April 24, 1962 J. R. DRESSER ET AL 3,031,043

BUILDING CONSTRUCTION

Filed July 26, 1957 11 Sheets-Sheet 1

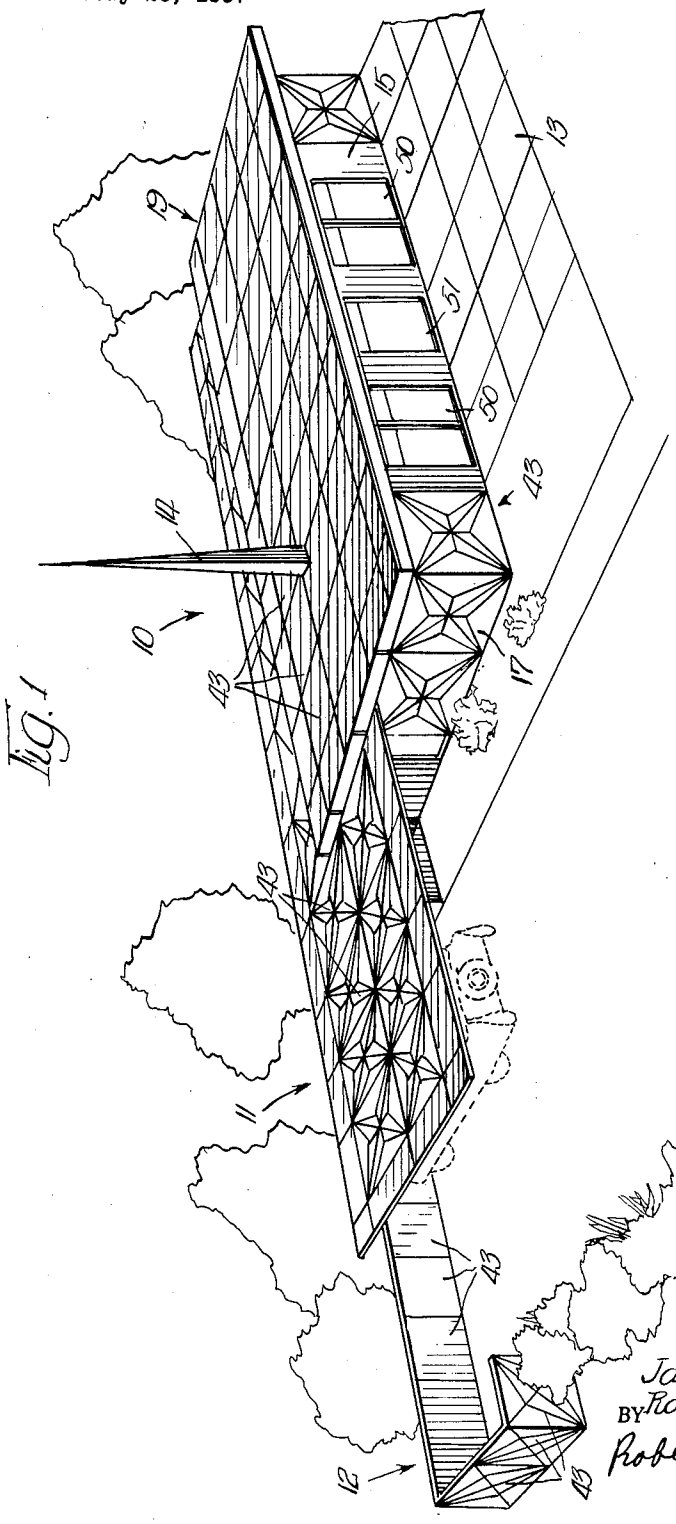


Fig. 1

INVENTORS.
James R. Dresser
BY Robert A Rosenthal,
Robert R. Lockwood
Atty.

