the unit or evaporator, a considerable change in temperature may take place in one particular compartment and may exist quite a considerable time before the vapor tension of the refrigerant within the boiler or evaporator unit is influenced thereby sufficiently to start the apparatus.

Furthermore, in the present commercial cabinet, considerable heat is admitted at the top of the compartment while ice cream or other commodity is being served therefrom. In order to keep the ice cream at the top of the can from becoming too soft the temperature at the bottom of the can is maintained so low that the cream at the bottom of the can is frozen so hard that it cannot be served and becomes icy. It is therefore quite desirable that the temperature be somewhat equalized between the top and bottom of the container or refrigeration compartment. To effect such equalization it is desirable that all refrigeration should be produced as near as possible and practicable to the surface of the brine so that a stratum of warm brine cannot exist. By thus cooling the top stratum of the brine, the cooled brine being of greater density than the warm brine, currents will be induced in the brine tank and the entire body will be cooled by convection. Refrigeration thus produced about the top of the container or pockets or other refrigeration compartments prevents softening of the ice cream at the surface and does not produce an extremely low temperature and cause the cream to be frozen too hard at the bottom of the can. Moreover, such refrigeration should be produced uniformly about each and all the containers or refrigeration compartments at whatever distance they may be located from the point of entrance of the refrigerating medium.

To overcome the difficulties and meet the requirements as outlined above, the present unit or boiler evaporator embodies a vertically disposed vessel or receiver for liquid refrigerant extending downwardly to approximately the bottom of the unit. This vessel or receiver is of comparatively large cross-sectional area, and is preferably al-

though not necessarily, insulated. From the bottom of this vessel or receiver extends a refrigerant coil or conduit, which after making a series of convolutions, preferably closely about the exterior of the container or compartment discharges back into the top of the receiver or vessel, above the liquid level thereof. Inasmuch as the heat absorbed is directly proportional to the surface exposed the heat absorption per unit of cross section is much greater for the refrigerant coil or conduit than for the vertically disposed vessel or receiver. The absorption of heat by the refrigerant within the conduit being greater, such refrigerant will be caused to boil or vaporize violently therein, compared with that within the vessel. Each bubble of gas effects a considerable upward expansion within the coil or conduit, carrying with it a small overlying quantity of unevaporated liquid which is thence delivered to the top of the receiver or vessel. There is thus effected a continuous circuitous flow of the refrigerant from the bottom of the vessel or receiver closely about the exterior of the refrigeration compartments or containers and back to the vessel. The convolutions of the refrigerant coil or conduit are located only about the upper portion of the containers or refrigeration compartments or are more closely spaced about the upper portion than about the lower portion of the chambers or containers, thereby securing a greater degree of refrigeration at the top of the container and in the upper stratum of brine, and so equalizing the temperatures.

The object of the invention is to simplify the structure as well as the means and mode of operation of evaporation units or expansion coils of refrigeration apparatus whereby they will not only be cheapened in construction, but will be more efficient in use, automatic and continuous in operation, uniform in action and unlikely to get out of repair.

A further object of the invention is to provide for means for securing uniform and continuous circulation of refrigerant medium within the expansion coils or refrigerating unit.

A further object of the invention is to provide means for equalizing the temperature within a refrigerator compartment or chamber, whereby the commodity at the top of such compartment and that adjacent to the access opening will be maintained in a condition substantially uniform with that at the bottom of the compartment or container or that more distantly located from the access opening.

A further object of the invention is to provide means for preventing the accumulation of a stratum of warm brine at the top of the brine tank and to induce convection currents therein whereby the brine temperature will be equalized.

A further object of the invention is to assure substantial uniformity of temperature in each of several compartments located at different distances from the point of introduction of refrigerant.

With the above primary and incidental objects in view, as will more fully appear in the specification, the invention consists of the features of construction, the parts and combinations thereof and the mode of operation, or their equivalents, as hereinafter described and set forth in the claims.

