(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 688 385 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
23.06.1999 Bulletin 1999/25

(21) Application number: **93906191.7**

(22) Date of filing: **26.02.1993**

(51) Int Cl.[6]: **E04B 7/08**

(86) International application number:
PCT/US93/01624

(87) International publication number:
WO 94/19558 (01.09.1994 Gazette 1994/20)

(54) **LAMINATED PANEL MODULAR BUILDING STRUCTURE**

MODULARE GEBÄUDESTRUKTUR AUS LAMINATPLATTEN

STRUCTURE DE BATIMENT MODULAIRE REALISEE EN PANNEAUX STRATIFIES

(84) Designated Contracting States:
DE DK FR GB IE IT PT

(43) Date of publication of application:
27.12.1995 Bulletin 1995/52

(73) Proprietor: **EMMERT SECOND LIMITED PARTNERSHIP**
Oklahoma City, OK 73127 (US)

(72) Inventor: **EMMERT, Raymond, L.**
Oklahoma City, OK 73127 (US)

(74) Representative: **Gilmour, David Cedric Franklyn**
POTTS, KERR & CO.
15 Hamilton Square
Birkenhead Merseyside L41 6BR (GB)

(56) References cited:
CH-A- 468 534
DE-A- 3 149 865
DE-B- 1 094 439
FR-A- 2 537 186
GB-A- 603 573
US-A- 390 589
US-A- 2 231 065
US-A- 2 856 039
US-A- 3 068 534
US-A- 3 640 037
US-A- 4 275 534
US-A- 5 081 810

EP 0 688 385 B1

Description

Technical field

[0001] This invention relates to sandwich panels and more particularly to factory fabricated field assembled modular building structures and methods of assembly which efficiently utilize laminated sandwich panels.

[0002] There has been much effort and extensive work done in recent years to find solutions to the housing and building needs of third world countries and other low income areas of the world.

[0003] Heretofore, most of the efforts to solve the housing and community building needs for the less fortunate have met with little or no success. There are numerous reasons why others have had little success but the primary reason is that no one has been able to deliver a low cost, pre-packaged, factory fabricated, efficient, easy to assemble, structurally sound aesthetically appealing unit to he area of need. In order to meet such demanding criteria, it is necessary to provide a pre-engineered, insulated structural panel which can be produced and fabricated to exacting dimensional and structural standards and then effectively utilize that panel not only for the walls and partitions but also of the roof without depending upon other primary structural roof supports.

[0004] This invention discloses a novel and unique building system 3 which utilizes laminated panels structurally not only for the walls but also for a completely self supporting cathedral type roof. Such a laminated panel roof structure, without requiring interior supports, makes an exceptionally efficient and versatile building with the option of leaving the interior completely open or arranging interior partitions for complete design flexibility. The efficient module units of this invention may be joined with passageway connectors to provide a wide variety of building combinations and arrangements. Used singly, the module units provide aesthetic single family dwellings or used in combination and various sizes, they become an impressive complex structure suitable for many purposes.

Background Art

[0005] Some prefabricated sandwich panel systems use post and beam wall and roof primary structures to which they attach panels. Others support roof panels with interior walls or ridge beams. Still others use conventional roof trusses to which they attach the sandwich panels. None use the panels themselves as the primary roof support.

[0006] United States patent number 390,589 issued October 2, 1888 to Goodnow for portable house discloses erecting a four wall building in which posts are mounted on the foundation and secured to a sill by strap metal plates. A top rail joins the upper ends of the posts and the spaces between the posts are filled with paper or cardboard and the respective adjacent corners of the walls are secured together by removable hinge pintles. The four trianguler section roof is simil.iarly formed by a side piece hinge joined to the top rail of the respective wall with its side rafters joined to the roof side piece by strap iron members and the roof hip rafters have hinges connected by romovable hinge pintles. United States patent number 2,231,065 issued February 11, 1941 to Gable for sectional metal building discloses four single thickness metal walls and a four triangular section roof in which the wall corners are joined by interlocking flanges and the roof depending edge joined to the respective upper wall edge by interlocking flanges and the hip roof rafter edges simil.iarly joined by interlocking sliding flanges. Swiss patent number 4,685,534 issued to Oksakowski discloses prefabricated concrete roof structures supported by their base edges on concrete walls.

[0007] This invention is distinctive over the above mentioned systems by providing a completely self supporting paneled roof structure and other unique and novel associated systems by a panel, formed by a pair of skins or face sheets bonded to an insulating core to form a panel unit of standard building panel dimensions normally having a length at least twice its width. The core is divided into three longitudinal sections, the major central section being 2/3 the width of the panel and two elongated longitudinal edge sections each being 1/6 the width of the panel. A pair of elongated planar stiffeners or bracing members, coextensive with the length of the insulating core sections, is symmetrically interposed between the core sections at 2/3 the width of the panel.

[0008] Longitudinal outer edge surfaces of the outermost core sections lie in a plane common to the surface of the adjacent edges of the respective skin or face. The skins or faces of the panel project beyond the end limit of the core sections a distance sufficient to nest a length of dimension lumber or other structural component when inserted therein. The outward longitudinal edge portions of the outermost core sections are beveled for receiving splicing members joining one longitudinal edge of one panel to another.

[0009] One end surface of the core sections is provided with a central groove extending transversely of the panel for receiving electrical wiring. Additionally, each outer core section is provided with a longitudinal groove communicating with the panel end transverse groove and extending toward the other end of the panel adjacent the outwardly disposed surface of the respective reinforcing or stiffening member.

Disclosure of the Invention

[0010] According to the present invention there is provided a modular building structure having a foundation, a floor and a plurality of upright interconnected modular exterior side walls supported by said floor, and a modular roof structure supported only by said sidewalls, said modular roof structure comprising a plurality of planar

modular roof sections of truncated apex triangular shape with said sections each having a lower end edge surface abutting said stop and being disposed in juxtaposed upwardly converging self-supporting cooperative relation from said stop and extending downwardly and outwardly at their depending ends above and beyond the vertical outer perimeter surfaces of said walls, and each roof section comprising a plurality of laminated insulating material structure panels joined in longitudinal edge fashion by splines, and, keystone box frame means interposed between and secured to the upper truncated apex ends of said roof sections; characterised by a top plate overlying the respective exterior side wall, and an upwardly extending wall reinforcing band located outwardly of said walls and circumferentially surrounding the outer upper vertical surfaces of said walls and forming a continuous retaining means preventing outward displacement of the walls and forming a continuous inwardly facing stop projecting above the upper limit of said top plate.

