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Wilder et al.

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[45] **Sept. 10, 1974**

[54] **INSULATED DOOR CONSTRUCTION**

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[73] Assignee: **Mesker Industries, Inc.**, St. Louis, Mo.

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[52] **U.S. Cl.** **52/309**, 52/620, 52/627

[51] **Int. Cl.** **E04c 2/38**

[58] **Field of Search** 52/455, 457, 458, 475, 52/620, 627, 404, 393, 309, 615

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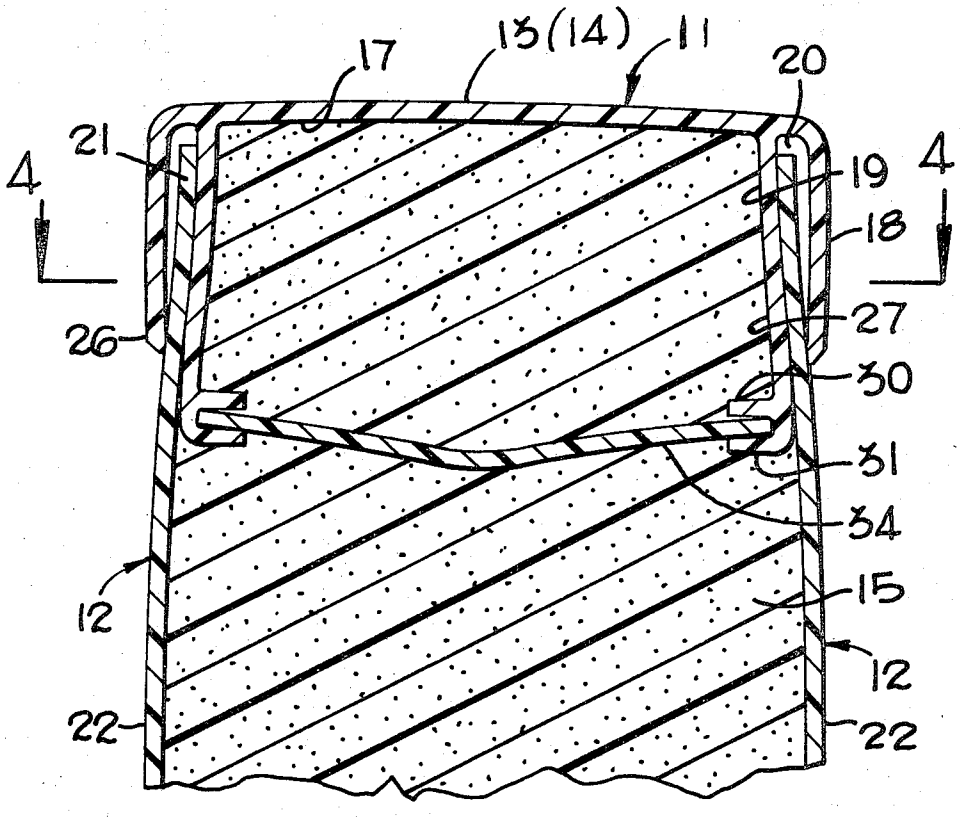
Primary Examiner—Price C. Faw, Jr.

[57] **ABSTRACT**

This insulated door construction includes extruded plastic framing members and sheet plastic side panels, which are connected without the use of fasteners. The framing members are U-shaped and include spaced inner and outer legs which are sprung apart to clamp the side panels in place. The door includes an expanded foam plastic core which cooperates with the framing members to resist separation of the framing members and the side panels. In one species the inner legs of the framing members are held apart by foam-embedded transverse spacer members. In another species, particularly adapted to suit hingedly mounted doors, a continuous interior member cooperates to hold the framing members in place and provide reinforcing for the hinge mounting.

