

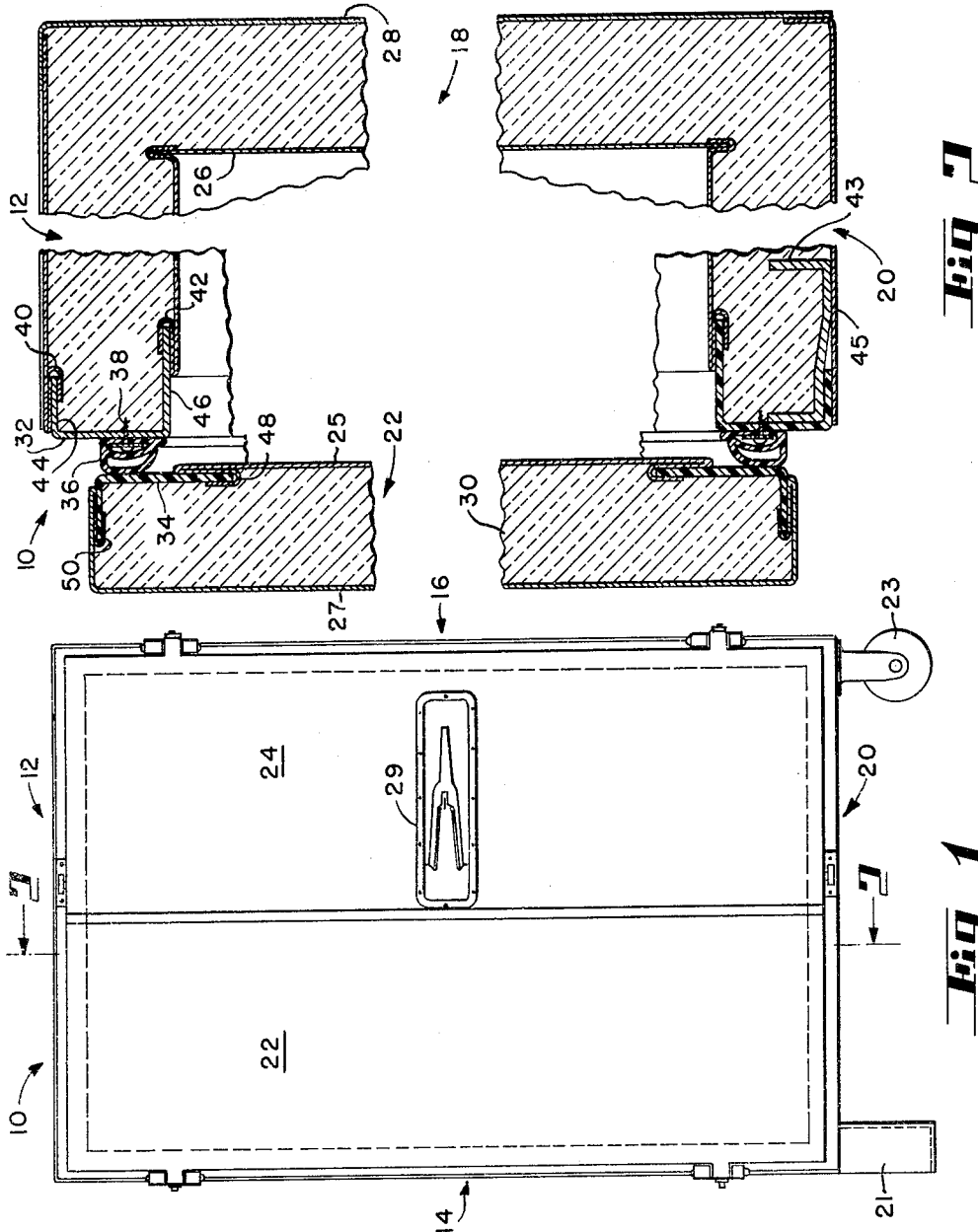
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BREAKER STRIP CONSTRUCTION FOR INSULATED CONTAINER

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BREAKER STRIP CONSTRUCTION FOR INSULATED CONTAINER

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This invention relates generally to insulated container constructions and, more particularly, to the construction and assembly for bridging the space between the outer shell and the inner liner of an insulated refrigerator-type cabinet.

Some modifications of foamed polyurethanes have insulation characteristics sufficient to make possible low cost, thin-walled, refrigerated cabinets or insulated containers having heat leaks lower than the present thick-walled cabinets insulated with glass or mineral wool. These polyurethanes have excellent adhesive properties, are low in weight, high in structural strength, and have high insulating properties. In accordance with this invention, I use the properties of the polyurethane foam for insulation, and as the means for securing a breaker strip to a cabinet to bridge the space between the outer shell and the inner liner without introducing a heat leak.

It is an object of this invention to provide an improved breaker strip construction wherein the use of fastening devices is entirely eliminated.

Another object of this invention is to provide a container or cabinet construction in which the insulating material is formed and cast within the double walls of the cabinet not only to provide superior insulating properties, but also to provide the means for bonding a breaker strip to the double walls.