[0011] Also according to the present invention there is provided a method of erecting a self supporting roof on the upper limit of a modular structure defined by a plurality of rigidly joined together upstanding exterior side walls, comprising the steps of: a) providing an end compression frame defined by a like plurality of vertical frame walls; b) surrounding the outer upper perimeter of the side walls with an inwardly facing stop forming reinforcing band, c) providing a like plurality of cooperating triangular shaped modular roof sections each including juxtaposed laminated insulating material panels defining a base edge and a truncated edge; d) temporarily centrally supporting said compression frame on scaffolding at a predetermined elevation above a horizontal plane defined by the upper limit of said exterior walls with the compression frame vertical walls parallel with the respective exterior wall; and e) interposing said roof sections in juxtaposed relation between the stop on the upper limit of the respective upstanding exterior wall and the cooperating compression frame vertical wall in a predetermined sequence.

[0012] The structure in general utilises modular components for forming building structures of a particular design.

[0013] The components are formed from a plurality of structurally reinforced insulating panels joined in longitudinal edge fashion by splines and joined at their respective top and bottom ends by elongated dimension lumber for forming relatively large surfaces, such as floors, walls and roofs, with cut-outs for doors and windows in the wall areas.

[0014] The several roof sections resting at their depending edge portions on the upper limit of the structure walls are self supporting at their upper limit requiring only a keystone-type box frame at their uppermost edge limits to provide light weight building structure modules formed by a plurality of insulating panels joined in longitudinal juxtaposed edge position including roof forming modules which are centrally self supporting.

Brief Description of the Drawings

[0015]

Figure 1 is a partially exploded, partly in section, perspective view of a building constructed in accordance with the invention;

Figure 2 is a fragmentary perspective view of the area encompassed by the arrow 2 of Fig. 1;

Figure 3 is a fragmentary horizontal cross sectional view taken substantially along the line 3---3 of Fig. 1;

Figure 4 is a fragmentary cross sectional view, to an enlarged scale, taken substantially along the line 4---4 of Fig. 1;

Figure 5 is a perspective view of an alternative cap for the skylight opening of the building illustrated by Fig. 1;

Figure 6 is a fragmentary vertical cross sectional view, to an enlarged scale, taken substantially along the line 6---6 of Fig. 1;

Figure 6A is a fragmentary cross sectional view, to a further enlarged scale, of the area encompassed by the arrow 6A of Fig. 6;

Figure 7 is a top view of a plurality of building structure formed in accordance with the present invention;

Figure 8 is a vertical cross sectional view taken substantially along the line 8---8 of Fig. 7;

Figure 8A is a fragmentary vertical cross sectional view, to an enlarged scale, of the area encompassed by the arrow 8A of Fig. 8;

Figure 9 is a vertical cross sectional view taken substantially along the line 9---9 of Fig. 7;

Figure 9A is a fragmentary vertical cross sectional view, to an enlarged scale, of the area encompassed by the arrow 9A of Fig. 9;

Figure 10 is a vertical cross sectional view taken substantially along the line 10---10 of Fig. 7;

Figure 10A is a fragmentary vertical cross sectional view, to an enlarged scale, of the area encompassed by the arrow 10A of Fig. 10;

Figure 11 is a fragmentary vertical cross sectional view, to a different scale, taken substantially along the line 11---11 of Fig. 7; and,

Figure 12 is a top view illustrating an alternative configuration of a building constructed according to the invention.

The Best Mode For Carrying Out The Invention

[0016] The reference numeral 10 indicates a building formed in accordance with this invention. The building 10 may be rectangular, as shown, or any desired perimeter configuration such a octagonal or hexagonal as at 10' (Fig. 12) having a floor 12, upstanding walls 14, a

roof assembly 16 and a roof apex open box frame assembly 18. Both the walls and the roof of the building 10 are formed by juxtaposed panel members 20 and 20'. Briefly stated, the structure of the panels 20 comprise structural boards 22 or skins (Figs. 3), bonded to opposing sides of a selected thickness of synthetic insulating material 24.

[0017] The skins 22 project beyond opposing ends of the insulating material 24 (Fig. 6) a selected distance sufficient for receiving dimension lumber for the reasons presently explained.

[0018] Longitudinal edges of each panel have the insulating material recessed inwardly adjacent the respective inner surface of the respective skin for receiving splines 26 (Fig. 3) for joining two adjacent panels 20 to each other in edgewise juxtaposed relation.

[0019] Each panel 20 is further provided with a pair of longitudinally extending stiffeners, not shown, extending the full length and transversely the thickness of the insulating material to add rigidity to the respective panel.

[0020] Referring also to Fig. 6, the concrete floor 12 and the footing 30 forms the foundation for the building 10. Anchor bolts 32 in the concrete secure a sole plate 34 thereto. Elongated lengths of drain flashing, indicated by the bold line 35, overly the outer lateral and upper edge portions of the sole plate and foundation below the adjacent panel skin.

[0021] The required plurality of the panels 20 are joined together in longitudinal edgewise juxtaposed position by the splines 26 as described hereinabove, to form each wall 14.

[0022] Each wall 14 is raised into position over the sole plate 34 wherein the panel bottom recess 36, formed by the skins 22 projecting beyond the bottom end of the panel, nest the sole plate 34. The skins are secured to opposing sides of the sole plate and the outer skin caulked, not shown. Adjacent wall end panels are cooperatively rabbeted in interlocking relation.

[0023] Similarly, a top rail 38 is nested by a similar recess in the top edges in the respective panels 20, thus rigidly securing the top and bottom edges of the wall panels 20.

[0024] Prior to applying the top rail 38, electrical wires 40 which preferably comprises a complete wiring assembly or "harness" unit is laid in the panel top horizontal grooves 42 and communicating vertical grooves preformed in selected panels to electrical outlet box positions 44 located on panel inner surfaces.

[0025] After installing the wiring harness unit, a top plate 46 overlies and is secured to the top rail 38. A face plate 48 coextensive with the respective wall 14 overlies its upper outer edge portion under the overhanging edge of the plate 46.

[0026] A U-shaped wall reinforcing band 50 extends around the perimeter of the building at the upper limit of its walls and projects above the plane of the top plate to form a roof stop 51 for the reason presently explained.

[0027] Additionally, an angular metallic brace 52 of selected dimensions reinforces the respective corner of the building to prevent separation of the walls at the respective corner of the building as a result of the mass of the roof 16 thereon.

[0028] The roof assembly 16 similarly comprises four substantially identical truncated apex isosceles triangular roof sections 54 formed by a plurality of panels 20' having predetermined lengths.

[0029] The box frame means 18 functions similar to an arch keystone in supporting the roof 16. The box frame means 18 comprises an open end compression frame 56 formed by a plurality, equal with the number of walls 14, of vertically disposed side wall members 58 of selected dimension. The box frame 56 is horizontally disposed and serves as a reference structure joining the roof sections and is initially supported at a predetermined elevation above the plane defined by the walls top plate 46 by scaffolding, not shown, and positioned relative to the walls by a plurality of roof adjusting bars 60 (Fig. 2).