6 Claims, 8 Drawing Figures



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SHEET 1 OF 2

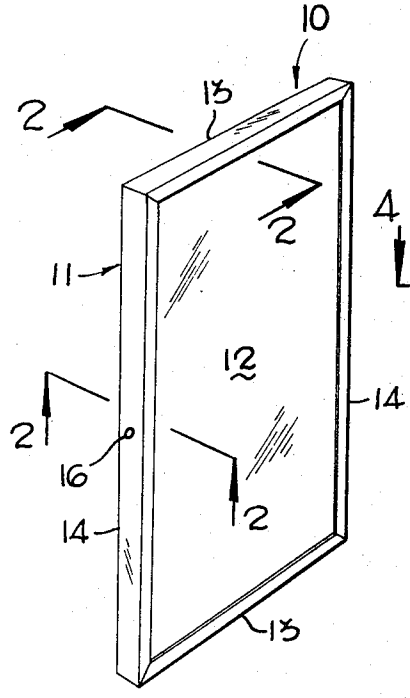

FIG. 1

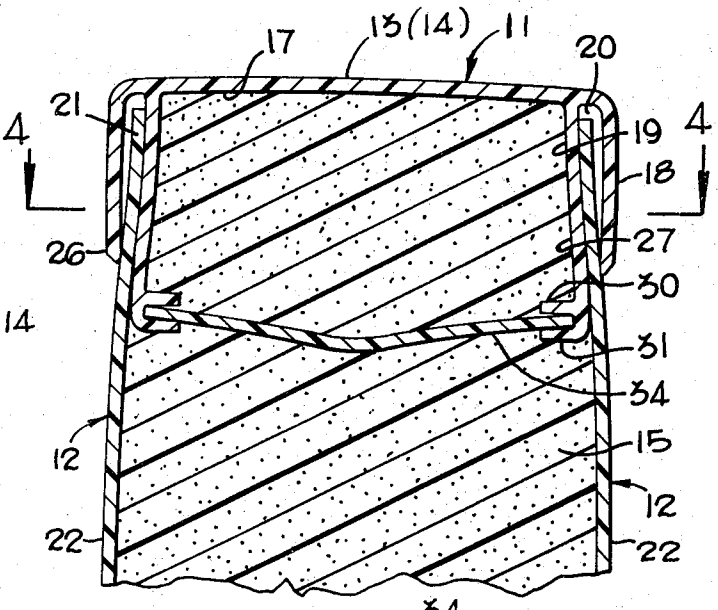

FIG. 2

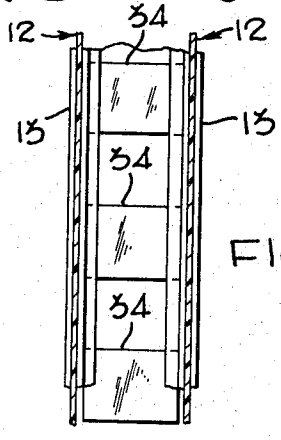

FIG. 4

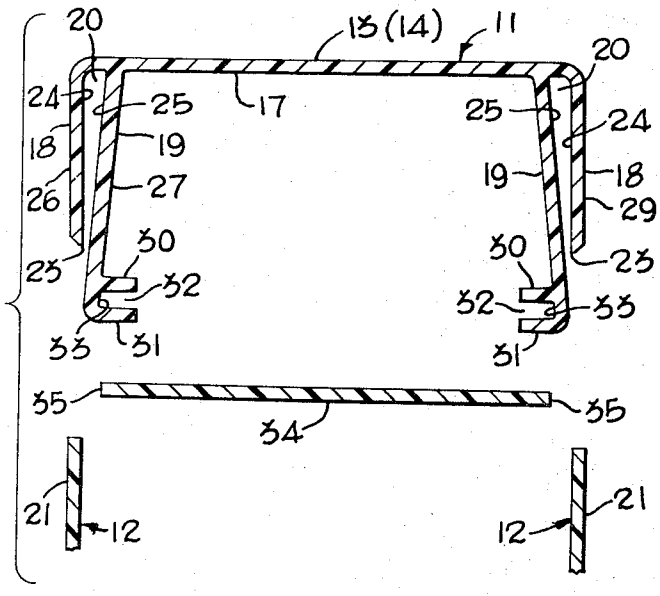

FIG. 3

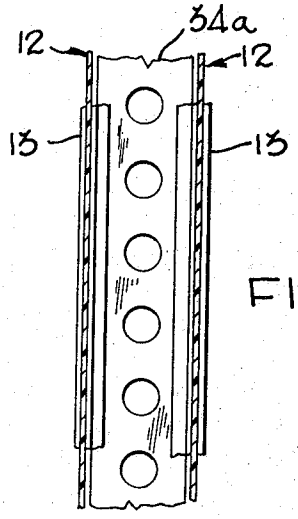

FIG. 5

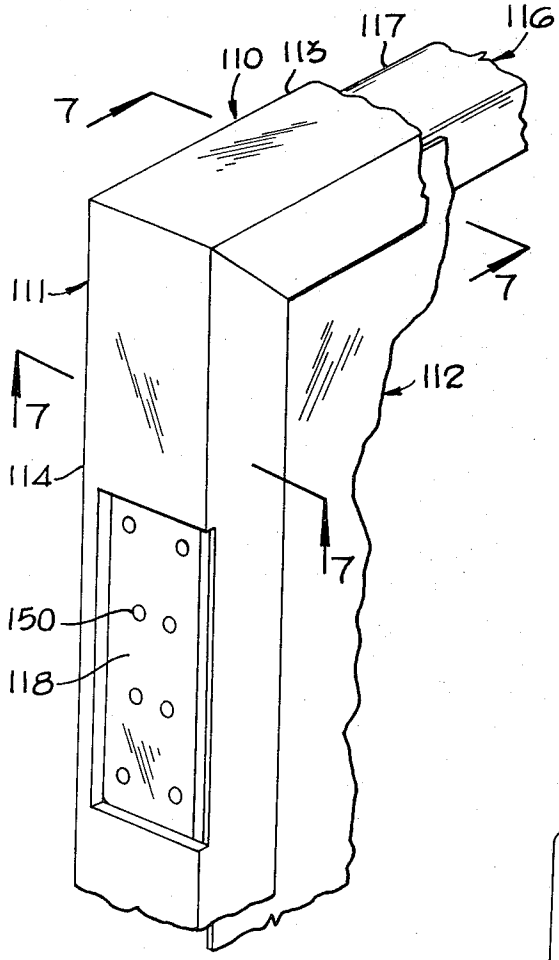

FIG. 6

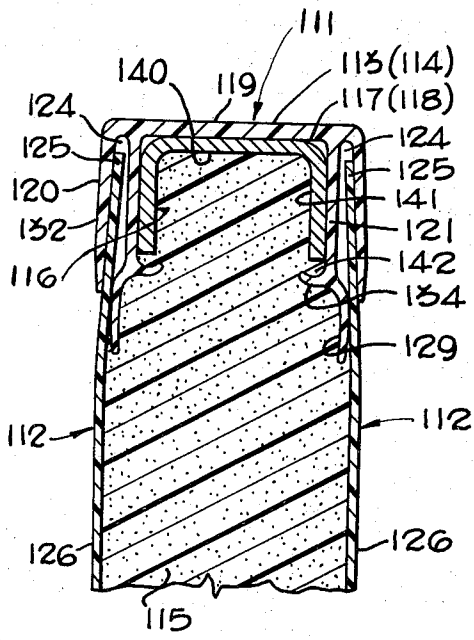

FIG. 7

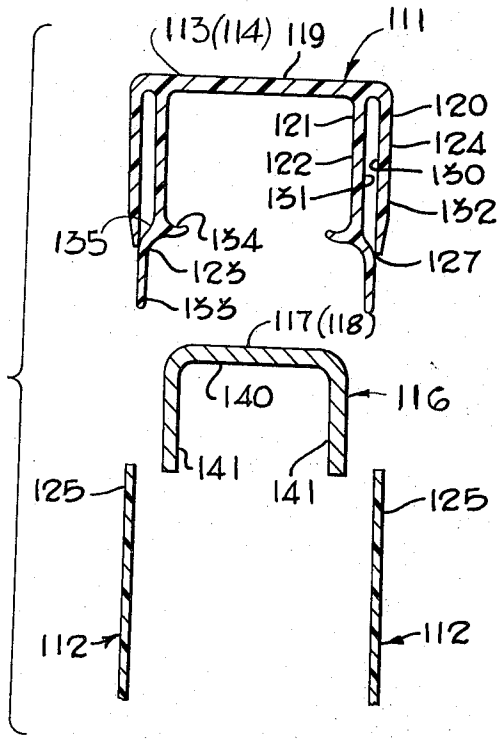

FIG. 8

INSULATED DOOR CONSTRUCTION

BACKGROUND OF THE INVENTION

This invention relates generally to an insulated door construction and particularly to an insulated door having an expanded foam plastic core.

The use of hollow metal doors having sheet metal panels and metal stiles and rails is well known and, in an effort to reduce the weight of such doors yet provide adequate reinforcing for the panels, honeycomb cores have been provided. Such doors tend to be costly because fabricated steel is an expensive form of construction. Moreover, metal doors cannot compete with wood or plastic doors when insulation characteristics are a primary consideration.

Lightweight plastic foam materials, such as urethane, have been used as an insulating medium for many years. However, it is only within the last few years that this material has been foamed in place within cavity doors to provide a strong, rigid