April 25, 1933. R. T. GRIFFITHS 1,905,853

HEAT INSULATING PANEL MEMBER

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Fig.1.

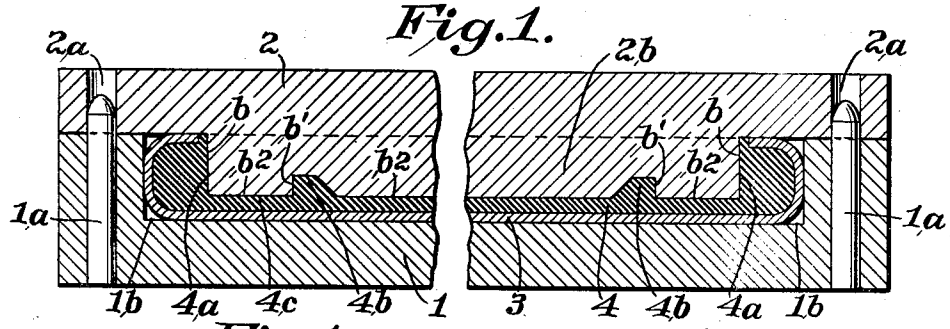


Fig.1a.

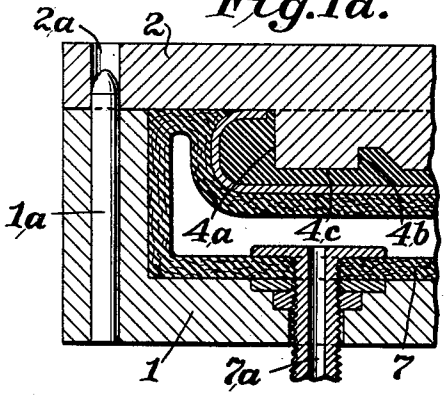


Fig.1b.

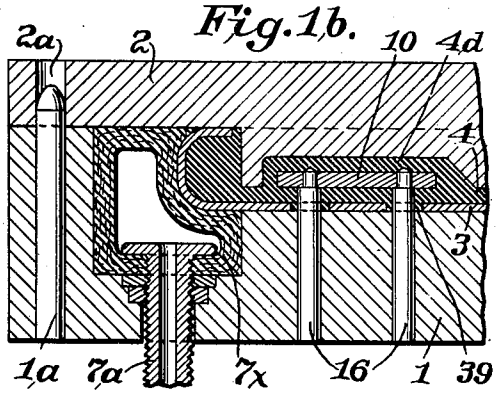


Fig.4.

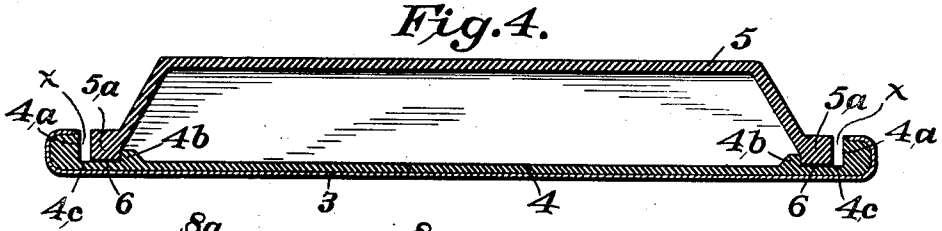


Fig.4a.

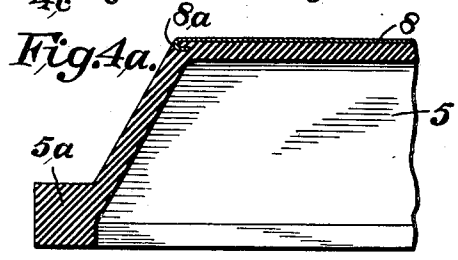


Fig.4b.