It is another object of this invention to provide a breaker strip assembly which effectively prevents the entrance of moisture and air into the heat insulation of a double-walled insulated container or cabinet using foamed-in-place insulating material having bonding and structural properties.

It is still another object of this invention to provide an improved breaker strip construction from the standpoint of appearance and to insure that the breaker strip will be rigidly retained in position in the normal use of an insulated container or cabinet.

Another object of this invention is to provide a breaker strip for a double-walled container insulated with foamed-in-place polyurethane, the breaker strip being fastened to the container by the bonding action of the insulation.

For further objects and advantages of this invention, reference should now be made to the following specification and to the accompanying drawing in which;

FIGURE 1 is a front elevation of an insulated cabinet constructed in accordance with this invention; and

FIGURE 2 is an enlarged sectional view taken through the line 2-2 in FIGURE 1.

The invention, as illustrated in FIGURES 1 and 2, comprises a cabinet generally indicated at 10 and having a top wall 12, side walls 14 and 16, rear wall 18, bottom wall 20, and a front opening closed by appropriately hinged doors 22 and 24. The entire cabinet is supported on a pair of legs 21 and a pair of wheels 23. The doors of the cabinet are provided with an inner liner 25 and an outer shell 27, while the walls of the cabinet are provided with an inner liner 26 and an outer shell 28. While liners of sheet aluminum for light weight and shells of sheet steel for strength were used in cabinets actually reduced to practice, it will be understood that any sheet material having the necessary structural characteristics may be used. A conventional latch 29 is also used. The space between the inner liners and outer shells is filled with insulation, hereinafter more fully described.

It will be noted that the inner liners and outer shells of the cabinet and the doors are not connected at the edges adjacent the periphery of the front of the cabinet. This space has been provided for the customary purpose of breaking the heat conductivity path from between the inner shells and the outer shells.

For the purpose of bridging the space between the shells and liners around the entire periphery of the cabinet without introducing a thermal connection between the inner and outer shells 26 and 28, a breaker strip 32 is secured, in a manner hereinafter to be explained, to the front edge of the cabinet in the plane of the cabinet opening. For the same purpose, a breaker strip 34 is secured to the doors 22 and 24 at positions opposite the breaker strips 32. A resilient seal 36 is secured around the entire periphery of the breaker strip 32 by any convenient means, such as screws 38. Preferably the breaker strips 32 and 34 are made of a rigid polymerized resin reinforced with fiber-glass mats to provide high strength and durability.

For the purpose of fastening the breaker strip 32 to the inner liner 26 and outer shell 28 of the cabinet, the front peripheral edge of each is provided with inwardly directed, double reverse bends to form U-shaped channels 40 and 42 around the periphery of the cabinet, the channels facing outwardly from the cabinet. For purposes not relevant to this invention, the channel 40 at the bottom of the cabinet is formed by an appropriately shaped reinforcing channel iron 43 welded to the outer shell 28 at 45. The breaker strip 32 is channel-shaped, having flanges 44 and 46 extending into and frictionally engaged by the walls of channels 40 and 42, respectively.

At a position adjacent the upper periphery of the channel of each door, the inner liner 25 and outer shell 27 are provided with similar inwardly directed, reverse double bends to provide U-shaped flanges 48 and 50, respectively. The edges of the breaker strip 34, which is right angular in cross section, extend into and are frictionally engaged by the walls of the U-shaped channels 48 and 50.

The volumes between the inner liners 26 and outer shells 28 of the cabinet, and the inner liner 25 and outer shell 27 of the doors, are filled with polyurethane foam 30 which is foamed in place. The foam 30 provides the necessary insulation, and also serves to secure the breaker strips 32 and 34 in place. In constructing the cabinet, the inner liners and outer shells are assembled and the breaker strips 32 and 34 are inserted into the respective U-shaped channels. Thereafter the polyurethane foam is introduced into the space between the shells and liners, foaming into the entire volume. Since the polyurethane foam has adhesive qualities, it serves to bond the breaker strips 32 and 34 to the interior of the respective liners and shells. In addition, the foam increases the pressure on the U-shaped channels in which the breaker strips have been inserted, and this serves to increase the friction on the breaker strips, thereby adhering the breaker strips to the shells and liners.

While many foamed materials can be used in the space between the liners and shells, polyurethane foams are the most desirable of materials available at this time because of their high structural strength, high insulating value, low weight, and excellent adhesive properties.

Although polyurethane foams do have excellent inherent adhesive qualities, the surface should be clean (free of dirt, oils, greases) and in the case of steel and aluminum (and most other metals), the surfaces should be primed. There are hundred of formulations for producing polyurethane foams. While polyesters foams were first available, polyether foams have generally replaced polyester foams in this field. An example of a formulation for the production of a halogenated hydro-

carbon blown foam based on a polyether polyol is as follows:

A polyoxypropylene sorbitol was prepared having a hydroxyl number of approximately 490 and an acid number of 0.3 or less. A portion of this polyether was reacted with an isocyanate mixture consisting of approximately 80% by weight 2,4-toluene diisocyanate and about 20% by weight, 2,6-toluene diisocyanate to produce a quasi-prepolymer having an NCO/OH ratio of 4.5/1.

