July 5, 1938. C. W. BAKER 2,122,675

HOUSEHOLD REFRIGERATOR

Filed Jan. 30, 1937 3 Sheets-Sheet 1

FIG.1.

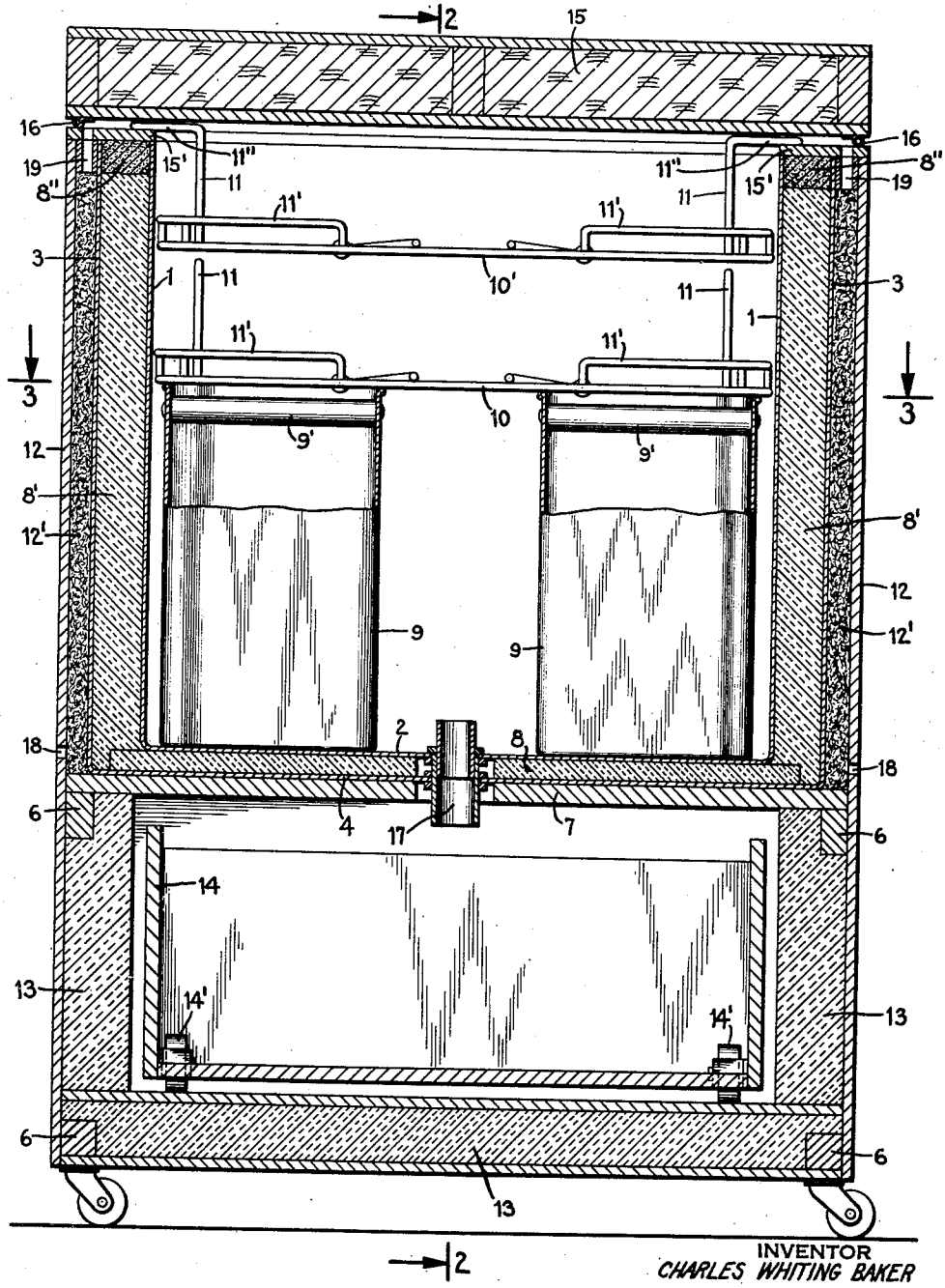

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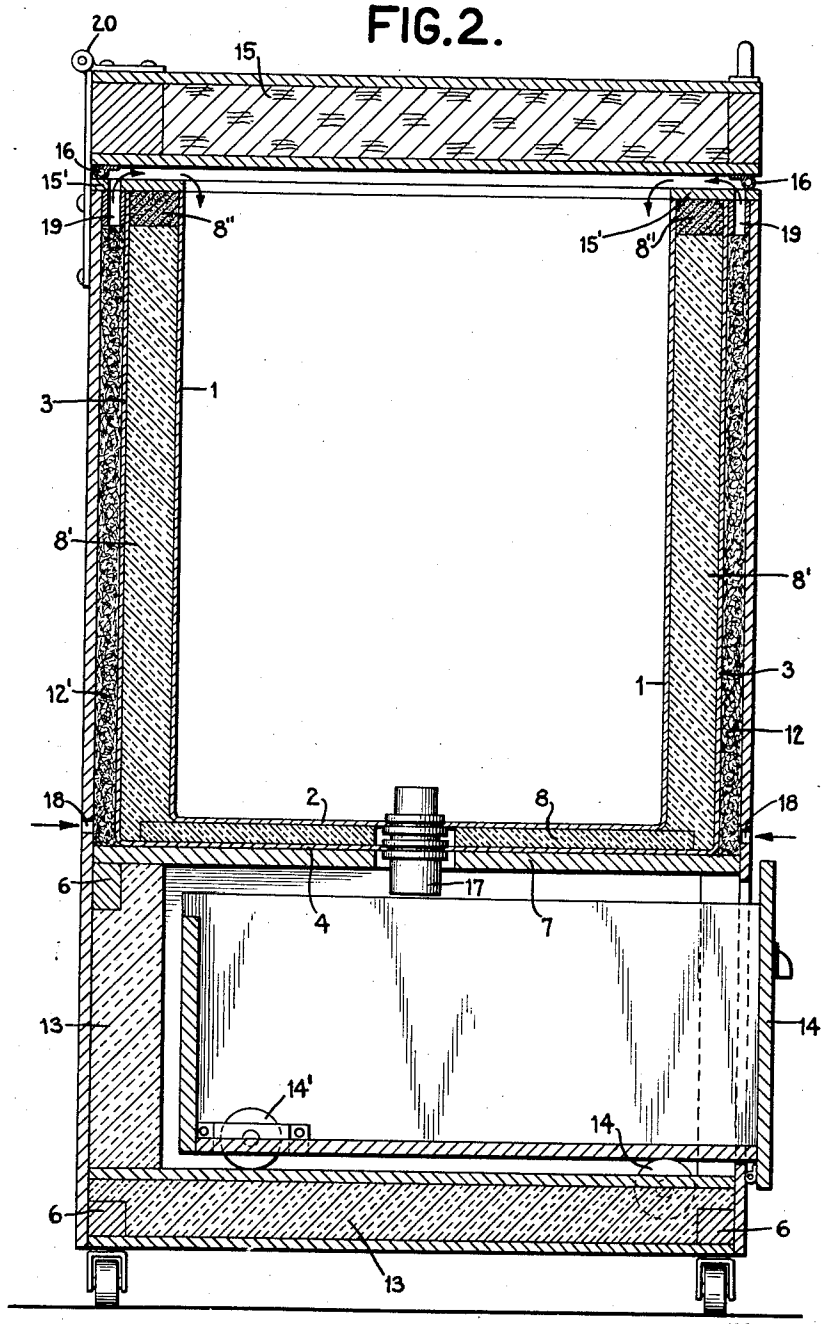
FIG.2.