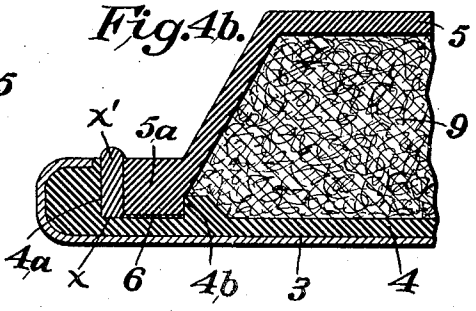
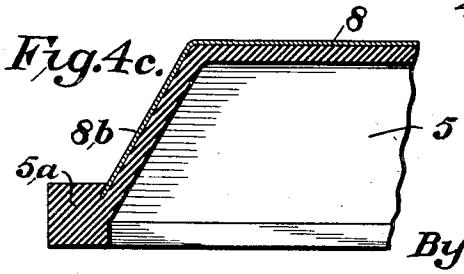


Fig.4c.



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Fig.2.

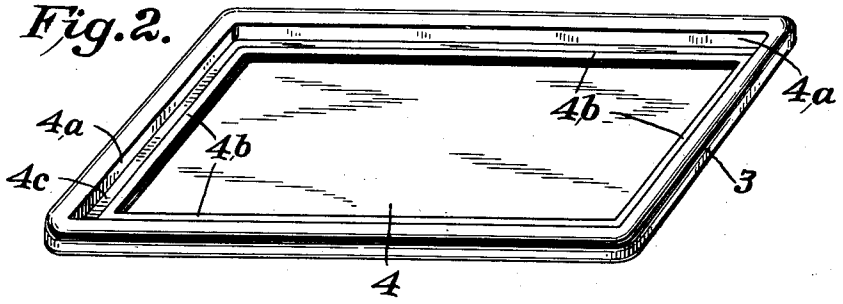


Fig.3.

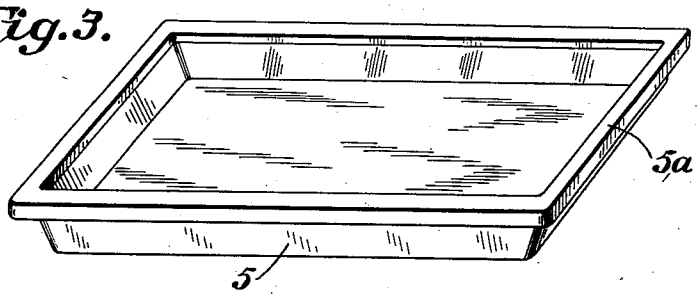


Fig.2a.

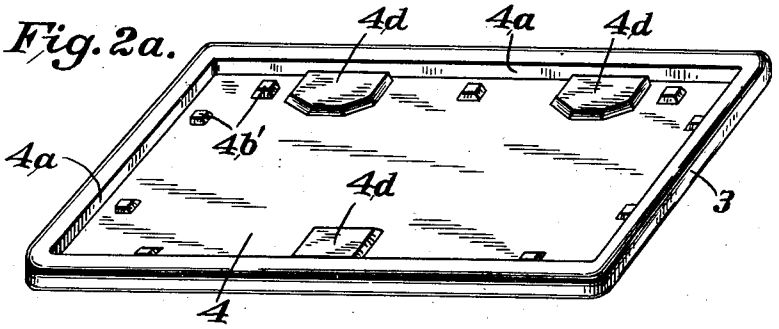
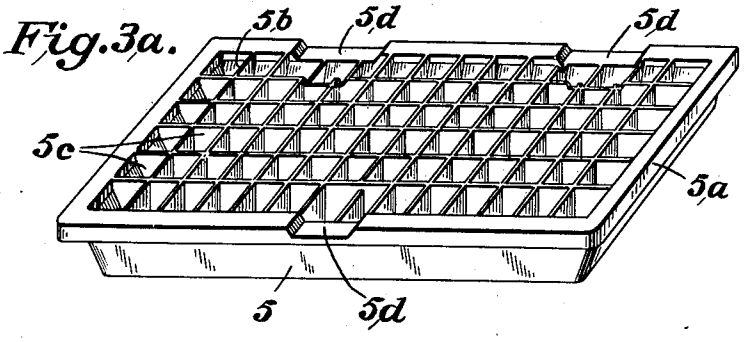


Fig.3a.



