

[54] METHOD OF VINYL COVERING A REFRIGERATOR DOOR PANEL

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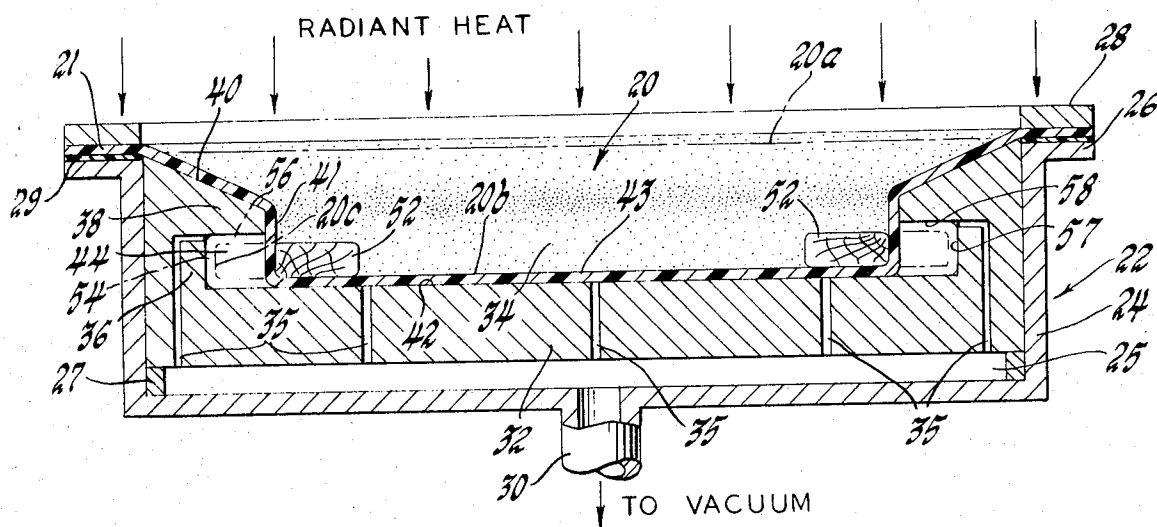
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