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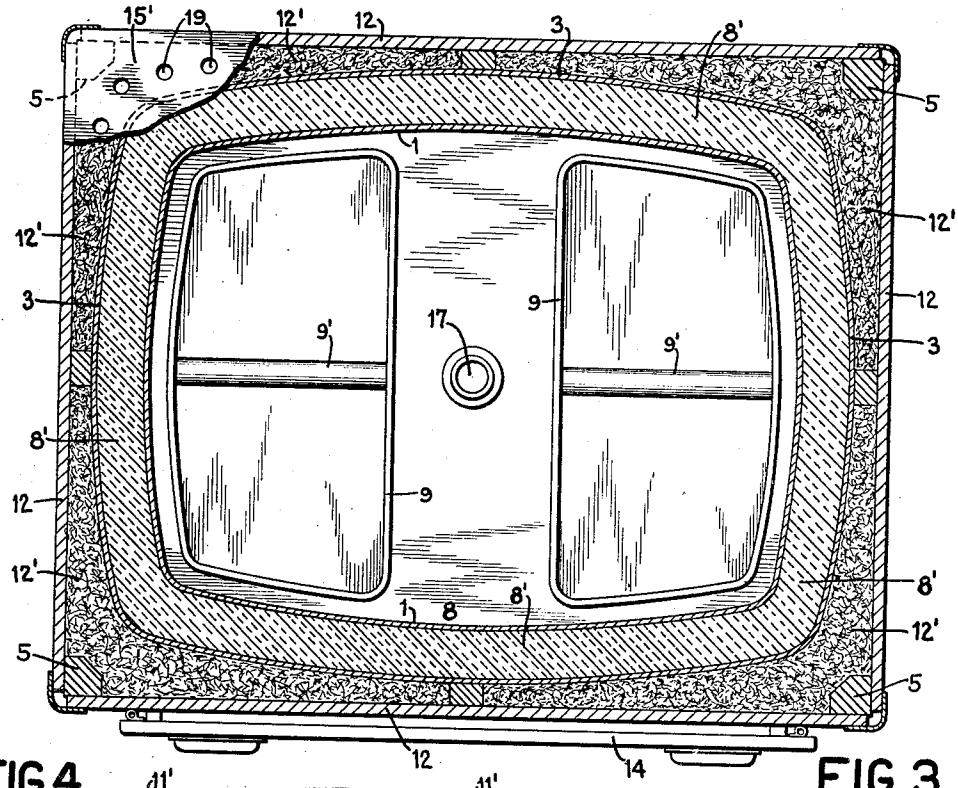
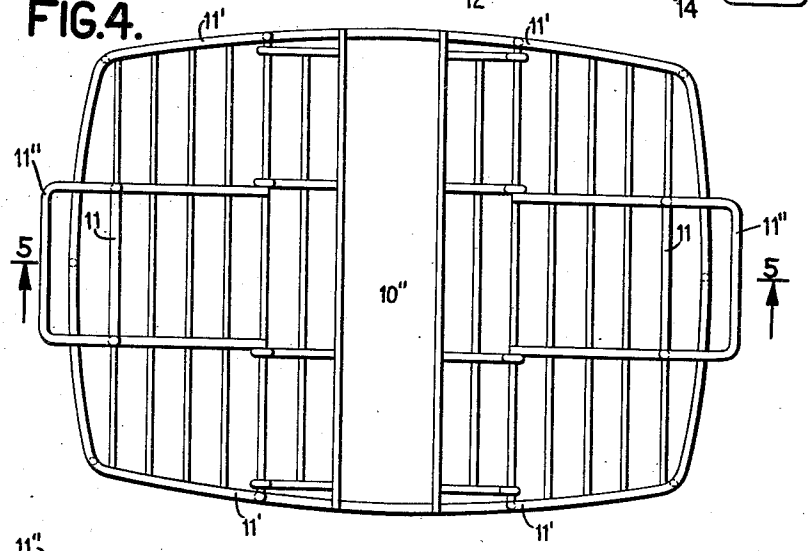


FIG. 4.

FIG. 3.