April 24, 1962 J. R. DRESSER ET AL 3,031,043

BUILDING CONSTRUCTION

Filed July 26, 1957 11 Sheets-Sheet 2

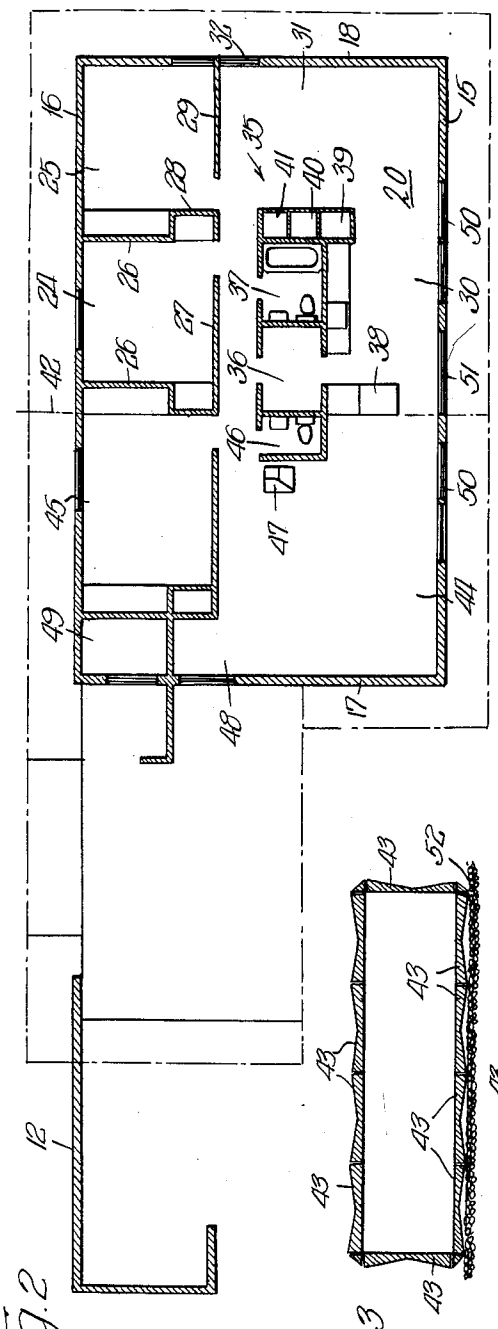


Fig. 2

Fig. 3

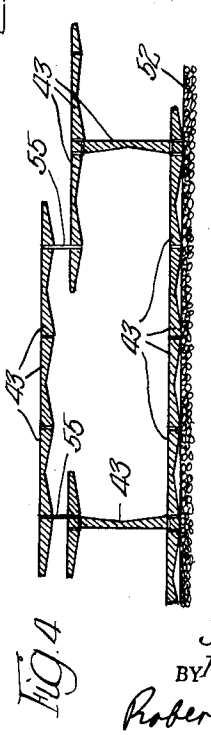


Fig. 4

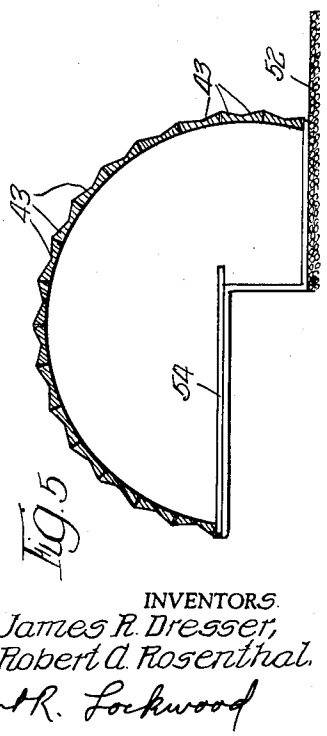


Fig. 5

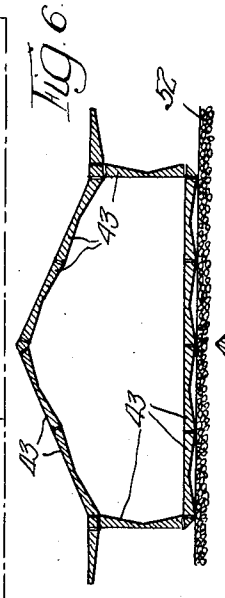


Fig. 6

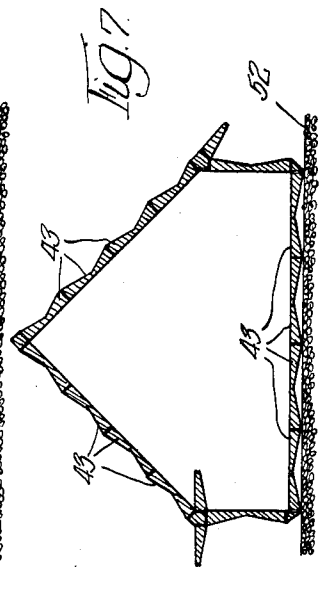


Fig. 7

INVENTORS.
James R. Dresser,
BY Robert A. Rosenthal.
Robert R. Lockwood
atty

April 24, 1962 J. R. DRESSER ET AL 3,031,043

BUILDING CONSTRUCTION

Filed July 26, 1957 11 Sheets-Sheet 3

Fig. 8

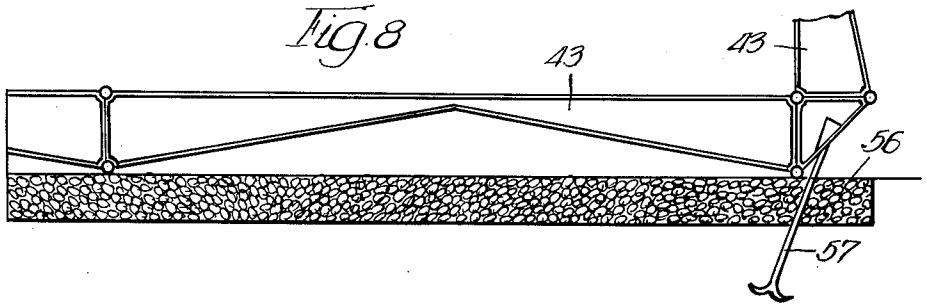


Fig. 9

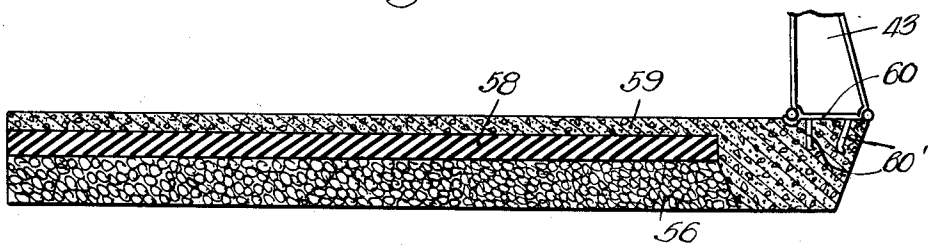
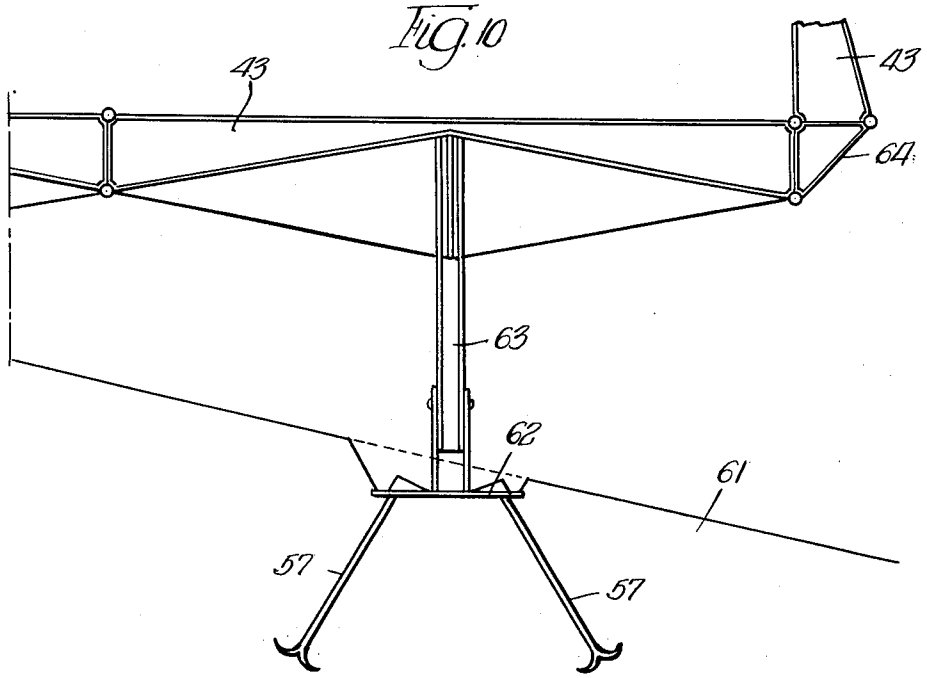


Fig. 10



INVENTORS.
James R. Dresser,
Robert A. Rosenthal,
BY
Robert R. Lockwood
Atty.

April 24, 1962 J. R. DRESSER ET AL 3,031,043

BUILDING CONSTRUCTION

Filed July 26, 1957 11 Sheets-Sheet 4

Fig. 11

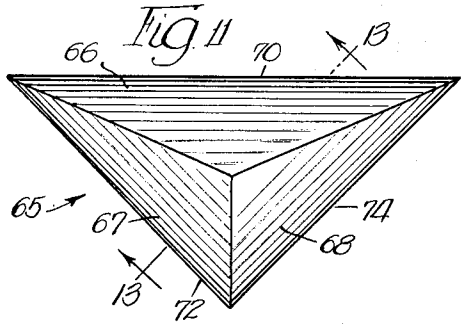


Fig. 12

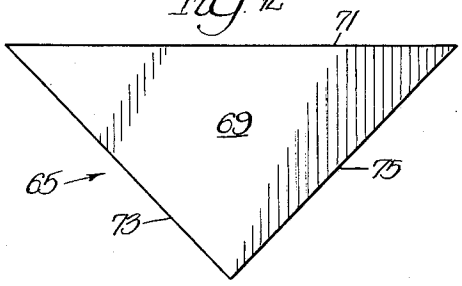


Fig. 15.

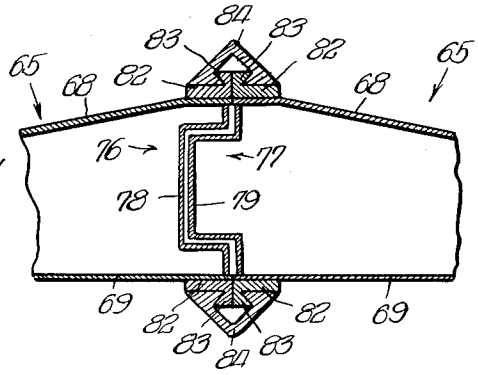


Fig. 13

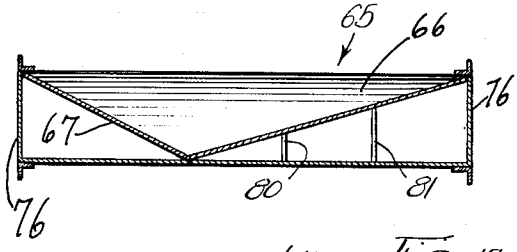
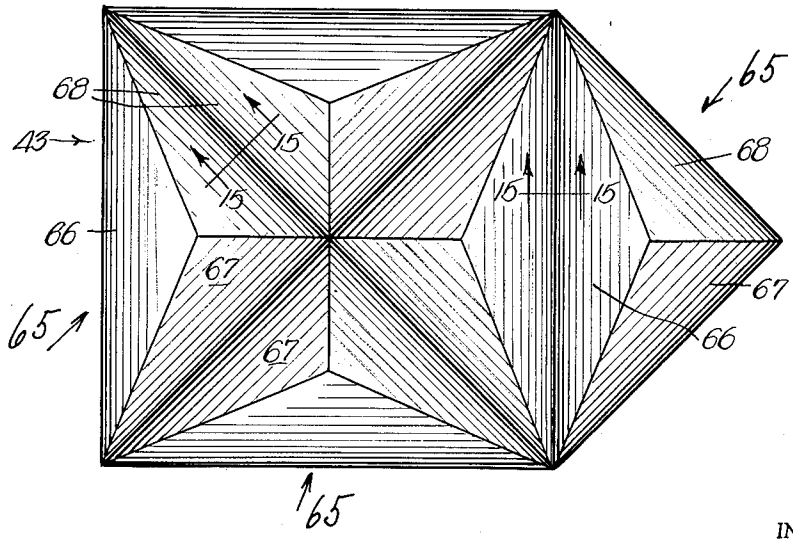


Fig. 14



INVENTORS
James R. Dresser,
BY Robert A. Rosenthal,
Robert R. Lockwood
Atty.

April 24, 1962 J. R. DRESSER ET AL 3,031,043

BUILDING CONSTRUCTION

Filed July 26, 1957 11 Sheets-Sheet 5

Fig. 16

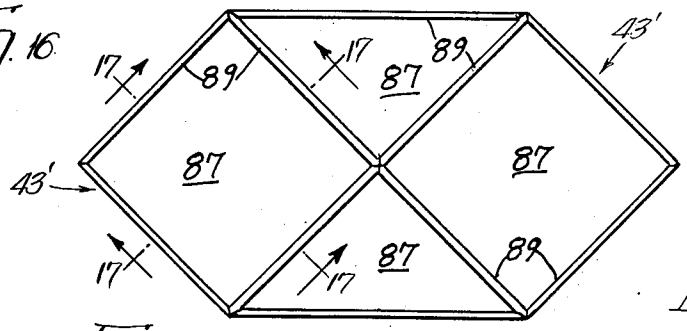


Fig. 18a

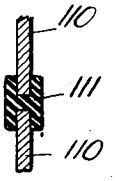


Fig. 18

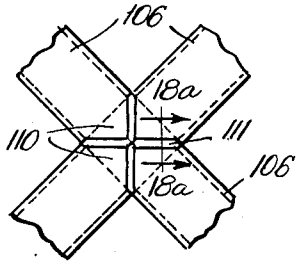


Fig. 17

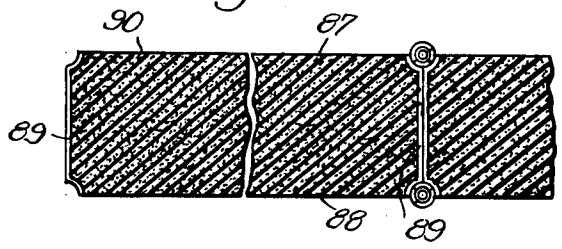


Fig. 19

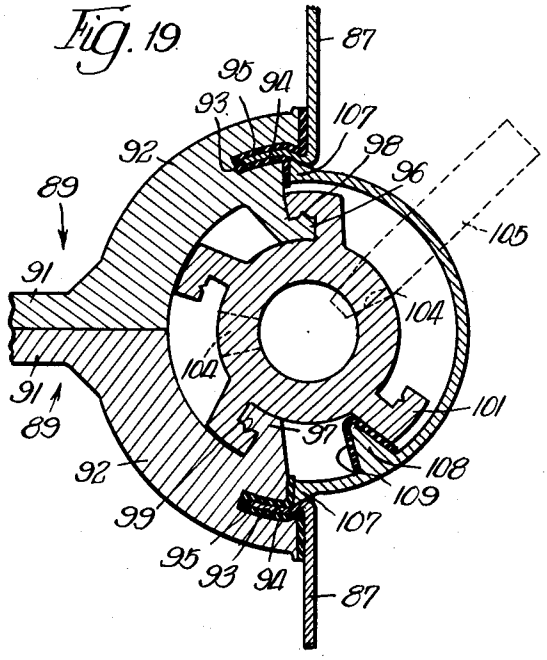


Fig. 20.

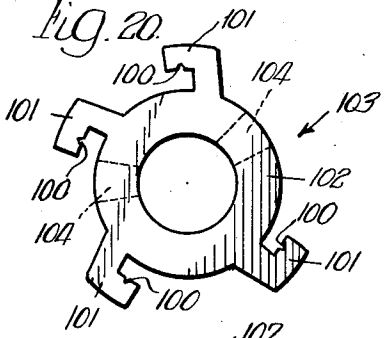
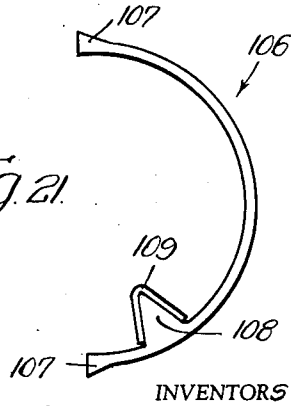


Fig. 21



INVENTORS

James R. Dresser,

BY Robert A. Rosenthal,

Robert R Lockwood

Attys.

