Jan. 5, 1943. O. H. YOXSIMER ET AL 2,307,093

REFRIGERATOR CABINET

Filed March 26, 1940 3 Sheets-Sheet 1

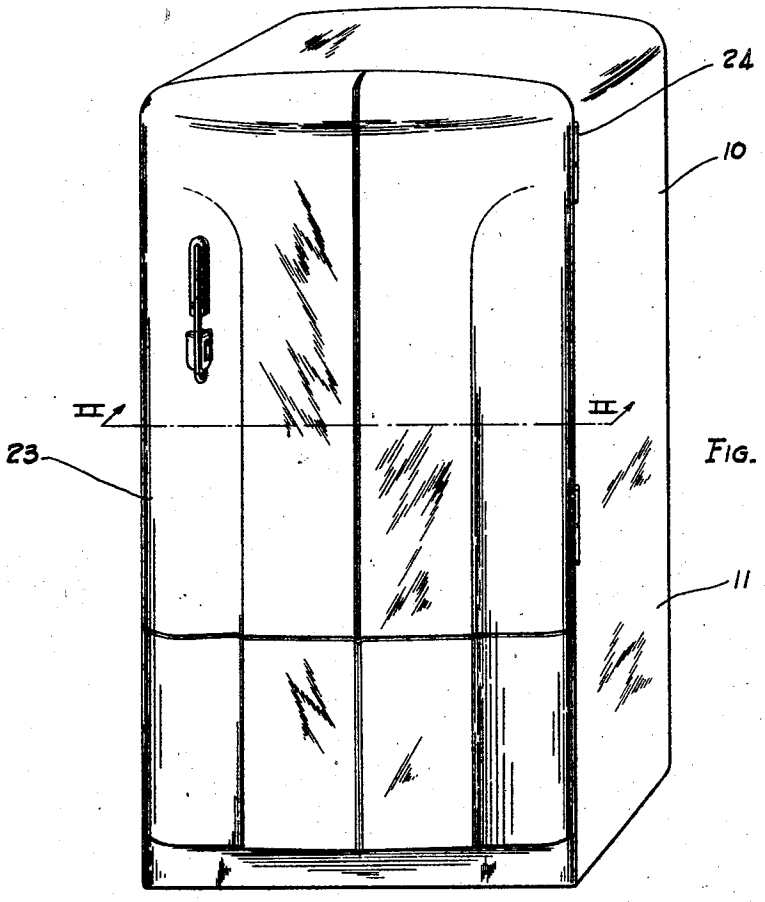


FIG. 1.