[0030] As illustrated by Figs. 1 and 5, the compression frame 56 may be closed by any substantially conventional skylight cover 61, 61', or 61".

[0031] Each bar 60 is bifurcated at its upper end portion, as at 62 (Fig. 6), for nesting a corner portion of the frame 56. The bar 60 depending end portion overlies the top plate 46 at respective wall corner forming junctures of the building.

[0032] Each panel of the roof sections 54 is trimmed to required dimensions and placed in position with its top end edge 64 in supporting contact with a box frame wall surrounding outstanding ledge 66 on the frame wall 58. By way of example, the roof assembly is erected by first interposing the central most panel 20' of each roof section 54 between the upstanding stop 51, formed by the band 50 above the plate 46, and the cooperating compression box wall 58. The depending edge portion of each roof section is secured to the top plate 46 and abuts the upstanding edge of the band 50 (Fig. 6). The remaining roof section panels 20' are similarly joined in edge to edge juxtaposed relation as described hereinabove for the panels 20. The under surface of the respective bar 60 forms a finished appearance for the roof sections junctures.

[0033] Roofing 70 is placed in overlying position on the respective roof section 54. Fascia boards 68 conceal the member 50 and the angle brackets 52 to provide a pleasing appearance.

[0034] The upwardly disposed end surface 72 of the respective roof section 54 defines a triangular, in transverse cross section, shaped void 74 (Fig. 6) adjacent the outer surface of the box frame wall 58. This space 74 is covered by flashing 76 extending around the perimeter of the box frame 56 and is characterized by a downwardly inclined planar section 78 overlying the adjacent upper outer edge surface of the respective roof section 54. This flashing 76 is transversely doubled back upon itself over the void 74, as at 80 (Fig. 6A), to form

a space open downwardly in the plane of the roof for closely nesting the upwardly disposed end edge portion 82 of the roofing material which substantially preludes any separation in a curling action of the roofing 70 relative to the roofing panels 20'. The upturned upper terminal edge portion 84 of the flashing abuts the outer surface of the box frame wall 58.

[0035] The upwardly disposed end portion of roof juncture sheet caps 71 overlie the upper surface of the flashing 76 and underlie the overhanging lip 59 of the box frame.

[0036] Similarly, the depending end portion of the roof sheeting overhanging the lower end limit of the respective roof section 54 is provided with a U-shaped, in cross section, length of flashing 86 which nests the depending end edge portion of the roof sheeting, as illustrated by Fig. 6.

[0037] The respective longitudinal juxtaposed edges of the roof sections 54 form a polygonal, in transverse section, shaped void or opening between the longitudinal edges of the respective roof sections, as best shown by Fig. 4. This polygonal shaped opening is cooperatively filled with a length of polygonal, in cross section, shaped insulating material 88. The apex 90 of the polygonal shape is longitudinally covered by a pair of the flashing 76 disposed in inverted V-shaped relation. A coextensive inverted U-shaped cap 92 joins the upstanding lip portions 84 of the flashings. The flashings 76 are similarly doubled back upon themselves to receive an edge portion 82' of the roofing 70 to form a waterproof joint at this location. A portion of the polygonal shaped void receives wiring 40 in the manner described hereinabove.

[0038] Obviously, selected panels of the walls 14 are apertured to form openings closed, respectively, by a door 65 or window 67, as desired.

Industrial Applicability

[0039] Referring also to Figs. 7-11, the building 10 may be connected in spaced relation with a plurality of other similar buildings of equal or smaller dimensions as at 100, 102 and 104, by covered walkways 106 and 108. Each of the structures 100, 102, and 104 are formed substantially identical with the building 10 as described hereinabove.

[0040] The walkways 106 walls (Figs. 10 and 11) are similarly supported by a concrete floor and foundation 110. The shaded side or north wall 112 is formed by upright wall panels. overlying roof panels 20" are joined in upper edge opposing relation by juxtaposed rabbeted edge dimension lumber members 114 (Fig. 8A) extending between and secured to the walls of the buildings 10 and 100, respectively. The longitudinal side edges of the roof panels abutting the respective building wall outer surface is secured thereto by other dimension lumber members 115 (Fig. 11). The member 115 being in turn longitudinally rabbeted for nesting an edge portion of the respective panel skin 22. The sunny side of the walkway 106 is formed by a relatively low in height wall 14' as at 116. The glass 116 being supported between the short wall 14' and the top roof panel 20" in a substantially conventional manner as illustrated by Fig. 10A.

[0041] The walkway 108 may comprise a green house having its base portion substantially identical with respect to the concrete foundation and short wall 14' as illustrated by Fig. 10 and having a similar roof overlying the shaded side of the walkway with upright light and heat admitting glass panes 120 on the opposite side of the walkway 108 including a portion of the roof being formed by glass panel 122.

[0042] Alternatively, an enclosed walkway 124 is formed similar to the walkway 106 with the exception that imperforate panel walls 112' enclose both sides of the walkway and are joined with the overlying roof panels in the manner illustrated by Fig. 9.

Claims

1. A modular building structure (10) having a foundation (30), a floor (12) and a plurality of upright interconnected modular exterior side walls (14) supported by said floor (12), and a modular roof structure (16) supported only by said sidewalls (14), said modular roof structure (16) comprising a plurality of planar modular roof sections (54) of truncated apex triangular shape with said sections (54) each having a lower end edge surface abutting a stop (51) and being disposed in juxtaposed upwardly converging self-supporting cooperative relation from said stop and extending downwardly and outwardly at their depending ends above and beyond the vertical outer perimeter surfaces of said wails, and each roof section (54) comprising a plurality of laminated insulating material structure panels (20') joined in longitudinal edge fashion by splines, and, keystone box frame means (18) interposed between and secured to the upper truncated apex ends (64) of said roof sections (54); characterised by a top plate (46) overlying the respective exterior side wall (14), and an upwardly extending wall reinforcing band (50) located outwardly of said walls and circumferentially surrounding the outer upper vertical surfaces of said walls and forming a continuous retaining means preventing outward displacement of the walls (14) and forming a continuous inwardly facing stop (51) projecting above the upper limit of said top plate (46),

2. A structure as claimed in claim 1 in which the box frame means (18) is characterized by a multiwall vertically open frame (56), and a weatherproof cover (61) overlying the frame.

3. A structure as claimed in claim 1 or 2 in which each

sidewall (14) is characterized by a plurality of juxtaposed longitudinally interconnected laminated insulating material panels (20).

4. A structure as claimed in any of claims 1 to 3, in which the modular roof structure is further characterized by roof sheeting (70) overlying said roof sections (54), and, roof flashing means (76) nesting an edge portion of said roof sheeting (70) for weather tight sealing edges of the latter together and with said box frame means (18).