April 24, 1962 J. R. DRESSER ET AL 3,031,043

BUILDING CONSTRUCTION

Filed July 26, 1957 11 Sheets-Sheet 6

Fig. 22

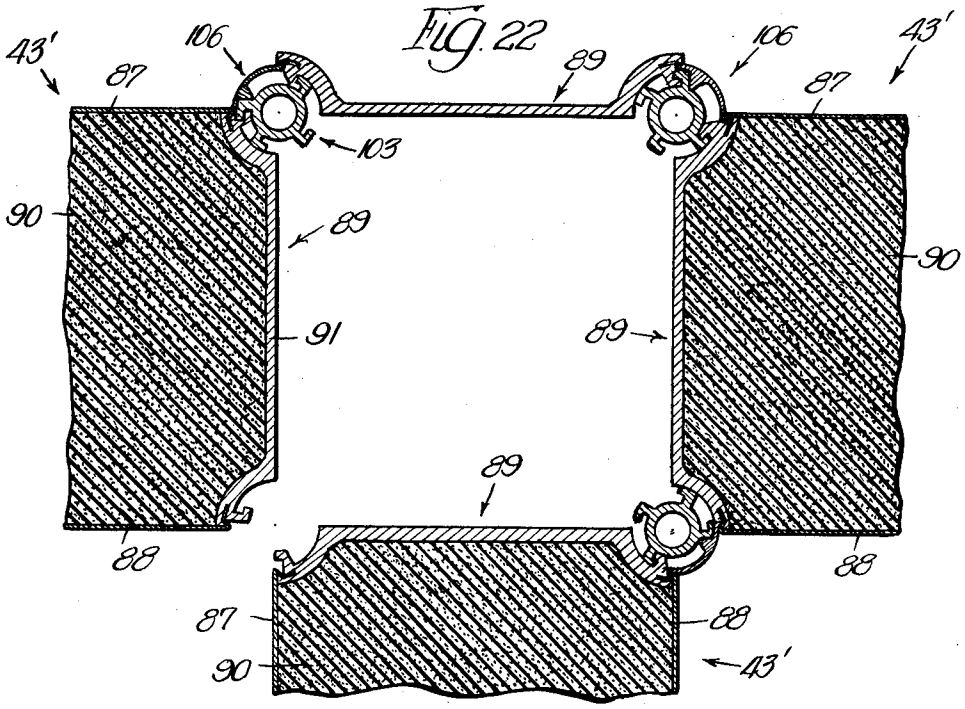
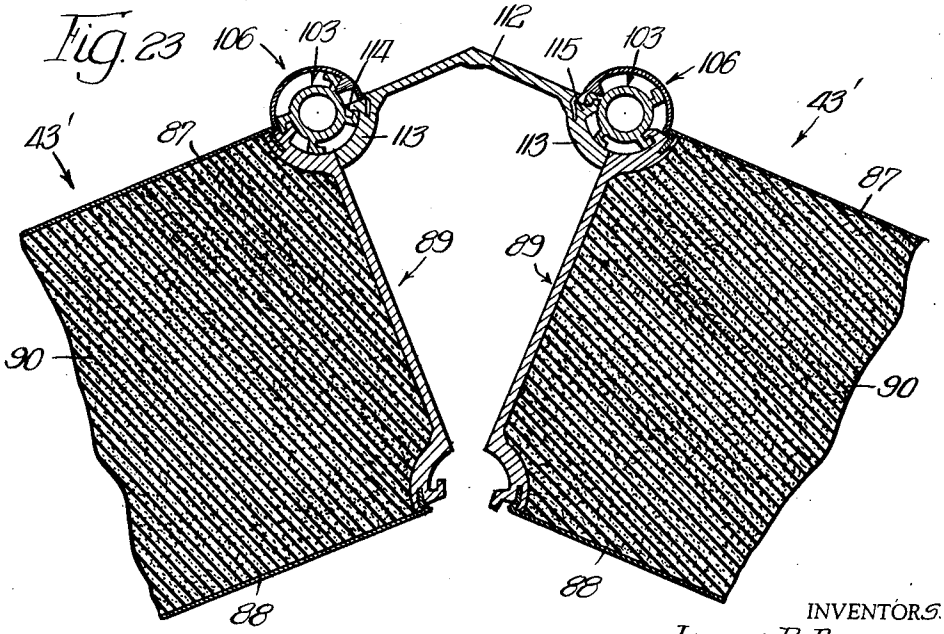


Fig. 23



INVENTORS.
James R. Dresser,
BY Robert A. Rosenthal,
Robert R. Lockwood
Attys

April 24, 1962 J. R. DRESSER ET AL 3,031,043

BUILDING CONSTRUCTION

Filed July 26, 1957 11 Sheets-Sheet 7

Fig. 24

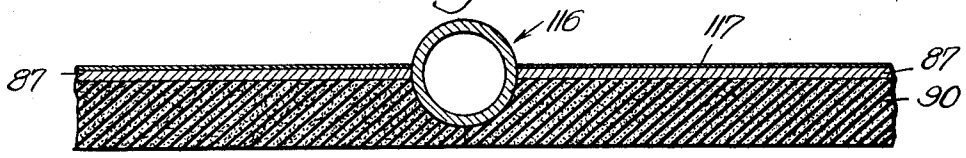


Fig. 25

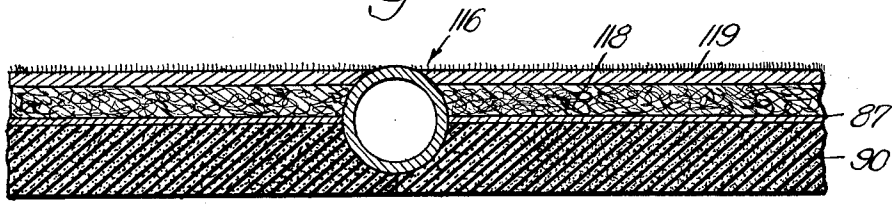


Fig. 26

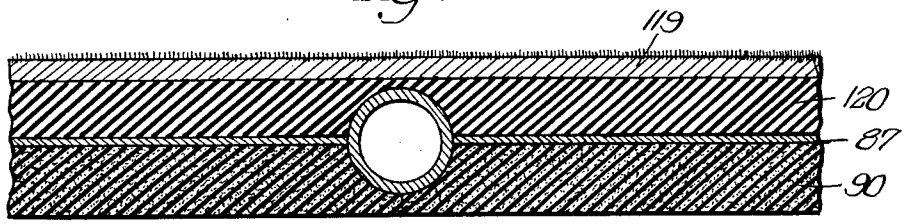


Fig. 27

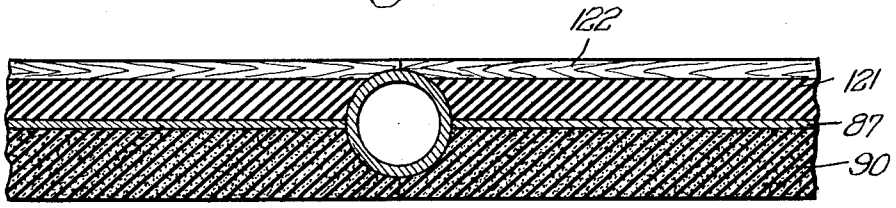
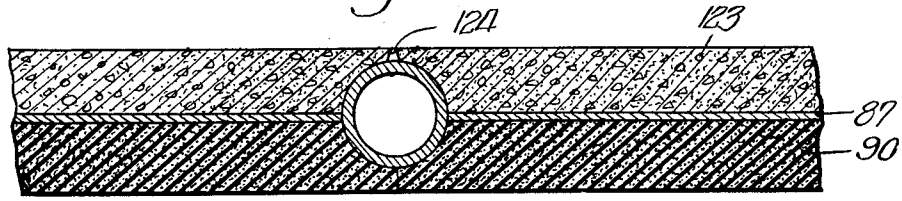