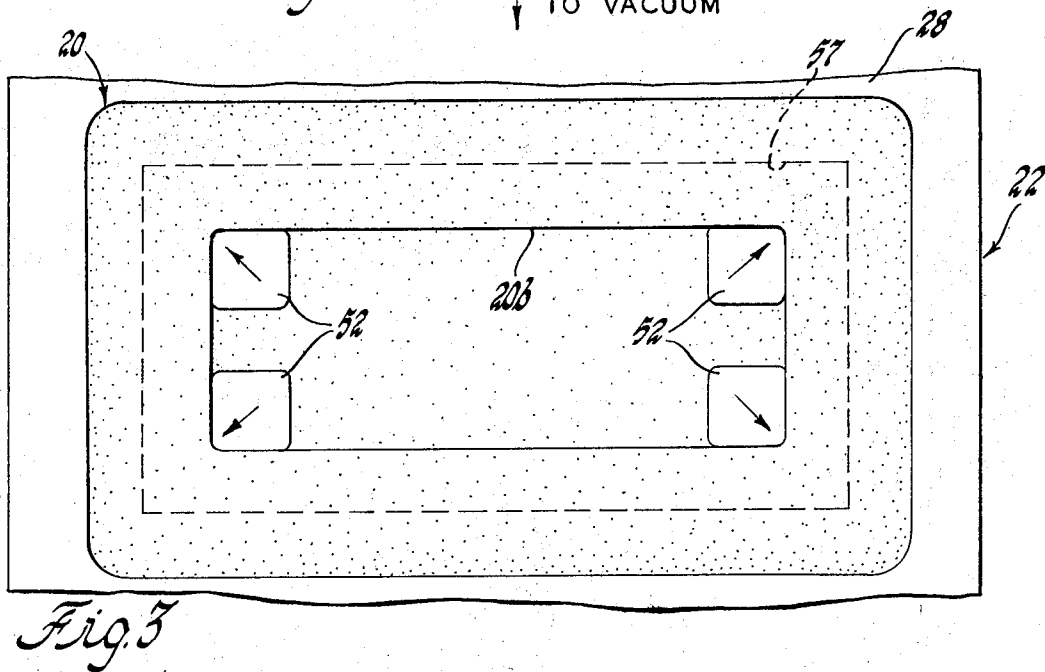
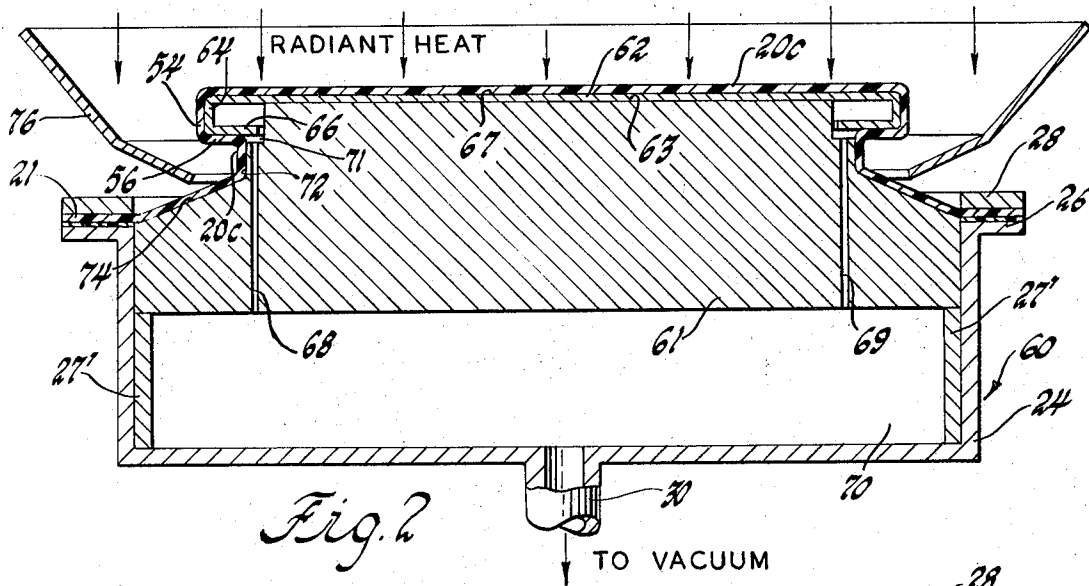
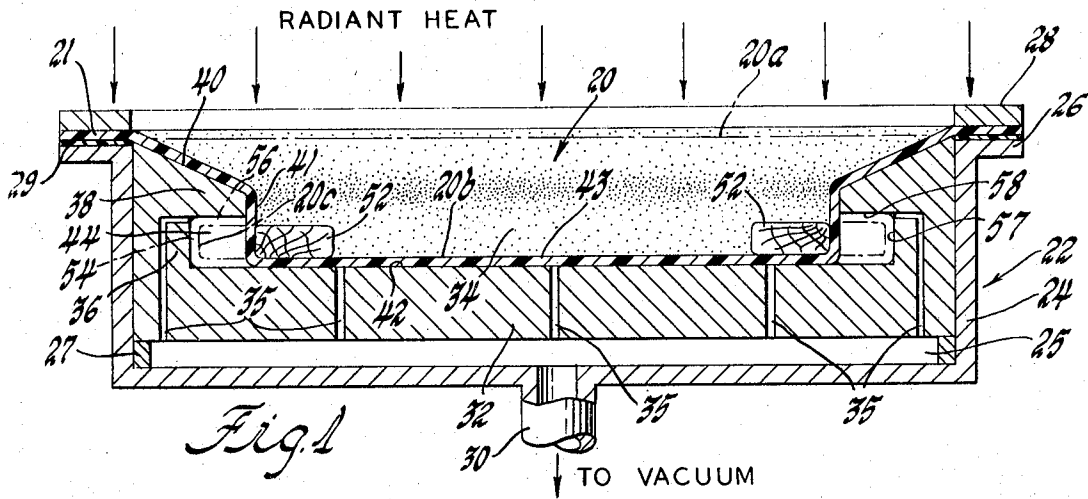
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[57] **ABSTRACT**