Referring to the accompanying drawings where is shown the preferred, but obviously not necessarily the only form of embodiment of the invention, Fig. 1 is a vertical sectional view of a commercial type of cooler or refrigeration cabinet, such as is employed for ice cream and other commodities, to which the present invention has been applied. Fig. 1*a* is a sectional view on line *a*—*a*. Figs. 2, 3 and 4 are detail sectional views of different forms of applying circulating conduits to the containers. Fig. 5 is an elevation partly broken away of a domestic refrigerator employing direct expansion system of refrigeration to which the present invention is applied. Fig. 6 is a simplified view, more or less diagrammatic, illustrating the principle of operation by which continuous flow or pumping effect of the refrigerant is induced. Figs. 7, 8 and 9 illustrate various applications of the present invention to the present commercial type of evaporator or refrigerating unit.

Like parts are indicated by similar characters of reference throughout the several views.

Referring to the accompanying drawings, 1 is the cabinet or insulated housing of a commercial refrigerator or cooler such as is ordinarily used for ice cream and like commodities. Within the cabinet or housing 1 is a lining 2 forming a brine tank within which are submerged one or more compartments, which in the present instance are shown as cylindrical receptacles 3 connected with the cover or top 4 of the cabinet. Each compartment or receptacle 3 is open at its top to receive a can of ice cream, or the like, and is provided with a closure lid 5.

The refrigerator unit or evaporator comprises a receiver or vessel having at its top a float chamber 6 and a dependent liquid containing portion 7. This dependent portion 7 is somewhat larger in cross area than the circulating coils for refrigerating medium. It is preferably, though not necessarily, insulated as at 8. Within the float chamber 6 is a float 9 controlling an inlet valve 10 for liquid refrigerant, which in the present instance has been shown as a needle valve. Obviously any suitable type of valve may be employed. The valve 10 is opened and closed in accordance with fluctuations of the liquid level of refrigerating medium within the receiver or vessel and operates to maintain such liquid level at substantially a mid-height point of the float chamber 6. Thus when the dependent portion 7 of the vessel or receiver and the lower portion of the float chamber 6 to a mid-height point are filled with liquid refrigerant there is left ample space 11 in the top of such float chamber for the reception and passage of the returning spent refrigerant in gaseous form. This space 11 above the level of the refrigerant in the float chamber 6 communicates with an outlet chamber 12 in the head of the receiver or vessel from which leads the exhaust or return conduit for the expanded gases to the compressor. As indicated in the detail view, Fig. 1*a* this outlet chamber 12 communicates at its top about opposite sides of the refrigerant inlet conduit 13, with the gas space in the top of the float chamber. Thus while the inlet passage 13 for liquid refrigerant is intermittently opened and closed by the rise and fall of the float 9, the outlet for the expanded gas from the top of the float chamber through the outlet chamber 12 and return exhaust conduit 14 is always open.

To the lower end of the dependent portion 7 of the vessel are connected one or more coils or conduits 16 for refrigerant. These coils 16 extend about the exterior of the compartments or receptacles 3 and discharge into the upper portion or gas space 11 of the float chamber 6.

The convolutions of the coils 16 are more closely spaced adjacent to the top of the compartments or receptacles 3 and if so desired may be located only about the upper portions of such receptacles.

While the dependent portion 7 of the vessel possesses some heat absorption or refrigerant effect such dependent portion 7 is preferably, though not necessarily, insulated as at 8. There is thus maintained in the dependent portion 7 of the receiver or vessel a substantially dense or heavy column of liquid refrigerant.