Fig. 28



INVENTORS.
James R. Dresser,
BY Robert A. Rosenthal,
Robert R. Lockwood
attys

April 24, 1962 J. R. DRESSER ET AL 3,031,043

BUILDING CONSTRUCTION

Filed July 26, 1957 11 Sheets-Sheet 8

Fig. 30

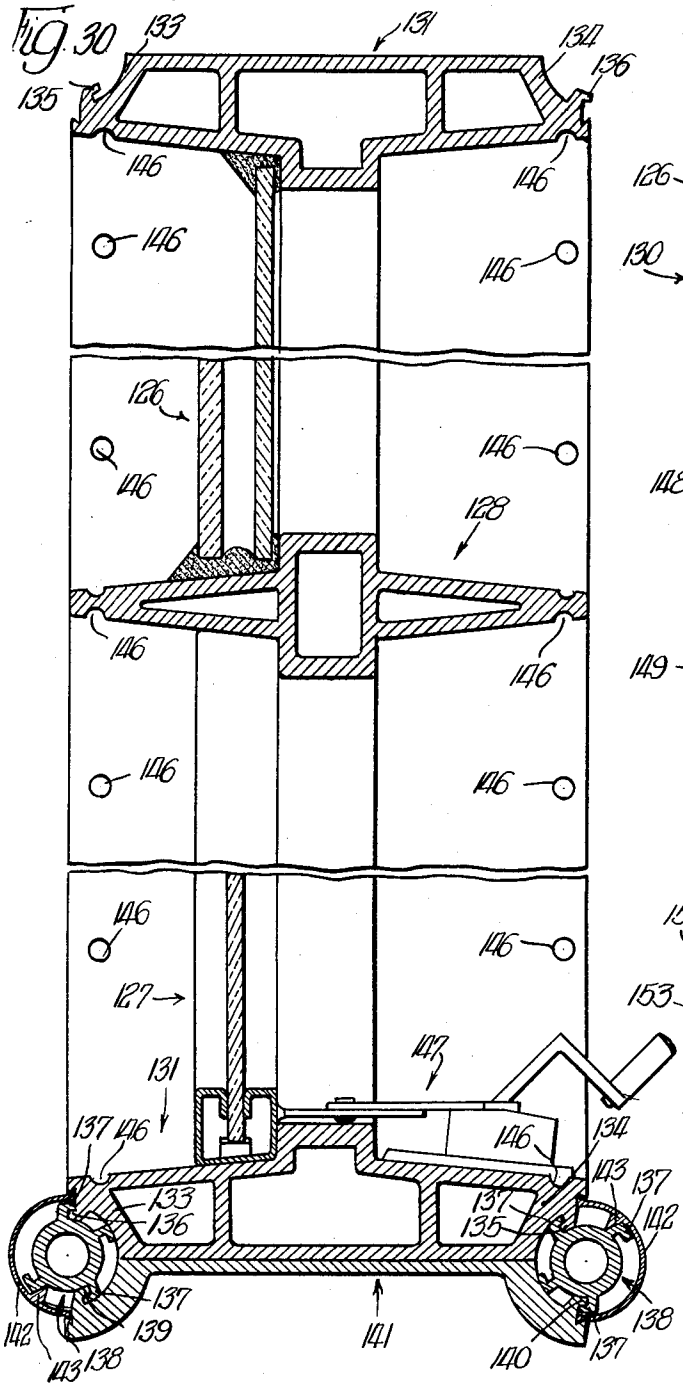


Fig. 29

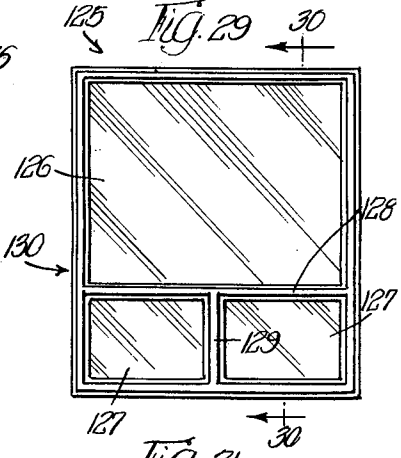


Fig. 31

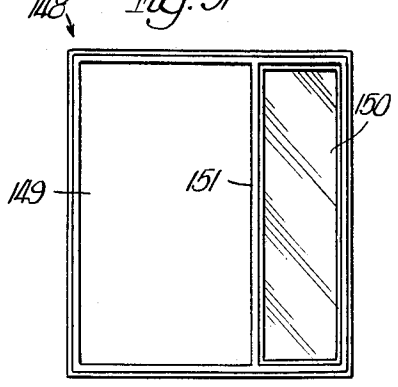
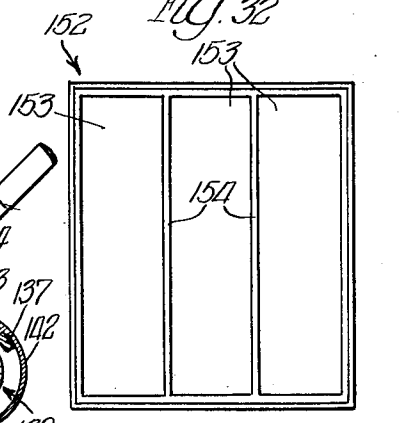


Fig. 32



INVENTORS
James R. Dresser,
BY Robert D. Rosenthal,
Robert R. Lockwood
atty

April 24, 1962 J. R. DRESSER ET AL 3,031,043

BUILDING CONSTRUCTION

Filed July 26, 1957 11 Sheets-Sheet 9

Fig. 33

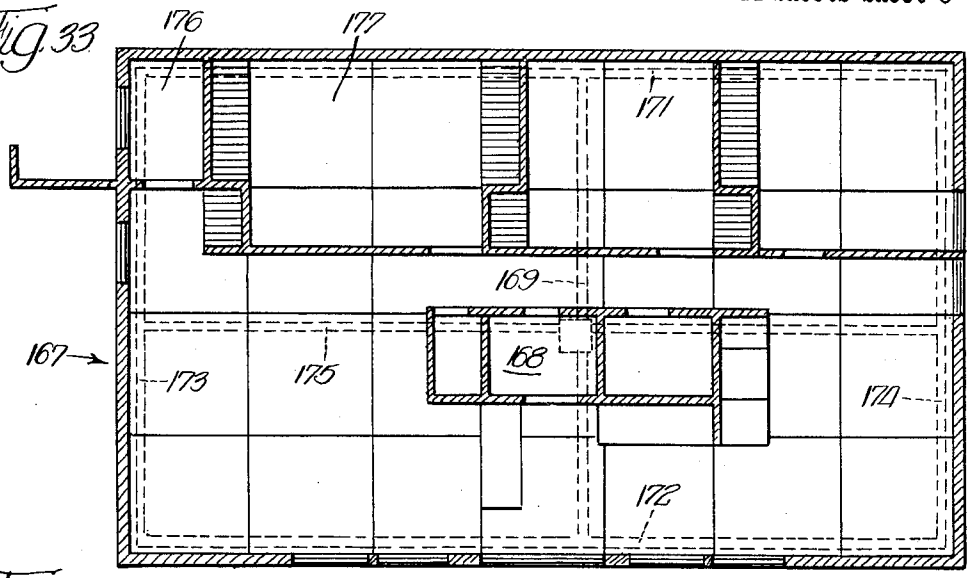


Fig. 34

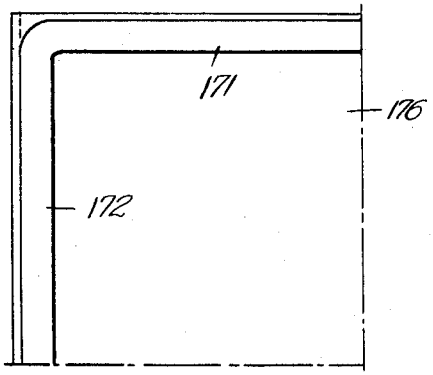


Fig. 35

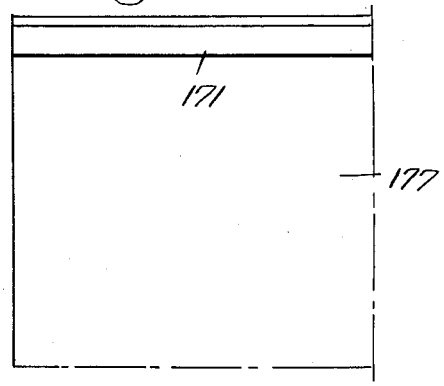
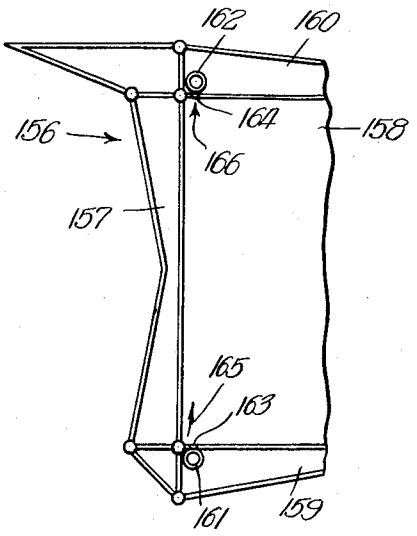


Fig. 36



INVENTORS.
James R. Dresser,
BY Robert A. Rosenthal,
Robert R. Lockwood
Atty

April 24, 1962 J. R. DRESSER ET AL 3,031,043

BUILDING CONSTRUCTION

Filed July 26, 1957 11 Sheets-Sheet 10

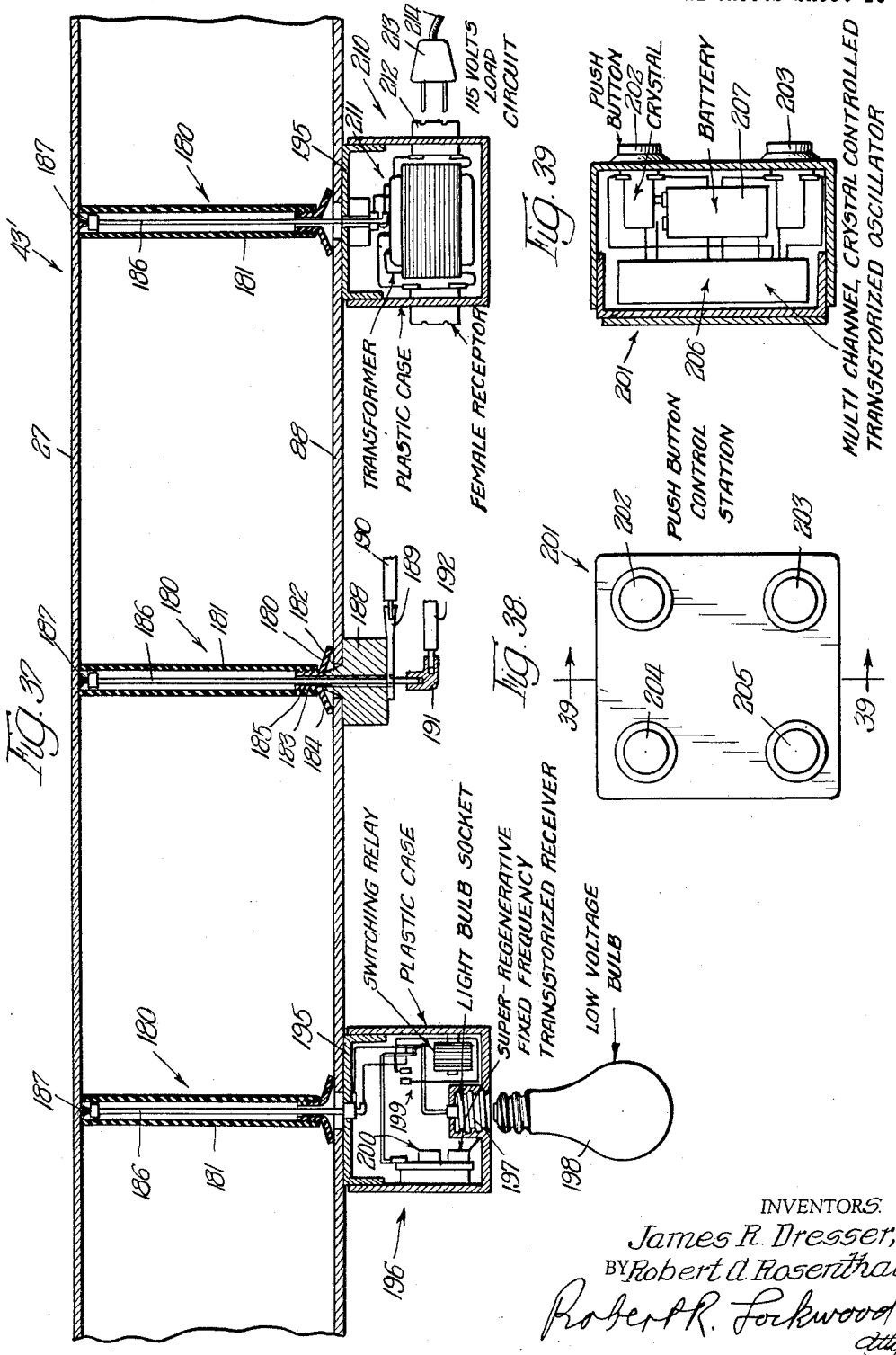


Fig. 30

Fig. 38

Fig. 39

INVENTORS.
James R. Dresser,
BY Robert A. Rosenthal
Robert R. Lockwood
Atty.