125 grams of this prepolymer was blended with 1.2 grams of an organosilicone fluid (a surfactant), and 36 grams of trichlorofluoromethane (F-11 blowing agent). This blend was retained as the "A" component.

The "B" component consisted of 86.4 grams of the polyoxypropylene sorbitol polyether and 1.95 grams of triethylene diamine (catalyst).

The "A" and "B" components were combined and mixed at a speed of 2800 r.p.m. using a crimped disc blade approximately 2 inches in diameter. Mix time was 30 seconds.

The resulting foam was handleable in 10 minutes at room temperature (75° F.) and the density of the foam was approximately 2 lbs./ft.³.

An example of a formulation for the breaker strip 32 is as follows:

A solution of an unsaturated alkyd in a vinyl monomer such as styrene, alpha methyl styrene, or vinyl toluene wherein the alkyd is a polyester of polyhydric alcohol (such as ethylene glycol, diethylene glycol, dipropylene glycol or triethylene glycol) and dicarboxylic acids (such as phthalic, fumaric, maleic, adipic, succinic) or their anhydrides, and wherein at least 25% of the acids (or anhydrides) are alpha unsaturated, alpha, beta-polycarboxylic acids (such as fumaric acid or maleic anhydride). This solution also contains a small inhibiting amount (less than 0.050%) of a material such as tertiary butyl catechol or hydroquinone. Specifically, the following may be used:

Maleic anhydride	-----moles-----	1.0
Phthalic anhydride	-----do-----	1.0
Propylene glycol	-----do-----	2.2
Hydroquinone (inhibitor)	-----percent-----	0.013
Acid No. of alkyd	-----	45-50

Dilute with monomeric styrene to the extent that the styrene total content by weight will not exceed 30%.

This resin may be activated by first blending with 0.1% by weight cobalt naphthenate (containing 6% cobalt metal) and then with 1.0% methyl ethyl ketone peroxide (that is a 60% solution in dimethyl phthalate). This gives a gel time of approximately one hour at 77° F.

Another method of activation would be by the addition of 0.92% benzoyl peroxide by weight and placing an ambient of approximately 240° to 255° F. Gel time is approximately one minute.

The glass fibers used may be what is recognized in the industry as chopped strand mat, unidirectional fibers, woven roving, or various grades and weaves of glass cloth and/or combinations of any of these.

While examples of particular breaker strip and foam formulations have been given, it will be recognized that any cellular plastic (e.g., phenolic, epoxy, expanded bead styrene or polyurethane foam) may be used provided it can be placed in the volumes between the inner liners and outer shells and at least partially expanded by either chemical or physical means with resulting adhesive character. In addition, the epoxy resins, which are either condensates of epichlorohydrinbisphenol reaction or

epoxidized polyolefins, may be used in the place of polyester resins. Thermoplastic materials may also be used either with or without reinforcement. Among these are rigid (unplasticized) polyvinyl chloride, styrene, acrylonitrile-butadiene-styrene (ABS plastic), acrylonitrile-styrene, acrylic, nylon, etc.

It will be seen that this invention achieves at least the following advantages: (1) elimination of the need for blind fasteners such as screws, nails, and blind rivets; (2) elimination of any type of mechanical fastener for securing the skins to the edge member; (3) reduction in time and labor for assembling of the panels because of simplicity of the fabrication method; (4) the resultant continuous bond along the joint that is much more desirable than the intermittent bonds resulting from the use of fasteners.

Many modifications of this invention will at once become apparent to persons skilled in the art, and for that reason it is my intention that the invention not be limited to the structure illustrated but only by the scope of the appended claims as interpreted in the light of the prior art.

What is claimed is:

1. In a cabinet enclosure, an insulated wall comprising:
 - a outer shell;
 - an inner liner spaced from said outer shell, said outer shell having an edge adjacent and parallel to an edge of said inner liner, each of said edges having a U-shaped channel formed thereon, the trough of said channel being located in the space between said inner and outer shells, said trough facing outwardly therefrom;
 - a rigid low heat-conducting channel-shaped breaker strip having at least two side walls, said breaker strip bridging the space between said troughs, the edges of said side walls of said breaker strip being frictionally engaged in said troughs of said U-shaped channels; and
 - a foamed in place plastic insulating material in the space defined by said shell, said liner, and said breaker strip, said material adhering to said shell, liner, and breaker strip, the pressure of said foamed insulating material on said U-shaped channels increasing the friction between said breaker strip and said channels, whereby said breaker strip is secured to said outer shell and said inner liner solely by the increased friction and by the adherence of said material to said shell, liner, and breaker strip.
2. The invention as defined in claim 1 wherein said material is a polyurethane plastic.
3. The invention as defined in claim 1 wherein said outer shell and inner liner are parallel.
4. The invention as defined in claim 1 wherein said outer shell and inner liner are made of sheet metal and wherein said breaker strip is made of a rigid polymerized resin reinforced with fiber glass.

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