So long as the temperature within the brine tank and the compartments 3 remain at the predetermined low degree and the compressor-condenser apparatus of the system remains at rest, the liquid refrigerant within the coil 16 will remain at the same level as that within the vessel or receiver comprising the float chamber 6 and dependent portion 7. However, as the body of brine becomes warm or heat is admitted by opening a compartment 3, or by the introduction of a commodity to be refrigerated, the absorption of heat by the refrigerating medium within the coil 16 will cause expansion of the refrigerant and induce boiling and formation of gas bubbles within the conduit 16 as the refrigerant is vaporized. Inasmuch as the expansion downwardly within the coil is resisted by the weight of the column of refrigerant in the dependent portion 7 of the vessel or receiver such expansion will occur upwardly and an automatic pumping action or circulation of refrigerant is induced within the coil wherein unvaporized portions of the liquid refrigerant are forced through the coil by the expansion of the liquid and the formation of globules or bubbles of gas or vapor therein and will be discharged through the outlet 17 of the coil into the gas space 11 at the top of the float chamber 6. The float chamber 6 is provided with an L shaped baffle plate 19, which assists in the separation of the dry gas from the liquid and prevents undue agitation of the liquid within the receiver or vessel and obviates the bobbing of the float. The vapor or expanded gaseous refrigerant passes over the top of the baffle 19 and through the gas space 11 in the top of the float chamber to the outlet chamber 12 from which it is drawn to the compressor for recompression and condensation to liquid form. The liquid refrigerant discharged from the conduit 16 is added to the contents of the dependent portion 7 of the receiver or vessel thus replacing the liquid refrigerant drawn therefrom through the coil 16 and adding to the weight and height of the column of liquid refrigerant therein, from which it returns to the circulation conduit 16 thus affording a circuitous flow.

This automatic pumping or circulation of the refrigerant is illustrated diagrammatically in Fig. 6, wherein 20 indicates the vessel or primary column of liquid refrigerant and 21 indicates the coil or conduit wherein the liquid refrigerant is raised normally to an equivalent level x—x by the weight or pressure of the column of liquid in the vessel 20. However as the liquid within the conduit or coil 21 expands under the influence of heat and the formation of gas bubbles therein and hence becomes less dense than the liquid within the vessel 20 the liquid level of the lighter refrigerant within the conduit 21 will rise above that of the liquid within the vessel 20 and will overflow through the upper end 22 of the conduit or coil back into the vessel or receiver 20. There is thus induced an automatic circulation by the unbalanced weight of the dense and expanded liquid in the parts 20 and 21.

The delivery of gas or vaporized refrigerant into the float chamber and then into the exhaust or suction conduit will set in operation the compressor-condenser apparatus in the event that direct pressure or suction control is employed. Otherwise such apparatus is started and stopped by the operation of a thermostatic control device governed by fluctuations of temperature of the body of brine.

It will be obvious that in the event that several compartments or containers are connected to the same receiver or vessel as is illustrated in Fig. 1, they will be maintained at substantially the same temperature and in the event that heat is admitted to one of such compartments or containers by the introduction of a can of ice cream or the like, or by opening the compartment for removal of its contents those coils or conduits pertaining to such compartment will at once begin to pump refrigerant and the circulation of refrigerant about the compartment will be automatically initiated. Substantially all, or at any event, the greater portion of the refrigeration will be produced within the top stratum of the brine and around the top of the compartment or container. The degree of refrigeration may be governed somewhat by the number of turns or length of the coils. The coils are preferably located in close contact with the wall of the compartment or container as shown in Fig. 2. This prevents the intervention of a stratum of brine between the coil and the wall of the compartment. The cooling effect of the coil is thus transmitted directly to the wall of the compartment or container 2, which is preferably of copper. Hence the container itself becomes a heat absorbing and conducting element having direct heat transference communication with the refrigerant coil. This permits the length of the coil 16 to be decreased. Since the coldest temperature is produced immediately surrounding the compartment or container the heat losses through the side walls of the cabinet are greatly minimized. In lieu of coiling the conduit 16 closely about the walls of the compartments or containers 3, such coils or conduits are preferably integrally united therewith by soldering, brazing, or welding as shown in Fig. 3. Such construction assures better heat conductivity between the container wall and the refrigerant conduit and prevents intervention of brine. As a further variation of this construction the compartments or containers may be formed with double walls about their upper portions as shown in Fig. 4, affording an annular compartment or chamber 23 through which the liquid refrigerant is circulated.

As is shown in Fig. 1 of the drawings, the convolutions of the refrigerant conduit are confined to the upper portion of the compartments, the greater extent of the conduit being well within the upper third thereof, but may be extended to cover a greater area according to the conditions of use.