A vinyl plastic sheet is preformed by being positioned over a first rectangular vacuum forming female mold having undercut peripheral edges for forming a return flange border allowing the vinyl sheet to be heated and vacuum formed into a preformed cover with the aid of plug assists which are used to develop boxlike corners while preventing excess reduction in the sheet material thickness. The preformed vinyl cover is then loosely slipped over a refrigerator metal door panel on whose outer surface an epoxy adhesive solvent has been applied. The door panel and vinyl cover are next located in a second male mold and initially heated. Upon partial shrinkage of the cover a vacuum assist is established to cause the vinyl cover to conform to the door panel and return flanges whereby ridging of the material on the underside of the return flange corner junctures is prevented.

1 Claim, 3 Drawing Figures



METHOD OF VINYL COVERING A REFRIGERATOR DOOR PANEL

This invention relates to a refrigerator cabinet construction, and more particularly with a method of forming refrigerator cabinet door panels covered with a decorative sheathing of vinyl plastic material.

Recently it has become popular to cover the door panels of refrigerator cabinets with various decorative upholstery or plastic sheathing material of various colors by means such as a removable trim strip typified by U.S. Pat. No. 2,760,301 issued Aug. 28, 1956 to Derr et al. Recent attempts to permanently bond plastic sheeting to appliance doors have encountered the problem of providing a smooth, conforming covering at the deeply drawn flange corner areas of the door panel without having the plastic sheathing on the underside bunch-up into raised "bridges" or mounds on the return portion of the flanged corners while obviating extreme thinning of the drawn material to a point of possible rupture or tearing.

It is an object of this invention to provide a simple inexpensive process for vacuum forming an integral vinyl sheet plastic decorative laminate cover for a refrigerator rectangular door panel having return flanges such that the plastic sheathing is bonded to and conforms with the panel contours including the corner junctures formed by the panel return flanges.

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 vertical section view illustrating the first step in vacuum forming the vinyl cover for use with the door panel;

FIG. 2 is a vertical sectional view of the second step showing the completion of the vacuum forming process by means of a male mold;

FIG. 3 is a plan view of the female vacuum mold shown in FIG. 1.

Referring now to FIG. 1 there is shown a plastic vinyl sheet 20 having a trim or scrap border 21 in position in a female mold assembly generally indicated at 22 in position to be preformed on the inner surface of the mold 22. The sheet 20 is a polyvinyl chloride (P.V.C.) thermoplastic material having a thickness within the range of approximately 0.035 to 0.040 inches. The vacuum forming female mold assembly includes a rectangular box-like fixture or vacuum pan 24 defining a chamber 25 having an outwardly directed peripheral flange 26 on its side and end walls. The chamber 25 of the pan 24 is adapted to be subjected to a vacuum source (not shown) through a suitable pipe 30. An open rectangular frame or clamping ring 28 is clamped to the upper face of flange 26 by suitable clamp members (not shown). Positioned between the opposed ring and flange surfaces is a relatively incompressible gasket or seal 29, formed of heat resistant rubber-like material such as neoprene or the like, which together with the trim or scrap portion 21 of the vinyl sheeting 20 is held in sealing engagement by the clamping ring 28.

A female mold member or base 32 is positioned in the pan 24 on a support member 27 with the base having an undercut cavity 34 therein formed by an upwardly directed continuous rectangular rim 36 and cantilevered projection 38 including a downwardly and

inwardly sloped perimeter 40 terminating in flush relation with the outturned flange 26. In communication with the rectangular box-shaped cavity 34 there are provided passages 35 through which air or gas may pass to evacuate the cavity. The textured vinyl skin or sheeting 20 is located stretched in a horizontal plane over the female mold on the flange 26 as shown by its dashed line position 20a in FIG. 1. Heater means such as a Calrod resistance heater (not shown) is located above the mold assembly 22 in a vertically adjustable manner such that it can be lowered to a predetermined height and energized to deliver radiant heat to the sheeting 20. In the preferred form the heater is lowered to a vertically disposed position approximately 20 inches above the sheet 20 such that the vinyl sheet material is heated within the range of 290° F. to 300° F.