monolithic unit, which provides optimum insulation particularly suitable for walk-in refrigerators, dairy coolers and similar low temperature usages. Foam-filled hollow doors having wood frames and panels clad with plastic sheet such as polyvinylchloride (P.V.C.) are known but composite doors of this type are obviously expensive and are not completely free from warpage problems in comparison with plastic or metal.

In general, although plastic material such as P.V.C. is an excellent material for door finishes because it is lightweight, easy to maintain and impact resistant, there are problems in using this material for structural, door framing members. An important problem in the fabrication of hollow doors having the structural framing and side panels formed entirely of plastic lies in the difficulty of providing adequate connection between the door framing members and the side panels. In the interests of economy it is desirable to use side panels formed from flat sheet stock rather than stock having contoured margins which interlock with compatibly formed framing members. Unfortunately, relatively inexpensive connections for flat sheet stock made by bonding with an adhesive or by using fasteners, have not proven particularly satisfactory.

There are occasions when hollow plastic doors must be hingedly mounted. In order to provide plastic stiles having sufficient strength to support a hinged door, the cross sectional area of the structural framing material must be increased to an uneconomical point as compared with the cost of wood or metal frames and this has tended to inhibit the use of plastic as a structural medium.

The present insulated, plastic door construction overcomes the deficiencies noted above in a manner heretofore unknown in the past and provides a construction adaptable to both sliding doors and doors which are hingedly mounted.

SUMMARY OF THE INVENTION

This invention provides a lightweight door having superior insulation properties. The door framing and the side panels, both of plastic stock, are connected together without the use of fasteners. The door includes a foamed-in-place plastic core which is utilized to resist separation of the framing members and the side panels and provides a highly efficient insulating material. The foam core provides a strong rigid monolithic door particularly suitable for refrigerators, dairy coolers and the like.

The construction of the door in a second embodiment utilizes a continuous, interior reinforcing frame of metal so that the door may be hingedly mounted without the necessity of providing excessively thick stiles and rails.

The insulated door is relatively inexpensive to manufacture and simple to assemble and yet is substantially maintenance free because of the all plastic exterior.

