May 19, 1970 R. K. HUPFER 3,512,323

INSULATED WALL STRUCTURE

Filed July 21, 1967

FIG.1

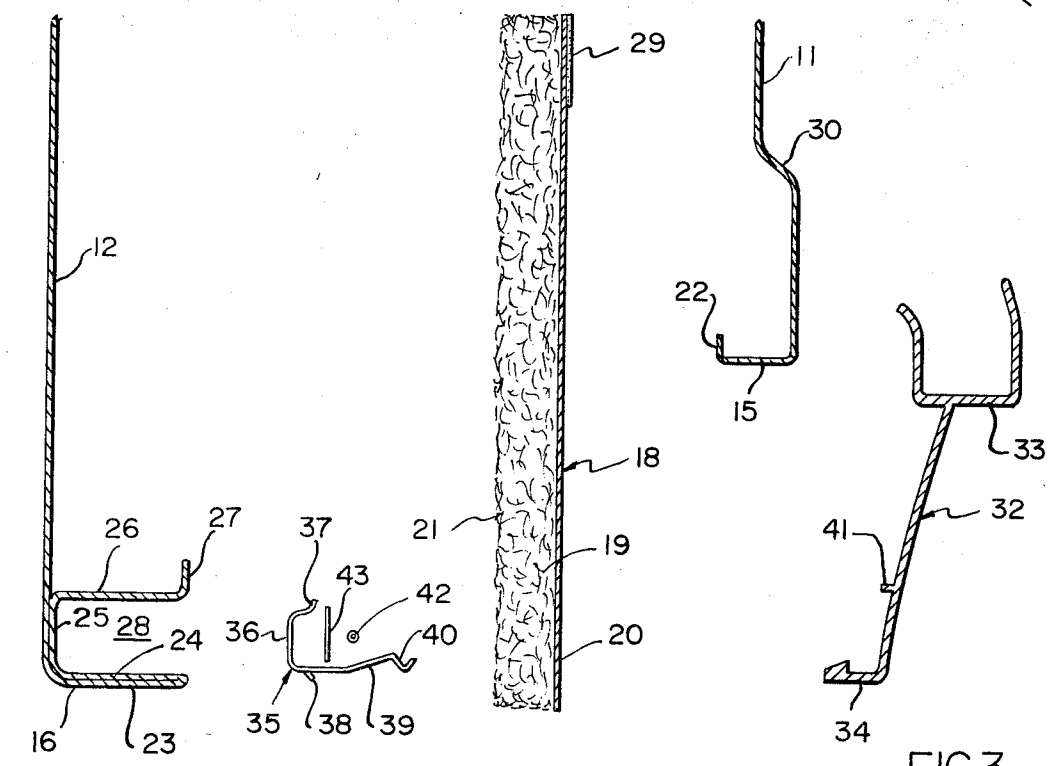


FIG.2

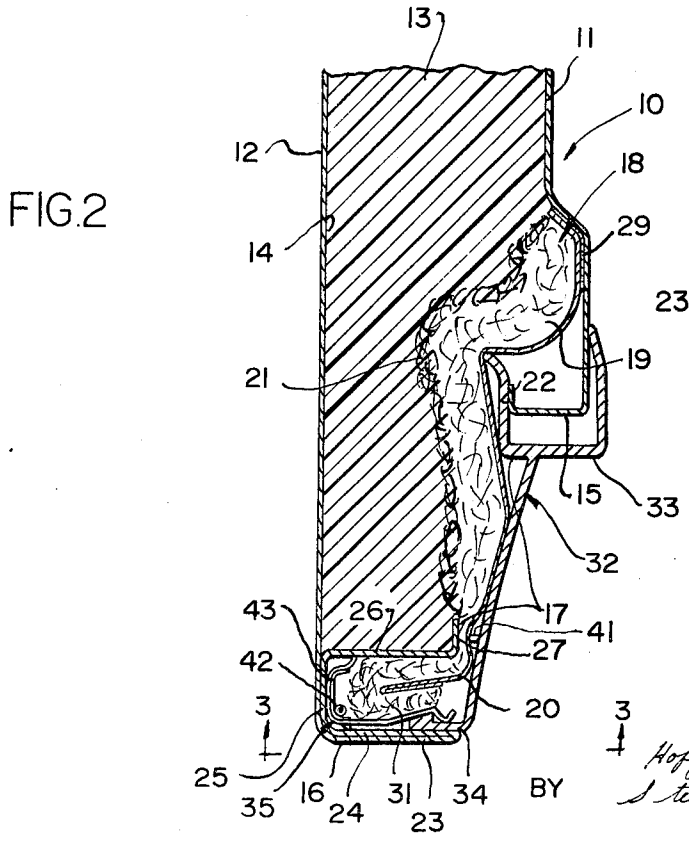
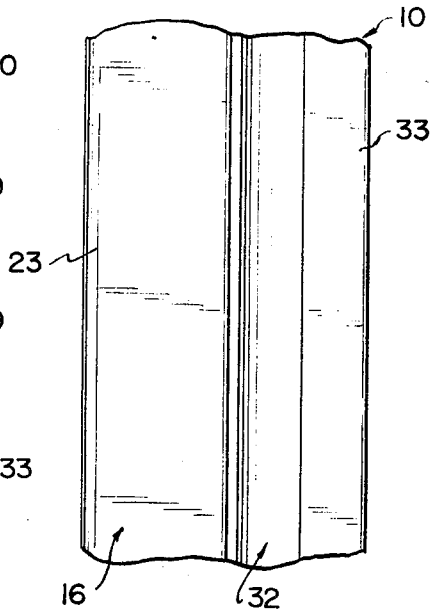


FIG.3



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INSULATED WALL STRUCTURE

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ABSTRACT OF THE DISCLOSURE

An insulating wall structure for use in cabinets such as refrigerator cabinets. The wall structure includes a pair of spaced panels and a body of foamed-in-place insulating plastic between the panels. A sheet of fibrous material extends across the space defined by juxtaposed edges of the spaced panels to define a boundary of the insulating plastic and permits the removable installation of a breaker strip between the panel edges.

This invention relates to insulating wall structures and in particular to foamed-in-place insulating wall structures.

In one improved form of insulating wall structure such as for use in refrigerator and freezer cabinets, a body of insulation material is disposed between spaced panels defining the inner and outer wall surfaces. The insulation material is foamed-in-place as by the method shown in the U.S. Letters Pat. No. 3,155,751, issued to Carl R. Morris on Nov. 3, 1964, and owned by the assignee hereof. Thus, as disclosed in the Morris patent, the foam material may comprise a urethane foam wherein the foam is generated by a chemical reaction upon mixture of the several ingredients placed in the space between the wall panels.

As a result of the chemical reaction, the mixed material foams in the space and rises to completely fill the space. Upon setting in the foamed configuration, a resultant bonded foamed-in-place insulating wall structure results. A problem, however, arises in such a foaming-in-place operation in that it is difficult to provide precisely