April 9, 1968 J. R. THYGESON, SR 3,376,678

INSULATED BUILDING PANEL ASSEMBLY

Filed Jan. 10, 1966 5 Sheets-Sheet 1

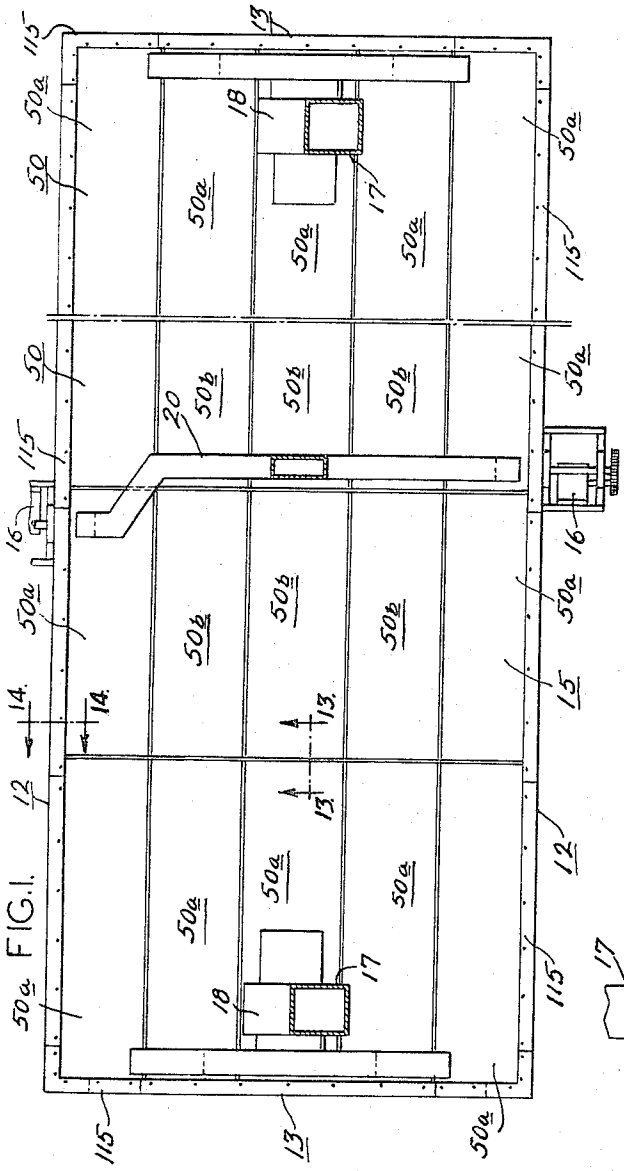


FIG. 1.

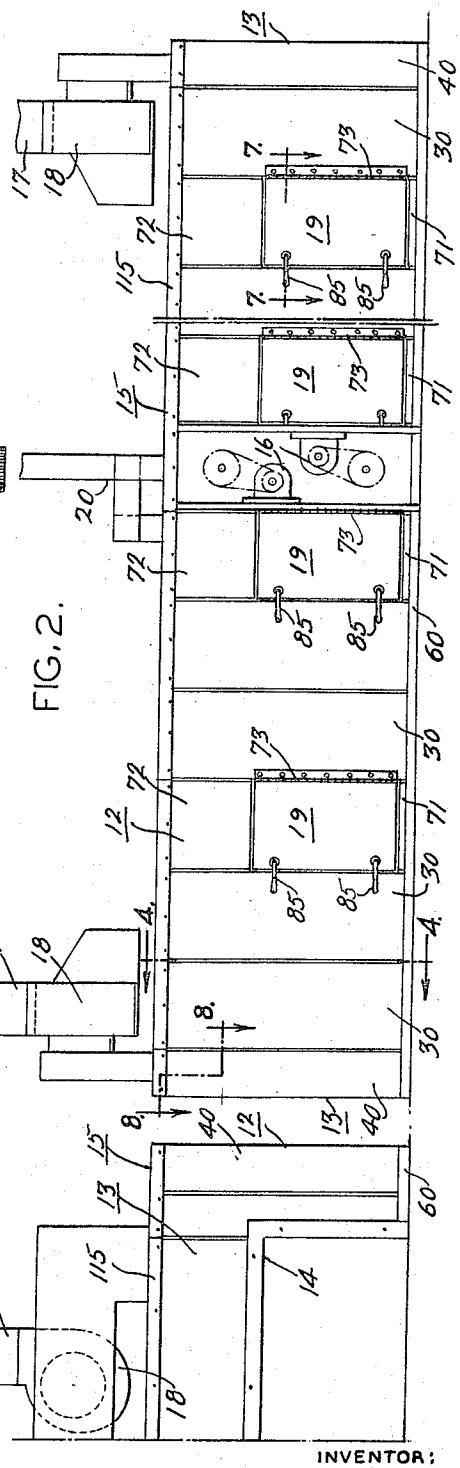


FIG. 2.