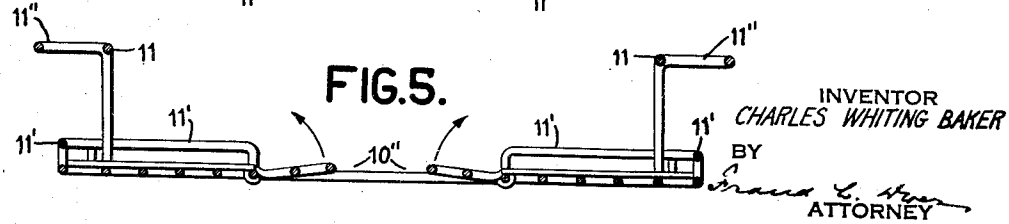


FIG. 5.

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UNITED STATES PATENT OFFICE

2,122,675

HOUSEHOLD REFRIGERATOR

Charles Whiting Baker, Montclair, N. J.

Application January 30, 1937, Serial No. 123,246

4 Claims. (Cl. 62—75)

My invention relates to improvements in household refrigerators and my object is to provide a refrigerator with which there will be a better preservation of food, high economy in the use of ice, greater convenience in use and a superior mode of operation, whereby the contents will be kept at a lower temperature than is now possible with refrigerators using ice, while at the same time the air within the refrigerator will not be deprived of its moisture with resulting deleterious effects, as frequently occurs with mechanically operated refrigerators.

With my improved refrigerator, the temperature therein will be maintained sufficiently low to provide safety in refrigeration for from 12 to 24 hours after the ice has completely melted, and the efficiency is such that reicing is required only 3 or 4 times a month instead of several times weekly in hot weather, as is now necessary with present ice refrigerators.

My improved refrigerator is entirely self-contained and is therefore preferably mounted on castors, whereby its position may be readily changed. Moreover, with my improved refrigerator the food shelves are so located that they may be reached without stooping and without requiring the removal of articles on the front of a shelf in order to reach others in the rear.

With both ice and mechanical refrigerators as now marketed, the air is in constant circulation over the ice or cooling coils above, and around the food stored below. With them, the change of air which occurs when the refrigerator door is opened and the heavy cold air from within flows out, is variable and uncertain and the resulting dilution by warm air entering from the outside frequently results in a dangerous rise of temperature. Furthermore, odors from the food stored inside accumulate during the night hours when the refrigerator is not opened.

With my improved refrigerator the air in the food chamber flows slowly but constantly downward without circulating or mixing, and this enables provision to be made by which the odors from food are carried off.

Heretofore in the construction of refrigerators cooled either by ice or mechanically, the chamber inside of which the food and the refrigerating means are placed has heat-insulating materials packed between it and the outside sheet metal casing. This insulation is fabricated to fit into its place and is often wrapped to protect it from moisture. Fabricated insulation is expensive to manufacture and to fit into place and it is difficult to seal hermetically. Besides, the inside sheet metal case (which may be at a temperature of 40 degrees or lower) and the outer sheet metal case (which is at room temperature) must be firmly secured together and the joint must be airtight. It is impossible to use compressible or porous insulating materials between these warm and cold sheet metal casings; relatively poor heat insulating materials are used, such as wood. Therefore this provides an area several feet in extent through which heat is constantly flowing into the refrigerator. A similar effect takes place through the inner and outer metal sections forming the door opening or openings and through bolts used for holding the two casings in their desired relationship.

The construction of my improved refrigerator is such as to almost wholly avoid this flow of heat into the cold chamber since the outer and inner sheet metal casings are separated by highly efficient insulation and no metallic paths are presented for the transfer of heat and the outer sheet metal casing is itself protected by insulation packed between it and the outer cabinet or case.

In order that my invention may be better understood, attention is directed to the accompanying drawings forming a part hereof and in which

Figure 1 is a vertical cross-section of the device.

Figure 2 a vertical cross-section at right angles to Figure 1.

Figure 3 a horizontal section on the line **3—3** of Figure 1, with a part shown in plan with cover removed.

Figure 4 a plan view of the upper removable basket shelf, and

Figure 5 a side view of the same.

In all of the above views, corresponding parts are indicated by the same numerals.