5. A structure as claimed in any of claims 1 to 4, further characterized by a foundation (30) supporting said walls, a sole plate (34) interposed between said walls (14) and the foundation (30), and, other weatherproof flashing (35) overlying the outer lateral and upper edge portion of the sole plate (34) and foundation (30).

6. A structure as claimed in any of claims 1 to 5, in which each roof section (54) comprises a plurality of laminated material structure panels (20'), and each panel (20') comprises a pair of skins (22) bonded to opposing sides of insulating material (24) and joined with adjacent panels (20') in longitudinal edge juxtaposition by splines (26).

7. A method of erecting a self supporting roof (16) on the upper limit of a modular structure (10) defined by a plurality of rigidly joined together upstanding exterior side walls (14), comprising the steps of: a) providing an open end compression frame (56) defined by a like plurality of vertical frame walls (58); b) surrounding the outer upper perimeter of the side walls (14) with an inwardly facing stop forming reinforcing band (50), c) providing a like plurality of cooperating triangular shaped modular roof sections (54) each including juxtaposed laminated insulating material panels (20') defining a base edge and a truncated edge (64); d) temporarily centrally supporting said compression frame on scaffolding at a predetermined elevation above a horizontal plane defined by the upper limit of said exterior walls (14) with the compression frame vertical walls (58) parallel with the respective exterior wall (14); and e) interposing said roof sections (54) in juxtaposed relation between the stop (51) on the upper limit of the respective upstanding exterior wall (14) and the cooperating comprehension frame vertical wall (58) in a predetermined sequence.

8. A method as ciaimed in claim 7 including the additional steps of: f) providing a planar top plate (38) for overlying the exterior side walls (14); g) securing said top plate (38) to the upper limit of the said walls (14) prior to step d); and, h) securing the perimeter band (50) to the upper limit of the side walls (14) in roof section stop (51) forming relation prior to step e).

9. A method according to claim 8 including the additional step of: i) interposing a roof section position adjusting bar (60) between the respective upstanding exterior side wall (14) and compression frame (18) vertical wall corner junctures.

10. A method as claimed in claim 9 in which step e) includes the additional steps of: j) centrally interposing the center most panel (20') of each roof section (54) between the upper limit of the respective upstanding wall (14) and the cooperating compression frame vertical wall (58); and, k) juxtaposing the remaining panels (20') of each roof section (54) with respective sides of the respective center most panel in a predetermined sequence.

11. A method as claimed in claim 7 including the additional step of: 1) interposing a roof section position adjusting bar (60) between the respective upstanding exterior side wall (14) and compression frame vertical wall (58) corner junctures.

Patentansprüche

1. Modulare Gebäudestruktur (10) mit einem Fundament (30), einem Boden (12) und einer Vielzahl durch den Boden (12) getragener, aufrecht stehender, miteinander verbundener modularer äußerer Seitenwände (14) und eine nur durch die Seitenwände (14) getragene modulare Dachstruktur (16), wobei die modulare Dachstruktur eine Vielzahl ebener modularer Dachabschnitte (54) mit stumpfscheitliger Dreiecksform umfasst, wobei alle Abschnitte (54) eine an einen Anschlag (51) anstoßende untere Abschlußkantenoberfläche aufweisen und ausgehend von dem Anschlag in nebeneinanderliegender, nach oben zusammenlaufender, selbsttragender, zusammenwirkender Beziehung angeordnet sind und sich nach unten und nach außen mit ihren abhängigen Enden oberhalb der vertikalen äußeren Umfangsoberflächen der Wände und über diese hinaus erstrecken, und alle Dachabschnitte (54) eine Vielzahl von laminierten Isoliermaterial-Strukturplatten (20') umfasst, die mit längsgerichtetem Kantenstoß durch Federn verbunden sind, und eine Scheitelkastenrahmeneinrichtung (18) umfasst die zwischen den oberen stumpfscheiteligen Enden (64) der Dachabschnitte (54) angeordnet und an diesen befestigt sind, gekennzeichnet durch eine die jeweilige äußere Seitenwand (14) überlagernde, obere Platte (46), und ein sich nach oben erstreckendes Wand-Verstärkungsband (50), das außerhalb der Wände angeordnet ist und die äußeren, oberen vertikalen Ober-

flächen der Wände über den Umfang umschließt und eine ununterbrochene Rückhalteeinrichtung bildet, das Verschiebungen der Wände (14) nach außen verhindert und einen über die obere Grenze der oberen Platte (46) herausragenden ununterbrochenen nach innen gerichteten Anschlag (51) bildet.

2. Struktur nach Anspruch 1, in welcher die Kastenrahmeneinrichtung (18) gekennzeichnet ist durch einen mehrlagigen, vertikalen, offenen Rahmen (56) und eine den Rahmen überziehende wetterfeste Abdeckung (61).

3. Struktur nach Anspruch 1 oder 2, in welcher jede Seitenwand (14) gekennzeichnet ist durch eine Vielzahl nebeneinanderliegender, längsgerichtet verbundener Isoliermaterial-Laminatplatten (20).

4. Struktur nach einem der Ansprüche 1 bis 3, In welcher die modulare Dachstruktur des weiteren gekennzeichnet ist durch eine die Dachsektionen (54) überlagernde Dachverkleidung (70) und Abweiseblecheinrichtung (76), die einen Kantenteil der Dachverkleidung (70) zum wetterdichten Versiegeln der Kanten derselben miteinander und mit der Kastenrahmeneinrichtung (18) verschachtelt.

5. Struktur nach einem der Ansprüche 1 bis 4, des weiteren gekennzeichnet durch ein die Wände tragendes Fundament (30), eine zwischen den Wänden (14) und dem Fundament (30) angeordnete Sockelplatte (34) und weitere wetterbeständige Ableiter (35), die den äußeren lateralen und oberen Kantenteil der Sockelplatte (34) und des Fundaments (30) überziehen.

6. Struktur nach einem der Ansprüche 1 bis 5 , in welcher jeder Dachabschnitt (54) eine Vielzahl von Laminatstrukturplatten (20') umfasst und jede Platte (20') ein Paar Außenhäute (22) umfasst, die an gegenüberliegenden Seiten des Isoliermaterials (24) gebunden und mit benachbarten Platten (20') mit längsgerichtetem Kantenstoß, nebeneinanderliegend durch Federn (26) verbunden sind.

