United States Patent [19]

Nicoll, Jr.

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[45] **Mar. 26, 1974**

[54] **BUILDING FORMED OF PRECUT, FOLDABLE SITE ERECTED PAPER BOARD PANELS**

[76] Inventor: **Frank S. Nicoll, Jr.**, Dolfield Rd., Owings Mills, Md. 21117

[22] Filed: **Dec. 27, 1971**

[21] Appl. No.: **212,345**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 195,139, Nov. 3, 1971, abandoned.

[52] **U.S. Cl.** **52/90**, 52/274, 52/293, 52/615, 52/630

[51] **Int. Cl.** **E04b 7/02**

[58] **Field of Search** ..... 52/90, 92, 71, 98, 105, 52/70; 46/12, 17–21, 30, 31, 1 L; 229/37 R, 37 E, 22; 248/174

[56] **References Cited**

UNITED STATES PATENTS

3,564,785	2/1971	Kephart	52/71 X
3,368,316	2/1968	Crowder	46/19 X
310,599	1/1885	Lybrand	229/37 R
3,577,672	5/1971	Nutting	46/12 X
3,699,731	10/1972	Arnold	52/71 X
1,988,388	1/1935	Midton	52/92
2,022,305	11/1935	Wellman	229/37 R
2,665,837	1/1954	Guyer	229/37 R
3,186,524	6/1965	Spaeth	52/86
3,427,767	2/1969	Schaefer	52/90 X

FOREIGN PATENTS OR APPLICATIONS

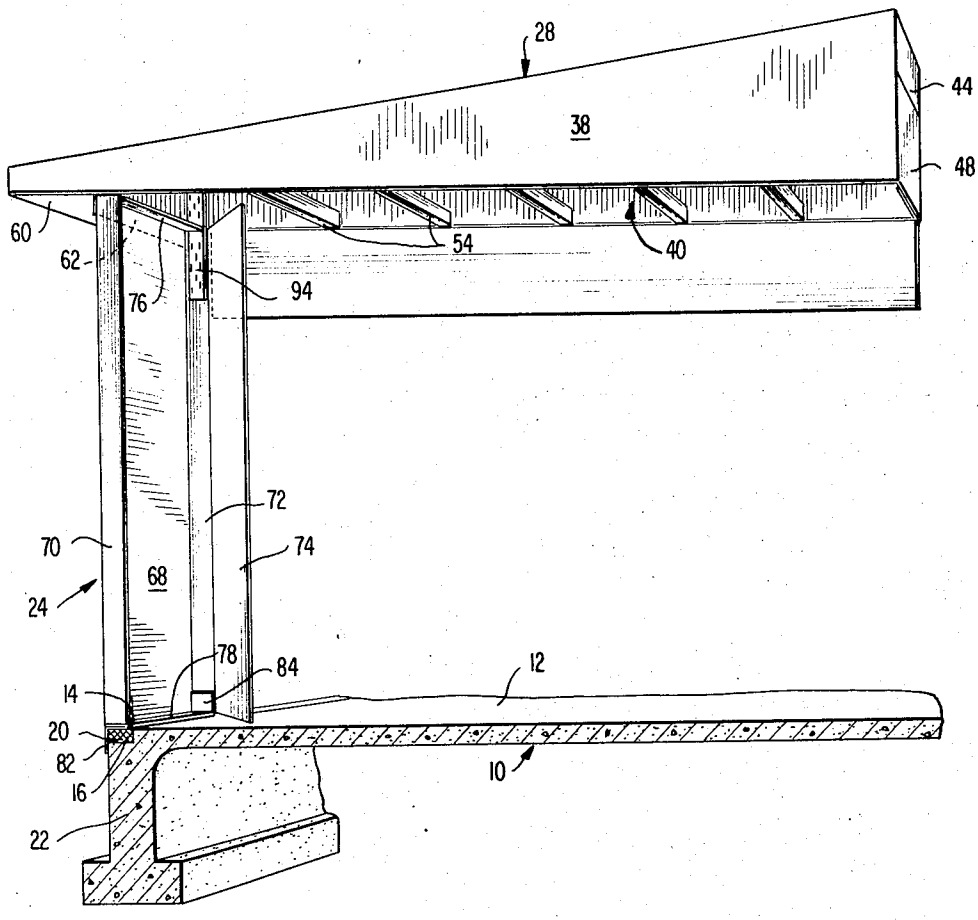
6,617,162	7/1967	Netherlands	229/37 R

Primary Examiner—Frank L. Abbott
Assistant Examiner—John R. Masterman
Attorney, Agent, or Firm—Sughrue, Rothwell, Mion, Zinn & Macpeak

[57] **ABSTRACT**

A building is constructed of precut, foldable, site erected waterproof and weather proof fiberglass reinforced, resin treated, paper board panels in the form of triangular roof trusses and rectangular end and side panels fastened in serial abutting fashion. Multi-ply panel portions are provided at load centers without compromising simplicity in design and ease in assembly of the panels to form the building, and rigidity and strength of the finished structure. Novel, high strength fasteners couple overlapping panel wall portions.