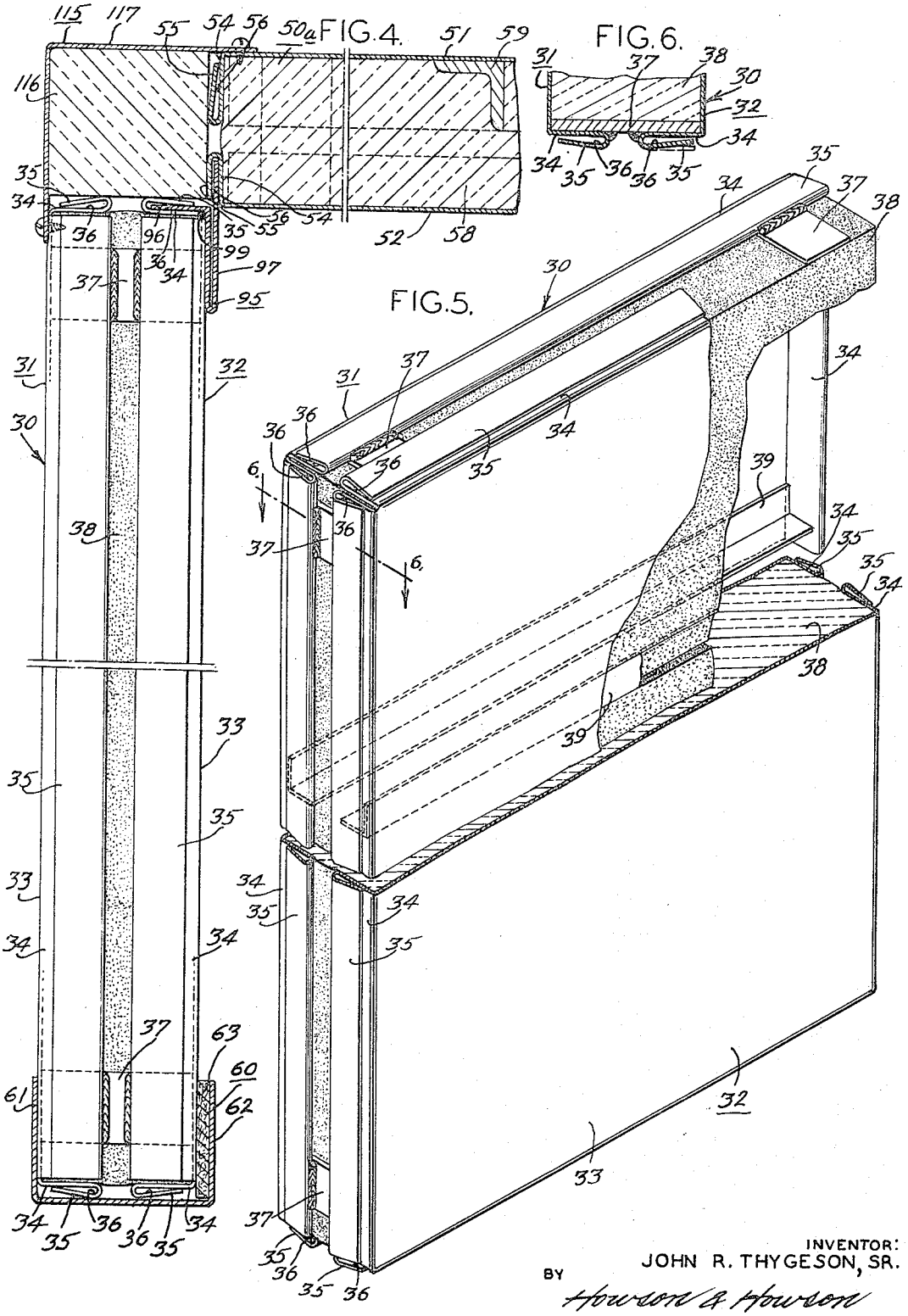
FIG. 3.

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INSULATED BUILDING PANEL ASSEMBLY

Filed Jan. 10, 1966 5 Sheets-Sheet 2



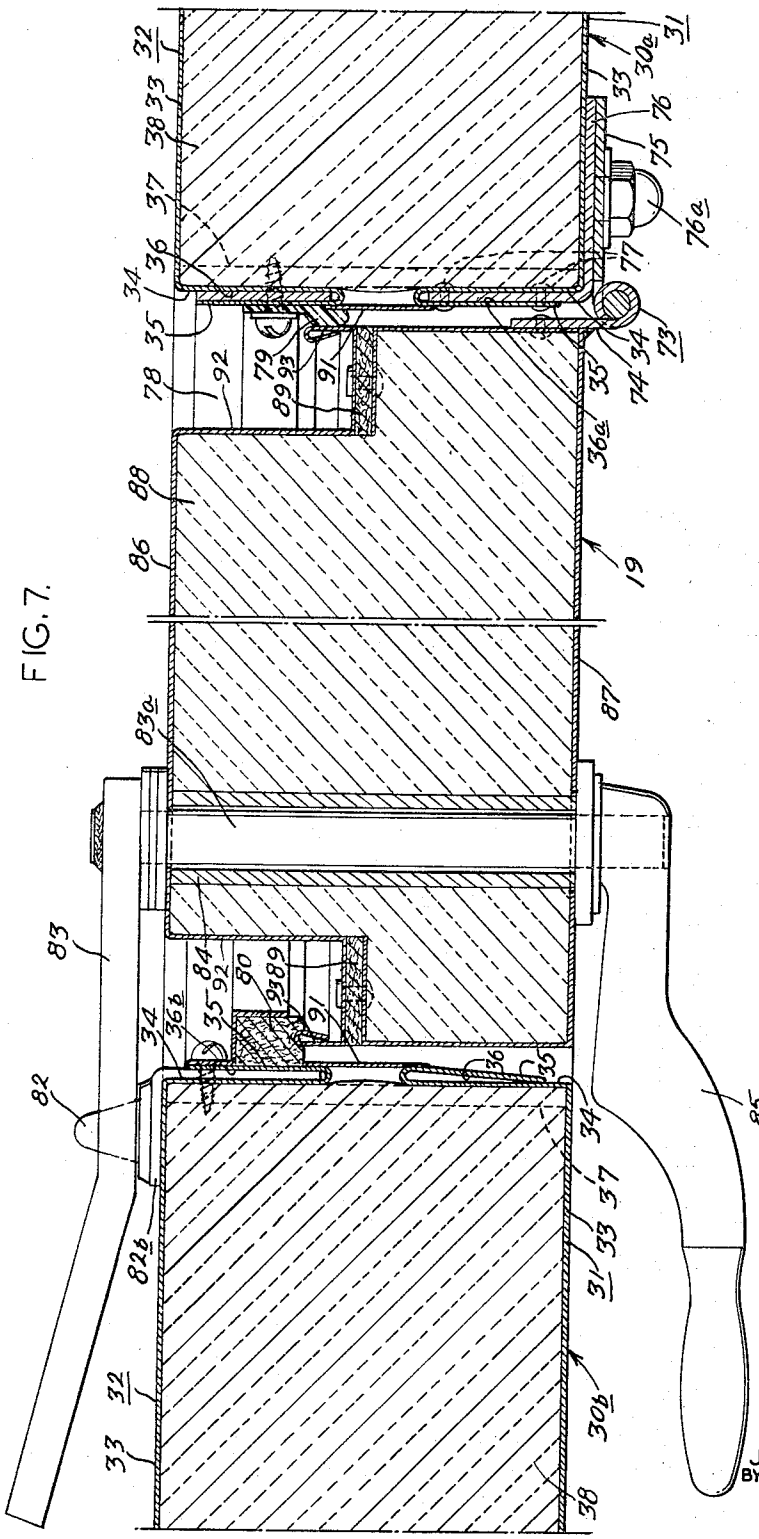
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INSULATED BUILDING PANEL ASSEMBLY

