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PLASTIC FOAM INSULATED DOOR STRUCTURE INCLUDING ELECTRICAL HINGE

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FIG. 1

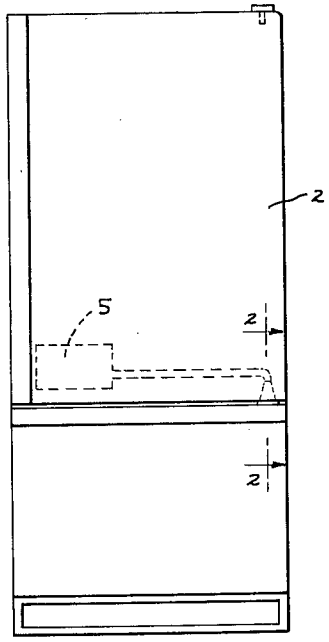


FIG. 2

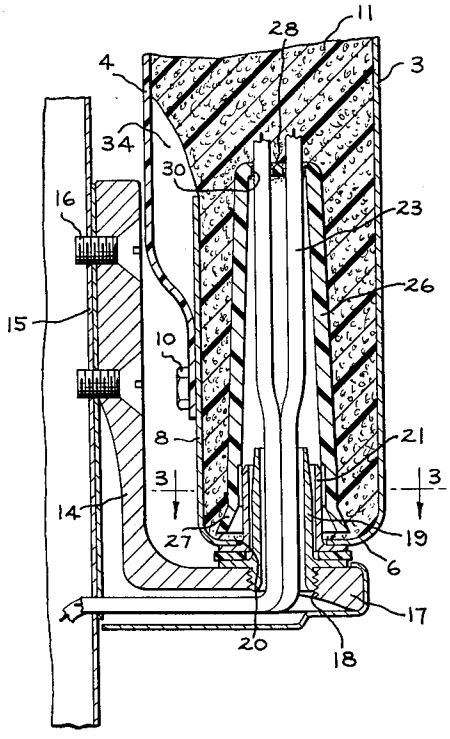
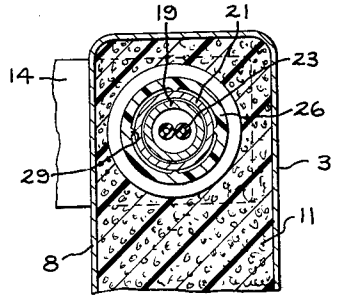


FIG. 3



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PLASTIC FOAM INSULATED DOOR STRUCTURE INCLUDING ELECTRICAL HINGE

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The present invention relates to plastic foam insulated door structures and is particularly concerned with a foam-insulated door including an electrical hinge arrangement for accommodating conductors supplying electric energy to an electrical device mounted on the door.

For some years it was common practice to provide, for example, on the inner panel of an insulated refrigerator door, one or more compartments designed to operate at a temperature somewhat above the normal cabinet temperature. To maintain this temperature differential it has also been common practice to provide an electrical heating element in association with such a compartment. This requires conductors for the transmission of current from the cabinet to the door entering the space between the inner and outer panels of the door at some point about the periphery thereof. A convenient point of entry has been through the hinge structure used for supporting the door on the face of the cabinet.

With the development of improved plastic foam insulation, such materials are now being used for insulating the walls of a refrigerator cabinet including the door component thereof. A preferred method of foam insulating a refrigerator door for example comprises introducing a foamable liquid resin mixture such as a foamable polyurethane resin mixture directly into the space between the inner and outer door panels or into the outer metal panel while that panel is confined in a mold having a shape and configuration such that the inner surface of the foam layer will conform substantially to the shape of the inner door panel and permitting the polyurethane foam to form in contact with the outer metal panel. This method of insulating the refrigerator door or the like has as one of its principal advantages the fact that the liquid foam producing resin can be caused to flow into all of the recesses and crevices within the panel structure and completely fill the door structure with the rigid foam insulation. However, as the flowable foam producing resin also tends to flow through and completely seal any openings provided in the door panel, the leads for a butter conditioner or the like must be inserted through such openings before the foaming operation. When such leads or conductors pass through the hinge structure, they must be given some freedom of movement to absorb and dissipate the twisting action resulting when the door is opened and closed so that the complete embedding of the conductors within the door and particularly adjacent the electrical hinge area by the rigid foam cannot be tolerated.

Accordingly, it is a primary object of the present invention to provide an improved rigid foam insulated door structure including an electrical hinge designed to provide a limited or twisting action of the conductors after the introduction and solidification of the foam insulation.

Another object of the invention is to provide an improved low cost electrical lead-in hinge structure in a foam insulated door.

Further objects and advantages of the present invention will become apparent as the folowing description proceeds and the features of novelty which characterize the invention will be pointed out with particularity in the claim annexed to and forming a part of this specification.

For a better understanding of the invention reference may be had to the accompanying drawing in which:

FIG. 1 is a front elevational view of a refrigerator cabinet embodying the present invention;

FIG. 2 is an enlarged sectional view taken along line 2—2 of FIG. 1; and

FIG. 3 is a sectional view taken along line 3—3 of FIG. 2.