8 Claims, 22 Drawing Figures



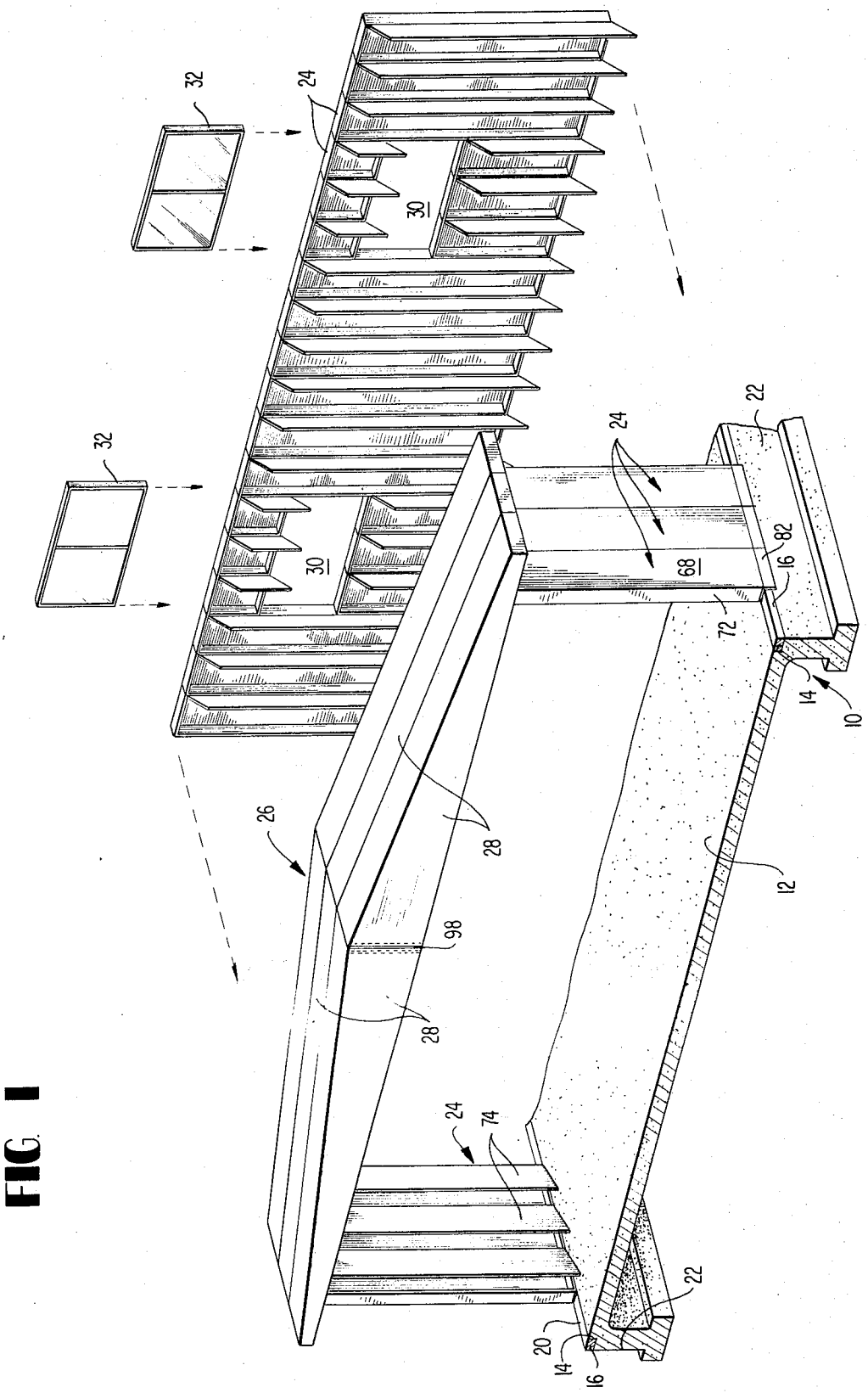
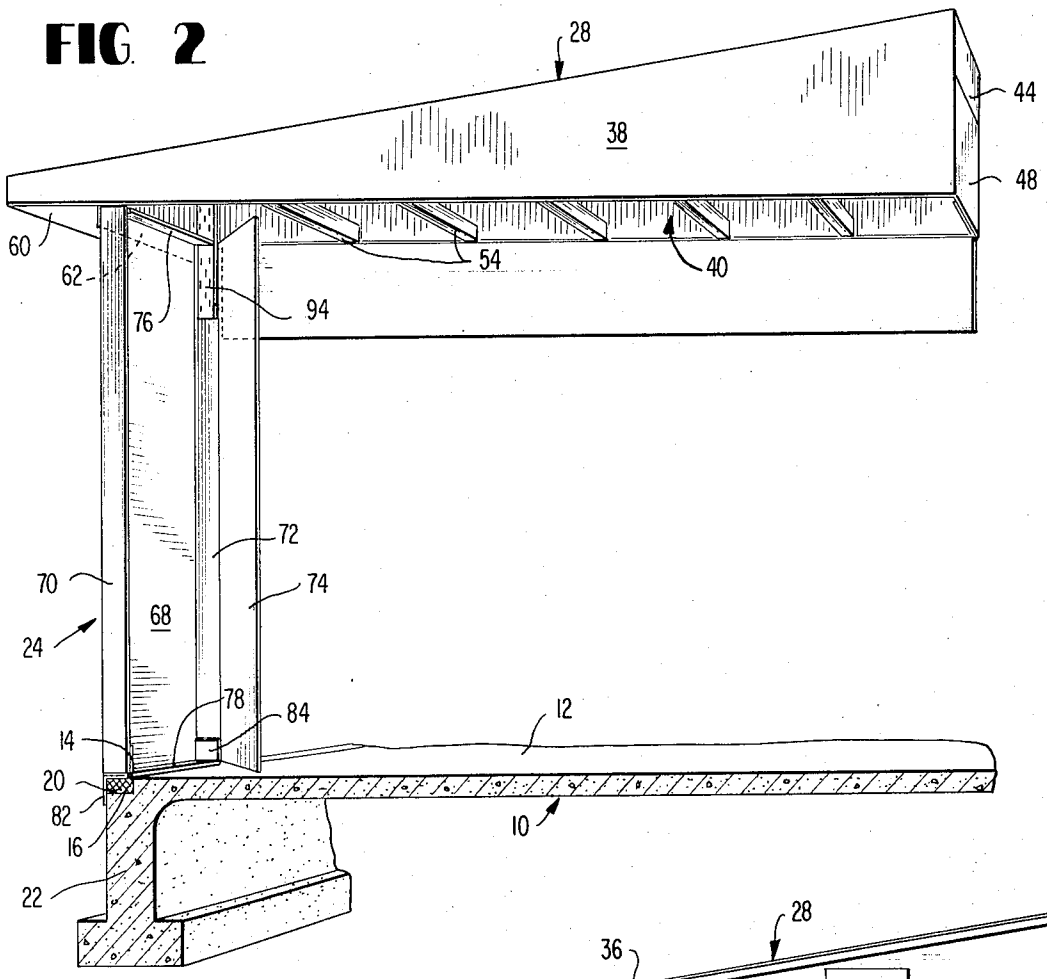