Filed Jan. 10, 1966 5 Sheets-Sheet 3

FIG. 7.



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INSULATED BUILDING PANEL ASSEMBLY

Filed Jan. 10, 1966 5 Sheets-Sheet 4

FIG. 8.

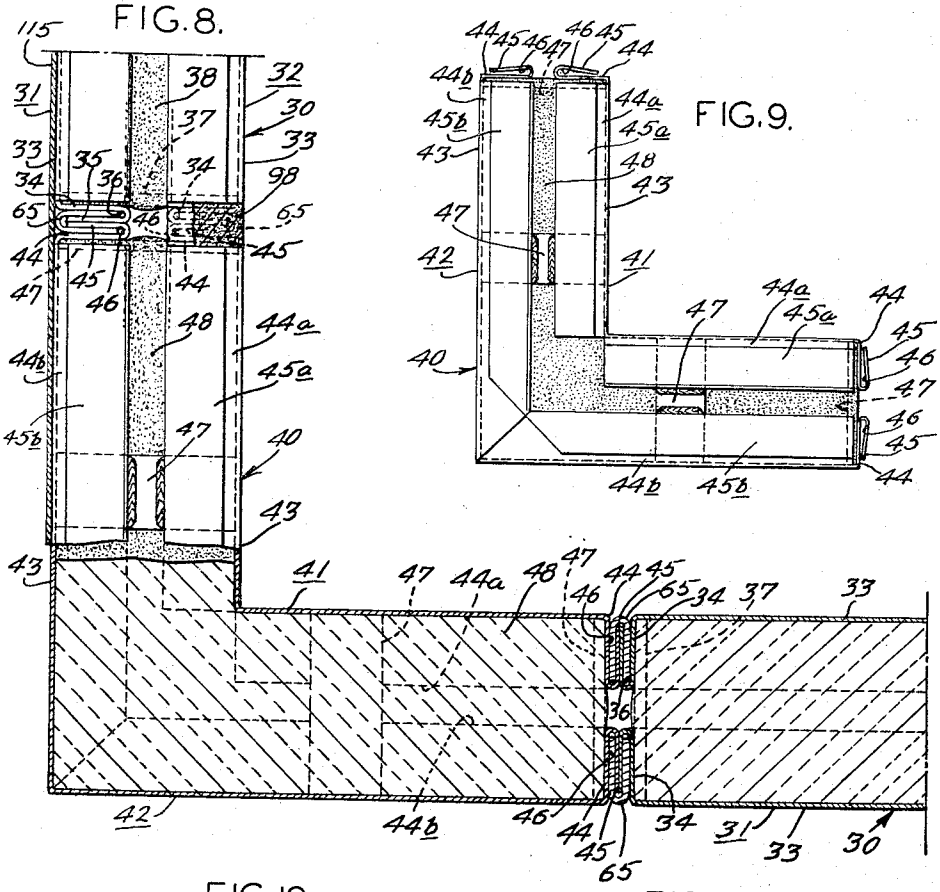


FIG. 9.

FIG. 10.

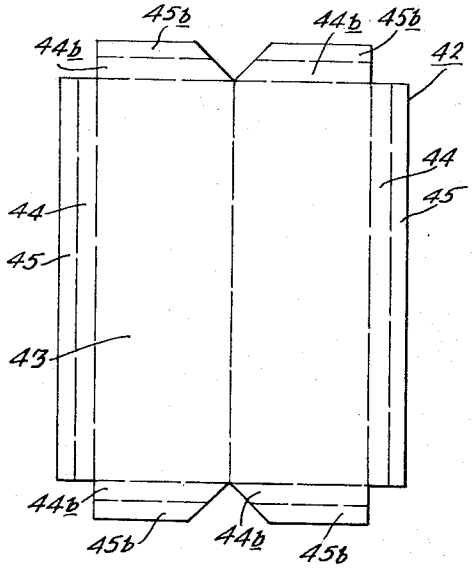
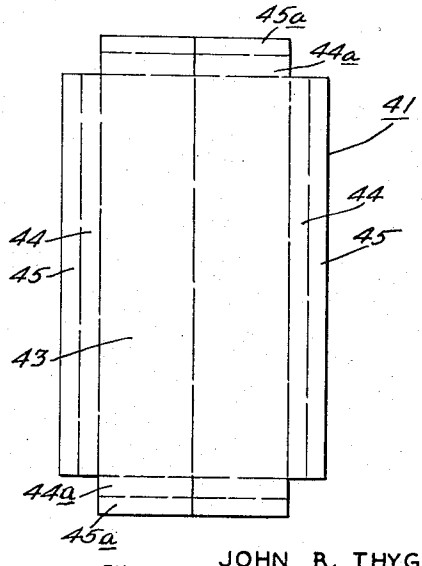


FIG. 11.