7. Verfahren zum Errichten eines selbsttragenden Dachs (16) auf dem oberen Abschluß einer durch eine vielzahl fest verbundener, aufrecht stehender äußerer Seitenwände (14) festgelegten modularen Struktur (10), umfassend die Schritte: a) Vorsehen eines durch eine gleiche Vielzahl vertikaler Rahmenwände (58) festgelegten offenendigen Druckrahmens (56), b) Umschließen des äußeren oberen Umfangs der Seitenwände (14) mit einem einen Innenanschlag bildendem Verstärkungsband (50), c) Vorsehen einer gleichen Vielzahl zusammenwirkender, dreieckig geformter modularer Dachabschnitte (54), die jeweils nebeneinanderliegende laminierte Isoliermaterialplatten (20') enthalten, welche eine Basiskante und eine stumpfe Kante (64) festlegen, d) zeitweises zentrales Unterstützen des Druckrahmens auf einem Gerüst auf eine vorbestimmte Höhe oberhalb einer durch den oberen Abschluß der äußeren Wände (14) festgelegten horizontalen Ebene mit zu den jeweiligen äußeren Wänden (14) parallelen vertikaien Druckrahmenwänden (58), und e) Anordnen der Dachabschnitte (54) in nebeneinanderliegende Beziehung zwischen dem Anschlag (51) auf dem oberen Anschlag der jeweiligen aufrechtstehenden äußeren Wand (14) und der mit dieser zusammenwirkenden vertikalen Druckrahmenwand (58) in einer vorbestimmten Ordnung.

8. Verfahren nach Anspruch 7, enthaltend die zusätzlichen schritte: f) Vorsehen einer ebenen oberen Platte (38) zum Bedecken der äußeren Seitenwände (14), g) Befestigen der oberen Platte (38) an dem oberen Abschluß der Wände (14) vor Schritt d) und h) Befestigen des Begrenzungsbands (50) an dem oberen Abschluß der Seitenwände (14) in Beziehung zu dem Dachabschnittsanschlag (51) vor Schritt e).

9. Verfahren nach Anspruch 8, enthaltend den zusätzlichen Schritt: i) Anordnen eines Dachabschnitts-Positionseinstellbalkens (60) zwischen der. jeweiligen aufrechtstehenden äußeren Seitenwänden (14) und den Eckfugen der vertikalen Wände des Druckrahmens (18).

10. Verfahren nach Anspruch 9, in Schritt e) enthaltend die zusätzlichen Schritte: j) mittiges Anordnen der mittleren Platte (20') jedes Dachabschnitts (54) zwischen dem oberen Abschluß der jeweiligen aufrechtstehenden Wand (14) und der zusammenwirkenden Druckrahmen-Wände (58) und k) Nebeneinanderlegen der übrigen Platten (20') der Dachabschnitte (54) an jeweiligen Seiten der jeweiligen mittlersten Platte in vorbestimmter Reihenfolge.

11. Verfahren nach Anspruch 7, enthaltend den zusätzlichen Schritt: 1) Anordnen eines Dachabschnitts-Positionseinstellbalkens (60) zwischen der jeweiligen aufrechtstehenden äußeren Seitenwand (14) und den Eckfugen der vertikalen Wände (58) des Druckrahmens.

Revendications

1. Structure de bâtiment modulaire (10) ayant des fondations (30), un plancher (12) et une pluralité de murs latéraux extérieurs modulaires (14) reliés les uns aux autres selon un agencement vertical, sup-

portés par ledit plancher (12) et une structure de toit modulaire (16) supportée seulement par lesdits murs latéraux (14), ladite structure de toit modulaire (16) comprenant une pluralité de sections de toit modulaire planes (54) ayant une forme triangulaire aux sommets tronqués, lesdites sections (54) ayant chacune une surface de bord d'extrémité inférieure venant en appui contre une butée (51) et étant disposée selon une relation de coopération d'autoportance convergeant vers le haut et juxtaposée à partir de ladite butée et s'étendant vers le bas et vers l'extérieur au niveau de leurs extrémités dépendantes au-dessus et au-delà des surfaces de périmètre extérieur verticales desdits murs, et chaque section de toit (54) comprenant une pluralité de panneaux (20') fabriqués dans une structure se composant d'un matériau isolant stratifié, assemblés par les bords longitudinaux par des cannelures et des moyens formant bâti en caisson à clef de voûte (18) intercalés entre et fixés aux extrémités supérieures des sommets tronqués (64) desdites sections de toit (54) ; caractérisée par une plaque supérieure (46) recouvrant le mur latéral extérieur respectif (14), et une bande de renfort de mur s'étendant vers le haut (50) située vers l'extérieur desdits murs et entourant circonférentiellement les surfaces verticales supérieures extérieures desdits murs et formant des moyens de retenue continus empêchant tout déplacement des murs (14) vers l'extérieur et formant une butée continue tournée vers l'intérieur (51) faisant saillie au-dessus de la limite supérieure de ladite plaque supérieure (46),

2. Structure selon la revendication 1, dans laquelle les moyens de bâti en caisson (18) sont caractérisés par un bâti à plusieurs murs verticalement ouvert (56) et une couverture résistante aux intempéries (61) recouvrant le bâti.

3. Structure selon la revendication 1 ou 2, dans laquelle chaque mur latéral (14) est caractérisé par une pluralité de panneaux stratifiés fabriqués en matériau isolant (20), reliés les uns aux autres longitudinalement et juxtaposés.

4. Structure selon l'une quelconque des revendications 1 à 3, dans laquelle la structure de toit modulaire est caractérisée en outre par un blindage de toit (70) recouvrant lesdites sections de toit (54) et des moyens de doublage de toit (76) logeant une partie de bord dudit blindage de toit (70) pour rendre étanches aux intempéries les bords de ce dernier en même temps que et avec lesdits moyens de bâti en caisson (18).

5. Structure selon l'une quelconque des revendications 1 à 4, caractérisée en outre par des fondations (30) supportant lesdits murs, une dalle (34) intercalée entre lesdits murs (14) et les fondations (30) et un autre doublage résistant aux intempéries (35) recouvrant la partie latérale extérieure et la partie de bord supérieure de la dalle (34) et des fondations (30).

6. Structure selon l'une quelconque des revendications 1 à 5, dans laquelle chaque section de toit (54) comprend une pluralité de panneaux (20') ayant une structure en matériau stratifié et chaque panneau (20') comprend une paire de revêtements (22) collés sur les côtés opposés du matériau isolant (24) et assemblés aux panneaux adjacents (20') par une juxtaposition des bords longitudinaux à l'aide de cannelures (26).

7. Procédé pour ériger un toit autoportant (16) sur la limite supérieure d'une structure modulaire (10) définie par une pluralité de murs latéraux extérieurs (14) verticaux et assemblés les uns aux autres de manière rigide, comprenant les étapes consistant à : a) fournir un bâti de compression à extrémités ouvertes (56) défini par une pluralité similaire de murs de bâti verticaux (58), b) entourer le périmètre supérieur extérieur des murs latéraux (14) avec une butée tournée vers l'intérieur formant une bande de renfort (50), c) fournir une pluralité similaire de sections de toit modulaire (54) en forme de triangles coopérant, chacune définissant un bord de base et un bord tronqué (64), d) supporter au centre de manière provisoire ledit bâti de compression sur un échafaudage à une hauteur prédéterminée au-dessus d'un plan horizontal défini par la limite supérieure desdits murs extérieurs (14), les murs verticaux (58) du bâti de compression étant parallèles au mur extérieur respectif (14) et e) intercaler lesdites sections de toit (54) en relation de juxtaposition entre la butée (51) sur la limite supérieure du mur extérieur vertical respectif (14) et le mur vertical (58) du bâti de compression coopérant dans un ordre prédéterminé.