The door includes opposed side panel members, which are connected by closure members having a generally U-shaped cross section. The closure members include outer and inner leg elements spaced from each other to define grooves receiving margin portions of said side panel members in clamped relation. An expanded foam core is disposed between said side panel members, and holding means is provided for resisting separation of said closure members from said side panel members.

The closure members are formed in straight lengths from extruded plastic material. The inner leg elements are longer than the outer leg elements, and said inner and outer leg elements are so spaced that they must be sprung apart to receive said side panel members. The resulting clamping action acts to hold the closure members and side panel members together in sealing relation and resists separation of said members.

In one embodiment the holding means also includes opposed, inwardly projecting lips integrally formed with the inner leg elements of the closure means and adapted to be embedded within the foam core. Spacer means extends between said inner leg elements to resist inward movement of said inner leg elements. Said spacer means include either a plurality of separate plates spaced along the length of said closure member or a continuous, apertured spacer plate, and is adapted to be embedded within said foam core.

A second embodiment of the door construction includes an interior, continuous reinforcing frame receiving the closure members in embracing relation. In the second embodiment the holding means also includes opposed inwardly projecting lips integrally formed with said inner leg elements and adapted to be embedded within the foam core.

The interior frame includes opposed framing members, U-shaped in cross-section and compatibly formed to fit between the inner leg elements of associated closure members. The remote ends of the leg elements of the interior framing members are spaced from the inwardly projecting lips by foam core material, whereby said interior framing resists separation of said closure members and said side panel members. In both embodiments adhesion between the foam core and the closure members resists separation of said closure members and side panel members.

The bight portion of the exterior members of the second embodiment is adapted to be partly cut away to expose the interior framing members, whereby to provide a hinge mounting recess for hingedly mounting said door.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a foam-filled door;

FIG. 2 is an enlarged, fragmentary cross-sectional view taken on line 2—2 of FIG. 1;

FIG. 3 is an exploded view of the door parts prior to assembly;

FIG. 4 is a cross sectional view taken on line 4—4 of FIG. 2, and

FIG. 5 is a similar view to FIG. 4, illustrating a modified spacer construction;

FIG. 6 is a fragmentary perspective view of a modified frame construction;

FIG. 7 is a cross-sectional view taken on line 7—7 of FIG. 6, and

FIG. 8 is an exploded view of the modified construction prior to assembly.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now by characters of reference to FIGS. 1, 2 and 3 it will be understood that the insulated door generally indicated by numeral 10 in FIG. 1 includes a peripheral frame 11 interconnecting opposed side panel members 12 spaced from each other by said frame 11. The frame 11 includes opposed end closure members 13 and opposed side closure members 14 having the same cross-sectional configuration. The closure members are formed from straight lengths of an extruded plastic material such as Polyvinylchloride (P.V.C.) and the side panel members are formed from a similar sheet plastic material.

It will be understood that, once assembled, the frame 11 and side panel members 12 define a cavity, which is filled with expanded foam material, such as polyurethane, to provide a rigid foam core generally indicated by numeral 15 in FIG. 2. The actual foam expanding process is conventional, and well known in the art, and a fill aperture 16 indicated in FIG. 1 is provided for this purpose.

As shown in FIG. 2 the expanded foam 15 exerts an internal pressure which, because of the structural relationship of assembled parts, assists in automatically sealing the overlapping related frame 11 and side panel members 12. The configuration of the frame 11 will be described with reference to the end closure member 13, which is illustrated in FIG. 3 in its unstressed extruded condition, it being understood that the side, or stile, members are identical except as to length.