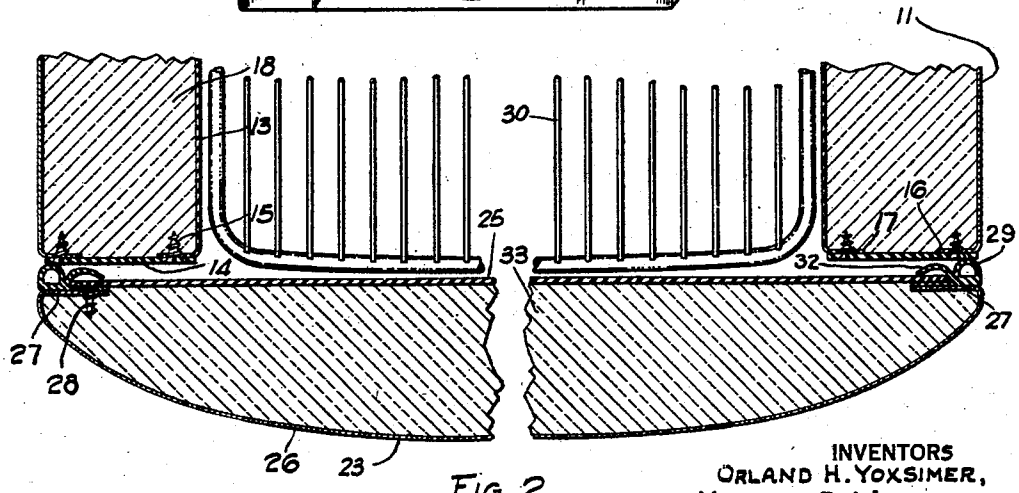


FIG. 2

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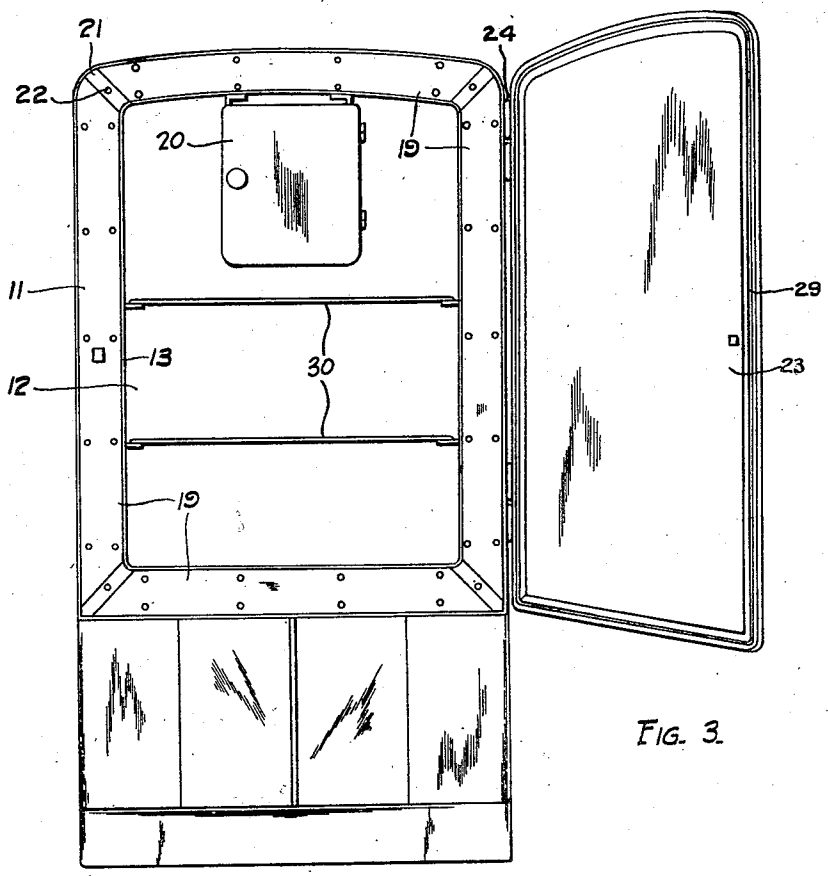


FIG. 3.

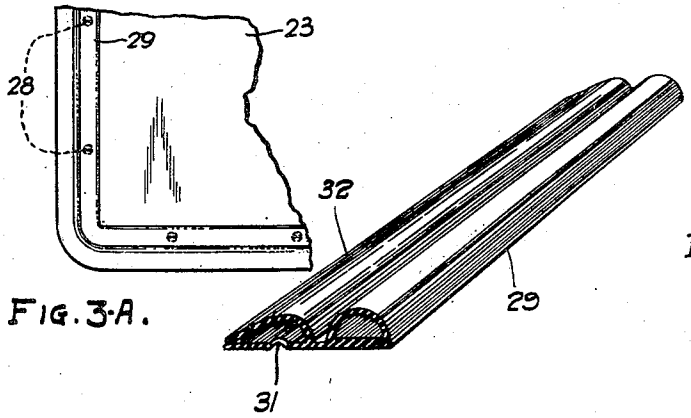


FIG. 3-A.

FIG. 4.

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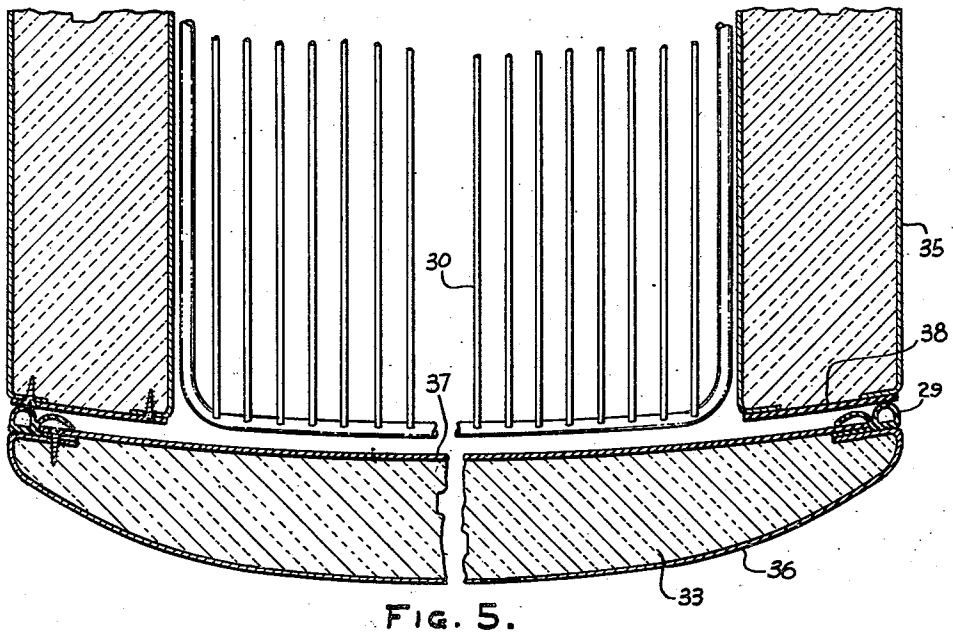