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Fig. 3b.

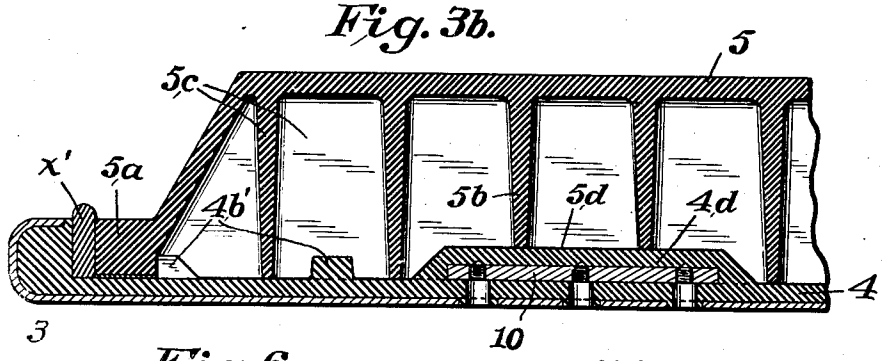


Fig. 6.

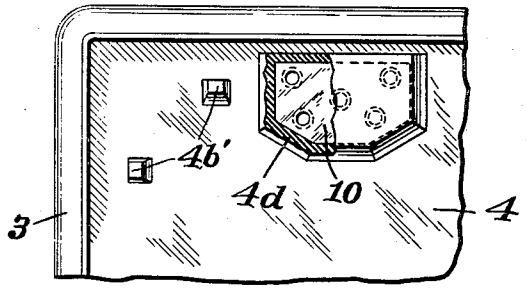


Fig. 7.

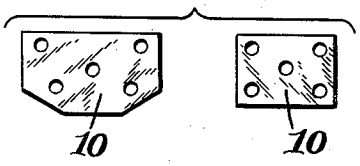


Fig. 8.

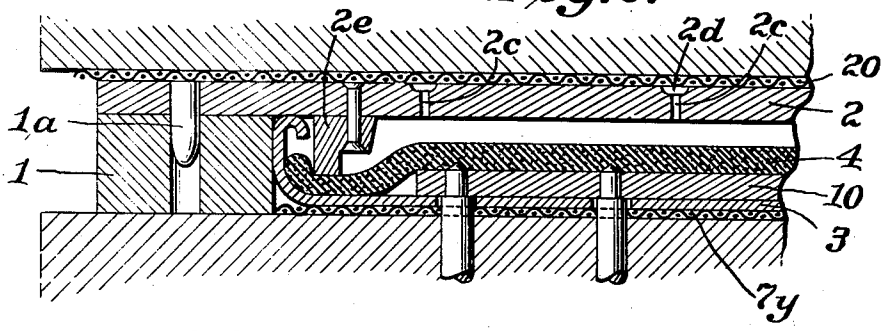
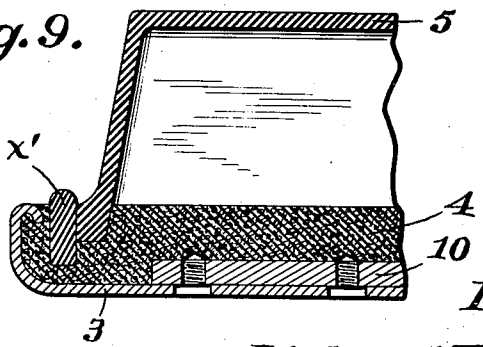


Fig. 9.