As extruded, member 13 is generally U-shaped in cross section and includes a bight portion 17 and spaced compound leg portions, each providing an outer leg element 18, and a relatively long inner leg element 19. The outer leg elements 18 are substantially parallel to each other and right-angularly related to the bight portion 17. The inner leg elements 19 are spaced from said outer leg elements 18 to define grooves 20 adapted to receive associated margin portions 21, of the side panel members 12. As shown in FIG. 3 the inner leg elements 19 are divergent in the unstressed conditions, prior to insertion of the side panel margin portions 21, so that the space between the legs decreases toward the remote end of the outer leg 18. The gap 23 at said remote end is less than the thickness of said side panel margin portions 21. In the preferred embodiment the inner face 24 of each of the outer leg elements 18 is substantially coincident with the outermost limit of the outer face 25 of its associated inner leg element 19.

The inner leg elements 19 each include a pair of inturned lips 30 and 31 at their remote end, and disposed below the remote end of the outer leg elements 18 and constituting lip means. Lips 30 and 31 are spaced apart to define a groove 32, which is adapted to receive a plurality of transverse spacer plates 34, said plates 34 constituting spacer means. The distance between the ends 35 of said spacer plates 34 in the preferred embodiment is substantially equal to, or less than, the distance between the ends 33 of oppositely disposed grooves 32.

FIG. 4 illustrates the disposition of the spacer plates 34 in the assembled condition and it will be observed that said plates 34 are spaced apart a distance approximately equal to their width. In the modified spacer plate construction illustrated in FIG. 5 a continuous, apertured spacer plate 34*a* is used in lieu of individual, spaced plates 34.

The assembled door is shown in FIG. 2. In the assembly procedure the spacer plates 34 are inserted within the grooves 32, either by sliding from one end of the extruded member 13, or by springing of the inner leg elements 19. The inner and outer leg elements 18 and 19 are sprung apart to receive the margin portion 21 of the side panel 12. Inward movement of the inner leg 19 is resisted by the spacer plate 34, said spacer plate acting, in effect, as a deflectible strut. When the margin portions 21 are fully inserted, the natural tendency of each leg to return to its original, unstressed disposition results in a tight seal between leg elements 18 and 19 and the associated panel member 12 in the vicinity of the remote end of the outer leg elements 18. In the assembled condition, the inner portions 22 of the side panel members 12 are spaced apart a distance substantially equal to the overall width of the closure member 13, said width being defined by the distance across the outer faces 26 of the outer leg elements 18. The outer margin portions 21 of the side panel members 12 are bent inwardly, relative to the inner portions 22 of said side panel members, because of the configuration of the closure member 13 and the strut action of the spacer plate 34 disposed below the remote end of the outer leg element 18.

When the door 10 has been fully assembled the foaming agent is injected within said door and, when expanded, completely fills the cavity to provide a foam plastic core 15. The resulting internal pressure tends to change the overall configuration of the closure member 13 somewhat with the result that the clamping pressure on said panel members is further increased.

It will be understood that the means holding the frame 11 to the side panel members 12 prior to emplacement of the foam core 15 is provided, without the use of fasteners, by clamping of said panel members between the sprung leg elements 18 and 19. Following emplacement of the foam core 15, a holding means between the frame 11 and the side panel members 12 is provided by engagement between the closure member 13 and the foam core 15. In particular, the holding means, which precludes separation of the frame 11 and side panel members 12, includes the combination of the inwardly projecting lips 30 and 31 and the spacer plates 34 which are, in effect, embedded in said foam core 15. Additional holding is provided by the adhesion between the foam core 15 and the inner face 27 of the inner leg elements 19.

Referring now by characters of reference to the second embodiment illustrated in FIGS. 6 through 8 it will be understood that the insulated door 110 is reinforced to provide the greater strength necessary when the door is adapted to be hingedly mounted. Specifically,

the door 110 includes a peripheral outer frame 111 interconnecting opposed side panels 112 spaced from each other by said frame 111. The frame 111 includes opposed end closure members 113 and opposed side closure members 114 having the same cross-sectional configuration and being formed from straight lengths of an extruded plastic material. The closure members and side panel members are preferably formed from the same plastic material as the first embodiment and the cavity likewise filled with an expanded foam material to provide a rigid foam core 115. Distinguishing from the first embodiment the outer peripheral frame 111 is disposed, in embracing relation, about a continuous, rectangular metal frame 116, which is substantially U-shaped in cross section, and which is welded at the corners to provide a rigid metal frame, said frame having opposed end members 117 and opposed side members 118.