In the form of embodiment illustrated in Figs. 3 and 4 one or more strips of sheet material are embossed by pressing, by stamping or rolling to define therein channels or recesses. Such channeled portions are then secured about the compartment walls to form double walled areas affording therebetween interwall conduits for circulation of refrigerant. Fig. 3 shows a succession of embossed relatively narrow channels in the outer wall and disposed in parallel relation

and affording a tortuous refrigerant passage. Fig. 4 shows a wider outer wall or stratum recessed or embossed to afford a wall portion of double thickness having an interwall enlarged refrigerant channel for circulation of refrigerant.

While the invention has been heretofore described in its embodiment in a commercial refrigerator cabinet for the storage of ice cream and the like, and in its connection with a brine tank, it is to be understood that it is not limited to such embodiment or installation, but may be applied to other forms of refrigeration installation and may also be employed in a direct expansion system.

In Fig. 5 there is shown a portion of a domestic refrigerator in which the present unit has been installed. Merely as illustrative of a different method of installation the receiver or vessel comprising the float chamber 6 and dependent portion 7 have been shown located in a separate insulated compartment 23 of the refrigerator separated from the cooling compartment 24 by an intermediate insulating wall 25. In the present instant the coil or refrigerant conduit 16' is located in the cooling or food compartment 24 connected with the top and bottom of the receiver or vessel through the intervening insulated wall 25. As in the previous construction described, the refrigerant coil may have an increased number of convolutions more closely spaced adjacent to the top of the cooling compartment 24 and hence in the top stratum of warmer air which naturally arises to the top of the compartment. Thus in this case, as well as in the previous construction described, the greatest degree of refrigeration occurs adjacent the top of the compartment and the lower portion is cooled by convection due to the falling currents of cooled dense air.

In Figs. 7, 8 and 9 the broad idea of the invention has been shown applied to the conventional or commercial type of evaporators or refrigerating units now in general use. These refrigerating units as generally constructed, include a boiler or receiver chamber 26 in which is located a float-operated valve regulating the admission of liquid refrigerant. From such boiler or large header there are provided a plurality of dependent loops of conduit or tubing 27 which loops are connected at their opposite ends with the header or boiler 26. In such constructions as ordinarily employed, the loops 27 are filled with liquid, which as it becomes warmed and expands, vaporizes and the bubbles of vapor pass upward through both sides of the loop to the boiler or header 26. The generated gases or vapors bubble through the liquid in the bottom of the boiler or header 26 causing considerable commotion and disturbance. This evaporated refrigerant passes upwardly indiscriminately through both legs of the loop 27. It must be replaced by liquid refrigerant flowing downwardly through the same channels from the header or boiler 26 in opposition to the upwardly moving gas bubbles. There is thus induced a great degree of agitation, commotion and disturbance within the unit. To overcome this difficulty and bring an orderly circulation of refrigerant out of the chaos existing in the usual commercial type of evaporator the legs or sides of the loops 27 at one side of the unit may be insulated as shown at 28 in Fig. 7, thereby maintaining therein more dense columns of undisturbed liquid refrigerant. As the refrigerant in the bottoms and other sides of the loops 27 becomes warm and expanded and tends to rise, the weight of the column of refrigerant in the opposite sides of the loops 27 becomes unbalanced and the heavier and more dense columns of refrigerant protected by the insulation 28, bearing downward upon the expanded refrigerant in the bottoms and opposite sides of the loops cause such expanded refrigerant to rise through the unprotected or uninsulated slides of the loops in its return to the boiler or header 26, while the supply of refrigerant in replacement of that evaporated will descend primarily through the insulated sides of such loops. There is thus induced in the ordinary commercial type of evaporator a continuous circuitous flow or pumping action of the refrigerant within the coils wherein the outgoing vaporized gases are not opposed in their movement by the inflowing replacement liquid. Thus the movement of the refrigerant within the unit is reduced to an orderly circulation which will present increased efficiency in the absorption and dissipation of heat, and the rapidity with which the refrigeration process can be carried on.