FIG. 1

FIG. 2



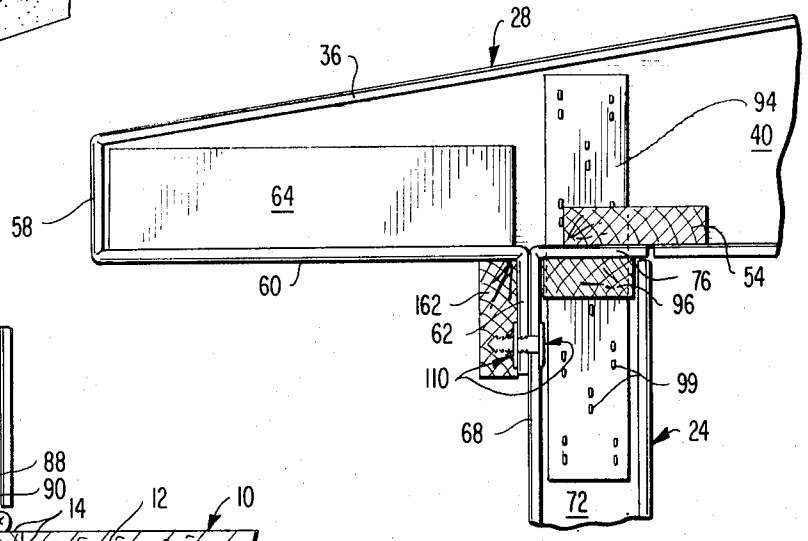


FIG. 3

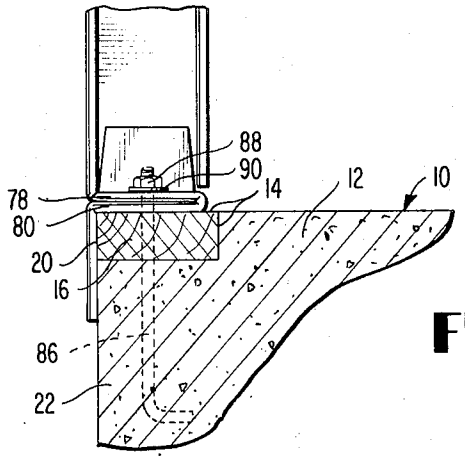


FIG. 4

FIG. 5

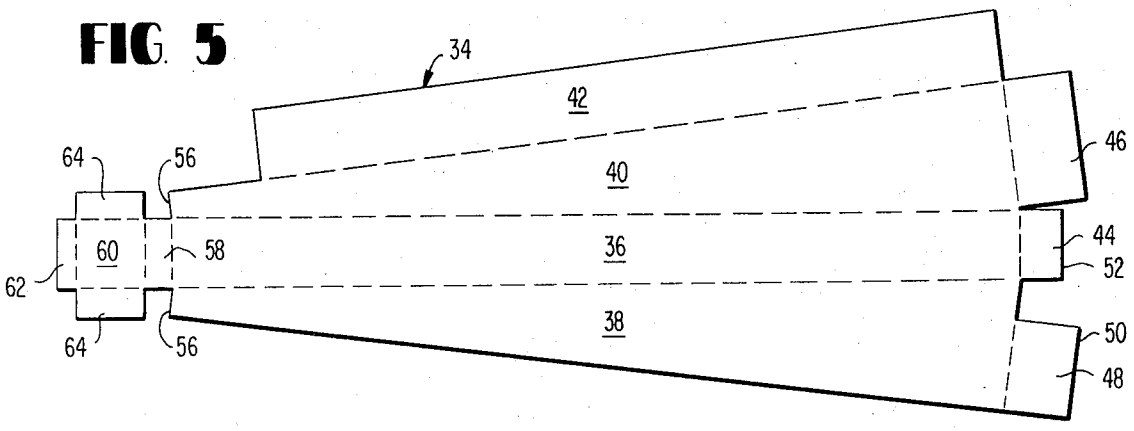


FIG. 6

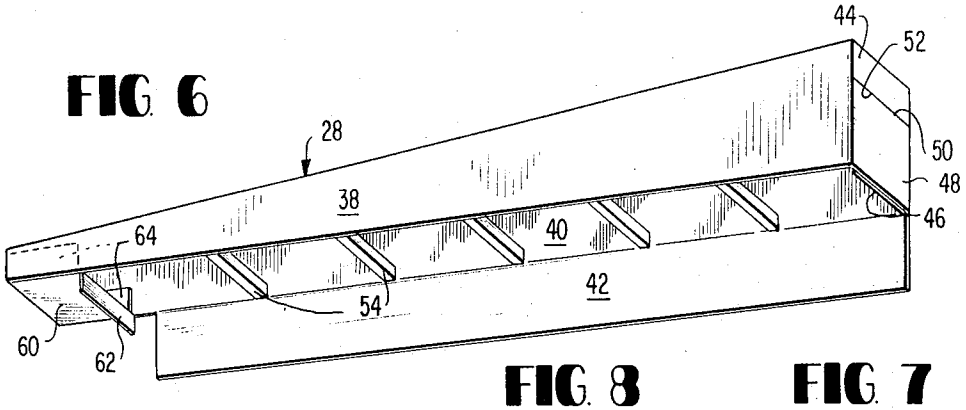


FIG. 8

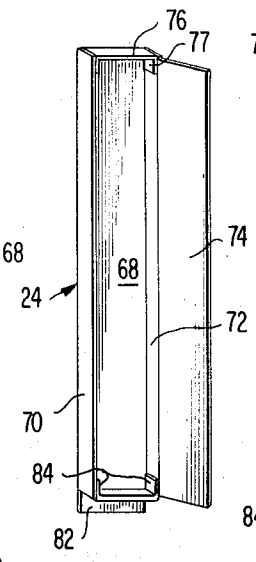
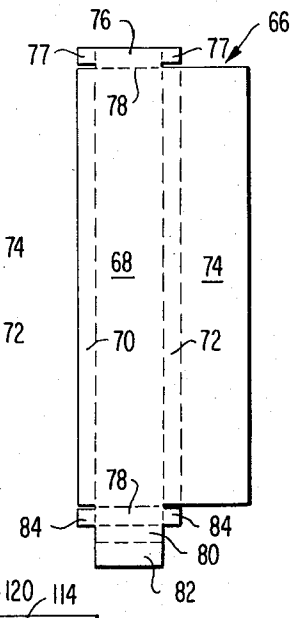