As extruded, the end closure member 113 includes a bight portion 119 and a pair of spaced compound leg portions providing outer leg elements 120 and relatively long inner leg elements 121. The outer leg elements 120 are substantially parallel and perpendicular to the bight portion 119. The inner leg elements 121 each include a first portion 122 spaced from the associated outer leg element 120 to define a groove 124; and a second portion 123 outwardly displaced toward said associated leg element 120. Each groove 124 is adapted to receive an associated margin portion 125 of a side panel member 112. The inner face 130 of the outer leg element 120 is substantially coincident with the outermost limit of the outer face 131 of the associated inner leg element 121. Each inner leg element includes an inner curved lip 134, which provides a means by which the closure members, such as member 113, are snap fitted over the rounded edges of the continuous metal frame 116, and an outer shoulder 135. It will be understood that the side panel members 112 are inserted within the grooves 124 at the same time as the closure members are installed in embracing relation on the continuous frame 116. As with the first embodiment the inner and outer leg elements are sprung apart to receive said side panel members, which, once inserted are retained in place by the inherent tendency of the leg elements to assume their original disposition.

The interior, metal frame members, such as member 117, are compatibly formed to be received within the space defined by the bight portion 119 and opposed, inner leg elements 121 of the associated closure element 113. For example, the bight portion 140 and the opposed leg elements 141 of the interior frame member 117, are adjacently disposed of the corresponding bight portion 119 and inner leg elements 121 of the closure member 113. As shown in FIG. 7, the remote ends of the interior framing member leg elements 141, in the assembled condition, are disposed in spaced relation from the inwardly projecting shoulders 130. It will be observed that the inner leg elements 121 extend beyond the associated interior framing member leg elements 141. Said leg elements 141 are much stiffer than leg elements 121 and, consequently, resist inward movement of said leg elements 121. The outer, margin portions 125 of the side panel members 112 are bent inwardly relative to said inner portions of said side panel members 126 because of the configuration of the closure shoulder 135 and because of the resistance offered by the interior member legs 141.

Prior to emplacement of the foam core 115 the means holding the outer frame 111 to the side panel members 112 is provided by clamping action between the sprung leg elements 120 and 121, it being understood that the outer frame members are substantially precluded from separation from the interior metal frame 116 by lips 134. When the door 110 has been fully assembled the core 15 is foamed-in-place and the internal core pressure from said core tends to increase the sealing force between the inner and outer leg elements 121 and 120 and the door panel members 112. Following emplacement of the core 15, a holding means between the outer frame 111 and the side panel members 112 is provided by engagement between the closure members 113, the associated interior member 117 and the foam core 115. In particular, the holding means, which precludes separation of the frame 111 and side panel members 112, includes inner lips 134, constituting lip means, which are embedded within the foam core 115. Moreover, the space 142 between the lips 134 and the remote ends of the interior frame leg elements 141 is filled with foam material. This foam material serves as fill and precludes any tendency of the closure member 113 to separate from the associated interior framing member 117.

As with the first embodiment additional holding is provided by adhesion between the foam core 115 and the inner face 129 of the inner leg elements 121. In the assembled condition the overall width across the closure members is substantially the same as the overall distance across the side panel members to provide a substantially flush door.

As shown in FIG. 6 the vertical side framing member 114 is cut away to expose the continuous metal frame 116. Once the frame is exposed it is a simple matter to drill and tap holes 150, which are adapted to receive the machine screws of a hinge [not shown] and to connect such hinge to the continuous metal frame 116 preparatory to mounting the door 110 in a conventional manner.