In Fig. 8, the same fundamental idea is embodied in a commercial type of evaporator unit, wherein, instead of insulating one leg or one side of each of the loops 27 being insulated, one leg thereof is made of increased cross-sectional area as at 29. As before mentioned, the ratio of heat absorption is in direct proportion to the exposed area, and in a construction as shown in Fig. 8 the heat absorption per area of cross-sectional dimensions in the large side 29 of the loop will be very much less than in the remainder of such loop 27 of smaller diameter. Consequently the column of liquid within the part 29 will be more dense and heavier than the warmer and expanded refrigerant in the opposite side of the loop and by this unbalanced relation a circuitous flow will be induced downwardly through the larger side 29 of the loop and upwardly through the smaller side thereof.

In Fig. 9 the result is accomplished by slight variations of construction, wherein, although both sides of the loop are of substantially equal cross-sectional area one side of the loop is of greater length than the other by including therein a succession of convolutions or turns 30.

Whatever the construction may be the unbalancing of the density and weight of the two opposing columns of refrigerant included in a circuitous conduit system induces an orderly flow of refrigerant wherein the expanded refrigerant moving in one direction is replaced by liquid refrigerant of greater density following from the opposite side of such circuitous system. The gas or vapor bubbles advance with them unvaporized portions of the refrigerant which are returned to the opposite side of the circulating system for recirculation.

By the herein described construction a more rapid transfer of heat is effected, and the efficiency of the apparatus materially increased, due to the fact that the liquid refrigerant is conducted throughout the entire length, or substantially the full length, of the expansion coils or conduits although considerable portions of such coils or conduits may be disposed at a higher level than the surface of the liquid in the vessel or receiver. Thus the area of wet or flooded expansion is materially increased resulting in greater efficiency.

The construction and arrangement induces an automatic "pumping" of liquid refrigerant to one or more points which may be higher than the surface of the liquid within the main vessel which

action is initiated and governed by the rise of temperature and need for refrigeration at such particular point. In an installation embodying a number of refrigeration compartments or chambers, the change of temperature in one such compartment and the initiation of a circulation of refrigerant through the coils pertaining thereto does not necessarily affect the temperature of other compartments and does not necessarily start the flow of refrigerant in other coils to further lower the temperature of other compartments, unless the temperature change has been sufficient to affect the body of brine generally. While having a common source of refrigerant supply and under certain conditions being subject to unison action of refrigerant, the compartments to a considerable extent are maintained at their predetermined low temperature independent of each other.

From the above description it will be apparent that there is thus provided a device of the character described possessing the particular features of advantage before enumerated as desirable, but which obviously is susceptible of modification in its form, proportions, detail construction and arrangement of parts without departing from the principle involved or sacrificing any of its advantages.

While in order to comply with the statute the invention has been described in language more or less specific as to structural features, it is to be understood that the invention is not limited to the specific details shown, but that the means and construction herein disclosed comprises the preferred form of several modes of putting the invention into effect and the invention, is therefore, claimed in any of its forms or modifications within the legitimate and valid scope of the appended claims.

Having thus described my invention I claim:

1. In a refrigerating apparatus an evaporator unit including a dependent container for liquid refrigerant, a plurality of conduits independently communicating with the container, the opposite ends of the several conduits being connected above and below the level of the refrigerant within said container, thereby forming a plurality of loops, of which the container forms a common side, whereby the heat absorption per cross sectional unit in opposite sides of each loop will be unequal, thereby inducing a greater upward expansion of refrigerant in one leg of the loop than in the other and effecting a circuitous flow of refrigerant therethrough, and a plurality of cooling compartments each subject to the influence of a different loop of the common evaporator unit whereby a temperature change is effected in any one of the compartments independent of circulation through the other loops.

2. In a refrigerating apparatus, an evaporator unit, including a dependent loop, one leg of which is insulated, to insure unequal heat absorption by the refrigerant in the opposite sides of the loop, thereby inducing a circuitous flow of refrigerant therethru, the opposite side of the loop being divided into a plurality of separate conduits, the ends of which are connected with the insulated leg above and below the level of the liquid refrigerant therein, thereby affording a plurality of independent courses for the circulation of the refrigerant and a plurality of cooling compartments each associated with different conduits of the plurality whereby a rise of temperature of one compartment will effect a circulation of refrigerant through a part of the system independent of circulation of refrigerant through the other portion of the system.