FIG. 7



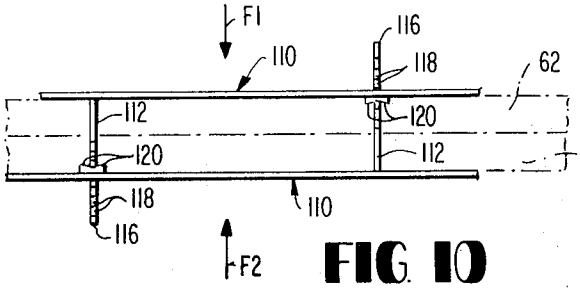


FIG. 10

FIG. 9

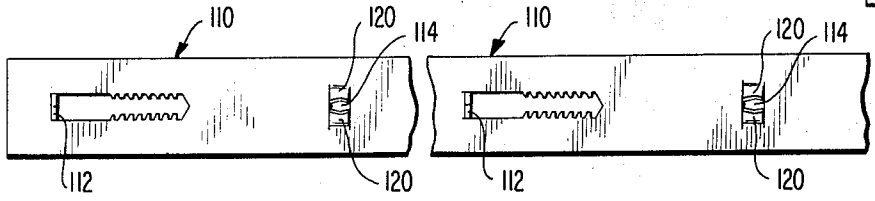
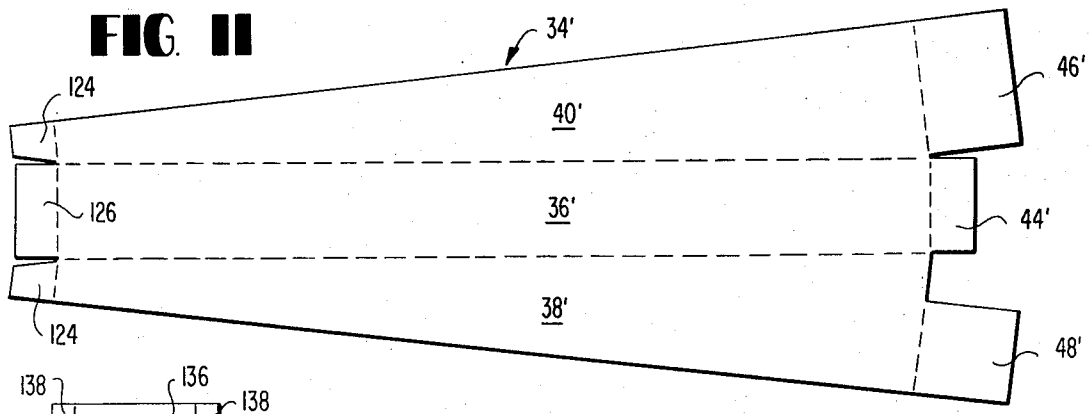


FIG. 11



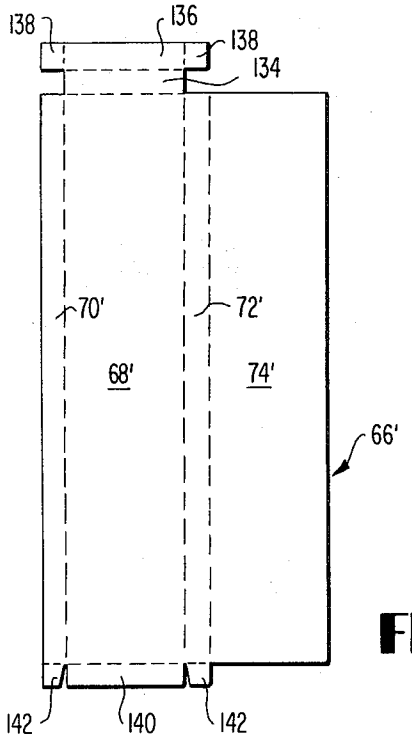


FIG. 12

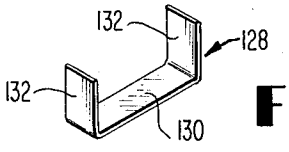


FIG. 14

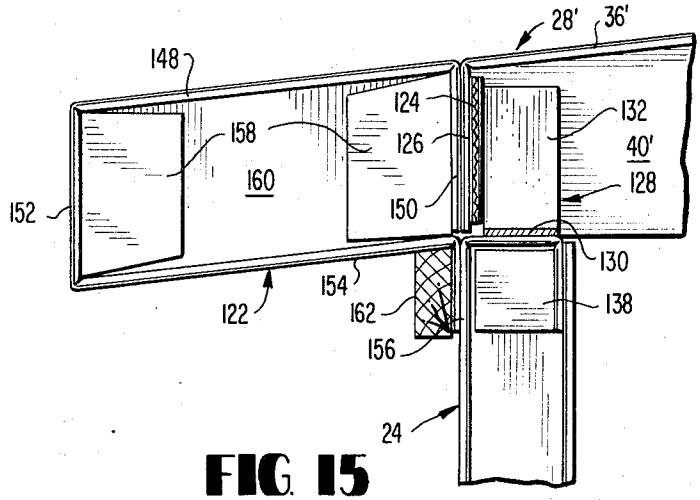


FIG. 15

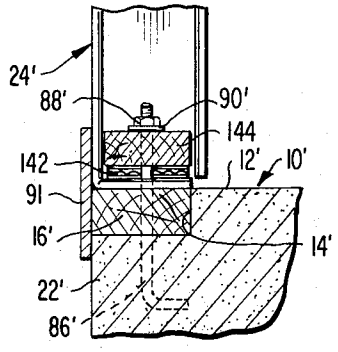


FIG. 13

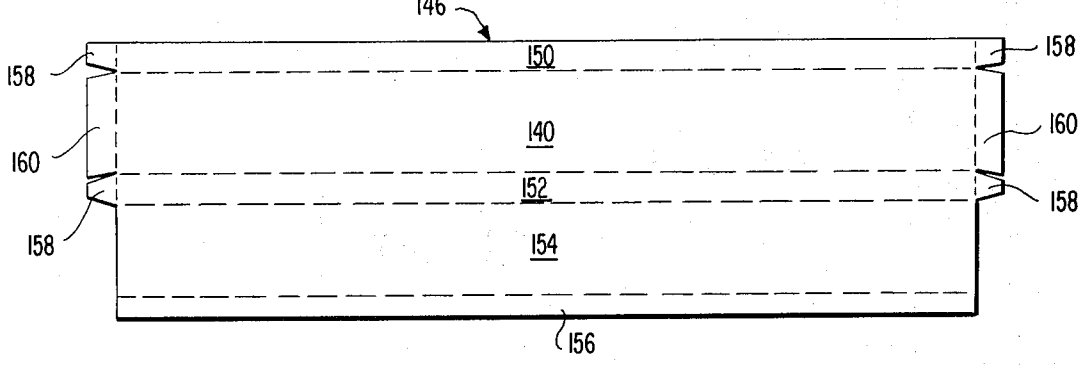
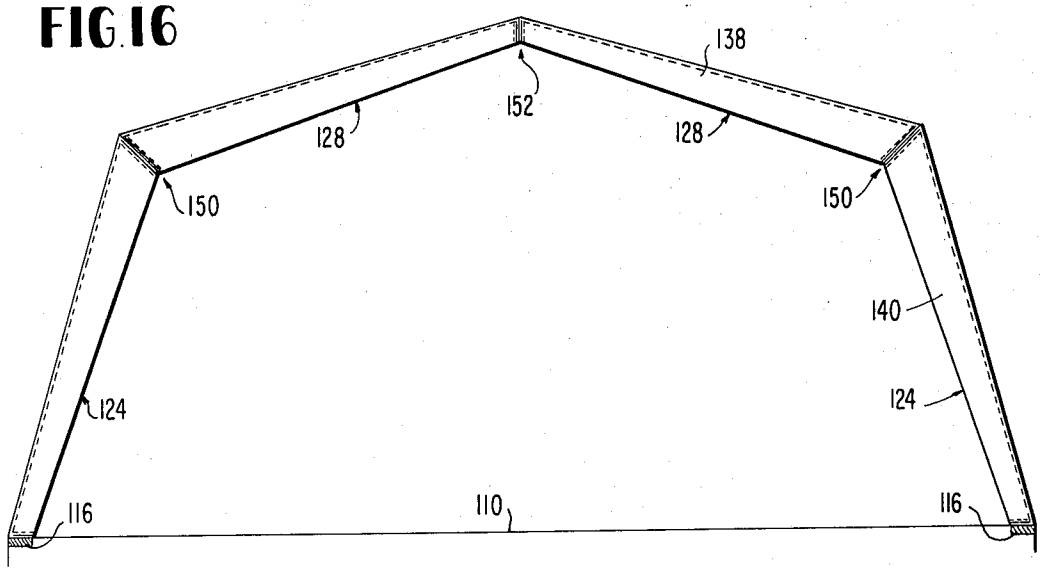