My improved refrigerator is of the so-called ice chest type, with a hinged cover affording the only access to the interior of the cold chamber. Instead of being a rectangular box of sheet metal with insulation between its inner and outer shells as at present, I make the inner and outer shells curvilinear so that the stress produced by packing the insulation between them places the outer shell in tension with the inner shell in compression, while at the same time there is no bending stress on the sheet metal at any point. Furthermore, the insulation packed between the inner and outer shells acts like a mechanical bracing so that the the two shells act together to resist stresses tending to deform them. Thus a blow against the surface of the inner shell will be re-

sisted by the outer shell as well as by the inner shell.

In the drawings, 1 indicates the vertical wall of the inner shell and 2 the bottom thereof preferably welded or soldered together, although in case of mass production these elements may be formed by means of suitable dies from a single sheet. 3 indicates the vertical wall of the outer shell and 4 the bottom thereof, similarly secured together. The formation of these inner and outer shells is the only sheet metal shop-work required in the construction of my improved refrigerators.

To support and protect this sheet metal construction I provide a skeleton wooden framework having vertical corner posts 5, horizontal sills 6 and a floor 7.

To assemble the refrigerator, the outer shell 3—4 is first set in place on the floor 7 in the skeleton framework and one or more layers of sheet insulation 8 are laid on the bottom. The inner shell 1, 2 is then set on top of this insulation. The two shells are held in their concentric relationship by any suitable means and insulating material 8', such as granulated cork, is poured between them and firmly packed. The insulating material 8' is finally sealed hermetically by pouring melted asphaltum 8'' into the space between the shells at the top. It will be understood, of course, that the assembly of the cold chamber thus formed may be effected outside of and independently of the framework.

As shown in Figure 3, the end walls and side walls of the cold chamber are arched, thereby forming a very strong construction which will not be deformed by tightly packing the insulation 8' into place.

To effect refrigeration in the cold chamber thus formed, I provide pails 9 having central handles 9' for lifting and carrying, said handles being located preferably below the tops of the pails as shown so as not to interfere with the functioning of the pails in supporting the lower shelf. These pails are filled with crushed or chopped ice. As shown particularly in Figure 2 they are preferably of a form to fit the ends of the cold chamber leaving a space of substantial width between for the storage of food. The outer surface of these pails, 9—9 is at a temperature of about 32 degrees from the time the ice-filled pails are set in the cold chamber until the ice is all melted. Thereafter the temperature will slowly rise as the water in the pails absorbs heat but I find in practice that even in hot summer weather it is perfectly safe to wait from 12 to 24 hours after the ice has melted before re-icing.

The space between the pails will be held at a temperature of from 34 to 40 degrees and it is in this space that perishable foods, such as milk and meat, are placed.

In the space in the cold chamber above the pails 9 are placed two shelves 10 and 10', the former resting directly on top of the pails 9 as shown and the latter being supported in any suitable way. Both of these shelves are of open wire and the central portion is left open at 10'' as shown in Figures 4 and 5 so that articles which are set on the bottom of the cold chamber between the pails can be readily reached. Each of these shelves 10—10' is provided with handles 11 by which the shelf and its contents may be lifted and removed from the cold chamber and each is provided with a rim 11' around its edge to prevent articles from sliding off when the shelf is so lifted.

The inner part of these wire shelves 10—10' is hinged to the main part of the shelf as shown in Figs. 4 and 5. When it is desired to place or remove large articles from the space between the pails 9—9, these hinged portions of the shelves 10—10' may be turned back. When turned inward they increase the width of the shelf and the projecting ends resting on the frame of the shelf, raise the edge of this hinged section sufficiently to prevent articles sliding off.

The handles by which the upper shelf is lifted preferably have projections 11'' which extend beyond the cold chamber and rest on the top thereof in the narrow space enclosed by the gasket insulation on the underside of the cover as later described.