8. Procédé selon la revendication 7, comprenant les étapes supplémentaires consistant à : f) fournir une plaque supérieure plane (38) pour recouvrir les murs latéraux extérieurs (14), g) fixer ladite plaque supérieure (38) sur la limite supérieure desdits murs (14) avant l'étape d), et h) fixer la bande de périmètre (50) à la limite supérieure des murs latéraux (14) dans la butée de sections de toit (51) en relation avant l'étape e).

9. Procédé selon la revendication 8, comprenant l'étape supplémentaire consistant à : i) intercaler une barre d'ajustement (60) de position des sections de toit entre les jonctions en coin respectives des murs latéraux extérieurs verticaux (14) et des murs verticaux du bâti de compression (18).

10. Procédé selon la revendication 9, dans laquelle l'étape e) comprend les étapes supplémentaires consistant à : j) intercaler de manière centrale le panneau le plus au centre (20) de chaque section de toit (54) entre la limite supérieure du mur vertical respectif (14) et le mur vertical (58) du bâti de compression coopérant ; et k) juxtaposer les panneaux restants (20') de chaque section de toit (54) avec les côtés respectifs du panneau respectif le plus au centre dans un ordre prédéterminé.

11. Procédé selon la revendication 7, comprenant l'étape supplémentaire consistant à : i) intercaler une barre d'ajustement de position (60) des sections de toit entre les jonctions respectives des murs latéraux extérieurs verticaux (14) et des murs verticaux (58) du bâti de compression.

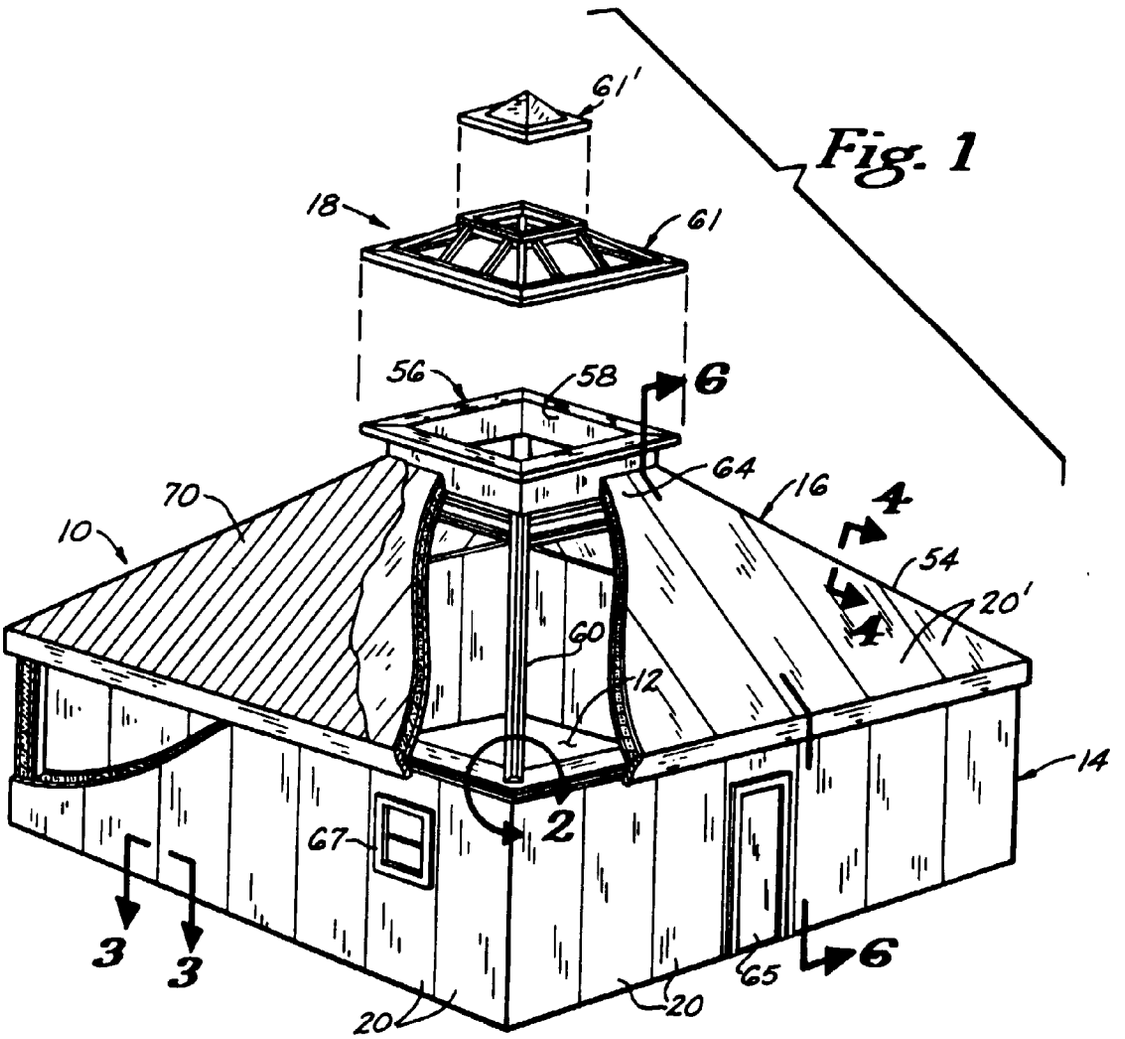


Fig. 1

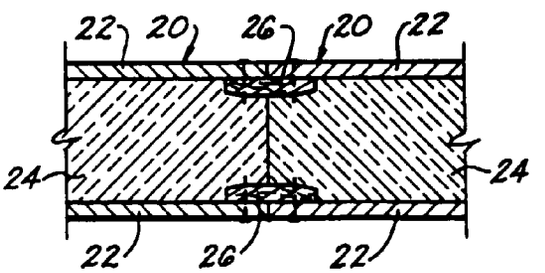
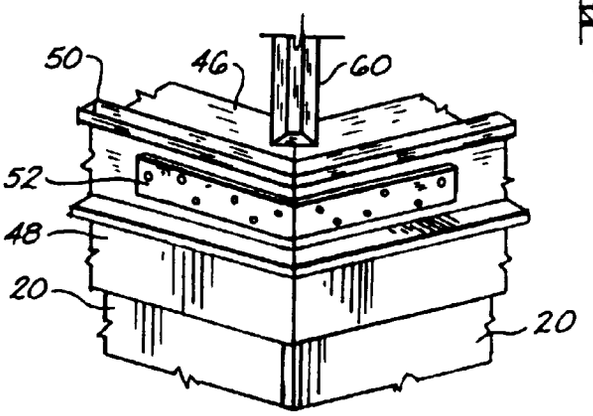