April 24, 1962 J. R. DRESSER ET AL 3,031,043

BUILDING CONSTRUCTION

Filed July 26, 1957 11 Sheets-Sheet 11

Fig. 40.

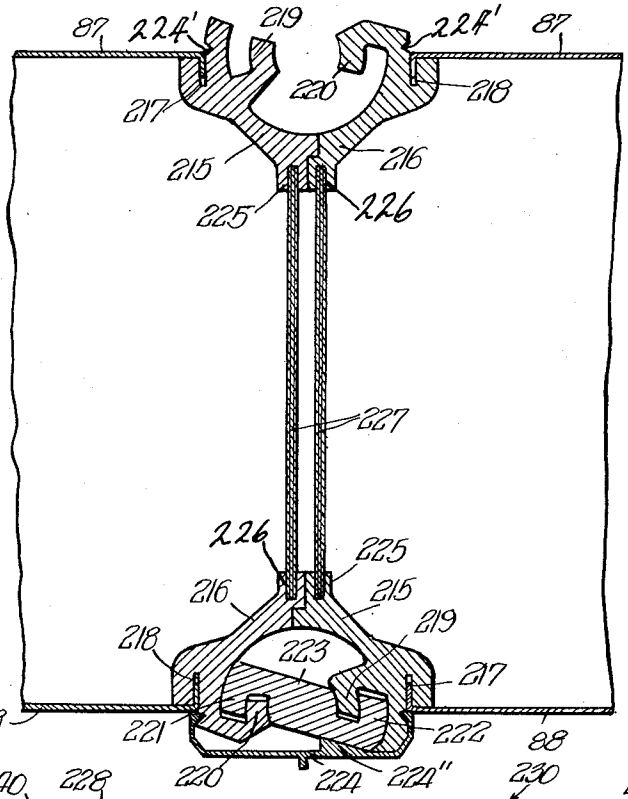


Fig. 41.

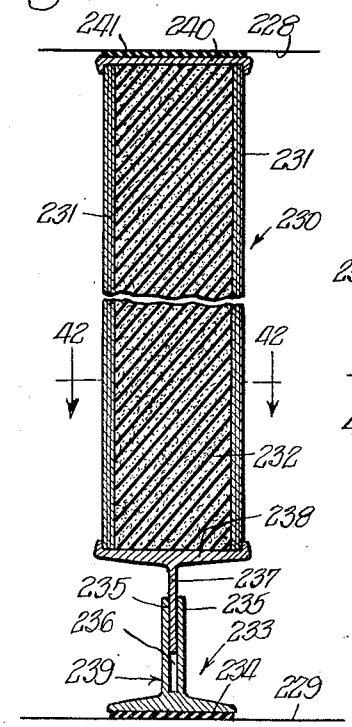
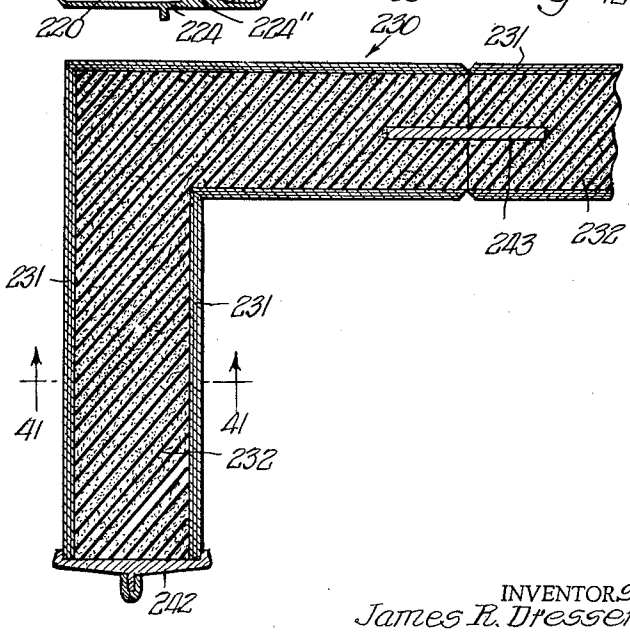


Fig. 42.



INVENTORS
James R. Dresser,
BY Robert A. Rosenthal,
Robert R. Lockwood
Attys.

United States Patent Office 3,031,043 Patented Apr. 24, 1962

3,031,043
BUILDING CONSTRUCTION

James R. Dresser and Robert A. Rosenthal, both of Rte. 3, Spring Green, Wis.; said Dresser assignor of thirty-seven and one-half percent to R. N. Howton, Williams, Ariz.

Filed July 26, 1957, Ser. No. 674,339
8 Claims. (Cl. 189—34)

This invention relates, generally, to building construction and it has particular relation to prefabricated building construction.

A prefabricated building, such as a dwelling house, garage, school, factory, etc., as presently understood is one which either is constructed at a factory and shipped as a unit to the site or the wall, partitions (roof, etc., are fabricated at the factory, either partially or entirely, and then assembled at the side. In either case a conventional building of the custom built type is the result. While some economies can be effected over the strictly custom built type of building, the so-called prefabricated building still is essentially a custom built house. In order to reduce further the cost of such constructions, identical or only slightly varying types are often employed. Usually they are unattractive and generally they lead to a condition where values tend to diminish faster than they otherwise would if the houses were dissimilar and more attractively constructed.

It has heretofore been proposed to employ off the site manufactured structural units which can be assembled at the site to form the building walls. However, they have been expensive to construct and difficult to assemble. Generally they are limited to use for the walls and partitions. They have not been readily adapted for floor and roof construction.

Accordingly, among the objects of this invention are: To provide a single universal panel construction that can be assembled at the site to form part or all of the floors, walls, partitions, and roof of a building; to construct the panel of light weight, weather proof material in such manner that the cost is a minimum; to arranged the panel in such manner that it can be assembled with other like panels by unskilled laborers; to provide the panel construction so that it can be disassembled from other panels without damage; to provide different interior and exterior finishes on the panels; to construct each panel of spaced apart relatively thin metallic or plastic skins and to electrically and heat insulate the skins on the opposite sides of the panel from each other; to interconnect the outer metallic skins and the inner metallic skins of adjacent panels and to energize them electrically to the end that they may serve to distribute electrical energy throughout the building; to interconnect adjacent panels by detachable links; to hold each link in place by a cooperating lock; to construct the lock of conducting material and arrange for it to electrically interconnect the metallic skins of adjacent panels; to fill the space between the skins with light weight, heat insulating material; and to provide for the construction of a large number of buildings of different design, appearance and size using a single panel design, or a combination of panels.

Other objects of this invention will, in part, be obvious and in part appear hereinafter.

This invention is disclosed in the embodiments thereof shown in the accompanying drawings and it comprises the features of construction, combination of elements and arrangement of parts that will be exemplified in the construction hereinafter set forth and the scope of the application of which will be indicated in the appended claims.

For a more complete understanding of the nature and scope of this invention reference can be had to the following detailed description, taken together with the accompanying drawings, in which:

FIGURE 1 is a perspective view of a typical dwelling house which can be constructed employing the panels of the present invention;

FIGURE 2 is a typical floor plan for the dwelling house construction as shown in FIGURE 1;

FIGURE 3 to 7 illustrate five common cross sections of building constructions that can be made employing the present invention, it being understood that they are merely typical of cross sections that can be made and that many other combinations can be employed;

FIGURES 8, 9 and 10 illustrate typical foundations which can be employed in conjunction with the present invention;

FIGURE 11 is a plan or elevation view of one side of a typical panel constructed in accordance with this invention;

FIGURE 12 is a plan or elevation view of the opposite side of the panel shown in FIGURE 11;

FIGURE 13 is a vertical sectional view taken generally along the line **13—13** of FIGURE 11;

FIGURE 14 is a plan or elevation view showing how five of the panels illustrated in FIGURES 11, 12 and 13 can be assembled in a unitary construction;

FIGURE 15 is a vertical sectional view, at an enlarged scale, taken generally along the line **15—15** of FIGURE 14 and showing one form of joint construction for fastening adjacent panels together, it being understood that the section is typical of any of the joints between adjacent panels;

FIGURE 16 is a plan or elevation view of another form of panel construction;

FIGURE 17 is a vertical sectional view taken generally along the line **17—17** of FIGURE 16 and illustrating how the adjacent panels are detachably interconnected;

FIGURE 18 is a plan or elevation view, at an enlarged scale, of that portion of the panels shown in FIGURE 16 adjacent the common meeting corners of four panels;

FIGURE 18*a* is a sectional view, at an enlarged scale, taken generally along the line **18*a*—18*a*** of FIGURE 18;

FIGURE 19 is a sectional view at an enlarged scale, showing the means whereby the panels illustrated in FIGURE 16 can be detachably interconnected and assembled;

FIGURE 20 is an end view of the link portion of the connecting means shown in FIGURE 19;

FIGURE 21 is an end view of the lock forming a part of the connecting means shown in FIGURE 19;