Referring now to FIG. 1 of the drawing, there is shown a household refrigerator cabinet 1 having a door 2 mounted on the front portion of the cabinet for the purpose of providing access to the interior or food storage space within the cabinet. This door comprises, as shown in FIG. 2, an outer panel 3 of sheet metal or the like and an inner panel 4 which is preferably composed of a sheet plastic material and is formed to include a butter storage and conditioning compartment 5 shown in dotted lines in FIG. 1 of the drawing. The outer metal panel is shaped to have an inwardly extending strengthening flange 6 extending around the peripheral edge thereof, this flange being bent back upon itself to provide a channel-shaped section providing an inner face portion 8 to which the plastic inner panel 4 is secured by means of a series of screws or other fastening means 10. The space between the outer panel 3 and the inner panel 4 is substantially filled by means of a resinous foam insulation such as polyurethane foam 11 prepared by expanding liquid polyurethane foam reactants in contact with at least the outer panel 3.

Since these reactants tend to flow and expand into and through any openings in the panel during the foaming thereof, there is provided in accordance with the present invention an improved electrical lead-in hinge structure including means for preventing the egress of foam through that structure and for providing a sufficient length of the lead-in conductors from becoming embedded in the foam within the door to absorb the twisting action resulting from the opening and closing of the door structure relative to the cabinet.

In the illustrated embodiment of the invention, the hinge comprises a bracket 14 secured to the face of the cabinet 15 by means of screws 16, the bracket including a horizontally extending arm 17 for supporting the door 2. The horizontal portion 17 of the bracket includes an opening 18 for receiving one end of a hollow hinge pin or pintle 19 which is secured to the bracket by any suitable means as by brazing or soldering. The adjacent flange portion 6 of the door is provided with an opening 20 for receiving a sleeve 21 which is press fit into the opening 20 and which extends into the space between the face of panel 3 and the inner face 8. This sleeve is adapted to receive the hollow pin 19 and to provide for pivotable movement of the door relative to the pin 19.

A pair of lead-in conductors 23 for energizing the butter conditioner heater extend from the cabinet through the hollow hinge pin 19 and into the space between the inner and outer panels 3 and 4. In order to prevent the liquid resin or foam from leaking out through the hinge pin 19 during the foaming operation and also to provide between the hinge bracket 17 and the point where the conductors 23 become embedded in the foam insulation 11 lengths of conductors sufficient to absorb the twisting action resulting from the opening and closing of the door, there is provided a plastic thimble 26 of somewhat tapered configuration and having an open lower end portion 27 which fits over and tightly engages the outer surface of the sleeve 21. Spaced longitudinal ribs 29 are provided for increasing the frictional engagement of the thimble with the sleeve 19. The upper or closed end 28 of the thimble is provided with a pair of openings 30 which snugly receive the conductors 23. As illustrated in FIG. 2 of the drawing this thimble 26 is of the substantial height, for example 2 or 3 inches in order to provide between the closed thimble end 28 and the bracket arm 17 the desired free lengths of the conductors 23 for pivoting purposes.

In one method employed for manufacture of the door as illustrated in the drawing, the conductors 23 are inserted into the sleeve 21 and through the openings 26 after which the thimble is pressed onto the sleeve. Both ends of the conductors 23 are then temporarily secured to an outer side edge or surface of the panel 3 by tape or the like and the resin foam-forming ingredients are introduced into the panel 3 while the panel is contained in mold having one surface conforming generally to the shape of the inner panel 4. The liquid foam producing mixture flows and foams into and around the thimble 23 thereby securely anchoring the thimble between the inner and outer face portions of the panel 3 and into permanent engagement with the sleeve 21. The thimble 26 thereby comes rigidly secured with reference to the panel 3. While the foam also tends to flow into the openings 30, the spaces between the conductors and the edges of these openings are held to a minimum so that the foam solidifies and fills the spaces before any significant amount has entered the thimble. As a result, the thimble protects the free portions of the conductors within the thimble from becoming embedded in the foam and also prevents foam from passing through the interior of the sleeve 19. After foaming of panel 3 the inside ends of the leads are arranged in the space 34 between the foam 11 and the inner panel 4 and are connected to the butter conditioner heater at the time the inner panel is secured in place on the outer panel. The other ends are passed throught the hinge pin 19 and connected to the power supply within the cabinet when the door is mounted on the cabinet.

While there has been shown and described a particular embodiment of the present invention it is to be understood that the invention is not limited thereto and it is intended

by the appended claim to cover all modifications within the true spirit and scope of the invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

A door structure comprising spaced inner and outer panels, one of said panels having an inwardly extending flange about the peripheral edges thereof, a hinge sleeve having a portion extending into said door through said flange, a hollow hinge pintle projecting into said sleeve, a tapered plastic thimble having its larger end snugly enclosing the portion of said sleeve extending into said door, said thimble having a pair of spaced openings in the other end thereof, a pair of conductors adapted to be connected to means mounted on said door, said conductors extending from the interior portion of said door through said openings in said thimble and said sleeve, and a mass of resin foam insulation formed in situ within the space between said inner and outer panels, said foam completely surrounding said thimble and anchoring said thimble on said sleeve and said sleeve preventing said foam from embedding the free lengths of said conductors within said sleeve whereby said lengths are free to absorb the twisting action thereof resulting from opening and closing movement of said door on said hinge pintle.

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