Fig. 3

Fig. 2



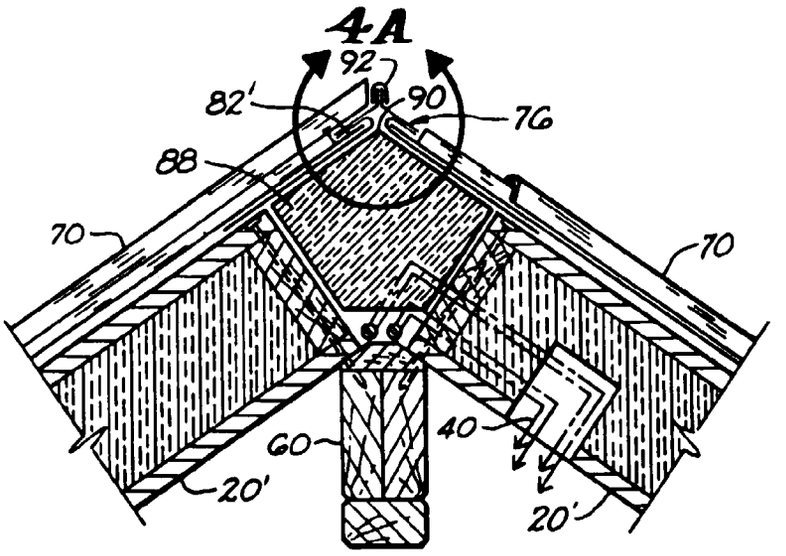


Fig. 4

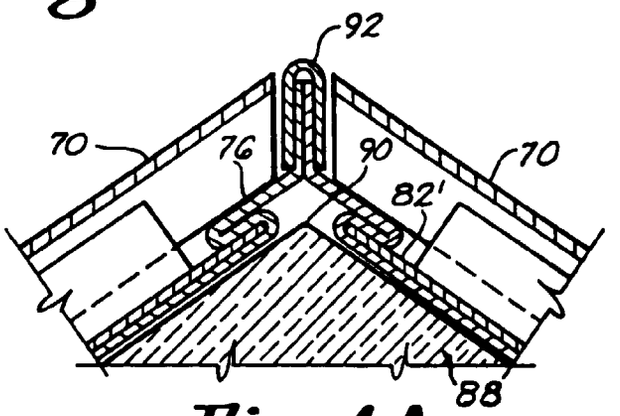
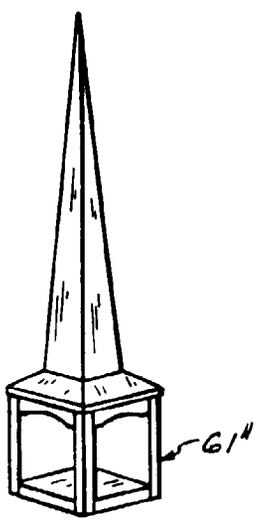