3. In a refrigerating apparatus a vessel open at its top, a refrigerating unit including a series of coils surrounding said vessel at differently spaced intervals with a preponderance of such coils adjacent the top thereof the lowermost convolutions of said coils being more widely separated, one from the other, while those at the top of the vessel are disposed closely adjacent to each other, affording an increased degree of refrigeration to compensate for the heat admitted by the opening of the vessel.

4. In a refrigerating apparatus, a tank for brine, a cooling compartment and a refrigerating unit therefor, including a tubular refrigerant conduit located in the brine formed integral with the wall of the compartment, the compartment and conduit having a common intermediate wall.

5. In a refrigerating apparatus, a cooling compartment including a double wall of materially less extent than the height of the compartment and a refrigerating unit therefor effecting a circulation of refrigerating medium within the double wall of the compartment.

6. An ice cream cabinet or the like including a plurality of compartments, a brine tank common to all the compartments and in which the compartments are located, independent refrigerating coils for each compartment, and a refrigerant reservoir common to the coils of the several compartments with which the different coils connect.

7. In a refrigerating apparatus, a cooling compartment, and refrigerating unit therefor including a refrigerant conduit integrally attached to the exterior wall of the compartment and extending thereupon through a tortuous lineal direction not more than the upper two-thirds of the height of the compartment.

8. In a refrigerating apparatus, a cooling compartment, a tank for brine, and a cooling unit including a refrigerant conduit formed integral with the wall of the compartment and extending throughout a tortuous lineal path, the conduit including a wall common to the conduit and the compartment and another wall common to the conduit and the brine space within the tank.

9. In a refrigerating apparatus, a cooling compartment, and a refrigerating unit therefor including a tubular refrigerant conduit, contacting the exterior wall of the compartment and integrally united therewith and confined within the upper two-thirds of the height of the compartment, and means for circulating refrigerant through such conduit.

10. In a refrigerating apparatus, a cooling compartment, a tank for brine, and a refrigerating unit therefor including a tubular refrigerant conduit formed integral with the compartment wall and extending thereabout at different levels, the compartment and conduit having a common intermediate wall and a common wall between the brine and the conduit.

11. In a refrigerating apparatus of the character described, a plurality of refrigeration compartments, an independent conduit for refrigerant associated with each compartment and arranged in heat exchange relation with the wall of the compartment, a reservoir for refrigerant common to the plurality of conduits, from which each conduit receives its supply of refrigerant and to which the refrigerant is returned from each conduit, means for thermally inducing cir-

culation of refrigerant in any one of the conduits independently of other conduits in accordance with change of temperature of the associated compartment.

12. In a refrigerating apparatus, a plurality of refrigeration compartments, a reservoir for refrigerant, a plurality of independent circulatory systems one for each compartment communicating with the reservoir and receiving refrigerant supplies therefrom, and means whereby a rise of temperature in one compartment will induce a thermo-syphon circulation of refrigerant through the corresponding system indepnndent of the circulation through systems pertaining to other compartments.

13. In a refrigerating apparatus, a cooling compartment, and refrigerating unit therefor including a channeled member fixedly secured to the exterior wall of the compartment with its concave side adjacent thereto to form a conduit for refrigerating medium.

14. In a refrigerating apparatus, a cooling compartment, and refrigerating unit therefor, and a separately formed tortuous concave convex channel member secured to the exterior wall of the compartment with its concave side adjacent thereto to form a conduit for circulation of refrigerating medium relative to the compartment.

15. In a refrigerating apparatus, a brine tank, a plurality of compartments therein surrounded by the contents of the tank, and a refrigerating unit including a container for liquid refrigerant and a plurality of independent branch conduits, one for each compartment, connected at both ends to the container, one end of each conduit being connected below and the other end thereof above the liquid level of the container, the circulation of refrigerant through each branch conduit being independent of the circulation through other branch conduits whereby the refrigeration of said compartments will be substantially equalized.