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INSULATED BUILDING PANEL ASSEMBLY

Filed Jan. 10, 1966 5 Sheets-Sheet 5

FIG. 12.

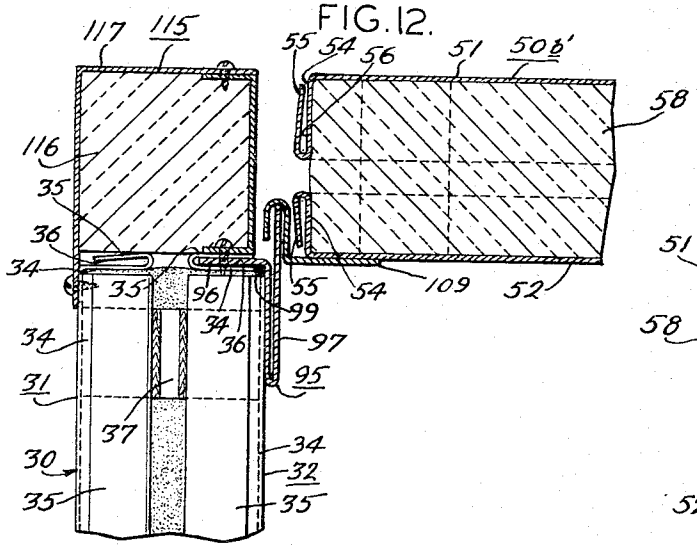


FIG. 15.

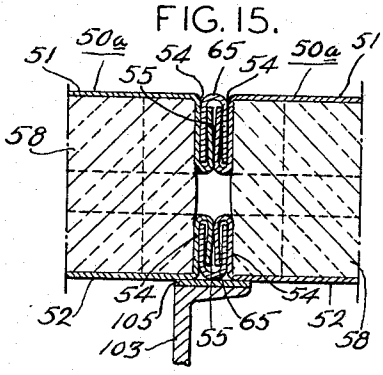


FIG. 13.

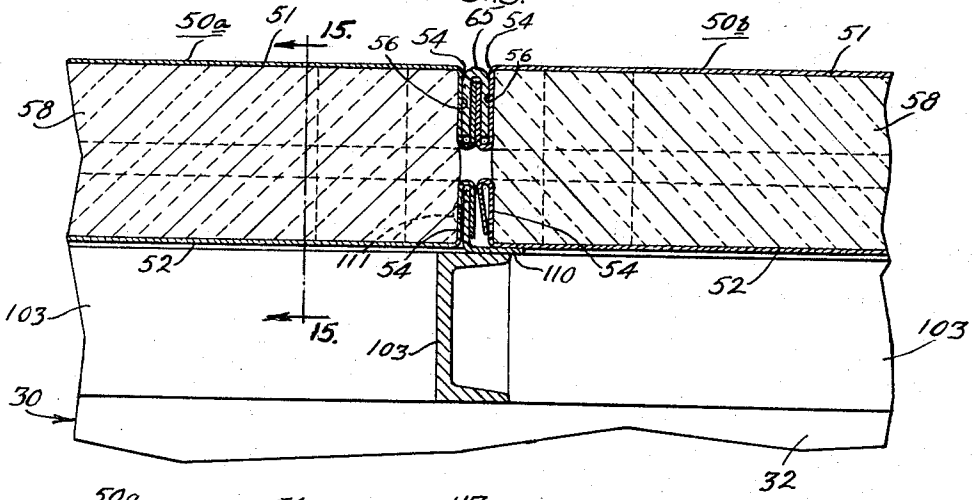
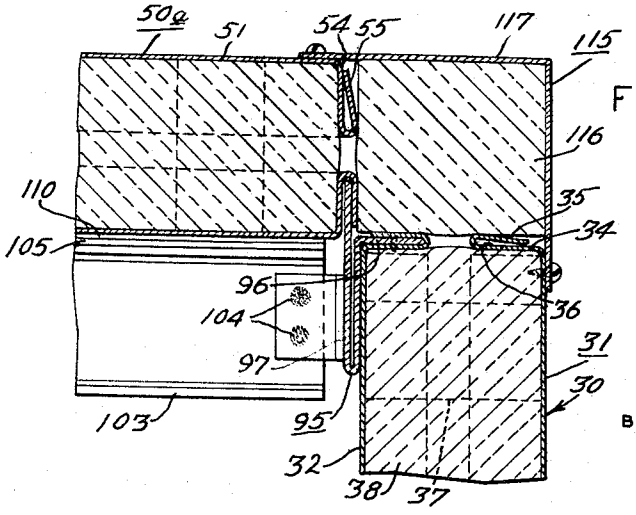


FIG. 14.



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United States Patent Office 3,376,678 Patented Apr. 9, 1968

3,376,678

INSULATED BUILDING PANEL ASSEMBLY

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Filed Jan. 10, 1966, Ser. No. 519,607
10 Claims. (Cl. 52—204)

ABSTRACT OF THE DISCLOSURE

A modular building panel, having insulation material positioned between parallel facing elements, is provided with an inwardly extending edge formation on each facing element which defines an outwardly opening slot therealong. A rigid wall is formed when panels, aligned edge-to-edge, are interconnected by a U-shaped connector. A T-shaped rail, positioned within a slotted edge formation along the top of each panel, supports the roof panels. An insulated door panel, having its hinge anchored within an adjacent panel slot, is peripherally sealed when the door is closed.

The present invention relates to building construction, and has particular application to an improved panel assembly for use in erecting buildings or compartments which must be insulated from the surrounding atmosphere.