FIG. 5.

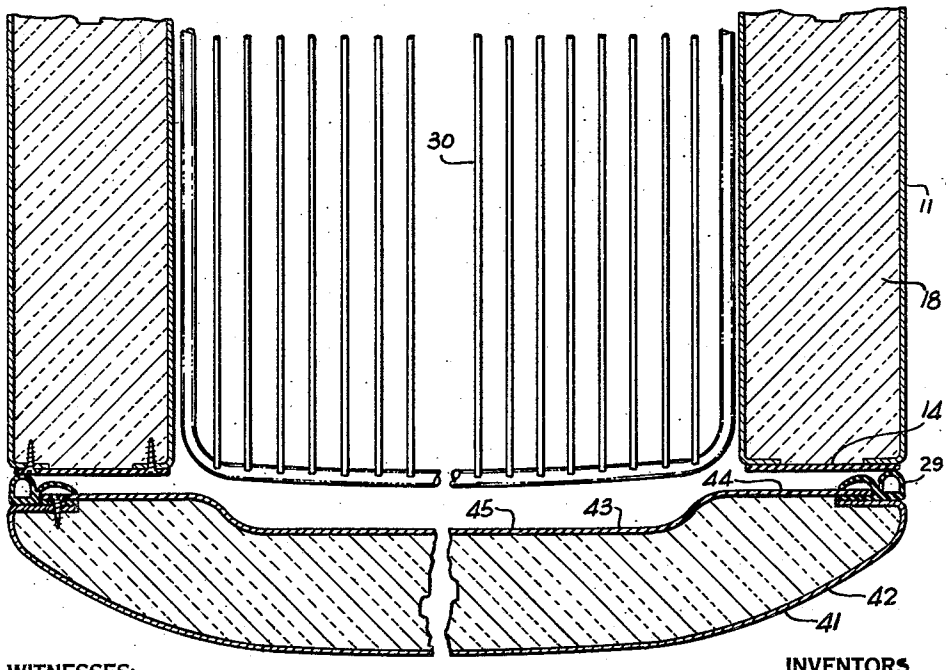


FIG. 6.

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UNITED STATES PATENT OFFICE

2,307,093

REFRIGERATOR CABINET

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Application March 26, 1940, Serial No. 325,976

11 Claims. (Cl. 20—35)

This invention relates to a refrigerator cabinet and more especially to the door and the construction at the door opening of a refrigerator cabinet. This application is a continuation-in-part of application, Serial No. 238,365, filed November 2, 1938 for Refrigerator cabinet.

It is an object of the invention to provide an improved heat insulating door for a refrigerator cabinet and to materially reduce the number of parts used in the door construction.

It is another object of the invention to simplify the construction of a refrigerator door and to reduce its weight and manufacturing cost without reducing its strength and heat insulating qualities.

It is another object of the invention to provide an improved construction of a refrigerator cabinet including the door and the construction around the door opening.

It is a further object of the invention to provide a refrigerator cabinet in which the leakage of heat at the door opening is materially reduced.

These and other objects are effected by our invention as will be apparent from the following description and claims taken in connection with the accompanying drawings, forming a part of this application, in which:

Fig. 1 is a perspective view of a refrigerator cabinet embodying the invention;

Fig. 2 is a section on line II—II of Fig. 1;

Fig. 3 is a view of a refrigerator illustrated in Figs. 1 and 2 showing the breaker strip of the cabinet;

Fig. 3—A is an enlarged view of a corner of the door shown in Fig. 3;

Fig. 4 is an enlarged view in perspective of a sealing gasket of the refrigerator cabinet;

Fig. 5 is a partial sectional view of a second embodiment of the invention; and,

Fig. 6 is a partial sectional view illustrating a third embodiment of the invention.