Fig. 4A

Fig. 5



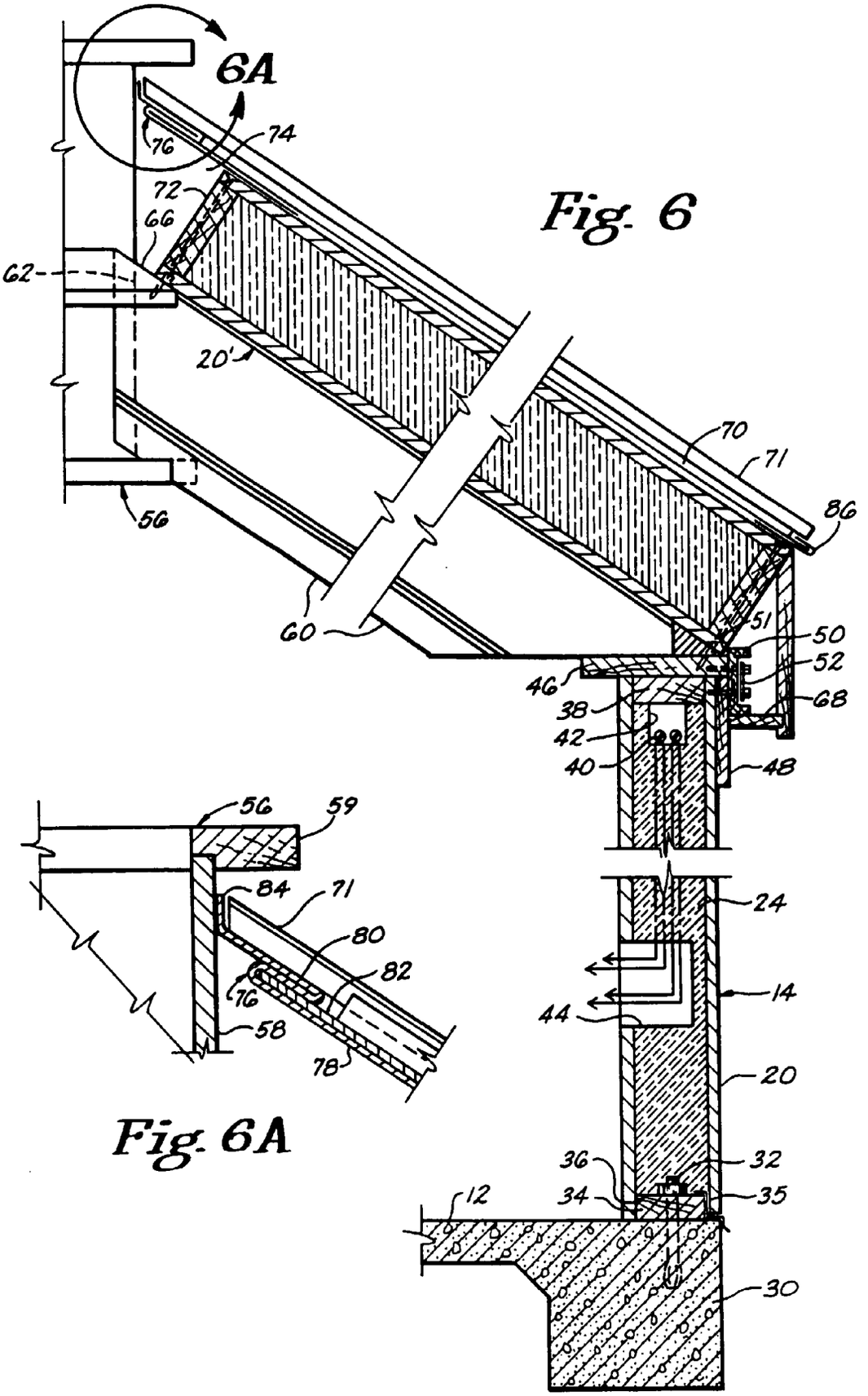

6A
76
74
72
66
62
20'
56
70
71
86
60
51
50
52
46
68
38
42
40
48
24
14
44
20
36
32
34
35
12
30

Fig. 6

56
59
84
71
80
82
76
58
78

Fig. 6A

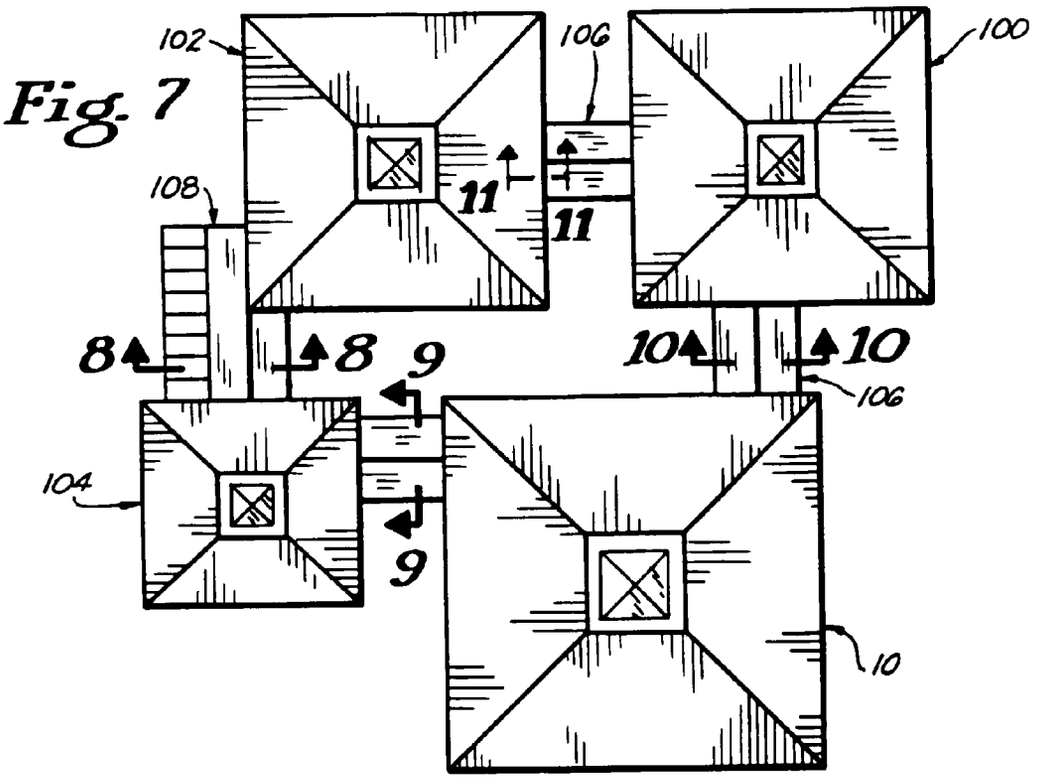


Fig. 7

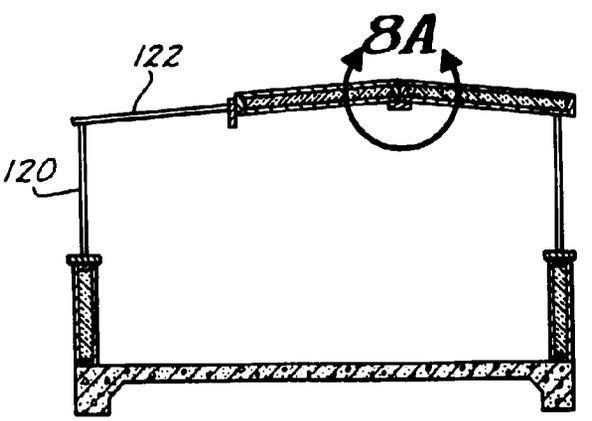


Fig. 8

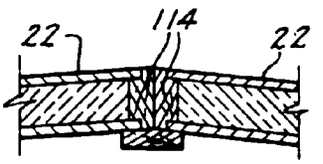


Fig. 8A

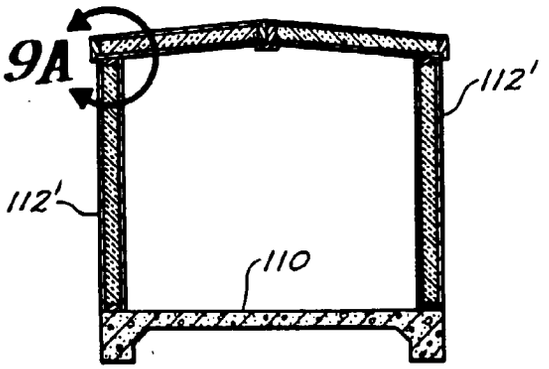


Fig. 9

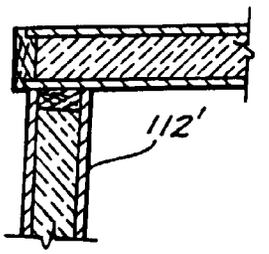


Fig. 9A

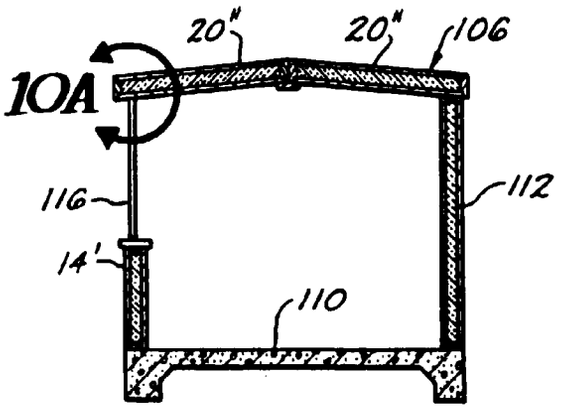


Fig. 10

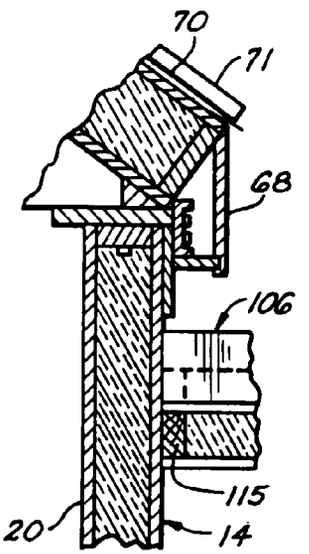


Fig. 11

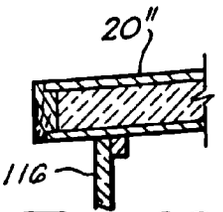


Fig. 10A

Fig. 12