the proper amount of ingredients to fully fill the space with the resultant foamed material. If too little foam material is provided, voids occur thereby decreasing the insulating efficiency of the wall structure, and if too much foam material is provided, excessive pressures are built up within the panels. Thus, it has been found necessary to very accurately control the quantity of the foam forming ingredients. Notwithstanding such accurate control, variations in conditions cause an undesirable amount of over-filled and under-filled cabinet structures to result.

The present invention comprehends an improved structural concept which solves the above discussed vexatious problem in a novel and simple manner. More specifically, the present invention comprehends the provision of means for effectively controlling the foaming action to permit a slight excess amount of ingredients to be used for assuring a complete fill of the wall structure, while yet preventing an excessive foam formation causing an over-pressure, or over-fill condition.

Thus, a principal feature of the present invention is the provision of a new and improved insulating wall structure.

Another feature of the invention is the provision of such a wall structure having new and improved means for controlling the foaming-in-place operation to prevent undesirable under-fill and over-fill conditions.

A further feature of the invention is the provision of such an insulating wall structure having new and improved means for permitting a slight excess of foaming material to be used in the foaming-in-place operation while yet effectively precluding an over-fill condition.

Still another feature of the invention is the provision of such an insulating wall structure having new and improved means for denucleating a portion of the foam material thereby to prevent an undesirable over-pressure or over-fill condition.