Referring specifically to Figs. 1 to 4, inclusive, for a detailed description of the first embodiment of the invention, reference numeral 10 represents a refrigerator cabinet comprising an outer shell 11 having a vertically-extending substantially rectangular door opening 12 in its upper portion. An inner liner 13 defines a food storage compartment 9 and is secured in the cabinet by means of a breaker strip 14 and sheet metal screws 15. The edges 16 of the sides and the top of the outer shell 11 are turned inwardly around the door opening 12 and the edges 17 of the inner liner 13 are turned outwardly to provide attachment flanges for the breaker strip 14. Heat insulating material 18 is packed between the inner liner and the outer shell 11. An evaporator 20 is disposed in the upper portion of the food storage compartment 9 and induces a vertical circulation of air therein which is usually down the back across the bottom, and up the front of the food liner 13. The breaker strip 14 comprises four panels or strips 19 of heat insulating material. The strips 19 are non-metallic and non-hygroscopic and are preferably formed of a thermoplastic such as a material impregnated with a resinous condensation product, such as the product known by the trade-mark "Micarta," or a coated cellulose material held by a suitable binder, such as the product known by the trademark "Masonite." The strips 19 lie in the same vertical plane and form a portion of the front wall of the cabinet. The meeting edges of the strips 19 are mitered and are concealed by corner clips 21 held in place by screws 22.

A frameless door 23 is secured to the cabinet by hinges 24 and comprises an inner panel 25 consisting of a flat sheet of stiff, moisture-proof heat insulating material and an outer dished sheet of metal 26, the edges 27 of which are turned inwardly and are secured to the inner panel 25 peripherally thereof by screws 28, as shown in Fig. 3—A. The inner panel 25 is also non-metallic and non-hygroscopic and is preferably formed of a themo-plastic such as that used for the breaker strips 19. It has been found that a thickness of between $\frac{1}{16}$ and $\frac{3}{32}$ of an inch of the product known by the trade-mark "Micarta," for example, provides a door which is extremely light and is sufficiently strong. The light inner panel 25 together with the lack of a frame internally of the door reduces the heat leakage through the door and the inertia developed by the door when it is slammed shut. Non-rigid heat insulation material 33 is preferably disposed between the inner and outer door panels. The door is as strong and rigid as many doors of the type including a frame or formed of inner and outer shells with a heat insulated breaker strip therebetween and such a door has a much lower heat leakage factor than comparable doors of the above type.

The screws 28 also engage a rubber sealing strip 29 through holes 31 and also clamp a portion of the strip 29 between the inner panel 25 and the outer metal sheet 26. The sealing strip 29 is shown in detail in Fig. 4 and has a flap 32 which may be lifted when inserting the screws 28.

When the door is closed the inner panel 25 of heat insulating material lies closely adjacent and

parallel to the breaker strips 19 and the sealing gasket 29 near the outer margin of the breaker strips 19 so that a long, narrow dead air space is formed between the door panel 25 and the breaker strips 19, substantially at right angles to the access opening. It is, therefore, clear that air entering or leaving the dead air space must turn a substantial angle before it enters or leaves the food storage compartment.

It will be observed that the inner panel 25 of the door 23 is one unitary sheet and does not contain joints formerly found between the inner panel and the breaker strip. As is well known, a refrigerator door is customarily closed by slamming and must be designed to stand the forces set up thereby. Upon slamming the door, the momentum of the mass of insulating material in the door as well as the momentum of the inner panel itself is borne by said inner panel. Joints in the inner panel not only weaken the wall but add to its weight and hence to its momentum when the door is slammed. As a result, the refrigerator doors of prior constructions require an inner wall of considerable strength to withstand the forces due to slamming. By utilizing the present invention a very light refrigerator door results because the inner panel is light but is rigid in all directions of bending to which a refrigerator door is subjected.

A further advantage of constructing the inner door of heat insulating material rather than of metal is that the insulating material is of lower heat storage capacity than metal so that it warms up quicker when the door remains open for a period of time and, as a result, less moisture from the room air condenses thereon. When the door is again closed, less heat is also transferred into the cabinet because of the low heat storage capacity of the inner panel. The joint between the inner panel and the outer sheet is located adjacent the sealing gasket 29 so that it is not strained appreciably when the door is slammed.