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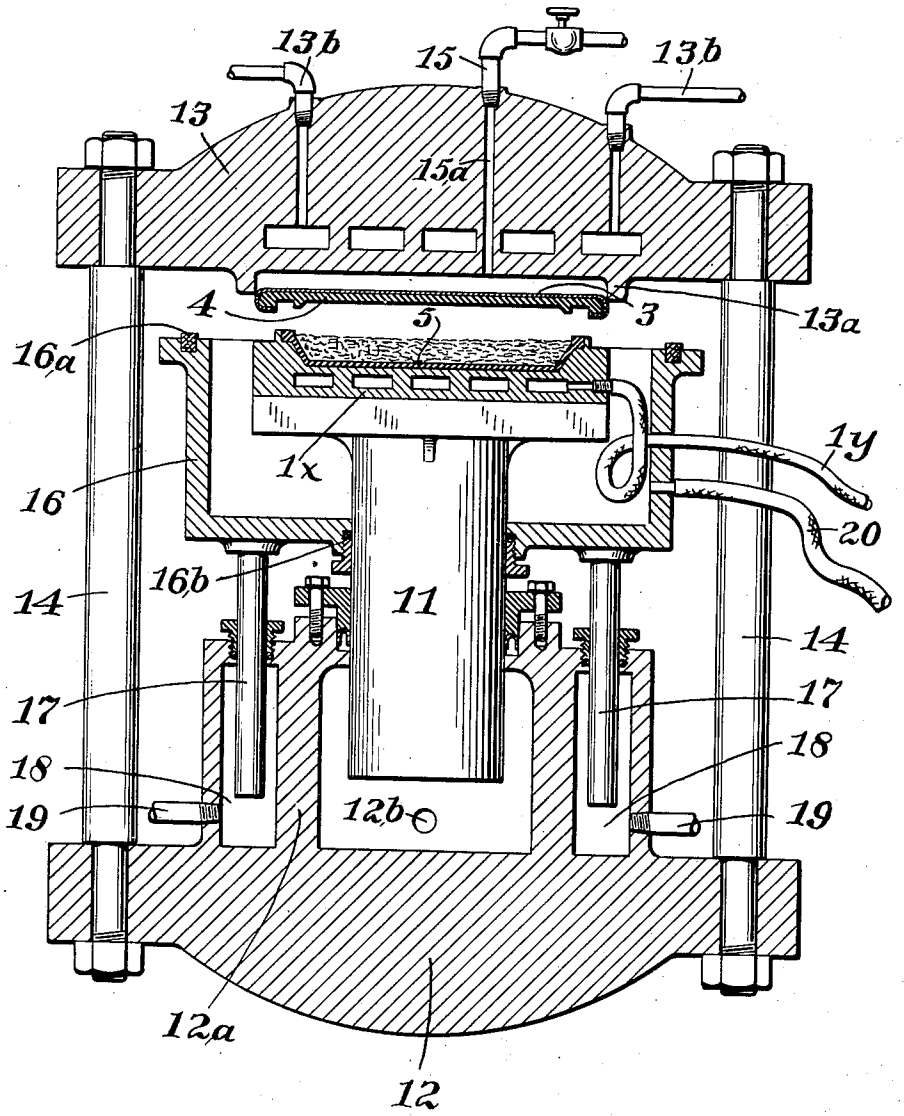
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Fig. 5.



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UNITED STATES PATENT OFFICE

RICHARD T. GRIFFITHS, OF AKRON, OHIO, ASSIGNOR, BY MESNE ASSIGNMENTS, TO MILLER RUBBER COMPANY INC., OF WILMINGTON, DELAWARE, A CORPORATION OF DELAWARE

HEAT INSULATING PANEL MEMBER

Application filed December 20, 1929. Serial No. 415,541.

My present invention concerns an improvement in panels, doors, or closure members for refrigerator structures and a method of making the same. While the invention is designed primarily for use in connection with the so-called iceless metal refrigerators which have come so extensively into use of late, and are usually made more or less of metal, it is obviously not limited to such use but is applicable to any type of container structure which is designed to insulate the contents from the warmth of the surrounding atmosphere or vice versa.

For convenience in illustrating and describing the invention, I have chosen for its embodiment a refrigerator door, but it will be understood that this is by way of example only, and to be regarded as in no way a limitation.

In the manufacture of refrigerators and the like as now commonly practiced, it is customary to make the article with interior and exterior walls of enameled or otherwise suitably finished metal spaced apart to form heat insulating spaces or chambers which are filled with insulation. Difficulty has been experienced in connecting the parts together in a manner which would exclude or prevent conduction of heat, which results in raising the temperature inside the container and consequent chilling of the outside, which, in a warm, humid atmosphere causes excessive sweating, moisture in the atmosphere condensing on the outside walls and dripping onto the floor and producing disagreeable results, besides detracting from the efficiency of the refrigerator or cooler.