FIGURE 22 is a sectional view showing how a partition can be joined to the side wall of a building construction employing the panels of the present invention;

FIGURE 23 shows the panels can be joined so that they are acute angularly related;

FIGURES 24 to 28 are sectional views illustrating how different coverings can be applied to the panels of the present invention;

FIGURE 29 is a vertical elevational view showing one form of panel arrangement containing a fixed sub-panel of glass and a pair of movable sub-panels which provide vents;

FIGURE 30 is a vertical sectional view, at an enlarged scale, taken generally along the line **30—30** of FIGURE 29 and showing certain details of construction;

FIGURE 31 is a view, similar to FIGURE 29, showing a panel arrangement employing a door and a fixed window;

FIGURE 32 is a view, similar to FIGURES 29 and 31, and shows a panel arranged to receive three doors;

FIGURE 33 shows a floor plan of the type illustrated in FIGURE 2 with provision made for one form of heat distribution;

FIGURE 34 is a top plan view illustrating how the

heating ducts are located in a corner floor or roof panel;

FIGURE 35 is a view, similar to FIGURE 34, showing how the heating duct is located in an intermediate floor or roof panel;

FIGURE 36 is a view showing overhung and wall panels together with roof and floor panels in which heating ducts are provided;

FIGURE 37 is a horizontal sectional view at an enlarged scale of a portion of a panel showing how the opposite skins can be energized for the distribution of electrical energy throughout a building constructed of such panels;

FIGURE 38 is a view, in front elevation, of a push button control station;

FIGURE 39 is a vertical sectional view taken generally along the line **39—39** of FIGURE 38 and showing in some detail the construction of the control station employing a radio transmitter;

FIGURE 40 is a sectional view showing another panel locking arrangement;

FIGURE 41 is a vertical sectional view, taken generally along the line **41—41** of FIGURE 42, showing details of construction of an interior partition; and

FIGURE 42 is a horizontal sectional view taken generally along the line **42—42** of FIGURE 41.

Referring now particularly to FIGURES 1 and 2 of the drawings, it will be observed that the reference character **10** designates, generally, a one story house which can be constructed in accordance with this invention. It will be understood that the house as illustrated at **10** is merely typical of a wide variety of constructions that can be made employing this invention. The house **10** can be provided with a car port, shown generally at **11**, and it can be extended by a fence as indicated at **12** to complete the construction and provide a balanced arrangement. Along the front of the house **10** is an exterior terrace **13**. Centrally located on the house **10** is a chimney **14**.

As shown by the floor plan in FIGURE 2 the house **10** has a front wall **15** and a rear wall **16** interconnected by side walls **17** and **18**. A roof **19**, FIGURE 1, overlies these walls and the entire combination is positioned on a floor **20** which, except for a slab containing the utilities, can be of a construction similar to that employed for the walls and roof.

Included in the floor plan shown in FIGURE 2 are bedrooms **24** and **25** which are formed by interior walls **26**, **27**, **28** and **29**, as shown. A combination kitchen and breakfast room is indicated at **30** while a family work room is indicated at **31**, the two being joined in a generally L-shape. A utility entrance is provided at **32**.

The layout and design of the house **10** are such that all of the utilities are located on a central slab which preferably is a concrete slab that is cast about the various utility lines after they have been installed. The utility center is indicated, generally, at **35** and it will be understood that the water, gas and sewer pipes are laid prior to the casting of the concrete slab on which the utility center **35** is positioned and that, if the electric circuit is run underground, suitable conduit will be provided therefor prior to casting of the slab. Included in the utility center **35** is a utility room **36** in which the heating plant or furnace is located. The utility center also includes a complete bathroom **37**. Since the incoming electric circuit preferably is located in the utility center **35** a kitchen range **38** is located conveniently thereto as are a refrigerator **39**, a washer **40** and a dryer **41**.

When it is desired to construct only a two bedroom house with essential living quarters, the side wall **17** can be located along the broken line **42**. Such a construction would provide modest living quarters for a small family with the construction being such that they could be expanded, in accordance with this invention, merely by adding additional panels for the extensions of the front and rear walls **15** and **16**, the construction of a new side wall **17** and extensions of the roof **19** and floor **20** all of which are constructed of panels, as indicated at **43**, and which will be described in detail hereinafter. By making various arrangements of these panels **43** and applying various coverings to opposite sides, an infinite variety of arrangements can be provided.

When the side wall **17** is positioned as illustrated in FIGURE 2, additional living space is provided. For example there is a living room **44** and a master bedroom **45**. The extension also permits the provision of a powder room **46** which is located adjacent the utility center **35** where the necessary plumbing connections can be made. If desired, a fire place **47** can be constructed in the living room **44** and connected suitably to the chimney **14**. The main entrance would then be provided as indicated at **48** and an exterior storage room **49** could be provided as illustrated. Overlooking the exterior terrace **13** are panels of uniform construction including windows **50** while centrally of the front wall **15** is a panel containing a single window **51**.

It has been pointed out that the particular building construction illustrated in FIGURES 1 and 2 is merely typical of an endless variety of arrangements that can be made. In order to illustrate a few of the different cross sections of buildings that can be constructed employing this invention, attention is directed to the illustrative arrangements shown in FIGURES 3–7 of the drawings.

In FIGURE 3 a rectangular cross section is shown that has the roof, floor and side walls formed of the panels **43**. The floor formed by the panels **43** is positioned on a gravel bed **52** which may be of concrete. The dimensions of the panels **43** are such that the height between the floor and roof is spanned by a single panel, a number being used to provide the wall.

Another arrangement that can be employed is shown in FIGURE 4 where the roof, formed of the panels **43**, inverted from the arrangement shown in FIGURE 3, is spaced by transparent or translucent glass panels **55** from overhanging panels that are carried by the side walls.

A semi-circular cross section is shown in FIGURE 5. Here a concrete slab **54** can be employed in lieu of floor panels.

FIGURES 6 and 7 show different arrangements of gable roof construction. FIGURE 6 shows one with a slight pitch while FIGURE 7 shows a roof construction with a greater pitch.

All of the constructions shown in FIGURES 3–7 are formed principally by the prefabricated panels **43** which can be constructed on a mass production basis in a factory and then transported to the building site where they can be assembled, as described hereinafter, by unskilled labor to provide the particular configuration desired. Because of the substantially limitless combinations which can be made from the panels **43**, in a single building development, it is possible to have a correspondingly large number of different appearing dwellings. It is then possible to avoid conventional row house constructions with the result the property values tend to either remain constant or improve over the years.

FIGURES 8, 9 and 10 illustrate a few of the many different foundation arrangements that may be employed with the present invention. Because of the relatively light weight of the panels **43** and the resulting light weight of the building construction, provision should be made for securely anchoring the final construction to the ground.

FIGURE 8 shows a portion of the floor and one side wall constructed of identical panels **43**. The completed building is located on a gravel bed **56** and an earth anchor **57** is employed for holding the building in place on the ground. It will be understood that a number of anchors **57** are employed, the number of course depending upon the size of the building, the type of ground in which they are positioned, etc.

FIGURE 9 shows the gravel bed overlaid with a layer of polystyrene insulation **58**. Then overlying the layer

58 is a concrete slab 59. In this case the floor is formed by the concrete slab 59 and a closure plate 60 is cast in the concrete slab 59 for receiving the panel 43 providing the side of the house. Fingers 60' formed integrally with the closure plate 60 and depending therefrom serve to further anchor the closure plate 60 in the concrete slab 59.

FIGURE 10 illustrates how the building construction of the present invention can be located on a site which has sloping ground 61 without requiring that it be excavated to provide a generally horizontal building surface. As here shown a foundation button 62 is positioned just below the ground level, the number depending upon the size and shape of the ultimate building. The foundation button 62, in each case, is secured in position by the anchors 57, previously described. Mounted on each foundation button 62 is a support strut 63 which is adjustable, as desired, for carrying the floor that is made up of panels 43. As before, the side wall is made up also of panels 43. A closure plate 64 extends over the joint between the panels 43 making up the wall and floor to seal the same against the weather.

It will be apparent that the panels 43, and similar panels described hereinafter, can be combined with conventional wall constructions of wood and masonry where desired.

Referring now to FIGURES 11–15 of the drawings, it will be observed that one form of construction of the panel is there illustrated together with one arrangement for interconnecting adjacent panels. Each panel 43 can be made up of four triangular panels shown generally at 65 in FIGURES 11 and 12. The face of the panel 65 as shown in FIGURE 11 is formed by three triangular skins 66, 67 and 68 which are sheets of relatively thin metallic material such as sheet aluminum. The skins 66, 67 and 68 and like skins disclosed herein can be formed of thermoplastic sheet material and also of a glass product sold under the trade name "Pyroceram." They are arranged in concave configuration to take advantage of the stressed skin construction. The opposite face or side of the triangular panel 65, shown in FIGURE 12, is merely a triangular skin 69 which overlies the three triangular skins 66, 67 and 68 of the other side. It will be observed that edge 70 of the skin 66 and edge 71 of the skin 69 are coplanar. Similarly, edges 72—73 and 74—75 are coplanar, thereby making it possible to receive a closure plate 76 of uniform width. The adjacent panel is provided with a corresponding closure plate 77 and they have nesting intermediate portions 78 and 79.

The skins 66, 67 and 68 can be spaced from the skin 69 by struts 80 and 81, as shown in FIGURE 13. Alternatively, or in addition, the space between the skins on the opposite sides of the panel 65 can be filled with a suitable insulation such as a rigid porous sponge like insulation. Also the space between the skins can be evacuated to provide insulation therebetween. Such a construction is facilitated when the skins are formed of plastic material, such as thermoplastic sheet material.

In order to join the triangular panels 65 together strips 82 are secured along the juxtaposed edges and they are provided with shoulders 83 for slidably receiving thereon the link 84. A dovetail connection is provided so that when the links 84 are slid over the juxtaposed shoulders 83 of the strips 82, the adjacent panels 65 will be secured firmly together and yet they can be disassembled merely by removing the links 84.

In FIGURE 14 it will be observed that four of the triangular panels 65 are employed to make up a single rectangular panel. It is this general type of construction that is illustrated in FIGURE 1 for the building construction and it is illustrated diagrammatically in FIGURES 3–7. By placing the concave portions of the panels 43 on one side or the other, different appearances can be provided as will be obvious.