We claim as our invention:

1. In a foam-filled insulated door construction:
   a. opposed side panel members disposed in spaced relation and including margin portions,
   b. a closure member generally U-shaped in cross section formed from extruded plastic material and including:
      1. a bight portion,
      2. a pair of flexible outer leg elements,
      3. a pair of flexible inner leg elements spaced from said outer leg elements to define grooves receiving associated margin portions of said side panel members,
   c. a foam core disposed between said side panel members,
   d. holding means between said foam core and said closure member resisting separation of said closure member and said side panel members said holding means including:
      1. an independently formed spacer means extending between the inner leg elements and resisting spreading of said inner and outer leg elements to receive the margin portions of the side panel members and tending to urge said leg elements together in clamping relation to said margin portions to form a foam barrier substantially pre-

cluding entry of foam into the grooves between said leg elements, and

2. opposed, inwardly projecting lip means integrally formed with said inner leg elements and overlappingly related to said spacer means, said lip means having foam material engaging each side thereof.

2. In a foam-filled insulated door construction:

a. opposed side panel members disposed in spaced relation and including margin portions,

b. a closure member generally U-shaped in cross section formed from extruded plastic material and including:

1. a bight portion,

2. a pair of flexible outer leg elements,

3. a pair of flexible inner leg elements spaced from said outer leg elements to define grooves receiving associated margin portions of said side panel members,

c. a foam core disposed between said side panel members,

d. holding means between said foam core and said closure member resisting separation of said closure member and said side panel members said holding means including:

1. opposed pairs of spaced lips integrally formed with said inner leg elements and spaced from said bight portion a distance greater than the remote ends of said outer leg elements, each pair of lips defining a groove, and

2. an independently formed spacer means including plate means extending between the inner leg elements and resisting spreading of said inner and outer leg elements to receive the margin portions of the side panel members and tending to urge said leg elements together in clamping relation to said margin portions to form a foam barrier substantially precluding entry of foam into the grooves between said leg elements.

3. An insulated door construction as defined in claim **2,** in which:

e. said spacer plate means includes a plurality of spaced, plate elements defining openings to admit foam between said inner leg elements.

4. In a foam filled insulated door construction:

a. opposed side panel members disposed in spaced relation and including margin portions,

b. opposed closure members generally U-shaped in cross section formed from extruded plastic material and including:

1. a bight portion,

2. a pair of flexible outer leg elements, and

3. a pair of flexible inner leg elements spaced from said outer leg elements to define grooves receiving associated margin portions of said side panel members,

c. an interior, independently formed, continuous reinforcing frame including opposed framing members each of said members receiving an associated closure member in embracing relation said framing members being disposed adjacent said bight portion and between said inner leg elements and resisting inward movement of said inner leg elements toward each other,

d. a foam core disposed between said panel members, and

e. holding means between said foam core and said closure member resisting separation of said closure members and said side panel members said holding means including inwardly projecting lips integrally formed with the inner leg elements and overlappingly related to said frame members prior to emplacement of said foam whereby said closure members are snap fitted to said reinforcing frame.

5. An insulated door construction as defined in claim **4,** in which:

f. said inner leg elements include a shoulder convergingly related to said outer leg elements so that said elements are closer than the thickness of said margin portions, and

g. the inner and outer leg elements are sprung apart in the vicinity of said shoulder to receive said panel margin portions whereby said margin portions are clamped between said elements.

6. An insulated door construction as defined in claim **4,** in which:

f. the interior framing members are substantially U-shaped in cross section to include a bight portion having rounded corners to facilitate the snap action said bight portion being adjacently disposed of the bight portion of the associated closure member, and a pair of leg elements, and

g. the remote ends of said interior framing member leg elements are disposed in spaced relation from said inwardly projecting lips of said closure member and separated therefrom by said foam core said foam core providing a fill between said remote ends and said lips.

* * * * *