Dec. 27, 1927. 1,654,504

J. G. KING

REFRIGERATING APPARATUS

Original Filed Oct. 3, 1923

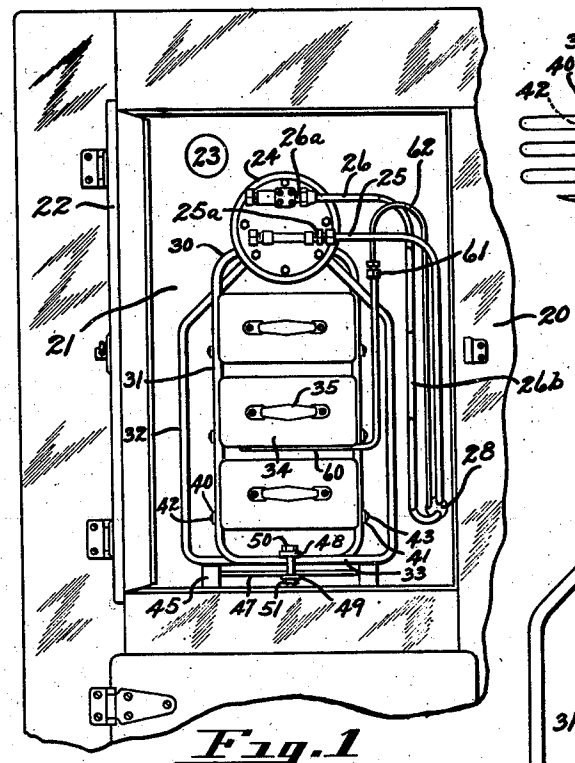

Fig. 1

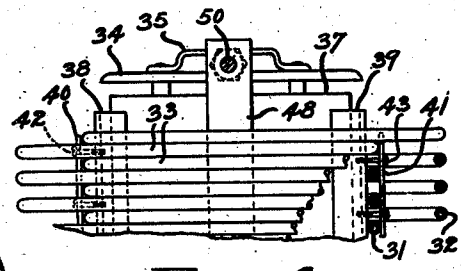

Fig. 4

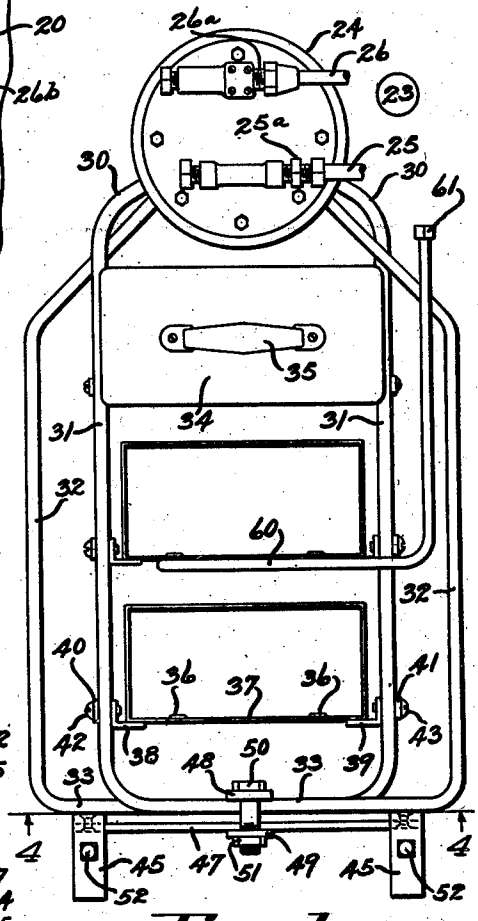

Fig. 3

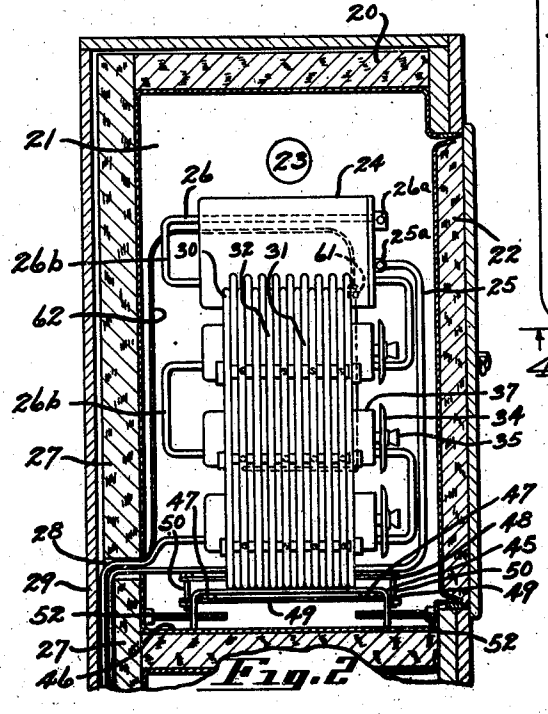

Fig. 2

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UNITED STATES PATENT OFFICE.

JESSE G. KING, OF DAYTON, OHIO, ASSIGNOR TO DELCO-LIGHT COMPANY, OF DAYTON, OHIO, A CORPORATION OF DELAWARE.

REFRIGERATING APPARATUS.

Application filed October 3, 1923, Serial No. 666,257. Renewed November 30, 1927.

This invention relates to refrigerating apparatus, and particularly to apparatus for household use.

The object of this invention is to provide an improved cooling unit which when installed in a refrigerator will maintain the food or storage compartment of the refrigerator at the desired temperature, not too cold for general refrigeration, and which will at the same time provide colder or freezing temperatures for quickly and efficiently freezing or congealing substances. My invention contemplates the provision of what may be termed a freezing zone for quickly cooling or congealing substances placed therein, and what may be termed a cooling zone which is adapted to provide the general cooling for the refrigerator. In carrying out this invention I so construct and arrange the heat exchange means of the cooling unit, which may be formed of ducts or otherwise, that a portion of said means provides the freezing zone while another portion thereof provides the cooling zone. I find also that the accomplishment of the invention may be facilitated and simplified by so disposing the material or heat exchange means of the cooling zone that it will more or less protect the freezing zone from the warming effect of the air or cooling medium which flows over the cooling unit in normal operation.

Another object of this invention is to provide for the economical and efficient construction of the cooling unit, and also to provide a cooling unit which is adapted to be installed in the ordinary ice containing compartment of a refrigerator cabinet, so that an ice refrigerator can be adapted for iceless refrigeration.

Other and further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred embodiment of the present invention is clearly shown.

In the drawings:

Fig. 1 is a fragmentary elevation of a refrigerator cabinet showing the door of the cooling compartment open and a cooling unit for iceless refrigeration installed within said compartment;

Fig. 2 is a sectional view through the ice compartment of a refrigerator showing the cooling unit installed;

Fig. 3 is a front elevation of the cooling unit on a larger scale with two ice trays removed from their shelves;

Fig. 4 is a fragmentary view partly in section, the section being taken on the line 4—4 of Fig. 3.

Referring to the drawings, 20 designates a refrigerator cabinet of the conventional type for ice refrigeration in homes. The cabinet 20 includes a compartment 21 adapted to contain ice and closed by a door 22. The cooling unit designated as a whole by numeral 23 is adapted to be installed in the compartment 21 and act as a substitute for a cake of ice. This unit is connected with refrigerating apparatus (not shown) located outside of the refrigerator.

The unit 23 includes a tank or header 24 which is connected by inlet pipe 25 and outlet pipe 26 with a refrigerating machine located outside of the refrigerator cabinet. These pipes are brought out from the cabinet lining 27 through a hole 28 and then down between the back wall 29 and the refrigerator lining 27. The pipe 26 includes coils 26^b which provide for refrigerating in addition to the cooling unit.

The tank 24 is connected with and supported by a plurality of cooling coils or turns 30 which are identical in contour and are connected with the tank in staggered relation by alternately reversing the coils. That is, considering that each coil includes vertically disposed branch portions or legs 31 and 32 joined by a horizontal yoke portion 33, the branch portion 32 of one coil extends to the right of the tank 24, and the branch 32 of the next adjacent coil extends to the left. By virtue of this arrangement of the coils, two groups of coils are provided, each group of coils having coil branches in spaced alinement, and the coils of one group alternate with the coils of the other group. Each group of coils includes at least one

set of alined straight branches, which are connected together in one plane, and both groups of branches are tied together by means which supports the ice tray drawers or sleeves. Thus a frame work is provided by means of the groups of coils and ice tray supports for supporting the expansion tank.