FIG. 16



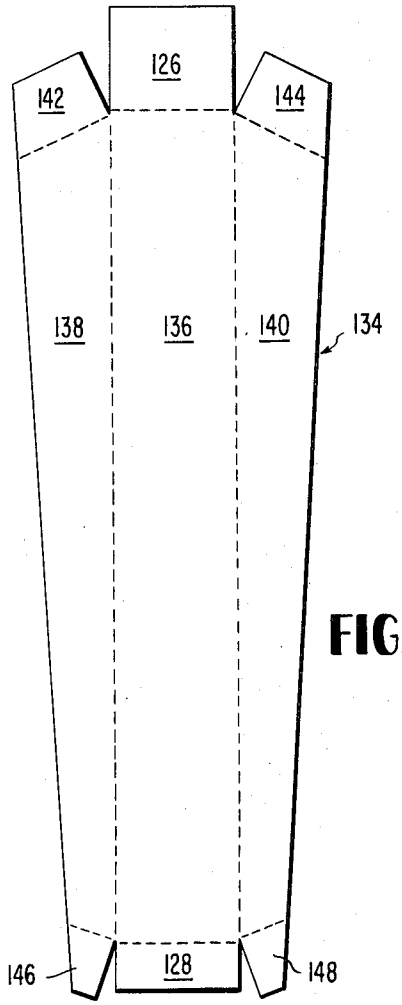


FIG. 17

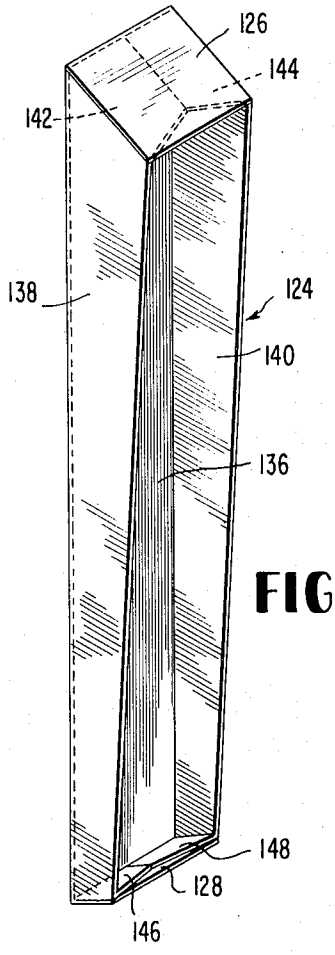
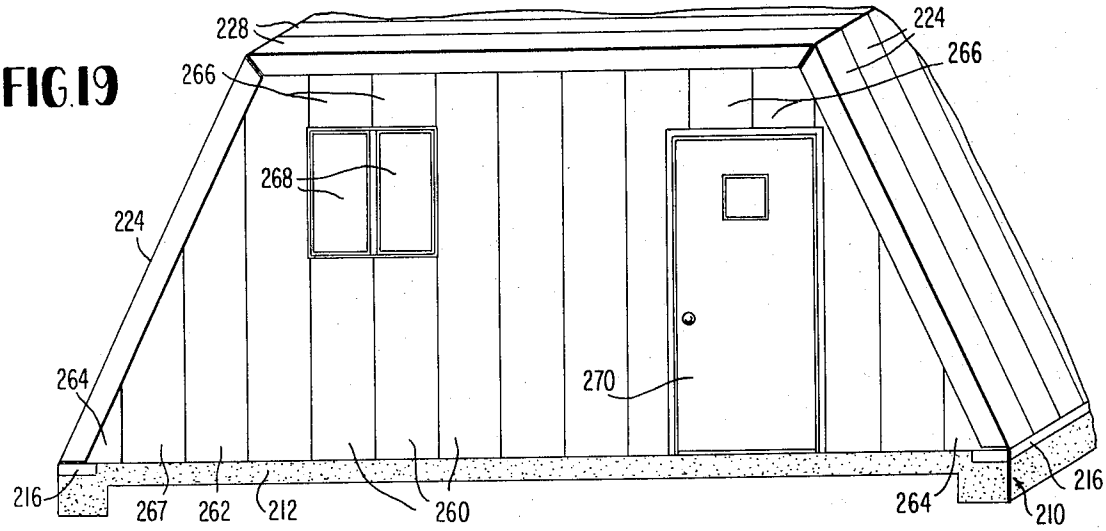


FIG. 18

FIG. 19



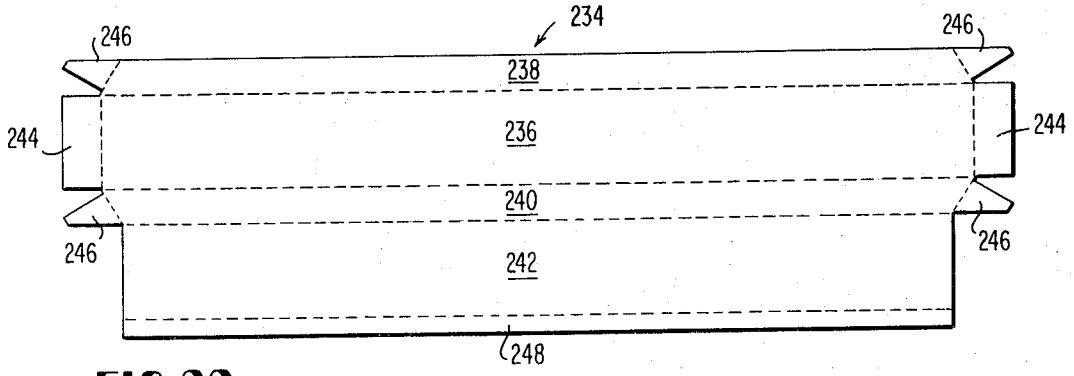
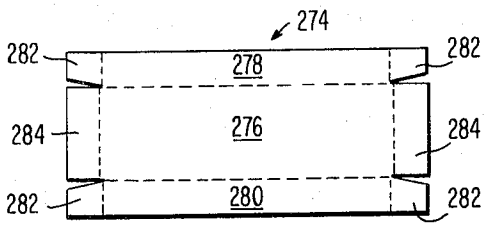