The present invention aims to avoid these results and to provide a door or panel structure having metal inside and outside walls which will be effectively united in a manner to reduce heat conduction to an absolute minimum; to provide an article and method of making the same which will result in extreme economy in production, and one in which the resulting article will be extremely durable in use and will be free from bolts, screws, rivets and the like for connecting the metal parts together.

With these and other objects in view, which will hereinafter appear, the invention includes the novel article and method of making the same hereinafter described and defined by the appended claims.

In the accompanying drawings:

Figure 1 is a transverse section through a mold such as may be used for forming one of the units of a panel member of a refrigerator or like structure, such for example as a refrigerator part or door, tank closure or cover of the type used for storage of ice cream, a refrigerator door being selected for purposes of illustration, such unit being shown in place in the mold, said figure being partly broken away.

Fig. 1*a* is a similar view illustrating a modified method of procedure.

Fig. 1*b* is a similar view showing a method of procedure as modified to produce a door adapted to be secured to a refrigerator by hinges and having provision for door fastening means.

Fig. 2 is a perspective view of the member produced by the mold shown in Fig. 1.

Fig. 2*a* is a similar view of a member produced by the method shown by Fig. 1*b*.

Fig. 3 is a perspective view of a member for assembly with that shown in Fig. 2 to produce the panel member.

Fig. 3*a* is a perspective view of a modification of the member shown in Fig. 3, such modified member being designed to cooperate with the member shown in Fig. 2*a*.

Fig. 3*b* is an enlarged sectional detail of the assembly of Figs. 2*a* and 3*a*, partly broken away.

Fig. 4 is a cross sectional view of the assembled parts of Figs. 2 and 3.

Fig. 4*a* is an enlarged sectional detail showing a modification of member shown in Fig. 3.

Fig. 4*b* is an enlarged sectional detail showing one side portion of the assembly of Fig 4, but with the space between the members filled with insulating material, and with the packing strip in the groove or channel provided therefor.

Fig. 4*c* is a modification of the form shown in Figure 4*a*.

Fig. 5 is a section elevation, largely of a diagrammatic nature, showing a press for

uniting the front and back members with the air exhausted from the space formed within the same.

Fig. 6 is an enlarged detail in plan, partly broken away, of member shown in Fig. 2*a*.

Fig. 7 is a detail of attaching plate.

Figs. 8 and 9 are detail views of a further modification.

Referring by reference characters to these drawings, which taken together, not only illustrate my novel article but the method of producing the same, the numerals 1 and 2 designate two cooperating mold sections having respectively dowel pins 1*a* and dowel openings 2*a* for securing proper alinement in the closing of the mold.

Mold section 1 has a rectangular mold cavity 1*b* adapted to receive a member 3 of pressed sheet metal which is designed to form the outer face of the closure or panel member, such member 3 having its edges preferably curved upwardly and inwardly as shown.

The member 2 of the mold is provided with a cavity entering part of male formation indicated as a whole by the number 2*b*. This male part of the mold is so shaped as to provide outwardly facing substantially vertical walls *b* spaced from the side walls of the mold cavity and inwardly facing substantially vertical walls *b'* formed by channels in the under face b^2 of said male part, which under face, when the mold is closed, is spaced from the bottom of the mold cavity.

Prior to the closing of the mold, a quantity of rubber compound 4 is placed therein upon the sheet metal facing member, sufficient to completely fill the mold cavity when the mold is closed. Thereupon the mold member 2 is applied and the mold placed in a press of the customary form and subjected to heat to vulcanize the rubber to the metal facing member and in the shape shown in Fig. 1, which it has been forced to assume by the closing of the mold.

The rubber may be an ordinary hard sponge rubber compound or a hard or semi-hard rubber compound not containing cell-forming material, it being understood that hard or semi-hard rubber are both regarded by the trade as "hard rubber".