Each ice tray 34 is provided with a handle 35 and is slidable upon the rails 36 provided upon the bottom wall of a chamber which forms an ice tray shelf or sleeve 37.

The groups of coil branches 31 are clamped together in two substantially vertical planes by means of tie members which include sleeve 37 and angle bars 38 and 39 attached to the sleeve 37 preferably by welding, and by means of clamping bars 40 and 41. Screws 42 pass through bar 40 and are threaded into angle iron 38. Tightening screws 42 clamps one group of coil branches 31 to angle bar 38. In like manner, screws 43 and bar 41 clamp the other set of branches 31 to the angle bar 39. Since the cooling coils 30 are somewhat flexible, their set of branches 31 can be readily brought into vertical alinement, and the set of branches 32 can take whatever position they will as the result of the clamping of the branches 31. It is apparent that the two series of branches provide vertical walls enclosing a central opening located below the expansion tank 24.

The groups of coil branches 31 provide in effect walls of a freezing compartment or zone located between cooling coils and below the expansion tank 24, the bottom of this freezing compartment being provided by the yoke portions 33 of the cooling coils 30. This construction and arrangement can be obtained without materially distorting any of the coils because of the alternately reversed arrangement of the coils permitting the coil branches 32 to take up their positions free of restraint.

By virtue of this construction it will be apparent that the cooling unit provides a relatively cold or freezing zone adapted for freezing or congealing a substance and a cooling zone which lies outwardly of or overlaps the freezing zone, in the path of the circulating air. The two rows of vertically disposed portions or legs 32 bound or provide between them the cooling zone, and it will be seen that the material of the cooling zone is in intimate thermal association with the air which flows downwardly over the duct portions 32 and that such air is cooled thereby to the desired temperature suitable for general cooling within the refrigerator. The portions 31 being nested within the cooling zone enclosure formed by the portions 32 are protected thereby from the effect of the relatively warm air circulating over the cooling unit and it may be said, therefore, that the material of the cooling zone provides, without the aid of additional means, a shield of heat-exchange material for shielding the freezing zone from the action of the circulating air. The sleeves 37 by empeding the circulation of air within or through the freezing zone thus further contribute to the effectiveness of the arrangement.

A support for the cooling unit is provided by two U-shaped members 45, the branches of which provide legs resting upon the bottom wall 46 of the ice compartment 21. The coil yokes 33 rest directly upon the U-shaped members 45. The U-shaped members 45 are attached, for example, by riveting to cross members 47, thereby providing a rectangular supporting platform. The coil yokes 33 are clamped against the U-shaped members 45 by means of a bar 48 which extends over the yoke portions 33, a bar 49 which extends under the cross pieces 47, and two bolts 50, each extending through one end of the bar 48 and one end of the bar 49 and engaged by a nut 51. Tightening the nuts 51 on the bolt 50 causes the bars 48 and 49 to be moved together, thereby clamping the yoke portions 33 firmly upon the horizontal portions of the U-shaped members 45.

In order to secure the cooling unit 23 in position within the cooling compartment 21, each leg of the U-shaped members 45 is provided with a tapped hole for receiving a bolt 52 which may be turned so that its head will be pushed against the lining of the cooling compartment as shown in Fig. 2. In this manner the unit 23 is clamped between opposite walls of the compartment 21.

After the cooling unit has been installed within the compartment 21, the attachment of the pipes 25 and 26 to the tank 24 is made at the couplings 26^a and 25^a.

The cooling unit 23 supports a thermostat bulb 60 attached to a sleeve 37, for example, by welding. After installing the unit 23, bulb 60 is attached by coupling 61 to a pipe 62 connected with a pressure responsive device for controlling the operation of the refrigerating apparatus. This bulb and method of control is disclosed more fully in the copending application of Jesse G. King, Serial No. 670,359, filed October 23, 1923. Briefly, the bulb 60 contains a fluid such as sulphur dioxide which expands as the temperature of the cooling unit rises, and causes the pressure responsive device to start the refrigerating apparatus. When the temperature of the cooling unit decreases the fluid in bulb 60 contracts and the pressure diminishes resulting in stopping the refrigerating apparatus.

While the form of mechanism herein shown and described constitutes a preferred embodiment of one form of the invention, it is to be understood that other forms might be adopted and various changes and alterations made in the shape, size and proportion

of the elements therein without departing from the spirit and scope of the invention.