A second embodiment of the invention is shown in Fig. 5 and comprises a cabinet 35 and a door 33. The door 33 is constructed by attaching an outer sheet metal dished shell 36 to an inner shell or door pan 37 in the same manner as shown in Figs. 1 to 4, inclusive. The inner shell 37 is also preferably formed of a thermoplastic, such as a material impregnated with a resinous condensation product, such as described with respect to Figs. 1 to 4. The inner shell 37 in the present embodiment is provided with a slight spherical curvature in all directions, a horizontal cross section only being shown by way of illustration. Breaker strips 38, preferably formed of the same material as the inner door shell 37 are provided with a corresponding curvature so that the breaker strips 38 lie in a continuous surface and are closely adjacent and parallel to the inner door shell 37. A gasket 39 is provided on the door in the same relative position as shown in Figs. 1 to 4.

A third embodiment of the invention is shown in Fig. 6 and comprises a cabinet which is the same as shown in Figs. 1 to 4, like reference numerals being used for like parts. A door 41 is constructed in this embodiment of the invention by attaching an outer sheet metal dished shell 42 to an inner shell or door pan 43 in the same manner as shown in Figs. 1 to 4, inclusive. The inner shell 43 in the present embodiment is provided with flat marginal portions 44 and a curved central portion 45, the flat marginal portions 44 lying parallel and adjacent to the flat cabinet breaker strips. The inner door shell 43 is preferably formed of one of the materials described with respect to the inner door shell of Figs. 1 to 4, inclusive.

By providing a slight curvature in the inner shells 37 and 43 of the embodiments shown in Figs. 5 and 6, greater strength is obtained for the door and warpage of the thermo-plastic material is substantially prevented. This is of importance because in usual practice only the outer face of the inner door shell is provided with a finish and the unfinished inner side is slightly more pervious to any moisture that may condense thereon. Furthermore, by providing the inner door shells with a slight curvature, additional shelf storage space on shelves shown at 30 in Figs. 2, 3, 5, and 6, is available in the refrigerator cabinet. In addition, the clearance between the shelves and the door may be at a minimum since tolerance for warpage is not necessary.

Another important advantage of providing the inner door shells 37 and 43 with a slight curvature is that very thin material may be used, thus effecting savings in cost and weight. For example, it has been found that if the aforesaid resinous material known by the trade-name "Micarta" is utilized, the inner shell can be reduced to a thickness of $\frac{1}{16}$ of an inch.

In the embodiment of the invention shown in Fig. 6, all of the aforesaid advantages are obtained and in addition, the air gap is at right angles to the air flow and the width of the air gap is at a minimum, thus decreasing the heat leakage therethrough.

The term "continuous surface" as used herein defines any surface devoid of angles such as, for example, a plane surface or any curved surface which is a part of a sphere or a cylinder.

It is therefore apparent that the invention provides a composite door for a refrigerator cabinet which is light and inexpensive but which is of sufficient strength to perform the usual functions of a refrigerator door. Furthermore, the combination of the refrigerator door shown together with the position of the breaker strips on the cabinet provide a decreased heat leakage path at the door opening.

While we have shown our invention in several forms, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various other changes and modifications without departing from the spirit thereof, and we desire, therefore, that only such limitations shall be placed thereupon as are specifically set forth in the appended claims.

What we claim is:

1. In an insulated refrigerator door, the combination of an integral inner wall formed of thin substantially rigid heat insulating material having coplanar marginal portions, a domed outer wall having an inwardly extending flange provided thereon throughout its periphery lying parallel to the marginal portions of the heat-insulating material, said flange lying adjacent the edges of said marginal portions of the heat insulating material and overlapping therewith, and means securing the edges of the marginal portions of the heat insulating material to the flange of the outer wall throughout their peripheries, said inner and outer connected walls being substantially the sole members providing for the rigidity of the door.

2. In an insulated refrigerator door, the combination of an integral coplanar inner wall formed of thin substantially rigid heat insulating material having marginal portions, a domed outer wall having an inwardly-extending flange pro-

vided thereon throughout its periphery, said flange lying adjacent and parallel to the marginal portions of the heat insulating material and overlapping therewith, and means securing the edges of the marginal portions of the heat insulating material to the flange of the outer wall throughout their peripheries, said inner and outer connected walls being substantially the sole members providing for the rigidity of the door.