This sheet metal member 3 is the part of the panel or closure member which is exposed to the outside of the container and this is usually provided with an enamel or lacquer finish.

When the finish is applied to the sheet before the rubber is combined therewith and is of a brittle nature, I prefer to use cushion means below the sheet metal plate, which cushion means may take the form of an air bag 7, as shown in Fig. 1*a*, capable of being inflated by the nipple 7*a*, extending through the bottom of the lower mold section, or a layer of cushion fabric or the like as shown in Fig. 8 at 7*y*.

It will be noticed that the shape of the male part of the mold provides the rubber backing with inwardly facing vertical walls or shoulders 4*a* and outwardly facing abutment means in the shape of walls or shoulders 4*b* of less height and spaced therefrom, forming intervening channels 4*c* adjacent the four side edges, which are designed to receive the edges of an inverted pan-like member 5 of corresponding rectangular shape, which forms the back of the panel or closure member.

This pan-like member 5 is likewise formed of rubber compound similar to that described and may be shaped and vulcanized in a mold similar to that shown in Fig. 1, but having male and female parts shaped to conform to the inside and outside of the member 5, and shaped also to provide said member 5 with a thickened or reinforced edge indicated at 5*a*. This edge is designed to enter the channel (or channels) 4*c* of the member 4 and be positioned or centered by the abutment means, and the said edge is of such dimensions that, when the members are assembled as shown in Fig. 4, a space *x* is left between the outside edges 5*a* of the member 5 and the walls 4*a*, in which space is inserted an air cushion packing or sealing gasket *x'* to cooperate with the corresponding part of the container, or door jamb in the case of a refrigerator door.

Prior to the application of the member 5 to the member 4, the surfaces which are to contact are coated with a suitable rubber cement or a thin layer of soft unvulcanized rubber 6 is applied to the bottom of the channel and the assembly then subjected to the necessary heat and pressure to effect a vulcanized or homogeneous joint. Thereby I produce a panel, closure, or door member of hardened plastic non-conducting material, having an outer sheet metal face and an interior air chamber, all the parts being homogeneously united and all except the said metal face being of non-conducting material, and the heat insulating quality being further inceased by the space or chamber between the two members. In the process of vulcanization the heat expands the air and the excess escapes, so that after vulcanization a partial vacuum exists, which adds to the heat insulating qualities.

If desired, however, this space, in the assembling of the members, may be filled with any desired or known form of non-conducting material, as indicated at 9 in Fig. 4*b*.

The hard rubber of which the member 5 is made will, in the molding process, have a smooth inner surface, but if a surface therefor of enameled or lacquered metal is desired, this may be obtained by securing thereto a metal plate 8, as shown in Fig. 4*a*. This may be secured by vulcanizing it to the rub-

ber, or the plate may be provided with an inwardly turned edge 8*a* to form a mechanical interlock with the rubber.

The plate 8 may be enameled or coated subsequently to its application to the member 5 or it may be first enameled, and to prevent cracking of the enamel, cushion means may be used in the molding similar to that described in connection with Fig. 1*a*.

Obviously the plate 8 might be extended down over the inclined sides, as shown at 8*b* in Fig. 4*c*, in which event it is desirable to make such finishing plate of heat non-conducting material, such for example as Pyralin.

Where the panel or closure member is in the shape of a door, means must be provided for the attachment of hinges and the customary latch or closure fastening.

Constructions modified for this purpose are illustrated in Figs. 1*b*, 2*a*, 3*a*, and 3*b*.

In these the rubber 4 of the outer panel member has embedded therein metal blocks 10 having screw holes to engage and securing screws of the hinges or closure fasteners. This embedding may be accomplished by the use of a mold, as illustrated in Fig. 1*b*, in which the block 10 is shown, as supported spaced from finishing plate 3, by pins 16 carried by the lower mold section and having reduced upper ends engaging openings in the block 10, which openings, after removal of the pins, may have screw threads tapped therein for engaging the securing screws.

In said Fig. 1*b* I have shown at 7*x* a modified form of air bag for cooperating with the finishing plate 3.