Another panel construction is illustrated at 43' in FIGURE 16 of the drawings. Here the opposite sides of each panel 43' are formed by flat rectangular skins 87 and 88 and they are joined together by closure plates 89 along the four sides. It will be understood that the edges of the skins 87 and 88 are positioned in coplanar relation so that closure plates 89 of uniform width can be employed for interconnecting them and also for joining them to adjacent similar panels. The space between the skins 87 and 88, as shown in FIGURE 17, can be filled with a rigid porous sponge like insulation 90 such as foamed phenolic or polystyrene plastic. Such a material, while light in weight, has excellent insulating properties.

In FIGURE 19 is shown the manner in which the closure plates 89 are secured to the respective skins 87 and 88. It will be observed that each closure plate 89 has a central portion 91 and that these portions are juxtaposed when the panels are positioned in operative relation to form a roof, wall or floor. At each end of each flat central portion 91 is an offset arcuate end portion 92 which is provided with a slot 93 for receiving an inturned edge 94 of the adjacent skin 87 or 88 as the case may be. Since it is desirable to electrically insulate the skins 87 and 88 from each other, each slot 93 is provided with a layer 95 of insulation.

With a view to mechanically interconnecting the offset arcuate end portions 92 of the closure plates 89 they are provided with locking shoulders 96 and 97, the former projecting outwardly and the latter projecting inwardly. These shoulders are provided with ridges 98 and 99 for interfitting with grooves 100 in locking shoulders 101 which project radially and laterally from a central tubular section 102 of a link that is indicated, generally, at 103 in FIGURE 20 of the drawings.

It will be understood that the closure plates 89 and links 103 can be formed of metallic extrusions, such as extrusions formed of aluminum. The link 103 can be provided with radial openings 104 for receiving a removable tool, shown by broken lines at 105, which facilitates the rotating of the link 103 to position the ridges 98 and 99 in locking engagement with the grooves 100. Also, the tool 105 can be inserted in one or the other of the radial openings 104 to remove the link 103 from the connecting position shown in FIGURE 19 to permit disassembly of the adjacent panels.

In order to lock the link 103 in the retaining position shown in FIGURE 19 and to provide a weatherproof enclosure therefor a semi-circular lock 106 can be employed. Preferably it is formed of a metallic extrusion, such as aluminum, and it has shouldered ends 107 which interfit, as shown in FIGURE 19, with the inturned edges 94 of the skins 87 and are thereby held in position. Projecting radially inwardly from the lock 106 is a detent 108 that is arranged to interfit behind one of the locking shoulders 101, as shown. It is desirable to insulate the lock 106 from the link 103 and for this purpose a layer 109 of insulation can be used by providing the same in overlying relation along the detent 108. Since the shouldered ends 107 of the lock 106 are in mechanical and electrical engagement with the adjacent portions of the metallic skins 87, each lock 106 constitutes an electrical connection between the adjacent skin and thus continuity for one side of an electric circuit is provided. Since the skins 87 and 88 are electrically insulated from each other, they can be employed as conductors and can be energized for the purpose of distributing electricity throughout the building construction.

When four of the panels 43' are arranged as illustrated in FIGURE 16, the meeting portions of the semi-circular locks 106 can be provided with angular end portions 110. The edges of these end portions 110 are spaced slightly from each other and a gasket 111 having an H-shaped cross section, shown in FIGURE 18*a* can be employed to provide a weatherproof construction.

FIGURE 22 shows how a partition or roof and overhang panels can be joined to the panels making up an exterior wall. Here panels 43' are positioned in alignment

and in spaced relation for receiving the panel 43' at right angles thereto. At the inner juxtaposed edges the panels are joined in the manner illustrated in FIGURE 19, except that the adjacent skins are located at 90° to each other. This is permitted by the appropriate positioning of the locking shoulders **101** on the links **103**. Then the space opposite the panel **43'** which extends at right angles to the other two panels can be closed off by a closure plate **89** which is unattached to any panel or skin.

FIGURE 23 shows the panels **43'** in obtuse angular relationship. Here a closure plate **112** is employed and it is provided with arcuate end portions **113** which carry locking shoulders **114** and **115** to interfit with the respective links **103** therealong. Where an arch or dome construction is desired and a lesser degree of angular change between panels is required than that shown in FIGURE 23, a link **103** can be used at the outer side having a slightly larger diameter than that used at the inner side. This creates a slight calculated angle between the adjacent closure plates **89**.

FIGURES 24–28 illustrate a few of the many possibilities for applying various surface coatings to the panels **43'**. Here only one of the skins **87** and a portion of the insulation **90** of each of the panels **43'** is illustrated. The combination link-lock is illustrated diagrammatically at **116**, it being understood that in detail it is as shown in FIGURE 19.

In FIGURE 24 it will be seen that a plastic laminate or wall paper **117** can be applied to the surface of the skin **87**. When such an arrangement is used for a wall or ceiling, the plastic laminate or wall paper provides an appropriate decoration.

FIGURE 25 shows how the panels can be employed for a floor construction with a layer **118** of padding over the skins **87** and underlying carpet square **119**. The padding **118** and carpet square **119** can be applied in the factory so that, when the panels are assembled on the site the carpeted floor is provided immediately upon assembly. It will be noted here that a small portion of the link-lock **116** is exposed for ornamental purposes.

FIGURE 26 shows a filler **120** of foamed plastic with the carpet **119** overlying the same when continuous carpeting is used.

In FIGURE 27 a layer **121** of foamed plastic is employed and over it is a layer of wood **122** or artificial board all of which can be preassembled in the factory.

If desired, as shown in FIGURE 28, a layer **123** of concrete or terrazo can be poured on the skin **87** with a screed **124** being carried by the link-lock **116**.

Referring now particularly to FIGURE 29 of the drawings, it will be observed that the reference character **125** designates a panel which can be employed in a building construction made up of panels **43** or **43'** and can be interchangeably used therewith where it is desired to provide windows, doors, ventilators, etc. The panel **125** includes a sub-panel **126** of glass which may be fixed in position and two sub-panels **127** of glass which may be movably mounted to provide vents. The sub-panels **126** and **127** are separated by a transverse member or transom **128** while the sub-panels **127** are separated vertically by a mullion **129**. The panel **125** includes a four-sided frame, indicated generally at **130**, the details of construction of which are shown more clearly in FIGURE 30.

As there shown the frame **130** comprises four closure members, indicated generally at **131**, and formed preferably of extruded aluminum. Along the opposite edges of the closure members **131** offset arcuate end portions **133** and **134** are formed which are provided, respectively, with an inwardly projecting locking shoulder **135** and an outwardly projecting locking shoulder **136**. These locking shoulders on the arcuate end portions **133** and **134** are arranged, as illustrated at the lower portion of FIGURE 30, to cooperate with locking shoulders **137** on links **138**. It will be observed that the locking shoulders **137** on the links **138** are arranged to cooperate with shoulders **139** and **140** on a closure member or plate, that is indicated, generally, at **141** and corresponds to the closure plate **60**, previously described, which, as shown in FIGURE 9, can be cast in a concrete slab, if desired. Semi-circular locks **142** similar to the lock **106** are employed in overlying relation to the link **138**. Each lock **142** carries an inwardly extending detent **143** which fits behind one of the locking shoulders **137** and prevents rotation of the respective link **138** in the unlocking direction.

The inner faces of the closure members **131** along their edges are provided with spaced recesses **146** into which the ends of the transverse member or transom **128** can be snapped. It will be understood that a similar arrangement is provided for receiving the mullion **129**.

It will be understood that the glass sub-panel **126** can be provided by a single fixed pane or by double panes as may be desired for heat insulation purposes.

Suitable provision is made for movably mounting the sub-panels **127** of glass which serve as vents. A conventional operating mechanism, indicated generally at **147**, can be employed for opening and closing the sub-panels **127**. In FIGURE 31 another panel arrangement is illustrated at **148**. The frame details of construction are similar to those illustrated in FIGURE 30 in conjunction with FIGURE 29. However, in FIGURE 31 a door **149** is suitably swingably mounted while a window **150** is fixedly mounted. They are separated by a vertically extending mullion **151**.

FIGURE 32 shows another of the many combinations of panel construction that can be employed using the present invention. Here three doors **153** are mounted within a panel **152** and they are separated by mullions **154**.

It will be understood that the closure members **131** can be assembled into the frame **130** either in a factory or on the site as may be desired. Standard lengths of transoms and mullions can be provided to form any desired subpanel arrangement.

One manner in which the heating or cooling of the building construction embodying this invention can be accomplished is illustrated in FIGURES 33–36. Referring particularly to FIGURE 36, it will be observed that a portion of a building construction is illustrated, generally, at **156**. It is made up of an end wall panel **157**, a side wall panel **158**, a floor panel **159** and a roof panel **160**. It will be understood that these panels are constructed as described hereinbefore and illustrated at **43** or **43'**. In the space between the opposite skins of the floor panel **159** a duct **161** is positioned while another duct **162** is positioned between the skins of the roof panel **160**. If air is employed for heating or cooling, it flows from the duct **161** through a vent **163** in the inner skin of the floor panel **159** to the room space. A similar vent **164** is provided for exhausting the air from the room space into the duct **162**. The flow of air for heating purposes is indicated by the arrows **165** and **166**. Any suitable arrangement can be provided for effecting the circulation of air through the ducts **161** and **162**. Where cooling air is circulated through the ducts **161** and **162** it may be desirable to provide for it to flow from each duct into the room space or for the cooling air to flow only through one or the other of the ducts **161** or **162**.

FIGURE 33 shows a typical arrangement for the ducts in the floor or roof construction that is indicated, generally, at **167**. The heating equipment is located centrally as indicated at **168** and may be of any suitable type as will be understood. Assuming that a hot air heating system is employed, then a transverse return duct **169** can be provided for interconnecting side ducts **171** and **172**. They are interconnected by end ducts **173** and **174** that, in turn, are connected intermediate their ends by a longitudinal conduit **175** to the heating plant.

A typical corner floor or roof panel is indicated at **176** in FIGURE 34. Here a portion of a side duct **171** and a portion of an end duct **172** are shown.