A yet further feature of the invention is the provision of such an insulating wall structure including spaced apart panels having juxtaposed edges defining an opening, and a body of foamed-in-place insulating plastic between said panels, structure for closing the opening comprising a sheet of fibrous material extending across the opening and having an inner portion confronting the plastic, the fibrous material in the inner portion being coated with denucleated plastic, and means for securing the sheet to the edges.

A further feature of the invention is the provision of such an insulating wall structure further including a breaker strip and means for removably securing the breaker strip to the panel edges.

Another feature of the invention is the provision of such an insulating wall structure having an electric heater disposed therein and a removable breaker strip providing selective access to the heater when desired.

A further feature of the invention is the provision of such an insulating wall structure wherein the fibrous sheet material provides a body of insulation adjacent the heater.

A yet further feature of the invention is the provision of such an insulating wall structure wherein the fibrous sheet material is provided with an impervious backing layer.

Another feature of the invention is the provision of such an insulating wall structure wherein the fibrous sheet material is provided with a metal foil backing layer.

Still another feature of the invention is the provision of such an insulating wall structure wherein pressure sensitive adhesive means are provided for securing the fibrous sheet material to one of the panel edges.

In summary, the invention comprehends an improved insulating wall structure having new and improved means for closing the opening between the juxtaposed edges of the inner and outer panels of a foamed-in-place cabinet wall structure which provides an improved novel control of the foaming operation to effectively preclude an over-fill condition while yet assuring a fully filled condition.

Other features and advantages of the invention will be apparent from the following description taken in connection with the accompanying drawing wherein:

FIG. 1 is a fragmentary exploded transverse sectional view of an insulating wall structure embodying the invention;

FIG. 2 is a fragmentary section of the insulating wall structure; and

FIG. 3 is a fragmentary front elevation thereof.

In the exemplary embodiment of the invention as disclosed in the drawing, an insulating wall structure generally designated **10** is shown to comprise a pair of spaced panels **11** and **12** with a body **13** of foamed-in-place plastic therebetween. As indicated briefly above, the wall structure **10** may comprise cabinet wall structure such as for use in a refrigerator or freezer cabinet. Thus, the wall panel **11** may comprise an inner liner panel and the wall panel **12** may comprise an outer cabinet panel. The foam material may comprise a urethane foam material including as the ingredients thereof a polyester and/or polyether resin, toluene diisocyanate, a blowing agent such as Freon 11, Genetron 11, Isotron 11, or Ucon 11, a catalyst such as trimethylamine or triethylenediamine, a surfactant such as the water soluble silicone derivative

X–521 manufactured by the Union Carbide Company. The ingredients may be introduced into the spaces **14** between the panels **11** and **12** by suitable nozzles (not shown). After a period of time such as approximately 40 seconds, the ingredients commence foaming and the foam material rises in the space to effectively completely fill the space and form the desired insulation body **13**. In the foaming process, the foam body **13** forms a strong bond with the panels **11** and **12** to cause the wall structure to define an integral unit.

In the illustrated embodiment, the wall structure **10** comprises an upright side wall of such a cabinet. FIG. 2 shows a horizontal selection thereof and, thus, the edge portion **15** of the liner panel **11** comprises the front edge of the panel **11** and the edge portion **16** of the cabinet panel **12** defines the front edge thereof which in cooperation with edge **15** defines a front opening **17**.

During the foaming-in-place operation, the panels **11** and **12** may be disposed in vertically spaced relationship with the front edges **15** and **16** disposed uppermost. Thus, the foaming of the plastic causes the plastic to rise in the space **14** upwardly toward the opening **17**. As indicated briefly above, it is contemplated that in forming the wall structure **10**, a slight excess of the foaming ingredients be provided so that ordinarily an excess amount of foam material **13** would be foamed in the space **14** tending to flow outwardly to the opening **17**. Thus, it is assured that the space **14** will be completely filled thereby effectively eliminating voids and providing maximum insulating efficiency in the wall structure. To permit such excess ingredient usage while yet prevent excess foam formation tending to produce excessive pressures in the space **14** or forming of the foam material beyond the desired extent thereof, a foam control means generally designated **18** is provided herein which effectively denucleates a portion of the foam during the foaming process and thus eliminates the excessive pressure, over-fill condition