FIG. 20

FIG. 21



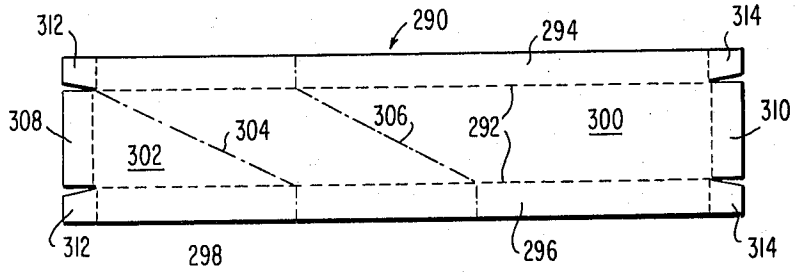


FIG. 22

BUILDING FORMED OF PRECUT, FOLDABLE SITE ERECTED PAPER BOARD PANELS

This application is a continuation in part application of application Ser. No. 195,139 filed Nov. 3, 1971, and identically entitled, now abandoned.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a new and novel method in the construction of buildings and, in particular, to paper board, triangular roof trusses, identical trapezoidal side wall and roof panels, and rectangular end and side panels used in the construction of houses, storage sheds, garages, motels, etc.

2. Description of the Prior Art

Reinforced, waterproof paper board sheet material has been employed in the construction of various types of buildings in recent years, taking the form of roof and side panels having structural rigidity and capable of sustaining normal loads. This has resulted in the construction of buildings formed almost entirely of paper board panels without the necessity of conventional metal or wood frames allowing on site erection or assembly of prefabricated modular sections premanufactured at factories remote from the building site.

One form of such paper board building makes use of modular panels in which the panels are precut from sheet material and provided with fold lines defining the various walls of the modular panels and provided at the ends with tabs such that on site formation of the panel consists of bending the sheet about the fold lines and fastening the panel walls together by stapling the overlapping tabs and/or walls. A panel consisting of at least one center wall and opposed right angle side or edge walls forms a modular panel with sufficient rigidity that it may be employed in conjunction with other panels to form roof and side wall sections of inverted U-shape. The U-shaped sections known as "tunnels" are then joined end to end by fastenings such as by stapling the abutting side or edge walls, and multi-ply, inverted, edge abutting U-shaped tunnels have their ends coupled to a floor or other foundation to form an angular rectangular building structure.

While paper board buildings constructed in such a manner have allowed fabrication of the panels from precut and scored sheets delivered to the erection site, to reduce cost in transporting of the building material, and while the modular building formed thereby may be constructed in a relatively inexpensive fashion by unskilled labor, paper board structures of this type to date lack the structural integrity at the load centers to allow such buildings to be built of comparatively large size. Further, the ability of such building panels to withstand adverse weather and other climatic forces are highly questionable.

SUMMARY OF THE INVENTION

The present invention is directed to an improved building structure formed of precut, foldable, site erected, fiberglass reinforced, resin-coated paper board panels in which multi-ply panel walls are provided at various load centers without compromising the simplicity in design and ease in assembly of the panels to form the building. The present invention further allows the paper board panels to take the form of triangular roof trusses and vertical rectangular end and side panels which are provided with optional internal walls in various expeditious manners.

Preferably, the building structure is formed of a plurality of prefabricated abutting fiberglass reinforced, resin-coated paper board panels with their sides fastened together to form a complete building side wall. The improvement resides in each side wall panel comprising at least one side wall having hinged end walls extending at right angles along the sides of the same to define stud flanges. In one embodiment, the side wall panel extends at one end beyond the ends of the edge walls and bears four fold lines defining three side wall extension portions, and, in that order, the first two are folded back on themselves and are of equal dimensions in the direction along the length of the panel to form a two-ply end wall with the third panel side wall extension portion acting as an extension of the side wall itself, lying coplanar therewith, and being at right angles to the two-ply end wall to thereby facilitate fastening of the panel at that end to a building foundation or base in mutually distinct right angle planes. Two tabs may extend outwardly on each side of one of the first two side wall extension portions for attachment to respective edge walls in mutually overlapping engagement to rigidly locate the edge walls at right angles to the side and form a rigid load bearing member.

The invention is further directed to a roof truss assembly consisting of two series of abutting end-to-end fastened, oppositely directed boxed end roof truss panels. Each panel is formed of a single sheet of fiberglass reinforced, resin-coated paper board material including fold lines defining a central, rectangular roof portion or central wall, and at least two side walls of trapezoidal shape extending along respective sides of the center wall. Aligned fold lines near one end of the center wall and side walls define tabs which mutually overlap when the side walls are folded at right angles to the center wall. The length of the center wall tab is less than the full width of one of the side wall tabs and the other side wall tab extends from its outer edge inwardly a length equal to the difference between the length of the edge from which it extends and the length of the center wall tab. The other end of the center wall extends beyond the ends of the side wall and carries fold lines to define three center wall extension portions, the first having a length equal to the height of the side wall at that end, and when folded abuts the same to form an end wall, said second center wall extension portion defining a bottom wall for the boxed end truss panels and the third center wall extension portion projecting downwardly and at right angles to the bottom wall of the truss panel to facilitate fastening of a side panel thereto. With oppositely directed roof truss panels being fastened end to end, there is formed a four-ply king post of high structural integrity, capable of supporting heavy loads.

The invention is also directed to a building structure in which the sides and roof and formed of multiple series of end to end connected identically configured panels, with each panel being formed of a single paper board sheet and comprising at least one center wall with integral side walls extending the length of the center wall and contiguous tabs extending from coextensive ends of said center and side walls as defined by fold lines therein, such that the center wall tabs are rectangular in configuration, while the side wall tabs are trapezoidal in configuration. The side wall tabs are defined

by fold lines inclined inwardly of the center wall tab fold line, with the side wall tabs being of a length equal to one-half the width of the center wall tabs such that when the end walls are folded at right angles to the center wall for each panel, in the same direction, and the center wall and side wall tabs are also folded at right angles in the same direction, the tabs lie in mutually overlapping positions to define a four-ply king post or girt connection between the end abutting panels.

In one form, the building structure is characterized by a series of horizontal roof panels which join at respective ends, oppositely inclined series of side wall panels, while front and rear walls comprise side wall abutting panels having identically formed multi-ply ends to the roof panels and the side wall panels. Alternatively, the building structure may consist of four side wall abutting series of panels which are trapezoidal in elevation with the series of panels in end to end abutment such that the outer two series of panels are inclined inwardly at an acute angle with respect to a horizontal support surface, while the inner two series of panels end abut each other and to the respective outer two series of panels to define obtuse angles therebetween. Further, the smaller ends of the outer two series of panels abut the horizontal support surface, while the smaller ends of the inner two series of panels abut each other to define the roof center, while the larger ends of both the inner and outer series of panels abut each other to form a four-ply, large surface area load center girt connection.