It will be noticed that by the manner in which the blocks or inserts 10 are supported, they are wholly surrounded by or embedded in the rubber, the upper mold member being correspondingly recessed, and this produces block-like formations 4*d* on the inner surface of the rubber layer 4, as will appear from Fig. 2*a*, in which form I have also shown lugs 4*b*′ as abutment means for positioning the back member instead of flanges 4*b*.

In connection with a front door member such as shown in Fig. 2*a*, I may use a back member such as shown in Fig. 3*a*, in which the dish or tray-like member 5 has intergral vertical webs 5*b* arranged longitudinally and transversely thereof (formed by suitably shaping the male member of the mold), which webs form pockets 5*c*, which may or may not be filled with insulating maerial, said webs serving materially to strengthen the back member, and also to hold it against collapse during vulcanization.

In the forming of this member, recessed portions are provided as indicated at 5*d* to receive the blocks 4*d*.

In the foregoing description I have used the term "panel member" as a generic term intended to include therein any structural element of slab-like form for forming a wall or closure part of a heat-insulating container, irrespective of whether such container is intended to retain the enclosed articles in a chilled container of the refrigerator or ice receptacle type, or a container of the fireless cooker type.

In order to permit the air to more readily escape during the vulcanizing the upper mold member 2 may be provided with vent openings 2*c* (Fig. 8) slightly enlarged at their upper ends and overlaid by a sheet of textile material 20 on which the upper press member bears, the air contained in the mold escaping through said vent openings and the pores in the fabric as the rubber compound 4 (shown in said figure as a sponge rubber compound, i. e. one containing a blower) expands and fills the mold cavity.

In this figure and Figure 9 I have shown the front member as slightly modified, the margins of the metal plate being reversely curved and I have also shown a modified from of upper mold member in which the male or entering part is formed by separate rib members 2*c* riveted to the member 2.

The metal facing plate 3 and likewise the back finish plate where this is used, may be caused to homogeneously unite with the juxtaposed rubber by the usual or known methods of vulcanizing rubber to metal.

I find it desirable in many instances to exhaust the air from between the members prior to their being homogeneously and hermetically joined, thereby increasing the non-conductivity, this air exhaustion being practiced irrespective of whether or not a non-conducting filling material is inserted and being desirable in connection with such filling which is generally of a loose nature.

Apparatus suitable for this purpose is illustrated in a conventional manner in Fig. 5.

In this pan-like or back member 5 is shown as being supported by a mold member 1*x* which is provided with steam cavities to which steam may be supplied by a flexible pipe 1*y* from any convenient source (not shown).

This mold member is carried by the movable or piston member 11 of a hydraulic ram, working in a cylinder member 12*a* carried by the down fixed press member 12, water being admitted to and exhausted from the cylinder or piston chamber through a port 12*b* by any suitable pipe and valve arrangement not shown, and the piston being suitably packed to prevent leakage.

Opposed to the mold member 1 is the press head 13 tied to the base by vertical rods 14, which head is provided with a depending flange or rim 13*a* forming a shallow channel to receive the metal plate 3 with its rubber part 4.

The head is also provided with a steam cavity to which steam is supplied by a pipe

system 13*b* whereby it, like mold member 1*x*, may be heated for vulcanizing purposes.

A pipe 15 connected with a port 15*a* passing through the head and also with any suitable vacuum producing means, (not shown) enables the member 3—4 to be held in place by vacuum prior to the elevation of the ram as hereinafter described.

Surrounding the mold 1*x* and upper portion of the movable member of the ram is a chamber forming member 16 which has a packing 16*a* carried by its upper edge designed to hermetically cooperate with the down face of the press head, and the opeinng in the bottom of said member through which the piston member of the ram passes is also provided with packing 16*b* to effect a fluid tight joint.

Said member 16 has depending from the bottom thereof a plurality of piston members 17 which depend into a fluid chamber or chambers 18 through suitably packed openings, said chamber or chambers being provided with means for admitting motive fluid thereto or exhausting it therefrom, indicated conventionally by pipes 19.