In order to support and protect the insulated sheet metal cold chamber and to provide additional insulation, I cover the wooden framework with a substantial fiber board 12, of which there are several examples obtainable on the market. For this purpose I prefer to use so-called Masonite quarter board. The space between this outer covering and the cold chamber I fill with bulk insulation 12', such as mineral wool. In addition and in order to secure further insulation the inside face of the outer covering 12 is covered with a waterproof paint of low emissivity such as asphalt aluminum paint. For the sake of appearance, the exterior is finished with an enamel paint which adheres much more firmly to fiber board than to metal.

Refrigerators of the ice chest type as hitherto made have been too low for convenient use and of insufficient capacity, both of which difficulties are eliminated in my improved construction.

The cold chamber is supported by the wooden framework at such a height as will be most convenient for use. The space beneath the cold chamber enclosed by the exterior covering is lined with thick sheet insulation 13 on its sides, rear and bottom and the enclosed and insulated cabinet thus formed is provided with a drawer 14 supported on ball bearing rollers 14'.

By suitably proportioning the insulation between the cold chamber and the under cabinet and by proper regulation of the flow of air for ventilation from the cold chamber into the latter, the flow of cold to the under cabinet may be such as will keep the contents of the drawer 14 at from 50 to 55 degrees, a low enough temperature to preserve fruit, vegetables, cooked food and the like. The amount of ice required to maintain this temperature in the under cabinet will be very much less than would be required if the under cabinet were a part of the cold chamber with no partition between them and furthermore it would not then be possible to maintain in the cold chamber a temperature sufficiently low for the preservation of perishable foods.

It will be apparent that the ice pails 9 may be of such size as will best meet the needs of the user. Pails of larger capacity of course will lessen the time between icings but smaller pails will provide more room for the storage of food between the pails. The use of pails of broken or crushed ice obviously avoids drainage difficulties encountered where ice cakes are used. When the ice has all melted, the resulting water, owing to the voids in the broken ice and the greater bulk of ice than water, fills the pails only about two-thirds full. Therefore the pail may be lifted out and emptied without spilling. The ice water left when the ice has all melted has sufficient refrigerating effect to maintain the cold chamber and its contents from 12 to 24 hours longer

before the temperature rises to a dangerous point.

In refrigerators as now made, the ice or the cooling coils are placed on top and the food below. With my improved refrigerator the pails of ice are placed on the bottom of the cooling chamber and the food is placed between the pails and on shelves above the pails. The circulation of air, which has been considered necessary in all refrigerators heretofore made, is absent here but my experiments show that while the space between the pails is held continuously at 34 to 40 degrees, far lower than in other ice refrigerators, there is radiation and conduction between the pails of ice and the food on the shelves, sufficient to keep the food at a safe low temperature, lower in fact than with other ice refrigerators.

To further facilitate this transfer of heat by conduction, I prefer to use a heavy gauge sheet metal for the inside wall 1 of the cold chamber. This not only gives a thicker section of metal in which the cold from the ice pails will flow toward the top, but the thicker and stiffer sheet allows the curved sides and ends 1, of the cold chamber to be of larger radius, thus increasing the volume of the cold chamber for given external dimensions of the refrigerator as a whole.

The cold chamber is opened by lifting the hinged cover 15 which is made very light, having a framework of light material such as balsa wood between an upper and lower sheet of fiber board and with a filling of cork or kapok. A member 15' of fiber board or other suitable material extends across the top of the two walls of the cold chamber and interposed between this top sheet 15' and the cover is the usual tubular gasket, affording a space within which will be located the horizontal portions 11'' of the handles 11' of the top shelf 10'. The weight of the cover is partially counterbalanced by spring hinges 20, and a flexible tension spring connected to the cover and the side of the cabinet prevents the cover from swinging too far back. The weight of the cover not counterbalanced compresses the packing or gasket 16 secured to the underside of the cover sufficiently to make an airtight joint between the cover and the top sheet 15' of the cold chamber. This avoids the difficulties with the latches on the doors of the refrigerators as heretofore made.

With refrigerators of the conventional type having doors in the front, the heavy cold air inside rushes out whenever the door is opened and warm air from the outside flows in to take its place, and this continues as long as the door is opened or ajar. The heat thus carried into the refrigerator adds to the consumption of ice or electric current.