More specifically, the foaming control means **18** comprises a strip of fibrous material **19** having an impervious backing layer **20**. Illustratively, the fibrous material may comprise fiber glass and the backing layer **20** may comprise a metal foil layer. In the illustrated embodiment, the fibrous material **19** may have a thickness of approximately one-half inch and the width of the strip, as shown in FIG. 1, may be approximately six inches. As will be brought out in greater detail here following, the control means **18** is installed within the wall structure **10** to extend across the opening **17** with the fibrous material **19** confronting the foaming space **14**. Thus, during the foaming operation, the urethane foam engaging the inner portion **21** of the fibrous material **19** becomes denucleated thereby tending to form a coating of gas-free material on the fibers and releasing the foaming gas therefrom. The amount of foam material which is so denucleated corresponds to the excess foam material formed by the slight excess supply of the foaming ingredients so that the foam body **13** may have normal low density, high insulation characteristics. Should the amount of excess ingredients be sufficient to cause the denucleated material to extend fully through the fibrous material, the impervious metal foil **20** prevents the flow of the material outwardly through the opening **17**. Thus, the foam control means **18** effectively defines a barrier at the end of the foaming space **14** which not only delimits the configuration of the foam body **13**, but also provides a novel denucleating effect providing control of the foaming operation.

Referring now more specifically to FIG. 1, the edge portion **15** of the liner panel **11** may comprise a turned end portion extending substantially at a right angle to the flat plate of the panel **11** toward the panel **12** and terminating in a return distal portion **22**. As shown, the panel **12** extends forwardly beyond the edge **15** of the panel **11** whereby the edge portion **16** is disposed substantially forwardly of the edge portion **15** of the panel **11**. The edge portion **16**, as shown in FIG. 1, includes an inturned portion **23**, a portion **24** folded back on portion **23**, a returned portion **25**, an inturned portion **26** and a distal returned portion **27**. The panel portions **24**, **25** and **26** define a channel space **28** opening away from the flat plane of the panel **12**. The opening **17** from space **14**, thusly, is defined by the distal portions **22** and **27** of the panels **11** and **12**, respectively.

The foam control means **18** is installed across the opening **17** by means of an adhesive strip **29** extending along one edge of the backing layer **20** for adhesively securing the edge of the control means **18** to the inner surface of the panel **11** at an offset portion **30** thereof spaced slightly from edge portion **15**. The opposite edge of the foam control means **18** is folded back upon itself, as shown in FIG. 2, to define a folded portion **31** received in the space **28** of the panel **12**.

The wall structure **10** may further include a breaker strip generally designated **32** including a bifurcated end portion **33** resiliently embracing the edge portion **15** of the panel **11**, and an opposite inturned latch portion **34** slidably engaging the folded panel portion **24** to removably overlie the foam control means **18**. The latch portion **34** is removably retained in the space **28** by means of a spring clip member **35** having an inner wall portion **36** bottomed in space **28** against the return panel portion **25** and having prongs **37** and **38** at the opposite ends thereof for bitingly engaging the panel portions **26** and **24**, respectively, to retain the clip member in the space **28**. The clip member further includes a spring leg **39** extending along the folded panel portion **24** and having a latch portion **40** at the distal end thereof interlocking releasably with the latch portion **34** of the breaker strip. As shown in FIG. 1, the breaker strip may be further provided with an inturned rib **41** which compresses the foam control means **18** against the distal portion **27** of the panel **12** to provide an effective seal of the foam control means **18** to the panel edge portion **27** and thereby in cooperation with the adhesive securing means **29** securing the foam control means **18** to the panel portion **30**, causes the foam control means **18** to define an effective barrier between the panels **11** and **12** inwardly of the opening **17**.

A heater wire **42** may be provided in the space **28** adjacent bottom portion **36** of the clip **35** for suitable electrical energization to prevent condensation on the wall edge portions. A strip **43** of masking tape may be provided on the clip member wall **36**. As shown in FIG. 2, the folded end portion **31** of the foam control means **18** provides electrical insulation adjacent the heater wire **42**, with the metal foil **20** being disposed within the folded portion **31** to be spaced substantially from the heater **42**.