It is common practice to erect buildings and compartments from prefabricated panel members which are assembled with similar panels at the building site. To provide the desired durability, the panel members comprise a block of insulation material having facing sheets or shells of metal or similar durable material which is normally inherently heat-conductive. The facing sheets or shells are interconnected by spacer elements which limit the heat conduction between the inner and outer facing elements of the panel. In assembling the panel members to one another, the panel members may be welded or otherwise permanently secured together to form the insulated compartment. In those installations where it is desired to avoid a permanent interconnection of the panel members, for example where the compartment is expected to have a short life of use or where it must be changed in dimension periodically, the practice has been to fabricate the panels so as to interlock with one another. This has to be done by forming the opposite side edges of the panel member with complementary locking forms which interengage to form the completed structure. Alternatively, separate locking members extending along the length of the assembled wall have been provided to interconnect the panel members into a unitary structure. None of the prior methods of assembly have been entirely satisfactory because of difficulties in assembling and disassembling the panel members or because of the substantial cost of the structure.

With the foregoing in mind, the present invention provides a panel assembly for use in erecting insulating compartments in which edge formation of the panel members is of uniform construction about their entire periphery and in which connectors span between and interconnect two adjacent panel members which may be disposed in side-wise-abutting and aligned relation.

The panel assembly of the present invention enables rapid erection of the assembly and at the same time affords easy disassembly of isolated panel members from the erected structure without disturbing other panel members, thereby affording easy replacement of damaged members or easy substitution of special-purpose panel members.

The panel assembly of the present invention also permits its use in extremely high-temperature operations

where the panel members are subject to expansion and contraction, since the assembly affords such expansion and contraction without buckling or otherwise damaging the structure.

The panel assembly of the present invention in addition to providing an insulated structure, provides a structure which is substantially air-tight so as to insure against escape of gaseous medium from the interior of the compartment into the body of the panel members or through the erected structure; except in cases of explosion where explosion panels are provided to afford emergency escape of the gaseous medium, the air tightness enabling the elimination of interior ductwork, distribution boxes, and the like.

The panel assembly of the present invention provides a rigid and structurally sound unit capable of supporting the normal loads associated with insulated compartments without the necessity for additional reinforcing or supporting frameworks.

All of the objects of the present invention are more fully set forth hereinafter with reference to the accompanying drawings wherein:

FIG. 1 is a plan view with a portion removed of a dryer housing embodying a panel assembly in accordance with the present invention;

FIG. 2 is a view in side elevation of the housing shown in FIG. 1;

FIG. 3 is a fragmentary end elevation of the structure shown in FIG. 2;

FIG. 4 is a fragmentary sectional view taken on the line 4—4 of FIG. 2;

FIG. 5 is a detached perspective view of a panel member with portions broken away to more clearly illustrate its construction;

FIG. 6 is a sectional view taken on the line 6—6 of FIG. 5;

FIG. 7 is a sectional view taken on the line 7—7 of FIG. 2 showing a door construction in an assembly of the present invention;

FIG. 8 is a sectional view taken on the irregular section line 8—8 of FIG. 2;

FIG. 9 is a plan view of a corner member of the panel assembly shown in FIG. 8;

FIGS. 10 and 11 illustrate the form of the facing elements of the corner member shown in FIG. 9;

FIG. 12 is a fragmentary view similar to FIG. 4 showing a modified mounting arrangement for an explosion panel;

FIGS. 13 and 14 are sectional views taken on the lines 13—13 and 14—14 of FIG. 1; and

FIG. 15 is a sectional view taken on the line 15—15 of FIG. 13.

Referring now to the drawings, FIGS. 1 to 3 inclusive illustrate a typical compartment embodying a panel assembly made in accordance with the present invention, in the present instance a drying chamber. As shown, the chamber comprises side walls 12, end walls 13 having portals 14 for the admission and discharge of the material to be dried, and a roof structure 15. The material is fed through the dryer by conveyors (not shown) and is dried, preferably by heated air circulated by central blowers (not shown) having drive mechanisms 16 (see FIG. 2) mounted on the side wall 12, and overhead exhaust ducts 20. Infiltration of fresh gaseous drying medium into the drying chamber is controlled by air lock exhausts comprising suitable ductwork, indicated generally at 17, and exhaust blower elements 18 mounted on the roof structure 15. Access doors 19 are provided in the side walls to permit entry of personnel into the chamber.

The chamber is erected with prefabricated panel members which are set in place and interconnected in a simple and expeditious manner. As best shown in FIG. 5, each

panel member comprises inner and outer facing elements **31** and **32** respectively on opposite sides of the center plane of the panel member. The elements take the form of rectangular sheet-like body portions **33** having peripheral flanges **34** projecting substantially at right angles to the body portion **33** inwardly of the panel member and having at their inner edges turned-back lips **35**. Preferably, the material of the facing elements **31** and **32** is hard, durable sheet material having a degree of resilience, such, for example, as aluminized steel sheets. As best shown in FIG. 6, the reverse lip **35** converges outwardly toward the flange **34**, the resilience of the material affording displacement of the lip into substantial parallelism with the flange **34**, as shown in broken lines, so as to provide between the flanges **34** and the lip **35**, a slot **36** for receiving a fastener or connector, as described more fully hereinafter.