A post passing through the wall of chamber 16 is connected by flexible pipe 20 with any suitable source of vacuum (not shown).

The member 5 having been placed in the cavity of mold 1*x* and its edge prepared for vulcanizing, and insulating material having been placed in the member 5 as indicated, steam is turned on to the mold cavity while the ram is in its lowered position, to heat the mold sufficiently to evaporate any moisture which may be contained in the insulating material.

The panel member 3—4 is placed in the cavity as shown, and held therein by suction (or equivalent means). Chamber 16 is then elevated by admitting water or other pressure fluid to chamber or chambers 18 until its gasket 16*a* effects hermetic junction with the down face of the press head whereupon the air from the chamber is evacuated, thus producing a vacuum between the panel members. Ram 11 is then elevated by admitting water or other pressure fluid to the ram chamber which forces the ram upward and the coated edges of member 5 into contact with the rubber member 4, whereupon sufficient steam is turned on to the steam cavities to form a vulcanized joint which will hermetically seal the interior space between the members against access of air and make permanent the vacuum therein.

Cold water may be admitted to the steam cavities after vulcanization by suitable pipe and valve arrangements, not shown, as being well known to those skilled in the art, whereby the parts may be cooled in situ if desired prior to opening of the press and removal of the completed article.

Having thus described my invention, what I claim is:

1. An insulating panel of the character described comprising a front member of hard rubber having a facing plate of metal homogeneously united thereto, and a self-supporting imperforate back member of hard rubber spaced therefrom and having a continuous non-conducting flanged margin homogeneously united to the rubber of the front member.

2. An insulating panel of the character described comprising a sheet metal facing plate having rearwardly turned marginal edges, a backing of hard rubber homogeneously united to said facing plate within said marginal edges and provided with a recess, and a back member of hard rubber spaced from said backing and having inwardly extending marginal flanges homogeneously united to said backing within said recess.

3. An insulating panel of the character described comprising a metal facing plate having marginal flanges, a backing of hard rubber homogeneously united thereto within said flanges, said backing having vertical inwardly facing walls and opposed abutment means, and a substantially dish-shaped self-supporting member of hard rubber having non-conductive sides with edges seated in the spaces between said walls and abutment means and homogeneously united thereto.

4. An insulating panel of the character described comprising front and back members of heat-non-conducting material, said back member being of substantially dish-shape and having its edges homogeneously united to said front member, said front and back members having finishing plates secured to the outer surfaces thereof.

5. An insulating panel of the character described comprising front and back members of heat-non-conducting material, said back member being of substantially dish-shape and having its edges homogeneously united to said front member, said front and back members having metallic finishing plates homogeneously united therewith and mechanically interlocked therewith at the edges of the finishing plates.

6. An insulating panel of the character described comprising front and back members, said front member having on its rear side vertical inwardly facing walls and abutment means spaced therefrom, said back member being of substantially dish-shape with its edge seated in the space between said inwardly facing walls and said abutment means, said edge being spaced from said inwardly facing walls, and a cushion packing held in the space between said walls and edge of the dish-shaped member.

7. An insulating panel of the character described comprising a front member of molded plastic heat insulating material, a back mem-

ber of similar material of substantially dish-shape having its edge homogeneously united to the back of said front member, said dish-shaped member having homogeneous non-conductive intersecting webs dividing the space between said members into a plurality of isolated compartments.

8. An insulating panel of the character described comprising imperforate front and back members, said front member having on its rear side vertical inwardly facing walls and abutment means spaced therefrom, said back member being of substantially dish-shape with its edge seated in the space between said inwardly facing walls and said abutment means, said edge being spaced from said inwardly facing walls, and a cushion packing held in the space between said walls and edge of the dish-shaped member, the edges of the back member being homogeneously united to the back of the front member.

9. An insulating panel of the character described comprising a front member of hard rubber, metallic blocks for attachment of hardware embedded in said hard rubber, and a substantially dish-shaped member of hard rubber having its edges homogeneously united to said front member.

In testimony whereof, I affix my signature.

RICHARD T. GRIFFITHS.