Panels may be fastened to other panels, tabs to side or end walls or tabs to each other in mutually overlapping fashion, by means of sheet metal fasteners consisting of metal strips on opposite sides of the paper board panel layers being coupled. The fasteners have projections or barbed prongs struck out of the same extending outwardly at right angles to the plane of the metal strip. The prongs have pointed ends and serrated sides defining barbs and are received within the hexagonal openings of the opposed metal strip. The serrations permit easy entry of the barbed prong within the hexagonal opening but resist retrograde movement. The height of the prong and the length of the barbed area permit the oppositely oriented, dual metal fastening strips to be applied to overlapping paper board sheets in layers numbering two or more.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective, partially exploded view of a building employing the improved fiberglass reinforced, resin-coated paper board panels of the present invention.

FIG. **2** is a perspective view of a portion of the building of FIG. **1**, partially in section, and illustrating the construction of the improved side panel and one section of the boxed end roof truss and ceiling panel forming portions thereof.

FIG. **3** is an enlarged, sectional view of the arrangement for connecting the side panel to the roof truss section illustrated in FIG. **2**.

FIG. **4** is an enlarged sectional view of the arrangement for coupling the bottom end of the side wall panel to the floor slab of the building of FIG. **2**.

FIG. **5** is a plan view of a precut paper board sheet forming the unitary truss panel illustrated in FIG. **2**, prior to set-up.

FIG. **6** is a perspective view of a truss panel after folding and fastening of the panel walls.

FIG. **7** is a plan view of a pre-cut paper board sheet forming a typical side or end panel employed in the construction of the building of FIG. **1**, prior to set-up.

FIG. **8** is a perspective view of the side or end panel of FIG. **7** after set-up.

FIG. **9** is a plan view of portions of a pair of metal strip fasteners employed in fastening the paper board panels of the present invention.

FIG. **10** is an elevational view of the pair of metal strip fasteners of FIG. **9** employed in coupling two paper board panels together.

FIG. **11** is a plan view of a pre-cut paper board sheet forming an alternate embodiment of the roof truss panel, prior to set-up.

FIG. **12** is a plan view of a pre-cut paper board sheet forming an alternate embodiment of the side wall, prior to set-up.

FIG. **13** is a plan view of a pre-cut paper board sheet forming a separate overhang panel in the embodiment of the building illustrated in FIG. **15**.

FIG. **14** is a perspective view of a U-shaped roof panel-wall panel connector employable in the construction of the building illustrated partially in FIG. **15**.

FIG. **15** is a side elevational view, in section, of an alternate embodiment of the present invention, employing the panels illustrated in FIGS. **11**, **12** and **13**.

FIG. **16** is a front elevational view of a building employing in alternate embodiment form, the improved fiberglass reinforced, resin-coated paper board panels of the present invention.

FIG. **17** is a plan view of a precut paper board sheet forming either a roof or side wall panel of the building of FIG. **16**, prior to set-up.

FIG. **18** is a perspective view of a side wall or roof panel employed in the construction of the building of FIG. **16**.

FIG. **19** is a perspective view of a building employing in yet another form, the improved fiberglass reinforced, resin-coated paper board panels of the present invention.

FIG. **20** is a plan view of a precut paper board sheet forming one of the side wall or roof panels of the building of FIG. **19**, prior to set-up.

FIG. **21** is a plan view of a precut paper board sheet of an end wall panel employed in the construction of the building of FIG. **19**, prior to set-up.

FIG. **22** is a plan view of a precut paper board sheet forming, after severance, a pair of identically configured end wall panels in the construction of the building of FIG. **19**, prior to set-up.

DESCRIPTION OF PREFERRED EMBODIMENTS

One embodiment of a high strength completely fiberglass reinforced, resin-coated paper board building constructed principally with the roof truss and side panels of the present invention is illustrated in FIG. **1**. The building consists of a pre-formed cast concrete foundation **10** having an integral floor slab **12** with the outside edges of the same being recessed at **14** and carrying a wooden mounting plate **16** which may be a 2 × 4, 2 × 8, 2 × 10 board, or the like, with the top of the plate **16** lying flush with the top of the floor slab **12** and the side **20** of the mounting plate lying flush with the side wall **22** of the foundation. The front, rear and side

walls of the building may be specially formed of panels **24** of rectangular configuration, hereinafter called side wall panels, while the roof comprises a roof truss assembly **26** consisting of two rows of side-to-side abutting, and end-to-end abutting, oppositely directed boxed end roof truss panels **28**, the roof truss panels preferably being of a width commensurate with the width of the side wall panels **24**. In the particular building illustrated, a rear wall is shown as being formed of panels **24** identical to the side wall panels with the exception that certain panels have been formed with openings **30** to receive window units **32** in conventional building construction fashion.

The special nature and construction of the roof truss panels and the side wall panels **28** and **24**, respectively, may be best seen by reference to FIGS. **2, 3** and **4**. Both the roof truss panels and the side wall panels are modular in nature, that is, a plurality of identically configured and formed panels **24** are fastened together in side-to-side abutting fashion to form the side and end walls, while identically formed and configured roof truss panels **28** are fastened together in a pair of oppositely directed longitudinal arrays, that is, from front to back in FIG. **1**, the elevational configuration of the roof truss panel being trapezoidal in form with the ends of greater height abutting each other at the center and forming the king post **98**.

The material forming the modular panels **24** and **28** is designated as being paper board and as such may consist of a corrugated board formed of paper or its equivalent and suitably waterproofed such as by being fiberglassed and resin impregnated, resin coated or by other conventional means. The present invention is not directed to the particular board forming the panel material, but rather to the structural and configurational details of the panels themselves and the method and means for fastening either the panels together or the portions of the sheet material forming the panels together, to complete a panel of high structural rigidity and strength. If necessary, subsequent to their formation and prior to or subsequent to their assembly into a completed building wall or roof, the outer surface of the panels **24** and **28** may be further reinforced and treated with resin impregnated fiberglass mat which is highly weatherproof.