The inner and outer facing elements **31** and **32** are interconnected in parallel relation by spacer elements **37** which span between and are secured to the spaced-apart flanges **34** of the elements **31** and **32**. In the present instance, the spacer elements are welded to the flanges. The spacers **37** maintain the facing elements **31** and **32** in spaced relation to limit heat conduction therebetween. In the present instance, limited conduction may occur through the spacer **37**, and if this limited conduction is unsatisfactory, the spacer **37** may be formed of a non-conductive material. To further limit heat transmission through the panel member, the space between the facing elements **31** and **32** is provided with insulation **38**, preferably of a fibrous batt type. In addition, where the panels are of substantial length, reinforcing angle members may be secured to the inner surface of the facing elements. As shown in FIG. 5, angle members **39** of right angle form have one flange secured to the body portion **33** of the facing element and the other flange projecting inwardly at right angles thereto, the depth of the flange being less than the depth of the peripheral flange **34** so that when the opposite facing elements **31** and **32** are united, the opposed angle reinforcing members **39** do not provide a path for heat conduction through the panel member. It should be noted that the peripheral flanges **34** and lips **35** of the panel member are of identical cross section about the entire periphery so that the members may be connected with similar members side-to-side, end-to-end, or even side-to-end.

At the corners of the structure, corner panel members **40** are provided (see FIGS. 8 to 11). The corner panel members **40** are similar to the panel members **30** comprising inner and outer facing elements **41** and **42** respectively. The panels are interconnected by spacer members **47** and have insulation **48** therebetween. The angular body portion **43** of the inner and outer face elements **41** and **42** have side flanges **44** with turned-back lips **45** cooperable with the flange **44** to provide a slot **46** identical to the slot **36** of the side panels **30**. The inside element **41** is provided along its upper and lower edges with flanges **44*a*** and lips **45*a*** cooperating to form a slot similar to the slot **46**; and the outer element **42** is provided at its upper and lower edges with flanges **44*b*** and lips **45*b***, which likewise cooperate to form a slot similar to the slot **46** formed by the flanges **44** and lips **45**.

The roof of the chamber is formed by similar panel members **50**. As shown in FIG. 4, the roof panel members **50** comprises an outer facing element **51** and an inner facing element **52**. Each of these elements has a peripheral flange **54** projecting inwardly therefrom and terminating in a reversely-turned lip **55** cooperating with the flange **54** to provide a slot **56**. Insulation material **58** is positioned intermediate the facing elements **51** and **52** and a reinforcing angle **59** serves to reinforce the panel. In the roof panels **50**, the reinforcing angle **59** has one flange secured to the outer facing element **51** and has its other flange extending toward the center plane of the panel. Such reinforcement is provided in areas where the roof panel must support a load. In other respects, the roof panel members are identical to the side panel members.

In the assembly of the building structure, the side panels **30** are erected in edge-to-edge abutment about the periphery of the chamber to be erected. This is accomplished by anchoring a sill member **60**, which consists of a U-shaped channel member having upstanding legs **61** and **62**, on the foundation to conform to the outline of the chamber. The side and corner panels are then engaged between the upstanding legs of the anchoring sill member **60**. The interior leg **62** of the sill member **60** has a sealing strip **63** disposed along its length so as to sealingly engage the inner facing element **32** of the panel members mounted therein. The panel members **30** are interconnected in edgewise abutting relation by means of clips **65** which are U-shaped in cross section, as shown in FIG. 8 and extend continuously along the vertical extent of the abutting panels. The legs of the U-shaped clip **65** engage respectively in the slots **36** of the two adjoining panels, the clip being pushed into the slots so as to deflect each lip **35** away from the flange **34** to provide space for engagement of the leg therebetween. The resilience of the material comprising the flange **34** and lip **35** insures a firm engagement of the clip **65**, and the flanges, lips, and clips cooperate to provide a labyrinth seal against the passage of gaseous medium therethrough. When the chamber is pressurized, the pressure within the chamber operates on the clips to assist in retaining them in engagement with the slots. It should be noted that the clip when engaged in the slots **36** as shown in FIG. 8, does not project beyond the surface of the body portion **33** of the facing element so that the entire assembly may be received between the legs **61** and **62** of the sill member **60** at the lower edge of the panel members.

The clip is inserted into the slots by engaging one end of the clip into the slots of the adjacent panel members at the associated end of the panel members, and then driving the clip into the slot whereby the legs of the clip serve to cam the lips **35** outwardly so as to open the slots **36** to receive the legs of the clips **65**. The clips **65** are engaged in the slots **36** on both sides of the wall formed by the panel members **30** so as to form an extremely rigid and sturdy wall assembly. The corner panel members **41** are united to the wall assemblies in a similar manner by the use of the clips **65**.

A wall embodying a panel assembly in accordance with the present invention, preferably employs panel members **30** of uniform size throughout. In accordance with the invention, when it is desired to replace or repair a damaged panel member, or to replace a plain panel member with a panel member having special characteristics, such as one including windows or instrument panel mounts, the particular panel member may be removed from the assembly without substantially disturbing the remaining panel members of the wall assembly. The removal of the panel member is accomplished by removing the clips uniting the panel member with the adjacent panel members and then simply lifting the freed panel member from the sill. This is possible because of the avoidance of overlap between adjacent panel members which enables free displacement of the panel member in either direction perpendicular to the plane of the panel member.

In addition to providing easy removal and replacement of panel sections, the U-shaped clips cooperating with the flanges and lips of the panels provide expansion joints along the length of the wall erected of the panel members. In drying chambers where the chamber is subject to wide fluctuations in temperature, the thermal expansion and contraction of the panel members has a tendency to buckle walls of conventional construction. The clips and flanges of the present invention provide an effective bellows action permitting expansion and contraction of the walls without buckling and without losing the sealing action afforded by the joint.

In the area where an access door is desired, a conventional panel **30** may be omitted and a door panel inserted in its place. As shown in FIG. 2, the door panel may consist of a door **19** having a width corresponding to the width of a panel **30**, a sill **71**, and a lintel member **72** below and above respectively the door **19**. As shown in FIG. 7, the door is hinged to the panel **30***a* at one side of the door opening and is latched to the panel **30***b* at the other side of the door opening. The panels **30***a* and **30***b* are standard panel members. The door is supported by a piano hinge **73** which has one leaf **74** secured to the door structure **19** and its other leaf **75** secured, for example by fasteners **76***a*, to a support angle **76** engaged in the slot **36***a* formed by the flange and lip of the panel **30***a* and anchored therein by suitable fasteners **77**.