In FIGURE 35 are intermediate floor or roof panel

177 is illustrated along one side of which there is a portion of the side duct 171.

FIGURE 37 shows one manner in which electrical connections can be made to the skins 87 and 88 of the panel 43'. It will be recalled that provision is made for energizing the skins 87 and 88 and for insulating them from each other so that electrical energy can be distributed throughout the building construction. Because of the relatively large cross section of conductors thus provided and because it is desirable to use a low voltage for safety reasons, provision is made for energizing the skins 87 and 88 at a relatively low voltage. For example, a voltage of the order of from six to twenty volts alternating or direct current is preferred. Any sutiable means such as a step down transformer energized from a conventional power distribution source can be employed for energizing the skins 87 and 88 in the manner described. If the direct current is used and it is desired to provide alternating current for operating certain devices, as described hereinafter, a suitable converter can be used, such as a vibrating type converter. It can be combined with the transformer assembly referred to hereinafter to energize the same.

In considering the illustration shown in FIGURE 37 it will be assumed that the skins 87 and 88 are energized at a difference of potential of the order from six to twenty volts alternating current. In order to make connection to the skins 87 and 88 an electrical conductor assembly, indicated generally at 180, can be employed. It includes an insulating tube 181 which can be inserted through a suitable opening 182 in the inner skin 88. At the adjacent end of the insulating tube 181 a fitting 183 is provided having bendable connecting flanges 184. Preferably the fitting 183 is threaded, as indicated at 185, into the tube 181 so that after the tube 181 is inserted through the opening 182, the fitting 183 can be unscrewed from the tube 181 to cause the connecting flanges 184 to engage and make good contact with the inner surface of the inner skin 88. Extending through and insulated from the fitting 183 is a connector pin 186. At the remote end a contact brush 187 is provided which has contact engagement with the inner surface of the outer skin 87. When the fitting 183 is unscrewed from the insulating tube 181, the contact brush 187 is urged in good contact engagement with the inner surface of the outer skin 87. Just outside the opening 182 is a connector block 188 which forms a part of the fitting 183 and to which a terminal 189 can be connected that, in turn, can be connected to a conductor 190. Likewise a terminal 191 is connected to the inner end of the connector pin 186 for connection to a conductor 192. It will be understood that the conductors 190 and 192 can be connected to any suitable load device that may be desired.

A typical application of the connector assembly 180 for use in conjunction with a load device is illustrated at the left hand end of FIGURE 37. Here it will be observed that an outlet box 195 is employed and is arranged to be secured suitably to the inner surface of the inner skin 88 centrally of the connector assembly 180. Also a lamp control assembly is shown, generally, at 196. It includes a suitable socket 197 for receiving a low voltage bulb 198. Energization of the bulb 198 is effected through a relay 199 which is controlled by a radio receiver 200. When the radio receiver 200 receives the proper signal, the relay 199 is energized, it contacts are closed and a circuit is completed for energizing the low voltage bulb 198.

The control of the radio receiver 200 can be effected from a push button control station that is indicated, generally, at 201 in FIGURES 38 and 39 of the drawings. The push button station 201 can be located at any convenient position in the house or it can be carried from room to room as desired. It is provided with a number of push buttons, for example four as indicated at 202, 203, 204 and 205, each of which is arranged to selectively control an oscillator 206 which may be powered by a battery 207. Each of the push buttons 202–205 is arranged to cause the oscillator 206 to transmit at a different frequency. Thus one or more of the radio receivers 200 can be arranged to receive and be operated by certain frequencies so that when the push button 202, for example, is depressed, the oscillator 206 operates to effect the transmission of the corresponding signal to operate the relay 199. Assuming that a number of lamp control assemblies 196 are tuned to operate on the same frequency, it will then be understood that all of such assemblies will be operated under the control of the push button 202. Other load devices can be controlled by means of the push button control station 201 or combinations thereof as may be desired.

It is often the case that the load devices are available only for operation on a relatively high voltage such as 115 volts. For such application the arrangement shown at the right hand end of FIGURE 37 can be employed. An electrical connector assembly 180 is applied and, assembled in operative relation thereto, is a transformer assembly indicated, generally, at 210. It includes a transformer 211 the low voltage primary winding of which is arranged to be connected for energization by the connector assembly 180 across the energized skins 87 and 88. The high voltage winding of the transformer 211 is connected to energize an outlet socket 212 that is arranged to receive a plug 213 which may be connected on one end of a two conductor cord 214 which, in turn, is connected to the device to be operated at the conventional voltage.

FIGURE 40 shows another arrangement for interconnecting juxtaposed panels which may be employed where unusually great stresses are involved. It will be observed that the skins 87 and 88 extend from arcuate fittings 215 and 216 that many be formed of extruded aluminum. Slots 217 and 218 are provided in the fittings 215 and 216 for receiving the inturned ends of the skins 87 and 88 as shown. Locking shoulders 219 and 220 are formed integrally with the fittings 215 and 216 for receiving shoulders 221 and 222 of a link 223 only one of which is shown at the bottom of this figure. Each link 223 is held in place by a lock 224 the ends of which are snapped into notches 224' in the fittings 215 and 216. An inclined shoulder 244'', formed integrally with the inner surface of the lock 224, bears against the link 223 to hold it securely in position.

Instead of providing an integral plate connection between the arcuate fittings 215 and 216, other means are provided for interconnecting them which reduces the expense of manufacture and provides insulation therebetween. It will be noted that slots 225 and 226 are provided in the fittings 215 and 216 respectively. Secured by cement or otherwise in these slots 225 and 226 are hardboard connectors 227.

The details of interior partitions that may be used in practicing this invention are illustrated in FIGURES 41 and 42 of the drawings. In FIGURE 41 the ceiling line is indicated at 228 and the floor line is indicated at 229. Between them a partition, shown generally at 230, is adjustably positioned. The partition 230 may comprise wood veneer skins 231 which are cemented in a suitable manner to a foamed plastic core 232. The assembly is adjustable between the ceiling and floor lines 228 and 229 through the agency of a base extrusion 233 which rests on a soft rubber gasket 234 that is adhesive coated and lies on the floor. The base extrusion 233, which is formed preferably of aluminum, is provided with upstanding flanges 235 having a slot 236 therebetween for receiving a depending tongue 237 of a bottom member 238 which underlies the wood veneer skins 231. A sinuous spring member is provided in the slot 236 for adjustably positioning the tongue 237 with respect to the base extrusion 233.

Along the upper edges of the wood veneer skins 231 is an extruded cap 240 which is overlaid by a soft rubber

gasket **241** that is adhesive coated to secure it to the ceiling and to the upper surface of the cap **240**.

As shown in FIGURE 42 the sides of the wood veneer skins **231** can terminate a door jam **242** that may be formed of extruded aluminum. In order to secure adjacent sections of the partition **230** together alignment splines **243** can be used. One of these is shown in FIGURE 42. The splines **243** can be formed either of metal, wood or hardboard as may be desired.

While various details of construction have been described with considerable particularity herein, it will be understood that a wide variety of combinations can be made employing the principles of this invention. Accordingly, since many combinations and modifications of the invention can be made without departing from the spirit and scope thereof, it is intended that all matters shown in the accompanying drawings and described hereinbefore shall be interpreted as illustrative and not in a limiting sense.

What is claimed as new is:

1. A building panel comprising, in combination, a pair of spaced relatively thin metallic skins having matching coplanar edges, and a closure plate of uniform width along each pair of skin edges having offset longitudinal concave edge portions secured to the respective skin edges and a locking shoulder projecting from each edge portion and juxtaposed to the respective skin edge, the locking shoulder along one edge of said closure plate projecting outwardly and the locking shoulder along the other edge of said closure plate projecting inwardly.

2. A building wall comprising, in combination; a plurality of juxtaposed panels each including a pair of spaced relatively thin metallic skins having matching coplanar edges, and a closure plate of uniform width along each pair of skin edges having offset longitudinal concave edge portions secured to the respective skin edges and a locking shoulder projecting from each edge portion adjacent the respective skin edge, one locking shoulder projecting outwardly and the other projecting inwardly; and links extending along the juxtaposed edges of said panels having shoulders interfitting with adjacent pairs of locking shoulders therealong for holding said panels in a unitary assembly.

3. The invention as set forth in claim 2 wherein locking means interfit with each link to hold the same in locked position.

4. The invention as set forth in claim 3 wherein the skin edges are insulated from the respective closure plates, and each locking means is a conductor and electrically interconnects the adjacent skins on the same side of the wall.

5. The invention as set forth in claim 2 wherein each link has a central tubular portion with the shoulders thereon projecting radially therefrom.

6. The invention as set forth in claim 5 wherein the central tubular portion is arranged to receive a removable tool for assembling or disassembling the link in the wall.

7. The invention as set forth in claim 5 wherein the central tubular portion has a radially outwardly extending locking shoulder between the other shoulders; and the locking means is semi-circular, has a radially inwardly projecting detent engaging said locking shoulder, and the longitudinal edges are detachably secured to the juxtaposed edges of the assembled panels.

8. A building and wall comprising, in combination, a plurality of juxtaposed panels each including a pair of spaced relatively thin metallic skins having matching coplanar edges, a metallic closure member of uniform width along each pair of edges interconnecting the same, insulating means between each closure means and said skins whereby the skins are insulated from each other, means interconnecting the adjacent closure members to hold the panels in position in the wall, means interconnecting the skins on opposite sides of the wall whereby they can be electrically energized, and connecting means extending through one skin for connection thereto and to the opposite skin to energize a load device connected thereto.

References Cited in the file of this patent

UNITED STATES PATENTS

1,421,124	Brandt	June 27, 1922
1,478,979	Stoehrer	Dec. 25, 1923
1,895,667	Junkers	Jan. 31, 1933
2,103,407	Dean	Dec. 28, 1937
2,193,550	Coe	Mar. 12, 1940
2,268,636	Becker	Jan. 6, 1942
2,349,358	McLaughlin	May 23, 1944
2,394,443	Guignon	Feb. 5, 1946
2,628,078	Krauss	Feb. 10, 1953
2,808,624	Sullivan	Oct. 8, 1957

FOREIGN PATENTS

796,356	France	Jan. 22, 1936