What I claim is:

1. A cooling unit for mechanical refrigeration comprising: an elongated header, a plurality of duct loops depending from said header, and arranged in staggered relation and forming two sets of loops, each set having its loops substantially in longitudinal alignment and offset laterally from the loops of the other set.

2. A cooling unit for mechanical refrigeration comprising: an elongated header, a plurality of duct loops depending from said header, said loops having substantially identical non-symmetrical shapes and alternate loops being reversely turned to form two sets of loops, one set being staggered relative to the other set.

3. A cooling unit for mechanical refrigeration comprising: an elongated header, a plurality of duct loops depending from said header, and arranged in laterally staggered relation to form two sets of loops, and a freezing compartment surrounded by said loops but fixed adjacent only one side of each loop.

4. A cooling unit for mechanical refrigeration comprising: an elongated header, a plurality of duct loops depending from said header, a freezing compartment located below said header and surrounded by said loops, each of said loops having one leg thereof adjacent said compartment and the other leg spaced from said compartment.

5. A cooling unit for mechanical refrigeration comprising: an elongated header, a plurality of duct loops depending from said header, a freezing compartment located below said header and having a housing surrounded by said loops, each of said loops having one leg thereof fixedly located adjacent said housing and the other leg spaced from said housing.

6. A cooling unit, comprising in combination, a cooling chamber, means for cooling said chamber, said means having a plurality of duct loops arranged in staggered relation to provide two groups of loops each having two legs, the loops of one group alternating with the loops of the other group, means for clamping together and aligning the inner set of legs of one group, means for clamping together and aligning the inner set of legs of the other group to provide two parallel sets of legs, and a supporting structure carried between said parallel sets of legs.

7. A cooling unit for mechanical refrigeration comprising: a header, a plurality of ducts having legs depending from said header and connected in parallel relation thereto, a freezing compartment having close thermal association with only a portion of said duct legs for maintaining said compartment substantially at a freezing temperature, while other duct legs are spaced from said compartment and have a more intimate thermal association with the circulating medium cooled thereby.

8. In a refrigerating apparatus, a cooling unit adapted to be placed in the path of the medium to be cooled thereby, said cooling unit comprising heat exchange means in intimate contact with a refrigerant and with said medium to be cooled, said heat exchange means having a portion constructed and arranged to provide a freezing zone, and another portion formed to provide a cooling zone in intimate thermal association with the medium flowing thereover to cool the latter, the material of said second-mentioned portion lying outwardly of the freezing zone in the path of the circulating medium and so constructed and arranged as to provide, without the aid of additional means, a shield of heat-exchange material for shielding the freezing zone from the action of the circulating medium.

9. In a refrigerating apparatus a cooling unit adapted to be placed in the path of the medium to be cooled thereby, said cooling unit comprising heat exchange means in intimate contact with a refrigerant and with said medium to be cooled, said heat exchange means having a portion constructed and arranged to provide a freezing zone, and another portion spaced from said first-mentioned portion and formed to provide a cooling zone in intimate thermal association with the cooling medium to cool the latter, the material of said second-mentioned portion being so constructed and arranged as to provide, without the aid of additional means, a shield of heat-exchange material for shielding the freezing zone from the action of the circulating medium.

10. In a refrigerating apparatus, a cooling unit adapted to be placed in the path of the medium to be cooled thereby, said cooling unit comprising heat exchange means in intimate contact with a refrigerant and with said medium to be cooled, said heat exchange means having a portion constructed and arranged to provide a freezing zone, and another portion formed to provide a cooling zone in intimate thermal associated with the medium flowing thereover whereby to cool the latter, the material of said second-mentioned portion lying outwardly of and spaced from the freezing zone on opposite sides thereof and being so constructed and arranged as to provide, without the aid of additional means, a shield of heat-exchange material for shielding the freezing zone from the action of the circulating medium.

11. In a refrigerating apparatus, a cooling unit adapted to be placed in the path of the medium to be cooled thereby, said cooling unit comprising heat exchange means in in-

timate contact with a refrigerant and with said medium to be cooled, said heat exchange means having a portion constructed and arranged to provide a freezing zone, and another portion surrounding the freezing zone to provide a cooling zone in intimate thermal association with the cooling medium to cool the latter, the material of said second-mentioned portion being so constructed and arranged as to provide without the aid of additional means, a shield of heat-exchange material for shielding the freezing zone from the action of the circulating medium.