In the disclosed form the temperature is recorded by the change in color of a series of thermotape strips placed on the outer surface of the sheet by means of suitable adhesive tape. The thermotape strips are selected so as to provide an incremental series ranging from 270° F., 280° F., 290° F., 300° F., 310° F. and 320° F. In this way the operator is alerted to the fact that the sheet is approaching the desired temperature range.

The heater is then deenergized and a partial vacuum assist is applied by a suitable valve control (not shown) in pipe 30 until the vinyl sheet material is located as shown in its solid line position 20b with sheet intermediate side walls 41 substantially perpendicular to the mold bottom wall 42 and its rectangular central portion 43 forced tightly against the mold bottom wall, whereupon the vacuum assist is interrupted and held to momentarily stop the flow of the vinyl sheet. Stated differently, the sheet material 20b is held just prior to its being reverse formed by returning into the mold cavity undercut channel-shaped pocket region 44 defined by projection 38. Four plug assist members or helper blocks indicated at 52 in FIGS. 1 and 3 in the form of rectangular wooden blocks approximately 3 inches square and 1½ inches thick, are simultaneously placed in contact with the vertical inner corner surfaces of the sheeting 20b and moved diagonally outwardly in the direction of the arrows such that the vinyl sheet material is forced into the four undercut female mold corners indicated by dash dot line position 20c to form box-shaped corners. After the plug assists 52 are located in the corner junctures the final vacuum assist is resumed to cause the remaining portion of the sheet side edge 54 and sheet return hem 56 configured in an L-shaped trim to conform to the female mold sides 57 and undercut edges 58. The vacuum assist is retained until the vinyl sheet has cooled to room temperature.

The plug assists 52 further operate to chill the vinyl sheet material 20 at the four corner junctures to thereby maintain the sheet material thickness in the range of about 0.010 to 0.015 inch and thereby insure against the vinyl sheet being excessively thinned down in the corner regions. Such thinning is undesirable because of possible rupture of the sheet during the final panel covering operation or because of poor life span while in service on the appliance door.

The vinyl sheet material is next cooled by suitable means such as blower fans (not shown) located on the heater until the material has cooled and taken a set whereupon the vacuum assist is removed and the preformed vinyl sheet is stripped from the mold.

A rectangular metal panel 62, including its inwardly extending peripheral flanges 64 and return flanges 66 has its outer surface 67 coated with a heat sensitive adhesive containing randomly dispersed relatively fine inert particles or "glass beads" of the type disclosed in U.S. Pat. No. 3,551,232 issued Dec. 29, 1971 to J. T. Thompson assigned to the same assignee as the present application, the disclosure of which is incorporated by reference herein. The adhesive is currently available from Inland Manufacturing Division of General Motors Corporation under the name INLOCK Specification No. 56799-001. The adhesive is preferably allowed a 24 hour drying period to insure that the panel surface is tack free or not sticky. The untrimmed preformed sheet 20C is then slipped on the door panel 62 for placement in the mold of FIG. 2.

As seen in FIG. 2 a second male mold assembly 60 includes the vacuum pan 24 having suitable means such as support members 27' therein for receiving a door panel support block 61 thereon. The block 61 has an upper horizontal surface 63 for supporting the vinyl covered door panel 62. It will be noted that the trim or scrap border material 21 of the sheeting 20 is retaining so that it is again placed between the clamping ring 28 and the flange 26 in a sealed manner as described for female mold 22 prior to evacuation of the chamber 70 through the pipe 30. The block has passages 68, 69 through which air or other gas may pass so as to selectively evacuate the cavity 70. It will be noted that the block 61 is conformed to limit the extent of coating on the return flange by means of vertical flange 72 such that in the preferred form the return position of the sheeting extends inwardly only approximately five-eighth inch of the total flange extent of three-fourth inch. The male or block mold 60 has a downwardly sloped border 74 complementary to the region 40.