16. In an apparatus of the character described, a vessel for condensed refrigerant and a plurality of independent expanison coils leading therefrom below the liquid level of the refrigerant and returning thereto at a point higher than the normal level of the refrigerant in said vessel, an automatic "pumping" action of the refrigerant through any one of said coils independent of such action in the other coils being induced by the unequal expansion of refrigerant in said vessel and coil whereby the liquid refrigerant is conducted to a higher level in the coil than the normal level of the liquid in the vessel.

17. In a refrigerating apparatus, a plurality of refrigerating compartments, a brine tank common to the several refrigerating compartments, separate circulatory systems for each of the compartments, and a refrigerant supply reservoir common to the plurality of separate refrigerant circulatory systems.

18. In a refrigerating apparatus, a plurality of refrigerating compartments, a body of heat absorbent medium common to all the several compartments, and a separate body of heat absorbent medium for each compartment additional to said common body thereof and a circulatory system for the said additional heat absorbent medium pertaining to the plurality of compartments, wherein the medium is automatically circulated by convection relative to any one or more compartments of the plurality independently of circulation of the medium relative to other compartments of the plurality, said common body being subject to the heat exchange influence of the several separate bodies.

19. In a refrigerating apparatus of the character described, a refrigerating apparatus including a plurality of refrigerating compartments, a separate refrigerant circulatory system for each compartment, a reservoir for refrigerant common to the plurality of circulatory systems, a supply connection for each circulatory system with said reservoir below the liquid level of the refrigerant within the reservoir and a return connection for each circulatory system with said reservoir above the liquid level of the refrigerant within the reservoir.

20. In a refrigerating apparatus of the character described, a plurality of refrigerating compartments, a separate refrigerant circulatory system for each compartment, a supply reservoir for refrigerant common to the several circulatory systems, each system being arranged and connected with the reservoir to effect thermo-syphonic circulation of refrigerant therethrough independently of the circulation through other systems of the plurality.

21. In a refrigerating apparatus of the character described, a plurality of refrigerating compartments, a plurality of thermo-syphonic circulatory systems for refrigerant, there being one for each compartment, said systems being arranged for heat exchange with said compartment and a supply reservoir for refrigerant common to the several systems.

22. A cooling unit for a refrigerating apparatus comprising a header adapted to contain liquid refrigerating medium, means for maintaining a substantially constant quantity of liquid in the header and a vertically extending coil connected to the header and disposed laterally thereof, said coil including a plurality of substantially horizontal loops forming an enclosure for a vertically arranged compartment, and being connected at both ends to the header.

23. An evaporator for refrigerating apparatus comprising in combination a header forming a reservoir for liquid refrigerant, means for maintaining a substantially constant level of liquid therein, means providing a thermo-siphon circulation of the refrigerant including a loop of conduit connected at its opposite ends to the header one end of the conduit being connected above and the other end thereof below the liquid level of the header and arranged in the general form of a helix having an upright axis.

24. An evaporator for refrigerating apparatus comprising in combination a header forming a reservoir for liquid refrigerant, means for maintaining a substantially constant level of liquid therein, a container for articles to be cooled, means providing a thermo-siphon circulation of the refrigerant including a loop of conduit connected at its opposite ends to the header level below the liquid level and arranged in the general form of a helix having an upright axis, said helix surrounding the container.

25. Refrigerating apparatus comprising a cabinet, a row of compartments in the cabinet, a header adapted to contain liquid refrigerant, means for maintaining a substantially constant quantity of liquid refrigerant in the header and means for circulating refrigerant including a plurality of generally horizontal spiral coils connected at their opposite ends to the header and surrounding the compartments of the row, said coils being positioned one above the other.

26. A cooling unit for refrigerating apparatus comprising a header adapted to contain liquid refrigerant medium, means for maintaining a substantially constant quantity of liquid in the header, means providing a thermo-siphon circulation of the refrigerant including conduit means formed into a plurality of individual spiral loops disposed substantially in horizontal planes, said loops being disposed laterally of the header and connected at both ends to the header, said loops being located one above the other and forming an enclosure for a vertical compartment.