Thus, the foam control means **18** effectively precludes bonding of the foam material **13** to the breaker strip and permits the breaker strip to be readily installed and removed relative to the wall structure **10**. Ready access may, therefore, be had to the electric heater wire **42** by simple removal of the breaker strip **32** which may be fabricated from any suitable well-known low heat conducting plastic material. After removal of thermal breaker strip **32** the folded end portion **31** of the foam control means **18** is withdrawn from the space **28** affording ready access to refrigerator electrical wiring such as the heater wire **42**. Since the fibrous material **19** is formed of a non-flammable material, such as fiber glass, the folded portion **31** effectively defines a fire barrier providing improved safety in the wall structure.

Thus, the illustrated foam control means **18** effectively defines a barrier in the end of the foam space **14** wherein the fibers of the fibrous material in the inner portion of the foam control means are permeated by the foam material such that the fibrous material is in intimate contact with the foam body **13**, and impervious foil backing layer **20** ensures easy removal of breaker strip **32** without destroying the breaker strip or disturbing the insulation. The present invention also permits easy access to refrigerator wiring such as heater wiring and provides an effec-

tive fire barrier around the heater wire as required by industry standards such as those of Underwriter's Laboratories. The present invention also facilitates easy removal and replacement of breaker strips which are easily broken since they are commonly fabricated from relatively fragile matetrial.

While I have shown and described one embodiment of my invention, it is to be understood that it is capable of many modifications. Changes, therefore, in the construction and arrangement may be made without departing from the spirit and scope of the invention as defined in the appended claims.

The embodiment of the invention in which an exclusive property or privilege is claimed is defined as follows:

1. In an insulating wall including spaced apart panels having juxtaposed edges defining an opening, and a body of foamed-in-place insulating plastic between said panels, structure for closing said opening comprising means for denucleating foamed plastic at said opening at the end of the foaming-in-place operation to prevent build-up of excessive pressure by an excess of plastic forming materials in the space between said panels, said denucleating means comprising a fibrous material sheet provided with an outer portion of material impervious to the foamed-in-place plastic and having an inner portion coated with denucleated plastic.

2. In an insulating wall including spaced apart panels having juxtaposed edges defining an opening, and a body of foamed-in-place insulating plastic between said panels, structure for closing said opening comprising: a sheet of fibrous material extending across the opening and having an inner portion confronting the plastic, the fibrous material in said inner portion being in intimate contact with the plastic; and means for securing the sheet to said panels, said sheet being provided with an outer metal foil layer.

3. In an insulating wall including spaced apart panels having juxtaposed edges defining an opening, and a body of foamed-in-place insulating plastic between said panels, structure for closing said opening comprising: a sheet of fibrous material extending across the opening and having an inner portion confronting the plastic, the fibrous material in said inner portion being in intimate contact with the plastic; and measn for securing the sheet to said panels, said securing means including adhesive mean for ecuring the sheet to one of said panels.

4. In an insulating wall including spaced apart panels having juxtaponsed edges defining an opening, and a body of foamed-in-place insulating plastic between said panels, structure for closing said opening comprising: a sheet of fibrous material extending across the opening and having an inner portion confronting the plastic, the fiborus material in said inner portion being in intimate contact with the plastic; and means for securing the sheet to said panels; a breaker strip outwardly overlying said sheet; and means for removably securing said breaker strip to said panel edges, said securing means including a clip member secured to one of said panel edges and having a spring portion resiliently releasably engaging said breaker strip, said fibrous material sheet engaging said clip member.

5. In an insulating wall including spaced apart panels having juxtaposed edges defining an opeing, and a body of foamed-in-place insulating plastic between said panels, structure for closing said opening comprising: a sheet of fibrous material extending across the opening and having an inner portion confronting the plastic, the fibrous material in said inner portion being in intimate contact with the plastic; and means for securing the sheet to said panels, said fibrous material sheet including an edge portion folded back upon itelf and one of said panel edges defining a channel snugly receiving said sheet edge portion.

6. In an insulating wall including spaced apart panels having juxtaposetd edges defining an opening, and a body of foamed-in-place insulating plastic between said panels, structure for closing said opening comprising: a sheet of fibrous material extending across the opening and having an inner portion confronting the plastic, the fibrous material in said inner portion being in intimate contact with the plastic; and means for securig the sheet to said panels, said securing means comprising a pressure adhesive strip on said fibrous material sheet.

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U.S. Cl. X.R.

52—404; 220—9; 264—45