Door stop means **78** is provided about the interior of the door opening and is secured to the interior flanges **34** and lips **35**. Suitable seals extend continuously about the door opening at **79** and **80** to make the door gas-tight. At the other side of the door, a keeper **82** is mounted by means of an angle member **82***b* in the slot **36***b* of the panel member **30***b* to cooperate with a latch element **83** carried by a shaft **83***a* pivotally mounted in a bushing **84** extending through the door. A handle element **85** is mounted on the shaft **83***a* on the exterior of the door. The door **19** is constructed somewhat similarly to the panel members **30** consisting of an inner facing element **86**, an outer facing element **87**, intermediate insulation **88**, and suitable spacer elements **89** interconnecting the inner and outer facing elements. In order to protect the interior insulation of the panel members **30***a* and **30***b*, cover strips **91** of tape or similar material bridge between the lips of the opposed facing elements of the panel.

It should be noted that the sealing arrangement of the door assembly is such that the sealing members **79** and **80** are not subjected to scuffing as the door is opened and closed. To this end, the inner facing element **86** is formed with a continuous inset wall **92** about its entire periphery and a reverse flange **93** projecting into the space provided by the inset wall. The door stop **78** and sealing member **80** is mounted on the latch side and top and bottom edges of the door opening to project into the space provided by the inset wall **92** so that, as the door swings closed, the flange **93** effects compressive engagement with the seal **80** without scuffing. By the same token, the seal **79** at the hinge side edge of the door is mounted on the inner facing element to project into the space provided by the inset wall so that as the door swings closed, the side of the flange **93** effects compressive engagement with the seal **79** without scuffing.

The panel members of the present invention are of sufficient structural rigidity to support the roof **15** without additional supporting framework. In drying chambers, it is frequently required to provide an explosion panel which is free to unseat in the event of explosion or conflagration within the dryer. With reference to FIG. 1, roof panel members **50***a* are fixedly mounted on the walls of the chamber and explosion roof panels **50***b* are mounted for upward displacement in the event of explosion.

The roof panel members are mounted on the side walls by means of a T-shaped rail **95** mounted with the leg **96** of the T engaged in the slots formed between the flanges and the lips extending along the upper edge of the wall panel members. The cross piece **97** of the T-rail has its lower portion bearing against the inner surface of the wall panel and its upper portion projecting upwardly therebeyond. The T-rail **95** is used around the entire periphery of the wall structure. In order to insure air tightness in the chamber, prior to assembling the T-rails to the upper edge of the panel, a suitable sealant, such as caulking **98** (FIG. 8) is deposited over the upper ends of the U-clips **65** and the associated flanges and lips confronting the interior of the drying chamber. In addition, as indicated at **99**, a bead of sealant may be laid along the upper edge of the body portion of the inner facing element to effect a seal between the lower portion of the cross piece **97** and the facing element.

As shown in FIG. 4, the fixed roof panels are mounted on the T-rails **95** by engaging the upwardly projecting portion of the cross bar **97** into the slots formed by the flanges and lips of the roof panel. In those installations where the roof panels are not supported on all sides by the side walls of the chamber, support beams are mounted to span between the side walls and underlie the otherwise unsupported edges of the roof panels. As shown in FIG. 14, the support beams may take the form of a channel beam **103** which is secured to rails **95** supported on the opposite sides of the chamber, for example by welding as indicated at **104**. The beam **103** may have a wear plate **105** extending along its upper surface. The beam underlies the free edge of the roof panel so as to support the same. If the adjoining roof panel is a fixed panel, the two panels are clipped together by U-shaped clips in a manner similar to the jointure of adjoining side panels, the supporting beam underlying the joint between the panels, as shown in FIG. 15. If the adjoining panel is an explosion panel, the junction shown in FIG. 13 is used, as described hereinafter.

The explosion panel **50***b* is mounted so as to be free for upward displacement in the event of explosion or conflagaration within the chamber.

In the area where the joint between the fixed panel **50***a* and the explosion panel **50***b* extends across the chamber intermediate the side walls as shown in FIG. 13, the explosion panel **50***b* is supported on a support strip **110** which is carried within the slot of the fixed panel **50***a*. To insure against inadverent displacement of the support member **110**, the member is fastened within the slot as indicated at **111**. To provide a seal against the escape of gaseous medium from the chamber, a U-shaped clip **65** may be engaged in the slots of the panels **50***a* and **50***b* to maintain these panels in proper engagement. The clip **65** does not exert sufficient resistance to separation of the panels in a vertical direction to retard an explosion-caused displacement of the explosion panel **50***b*. At the joint between adjacent explosion panels **50***b*, the panels are clipped together and supported by the beam **103** in the same manner as shown in FIG. 15.

Where it is desired to mount an explosion panel on the side wall, an L-shaped support strip is mounted on the T-rail **95**. To this end, as shown in FIG. 12, the explosion panel **50***b'*, which is identical in construction to the panels **50***b*, rests upon the L-shaped support strip **109**, one leg of which is provided with a reversely-turned lip to define a slot which is engaged upon the upwardly projecting portion of the cross bar **97** of the rail **95** about the side walls of the chamber. In this way, the panel **50***b'* is free for vertical displacement.