27. In combination, a cooling compartment and a cooling unit for cooling the compartment including a header disposed vertically in offset relation with the compartment, means for maintaining a substantially constant quantity of liquid in the header and conduit means including a plurality of substantially horizontal loops extending laterally from the header and enclosing the compartment, said conduit means being connected at its opposite ends to the top and bottom of the header respectively.

28. In combination, a cooling compartment and a cooling unit for cooling the compartment including a header disposed laterally relative to the compartment, means for maintaining a substantially constant quantity of liquid in the header, conduit means including a plurality of substantially horizontal loops extending laterally from the header and enclosing the compartment, said conduit means being connected at both ends to the header.

29. In a refrigerating apparatus, a cabinet, a plurality of refrigerating chambers therein, and an evaporator including a series of independent loops surrounding separate refrigerating chambers adjacent to the tops thereof, and a source of refrigerant common to the series of independent loops from which refrigerant is drawn and to which it is returned through each of the loops by thermo-siphon influence independent of the circulation of the refrigerant through other loops of the series.

30. In a refrigerating apparatus, a refrigerating chamber, and a refrigeration unit including a series of unequally distributed coils surrounding the chamber, succeeding convolutions of which are differently spaced apart, the coils being arranged to afford a progressively increased degree of refrigeration toward the top of the compartment.

31. In a refrigerating apparatus, an upright storage compartment, a jacket surrounding in spaced relation the side walls of the upper portion only of the compartment forming thereabout an intermediate space for circulation of refrigerant, the side walls of the lower portion of the compartment being unjacketed, a reservoir for a supply of refrigerant, a conduit for refrigerating medium communicating with the reservoir and leading to and from the jacketed space about the compartment for supplying refrigerant thereto, and means for inducing automatic thermo-syphonic circulation through the conduits and within said jacketed space about the upper portion only of the storage compartment, whereby the contents of the compartment will be subjected to increased refrigerating effect adjacent to the top thereof, in accordance with fluctuations of temperature occurring within the compartment.

32. In a refrigerating apparatus, a cabinet, a plurality of upright storage compartments, passages for refrigerant formed in the side walls of the compartments, a reservoir to contain a supply of refrigerant, a plurality of conduits separately connecting the side wall passages of different compartments with the reservoir for conducting refrigerant thereto and from constructed and arranged for inducing an unbalanced thermal condition of the refrigerant whereby an automatic thermo-syphonic circulation thereof is induced unequally through the side wall passages of different compartments in accordance with variations of temperature in the respective compartments.

33. In a refrigerating apparatus, a cabinet, a storage compartment therein, double side walls for a least a portion of the storage compartment comprising two metal sheets at least one of which has a portion deflected out of a common plane, to form a recess of materially less extent than that of the compartment wall, the wall sheets being interconnected at opposite sides of the recess to afford therebetween a compartment wall passage for refrigerant, a reservoir for a supply of refrigerant, a plurality of conduits connecting the reservoir with the compartment wall passage for circulation of refrigerant thereto and from.

34. In a refrigerating apparatus, a cabinet, a plurality of upright storage compartments therein, passages for refrigerant surrounding the compartments, common side walls separating the compartments and surrounding passages, a reservoir for a supply of refrigerant, a plurality of separate conduits connecting the surrounding passages of different compartments with the reservoir and conveying refrigerant to and from the said compartment passages, and means for inducing unequal automatic thermo-syphonic circulation of refrigerant through the surrounding passages of different compartments in accordance with variations of temperature occurring in said compartments.

35. In a refrigerating apparatus, a cabinet, a plurality of upright storage compartments therein, passages for refrigerant surrounding the compartments, disposed and arranged to afford a progressively increasing refrigerating effect toward the top of the compartments whereby the upper zones of the compartments will be subjected to a greater degree of refrigeration than lower zones thereof, a reservoir for a supply of refrigerant, a plurality of separate conduits connecting the surrounding passages of different compartments with the reservoir and conveying refrigerant to and from the said compartment passages, and means for inducing unequal automatic thermo-syphonic circulation of refrigerant through the surrounding passages of different compartments in accordance with variations of temperature occurring in said compartments.

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