Reflectors 76 are configured to extend below the door panel return flange 66 to supply reflected radiant heat to the underside edge 54 and hem 56 portions of the preformed sheet 20 of the flange. The overhead heater is again lowered to a position approximately 20 inches above the covered door and radiant heat is applied to heat the sheeting 20 to a softening temperature of about 290° F. to 300° F. for about three minutes. Upon the preformed sheet conforming to the door panel and just prior to the end of the 3 minute heating cycle a vacuum assist is applied to chamber 70 and by means of passage 68 to cavity 71 whereupon the preformed vinyl sheet 20C returns or shrinks to the exact configuration of the door panel including the box corners defined by continuous peripheral flange 64 and return flange portion 66 of the corner junctures without causing the gathering of the sheet material and the development of excessive ridges or bulges thereat.

It has been determined that a shrink factor for the vinyl sheeting of about 0.010 of an inch per inch for both the width and length of the door panel will allow for the proper shrinkage of the preformed sheet on the door panel.

We claim:

1. The method of vacuum forming a smooth flexible polyvinylchloride thermoplastic thin sheet cover having a thickness within the range of approximately 0.035 to 0.40 inches onto a rectangular metal door panel having an L-shaped continuous peripheral flange portion defining box-shaped corner junctures comprising the

steps of; providing a female mold assembly including a rectangular vacuum pan having an outwardly directed continuous clamping flange and a female mold insert positioned therein, said female mold insert having a rectangular cavity circumscribed by a continuous undercut channel-shaped peripheral pocket for forming an L-shaped hemmed portion defining a rectangular area around the vinyl sheet of material from which the cover is to be formed, placing the vinyl sheet over said female mold assembly with its decorative outer side facing downwardly with the outer marginal trim edge of said vinyl sheet placed in sealed contact with the pan clamping flange, preheating the vinyl sheet to a temperature of about 290° to 300° F. from a radiant heat source thereabove, removing the heat source and applying a difference in pressure to opposite sides of the vinyl sheet in the form of a vacuum assist whereby the vinyl sheet central rectangular area is forced into contact with the bottom wall of said cavity with the adjacent bordering portion of the sheet in vertical, flush relation with the open side of said channel-shaped pocket; interrupting the vacuum assist to momentarily stop the flow of the vinyl sheet into the channel-shaped pocket, placing a rectangular plug assist at each corner juncture of the vinyl sheet and simultaneously moving each of the plug assists diagonally outwardly into said female mold undercut pocket corners to force the vinyl sheet to conform with the four mold undercut pocket corners, resuming the vacuum assist to cause the remaining portion of said vinyl sheet to conform to the remaining portions of the undercut channel-shaped peripheral pocket and maintaining the vacuum assist until the sheet has cooled substantially to room temperature while said plug assists remain in said undercut pocket corners, applying a liquid adhesive layer including a plurality of randomly distributed inert particulate fillers onto the outer surface of a rectangular metal panel including the continuous L-shaped flange and allowing the adhesive to dry to a non-tacky state, removing the preformed vinyl sheet from said female mold and enveloping the rectangular sheet metal panel within the rectangular area of the preformed vinyl sheet such that the decorative side of said vinyl sheet is exposed, providing a male mold assembly including said vacuum pan and a supporting buck portion inserted therein for receiving the inner surface of the metal panel, supporting the metal panel with the vinyl sheet thereon over the buck portion of said male mold assembly such that the underside opposite said sheet decorative side of the marginal trim edge is placed in sealed contact with said pan clamping flange, placing radiant heat reflector means below the return flange portion of said metal panel continuous L-shaped flange, heating the vinyl sheet by means of the radiant heat source for a predetermined period to a temperature of about 290° to 300° F. whereby said reflector means directs radiant heat upwardly to the portion of the vinyl sheet covering the L-shaped flange and applying a vacuum assist to cause said vinyl sheet cover to conform to said metal panel including its box-shaped corners so as to achieve a shrink fit by said vinyl cover without developing ridges on the underside of the box-shaped return flange corners while limiting the degree of thinning of said vinyl cover to the range of about 0.010 to 0.015 inches at said corners.

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