About the periphery of the chamber at the junction between the side walls and the roof, a filler strip **115** is secured to the upper edges of the side panel members. As shown in the drawings, the filler strip **115** may comprise a block of insulation **116** having a facing sheet **117** mounted thereon. At the junction of the side walls with a fixed roof panel, as shown in FIG. 4, the facing sheet **117** may be secured directly to the side panel and the roof panel. In a location where an explosion panel **50***b'* is provided, the facing sheet **117** is modified so as to be secured solely to the side panel, as shown in FIG. 12. At locations where machinery or other equipment is to be mounted on the top of the dryer chamber, the filler strip **115** may be replaced by a similar strip having structural reinforcing elements incorporated therein to provide additional structural support upon which the machinery or other equipment may be mounted. In such cases, since the panel members making up the side walls have sufficient compressive strength in a vertical direction to support the normal equipment without buckling or otherwise failing, the structural reinforcement within the filler strip is desirable only to provide an effective distribution of the load of the

equipment over a number of the side panels and to provide a firm support to which the equipment may be secured.

From the foregoing, it is apparent that the present invention provides a self-supporting structural assembly for use as a housing which is designed to be air-tight so that it may serve as a treating chamber which uses a gaseous medium without the need for interior ducts or distribution boxes. The panel assembly of the present invention is easily installed and disassembled, and enables the use of panel members having standard dimensions so as to afford ready replacement of panel sections. The construction of the panel members affords simple connection thereto of trim strips and the like by frictional engagement of the clips and rail members into slots provided by the construction of the flanges and lips thereof. The manner interconnection of the panel members by the engagement of U-shaped clips into the slots formed by their flanges and lips affords a limited degree of thermal expansion and contraction, avoiding the necessity for providing expensive and complicated expansion joints. The panel assembly of the present invention also affords effective explosion-relief means without substantial increase in the cost of material or labor in erecting the assembly.

While a particular embodiment of the present invention has been herein illustrated and described, it is not intended to limit the invention to such disclosure, but changes and modifications may be made therein and thereto within the scope of the following claims.

I claim:

1. In an assembly of insulated panel members having parallel inner and outer facing elements on opposite sides of the center plane thereof, and spacer elements maintaining the same in spaced relation to receive insulating material therebetween, and connector means interconnecting said panel members in edge-to-edge alignment; the improvement wherein the panel members are formed with side edges cooperable with said connector means, the edge formation comprising an inturned continuous flange on each facing element projecting toward and aligned with the inturned flange on the opposed facing element, each of said flanges terminating short of the center plane of said panel member in an outer reversely-turned resilient lip biased towards a position converging outwardly toward said flange and cooperating therewith to define a slot extending along the edge of said panel member, the slots of adjoining interconnected panel members being disposed parallel to each other with the lips confronting each other, said connector means comprising a clip of U-shaped cross section coextensive in length with the line of juncture between said panel members, the legs of the U-shaped clip engaging respectively in the slots of the adjoining panel members and embracing the lips to firmly grip the legs of the clip therebetween, provide a labyrinth seal against the passage of gaseous medium through said juncture and effect the interconnection.

2. An assembly according to claim 1 wherein the legs of the U-shaped clip are shorter than the depth of the flange so that the clip does not project beyond the associated facing element, the spacing between the legs corresponding to the thicknesses of the lips received therebetween to provide a firm frictional engagement.

3. An assembly according to claim 2 including an anchoring sill member coextensive in length with and underlying said aligned panel members, said sill member comprising a U-shaped channel member having a pair of upstanding legs which are spaced apart a distance corresponding to the thickness of said panel members, said legs receiving the lower marginal portion of said assembled panel members therebetween.

4. An assembly according to claim 2 having roof panel members including a roof-supporting rail coextensive in length with said aligned side panel members, said side panel members having a top edge formation identical to said side edge formation, said rail having a T-shaped cross section with a horizontal leg and a vertical cross bar, the leg being engaged in the slot of said top edge formation, said cross bar having a portion below said leg bearing against the facing element of said side panel members and a portion above the leg projecting upwardly to support said roof panel members.

5. An assembly according to claim 4 wherein said roof panel members have edge formations identical to said side panel edge formations, the slot of said roof panel edge formation receiving said upwardly projecting portion of the cross bar.

6. An assembly according to claim 4 wherein said roof panel is supported so as to permit vertical displacement thereof to constitute said panel an explosion panel, said assembly including an L-shaped support strip, one leg of which has a reversely-turned lip defining a slot which is engaged upon the upwardly projecting portion of said rail, the other leg of which supports said explosion roof panel for vertical displacement.

7. An assembly according to claim 1 wherein the panel member assembly includes a pair of panel members in spaced-apart alignment to define therebetween a door opening, and a door panel mounted in said opening for swinging movement; said door panel comprising opposed parallel inner and outer facing elements operable when the door is closed to align with the inner and outer facing elements of said panel members, said facing elements of the door panel having inturned peripheral walls projecting toward the center plane of said door panel and connected to each other by an insulating spacer member, the wall of said inner element being continuous and inset from the wall of said outer element to provide a space surrounding said door about its inner periphery, said door panel including a continuous flange on said inset wall projecting into said space, hinge means connected to said outer facing elements of the door panel and the panel member at the hinged side of said door opening, and continuous sealing means mounted on the inner facing elements of the panel members and projecting into said space to cooperate with said flange of the inset wall to seal the door opening when said door is closed with the inner and outer facing elements of the door panel and panel members respectively aligned.

8. An assembly according to claim 7 wherein said hinge means comprises a piano hinge having one leaf secured to said door panel and its other leaf anchored in the slot formed by the flange and lip of the outer facing element of the panel member.

9. An assembly according to claim 7 including a door stop mounted on said panel members and projecting into said opening within the space provided by said inset wall, and a latch operable to retain said door panel engaged against said stop.

10. An assembly according to claim 7 wherein said sealing members are oriented in said space so as to effect engagement in a direction parallel to the center plane of the door on the hinged edge of the opening, and perpendicular to the center plane on the remaining edges of the opening.

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