12. In a refrigerating apparatus, a cooling unit adapted to be placed in the path of the medium to be cooled thereby, said cooling unit comprising heat exchange means in intimate contact with said medium to be cooled, said heat exchange means having a portion including duct means constructed and arranged to provide a freezing zone, and another portion providing a cooling zone so constructed as to be in intimate thermal association with the medium flowing thereover whereby to cool the latter, the material of said second-mentioned portion lying outwardly of the freezing zone in the path of the circulating medium and so constructed and arranged as to provide, without the aid of additional means, a shield of heat-exchange material for shielding the freezing zone from the action of the circulating medium.

13. In a refrigerating apparatus, a cooling unit adapted to be placed in the path of the medium to be cooled thereby, said cooling unit comprising heat exchange means in intimate contact with a refrigerant and with said medium to be cooled, said heat exchange means having a portion including duct means constructed and arranged to provide a freezing zone, and another portion also including duct means providing a cooling zone in intimate thermal association with the medium flowing thereover whereby to cool the latter, the material of said second-mentioned portion lying outwardly of the freezing zone in the path of the circulating medium and so constructed and arranged as to provide, without the aid of additional means, a shield of heat-exchange material for shielding the freezing zone from the action of the circulating medium.

14. In a refrigerating apparatus, a cooling unit adapted to be placed in the path of the medium to be cooled thereby, said cooling unit comprising a header and a plurality of duct means connected to the header in parallel circuit relation, said means having a portion providing a freezing zone, and another portion providing a cooling zone in intimate thermal association with the medium flowing thereover whereby to cool the latter, the material of said second-mentioned portion lying outwardly of the freezing zone in the path of the circulating medium and so constructed and arranged as to provide, without the aid of additional means, a shield of heat-exchange material for shielding the freezing zone from the action of the circulating medium.

15. In a refrigerating apparatus, a cooling unit adapted to be placed in the path of the medium to be cooled thereby, said cooling unit comprising a header and a plurality of ducts connected to the header in parallel circuit relation, certain of the ducts having portions co-operating with portions of other ducts to provide a freezing zone, and certain of the ducts having portions co-operating to provide a cooling zone in intimate thermal association with the medium flowing thereover whereby to cool the latter, the material of said cooling zone lying outwardly of the freezing zone in the path of the circulating medium and so constructed and arranged as to provide, without the aid of additional means, a shield of heat-exchange for shielding the freezing zone from the action of the circulating medium.

16. In a refrigerating apparatus, a cooling unit including a header, a plurality of duct means connected to the header in parallel circuit relation, said duct means having spaced apart portions providing a compartment therebetween and other portions within said compartment and spaced apart to provide an inner compartment.

17. In a refrigerating apparatus, a cooling unit including a header, a plurality of duct means connected to the header in parallel circuit relation, said duct means having upright member each connected to the header and spaced apart to provide a chamber therebetween, and other upright members within said chamber and connected with the header and spaced apart to provide an inner compartment within said chamber.

18. In a refrigerating apparatus, a cooling unit comprising a plurality of duct loops arranged in staggered relation and forming two sets of loops, each set having its loops substantially in longitudinal alignment and offset laterally from the loops of the other set, and means in intimate metallic contact with said loops for supporting ice-freezing trays.

19. In a refrigerating apparatus, a cooling unit including a header, opposed duct means extending downwardly from the header in spaced-apart upright planes disposed on opposite sides of said header, and means supported between said opposed duct means and in intimate metallic contact therewith for supporting an ice-freezing tray.

20. In a refrigerating apparatus, a cooling unit including an elongated header, opposed duct means extending downwardly from the header in spaced apart upright planes extending longitudinally of the head-

er, and means supported between and in intimate metallic contact with said opposed duct means for carrying an ice-tray.

21. In a refrigerating apparatus, a series of duct loops substantially in longitudinal alignment, said duct loops having vertical leg portions lying in opposed upright spaced apart planes, and means supported between and in intimate metallic contact with said opposed vertical leg portions for receiving an ice-tray.

In testimony whereof I hereto affix my signature.

JESSE G. KING.