With my improved refrigerator when the cover is lifted, the heavy cold air stays in place like water in a cup and even if the cover is carelessly left raised for a considerable time there will be little loss of cold.

A more important consideration, however, results from this feature of my improved refrigerator. The cold air inside a refrigerator, after it has stood for some time, is almost germ free but when the door of an ordinary refrigerator is opened the warm air rushing in carries with it millions of germs, which may start decay or mold or fungus growth upon the food inside. With my improved refrigerator there is no such inrush of warm germ laden air when the cover is lifted and this has an important influence in the preservation of food.

Since there is no ventilation of my improved refrigerator through change of air when the cover is opened, it becomes necessary to provide other means for carrying off the odors from stored food. This I do by providing a ventilating passage 17 from the bottom of the cold chamber through the insulation below it and through the floor 7 as shown in Figures 1 and 3. As the air in the cold chamber is much heavier than the air in the room outside, there will be a natural downward draft through this passage 17.

The air at the bottom of the cold chamber, at a temperature of 34 degrees to 36 degrees, will therefore flow downward into the drawer 14 in the under cabinet. This heavy cold air will lower the temperature in the drawer and will displace warmer air at the top or sides of the drawer through outlets provided for that purpose, for example, by leaving off part of the gasket along the top of the drawer, which forms a tight joint between the projecting flange of the drawer and the casing.

Of course, air must flow into the top of the cold chamber to replace the air flowing downward through the ventilating passage 17 and it is desirable that this inflowing air be as cool as possible and also be free from dust.

I therefore provide a number of perforations 18 in the outer walls 12 of the refrigerator, located as shown near the bottom of the cold chamber and I also provide a number of openings 19 in the top plate 15' and connected with the space between the cold chamber and the walls 12. Through the perforations 18, outside air enters and flows upward through the rock wool insulation 12' and thence through the openings 19 and through the space between the plate 15' and cover 15 into the cold chamber. In flowing through the insulation 12' the air is freed of any dust particles and it is also somewhat cooled below the room temperature. In this way, I provide for a slow seepage of air into and out of the cold chamber. While the actual movement of the air within the cold chamber is extremely slow yet it is sufficient to carry off odors from the food therein.

What I claim is:

1. An ice chest, comprising in combination, a cold chamber, refrigerating means in the bottom of the cold chamber, food storage shelves above said refrigerating means, a vent in the bottom of said cold chamber and means for continuously ventilating the interior of the cold chamber by a slow gravity flow of heavy cold air therein through said vent, said air flow extending from the top to the bottom of the cold chamber.

2. An ice chest, comprising in combination, a cold chamber, ice-containing pails in the bottom of said cold chamber, food storage shelves above said pails, a rectangular casing surrounding and supporting the cold chamber, a compartment in said casing below the cold chamber, a drawer in said compartment, a vent in said cold chamber opening into said lower compartment, means for continuously ventilating the interior of the cold chamber by a slow gravity flow of heavy cold air therein through said vent and into said lower compartment and means for the escape of air from said compartment.

3. An ice chest, comprising in combination, a cold chamber, a rectangular casing surrounding and supporting the cold chamber, a lower compartment in said casing below the cold chamber, a drawer in said compartment, a vent between the bottom of the cold chamber and said compartment, insulating material loosely packed be-

tween the cold chamber and said casing, an air inlet through a wall of said casing below the top of the cold chamber and an air passage connecting the cold chamber with a space between it and said casing whereby a circulation of air will be maintained through said opening, thence through the loose insulation, thence into and through the cold chamber and finally through said vent into said compartment.

4. An ice chest comprising, in combination, a cold chamber having two spaced vertical walls with insulation packed therebetween, a rectangular casing containing said cold chamber, a hinged cover closing the top of said cold chamber, two ice pails for containing cracked ice on the bottom of said cold chamber and a removable grill constituting a food shelf supported by said pails, and a second grill above the first supported by the top of the cold chamber.

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