3. In an insulated refrigerator door, the combination of an integral inner wall formed of thin substantially rigid heat insulating material having coplanar marginal portions, a domed outer wall having an inwardly extending flange provided thereon throughout its periphery, said flange lying adjacent and parallel to the marginal portions of the heat insulating material and overlapping therewith, means securing the edges of the marginal portions of the heat insulating material to the flange of the outer wall throughout their peripheries, said inner and outer connected walls and said flange being substantially the sole members providing for the rigidity of the door, and a gasket on said door having a portion disposed between the edges of the marginal portions of the heat insulating material and said flange.

4. In an insulated refrigerator door, the combination of an integral inner wall formed of a non-metallic, non-hygroscopic material of between $\frac{1}{16}$ and $\frac{3}{32}$ of an inch in thickness and having coplanar marginal portions, a domed outer wall having an inwardly extending flange provided thereon throughout its periphery, said flange lying adjacent and parallel to the marginal portions of the heat insulating material and overlapping therewith, and means securing the edges of the marginal portions of the heat insulating material to the flange of the outer wall throughout their peripheries, said inner and outer connected walls being substantially the sole members providing for the rigidity of the door.

5. In an insulated refrigerator door, the combination of an integral inner wall of thin rigid heat insulating material having a continuously curved surface, a domed outer wall having an inwardly extending flange provided thereon throughout its periphery, said flange lying adjacent and parallel to the marginal portions of the heat insulating material and overlapping therewith, and means securing the edges of the marginal portions of the heat insulating material to the flange of the outer wall throughout their peripheries, said inner and outer connected walls being substantially the sole members providing for the rigidity of the door.

6. In an insulated refrigerator door, the combination of an integral inner wall of thin rigid heat insulating material having coplanar marginal portions, a domed outer wall having an inwardly extending flange provided thereon throughout its periphery, said flange lying adjacent and parallel to the marginal portions of the heat insulating material and overlapping therewith, said inner wall of heat insulating material being curved at its center toward said outer wall, and means securing the edges of said marginal portions of the heat insulating material to the flange on the outer wall throughout their peripheries, said inner and outer panels being substantially the sole members providing for the rigidity of the door.

7. In a door for a refrigerator cabinet, the combination of a rigid outer member, an inner panel of thin insulating material having a curved portion and being secured solely at its edges to the rigid outer member and non-rigid heat insulating material between the panel and the outer member, the curved portion of the inner panel providing added rigidity thereto, said outer member and inner panel being substantially the sole members providing for rigidity of the door.

8. In a door for a refrigerator cabinet, the combination of a rigid outer member, an inner curved panel of thin heat insulating material spaced from said outer member and secured substantially solely at its edges to the rigid outer member, and non-rigid heat insulating material between the panel and the outer member, the curved portion of the inner panel serving to maintain the central portion thereof in its original spaced relationship with the rigid outer member, said outer member and inner panel being substantially the sole members providing for rigidity of the door.

9. In a door for a refrigerator cabinet, the combination of an inner panel of thin rigid heat-insulating material having coplanar marginal portions and curved portions, an outer thin metal domed panel having edge portions all of which extend inwardly and parallel to the marginal portions of the inner panel, means for securing the marginal portions of the inner panel and the edge portions of the outer panel together, and non-rigid heat-insulating material between the inner and outer panels, said inner and outer panels and said marginal portions of the outer panel being the only members which impart rigidity to the door.

10. In a door for a refrigerator cabinet, the combination of a curvilinear inner panel of thin rigid heat-insulating material having coplanar edge portions, an outer thin metal panel having integral edge portions extending inwardly and parallel to the edge portions of said inner panel and secured thereto, and non-rigid heat-insulating material between the inner and outer panels, said inner and outer panels and said edge portions of the outer panel being substantially the only members providing rigidity to the door.

11. A door for a refrigerator cabinet embodying external side and top walls, said door comprising an outer domed sheet metal shell and an inner shell formed of a non-hygroscopic, non-metallic material, said door extending to the external side and top walls of the refrigerator cabinet, the peripheral edges of the outer shell of the door being bent back upon themselves to form a hollow reinforcing channel about the door, the distance between the inner and outer shells of the door at the peripheral edges thereof being less than at the center of the door, the area defined by the inner shell of the door being at least the same as the maximum area defined by the outer shell of the door, said inner and outer shells being substantially the sole members providing for rigidity of the door.

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