Turning to FIG. **5**, each roof truss panel is formed in the preferred arrangement from a single sheet **34** of fiberboard and comprising in terms of scored fold lines indicated by the dotted lines in FIG. **5** of a roof portion or center roof panel **36** of rectangular configuration, trapezoidal side walls **38** and **40** extending along respective sides of center wall **36**, and an optional ceiling flap **42** of like configuration and dimensions to the center wall **36** and being joined to the outside of the side wall **40**. At the right hand or inboard end of the roof truss sheet **34**, integral tabs are defined by contiguous scored fold lines to form tab **44** as an extension to center wall **36** and of a width equal to the same and of a length less than the width of tab **46** which forms an integral extension or projection of side wall **40**. Tab **48** has a width less than the full width of panel side wall **38**, at that end, but is equal to the difference between the length of tab **44** and the full width of tab **46** such that, as indicated in FIG. **6**, when side walls **38** and **40** are folded at right angles to center wall **36** and extend in the same direction and in turn when tabs **46** and **48** are folded into planes in mutually overlapping fashion and when tab **44** is bent downwardly at right angles thereto, the free edges **50** and **52** of tabs **48** and **44** are in mutually abutting position and tabs **44** and **48** overlap respective portions of tab **46**, FIG. **6**. As shown, the optional ceiling flap **42** may then be bent inwardly and at right angles to the side wall panel **38** to form a trapezoidal hollow box. If desired, thermal insulation may fill the panel and 2 × 4 reinforcers **54** may form cross pieces at spaced longitudinal positions to give greater structural rigidity to the formed roof truss panel **28**.

The present invention is further directed to the manner in which the roof truss panel is provided with an integral, formed box overhang or sectional soffit at the left hand side or outboard end of panel **28** as illustrated in FIG. **6**. In this respect, the center wall **36** has three center wall extension portions, extending outwardly beyond the ends **56** of side walls **38** and **40** in order at **58, 60** and **62**. Further, the center wall extension portion **60** is provided with integral tabs **64** extending outwardly at right angles to the longitudinal axis of the panel at the sides thereof. During set-up to form the completed panel of FIG. **6**, center wall extension portion **58** is folded inwardly at right angles to form an end wall, the larger area wall extension portion **60** forms the bottom soffit of the box overhang, while wall portion **62** extends downwardly therefrom and at right angles thereto to facilitate coupling of a formed side wall panel **24** thereto at its upper end as best seen in FIG. **2**.

Further, tabs **64** are received within and extend upwardly on the inside of and adjacent to side walls **38** and **40** of the panel and are fastened thereto in the same manner as the other tabs forming the precut, roof truss panel **28**. In this respect, staples may be employed to fasten the end tabs to overlapping tabs or wall portions of the panel, but preferably metal strip fasteners **110** illustrated in FIGS. **9** and **10** are employed for these purposes. In addition, epoxy adhesives or like waterproof glues may be employed in lieu of or in conjunction with metal fasteners to fasten the walls and tabs in position.

The present invention is further directed to the improved side or end panels for use in the building structure of FIG. **1**. In this case, as illustrated in FIG. **7** a sheet **66** of paper board is precut and includes scored fold lines as indicated by the dotted lines to effectively produce when set up the side and end panel of FIG. **8**. The modular side or end panel **24** includes a center or side wall **68** facing the exterior, with fold lines defining on either side thereof, edge walls **70** and **72** forming stud flanges with an optional interior wall flap **74** being integrally formed therewith and extending from one of the edge walls such as **72** and being of a length on the order of the edge walls. Fold lines further define a center wall extension portion or tab **76** at the upper end and three fold lines at the bottom end of the same center wall **68**, define center wall extension portions **78, 80** and **82**, in that order. Center wall extension portion **78** carries tabs **84** of a width on the order of the width of edge walls **70** and **72** which extend outwardly therefrom. During set-up, the edge walls **70** and **72** are folded at right angles to the plane of the center wall **68** and in the same direction, panel center wall extension portion **76** folds at right angles to the plane of the center wall **68** and towards the upper edges of the edge walls **70** and **72** and are suitably joined thereto by fastening to tabs **77** which are folded at right angles to

edge walls **70** and **72** and lapped over **76**, at the top. Center panel extension portion **78** folds at right angles to the plane of the center wall **68**. Center wall extension **80** is folded at right angles to portion **78** after folding tabs **84** at right angles to said extension **80** to form a box-like structure of maximum rigidity, when fastened together. Further, the second center wall extension portion **80** folds back on itself, that is, it lies flush with center wall extension portion **78** to form a two-ply end plate while the lower and third center wall extension portion **82** projects away from the end wall formed thereby to define a flap which lies coplanar with the center or side wall **68**. The optional interior wall flap **74** may be closed upon the free edge of the stud flange **70** to complete a closed side or end panel, preferably after thermal insulation is placed therein and after the installation of electrical wiring, plumbing or the like.

From the above description, the construction of a complete building, in one embodiment, employing principally these two preformed and specifically configured panels may be readily apparent. Further, the improved structural integrity and load bearing capability of the panels may be visualized by reference to FIGS. **2**, **3** and **4**. Anchor bolts **86** extend upwardly, with ends buried in the foundation side walls **22**. Their threaded ends pass beyond the surface of the edge mounting plate **16**, through aligned holes within the two-ply side wall panel extension portions **78** and **80**. Coupling of plate **16** is completed by means of a threaded nut **88** and underlying washer **90**.

Turning to FIG. **3**, it is noted that, if necessary, a reinforcing plate may be epoxy glued and stapled or otherwise affixed to either or both side edges of the panel stud flanges. In this case, reinforcing plates **94** extend upwardly into the roof truss panel **28** with their lower ends within the side wall panel **24** and are stapled respectively to the edge walls or stud flanges **70** and **72** and to the side walls of the roof truss panel **28**. In lieu of staples **99**, the special strip fasteners **110** of the present invention as illustrated in FIGS. **9** and **10** may be employed. It is noted that sealed joints are provided between the bottom end of the side wall panel and its foundation and the top or upper end of the side wall panel and the truss panel **28** to form the box overhang. In this respect, the end flap **62** of the truss panel center wall **36** overlies, is sealed to and mechanically affixed, to the upper end of the side wall panel center wall **68**. In addition to the 2 × 6 or 2 × 4 beams forming the laterally extending reinforcing means **54** at spaced longitudinal positions between side walls **38** and **40** of the improved truss panel 2 × 4s may also form additional reinforcing members between the edge walls or stud flanges **70** and **72**; one such lateral reinforcing member being shown at **96**, adjacent edge flap **76** which lies at right angles to side wall **68**. 2 × 4s or similar wooden beams may extend between the stud flanges of the side panels, at spaced vertical positions to give greater structural integrity and act as a base for fastening interior finishes to the side walls if necessary or desired. Again, staples or their mechanical equivalent may be employed to fasten the 2 × 4s in position and the paper board thereto.

Of importance to the invention is the fact that the optional interior flaps **42** and **74** for the side wall panels and the roof trusses of appropriate length may be formed integral with either side walls **38** or **40** for the roof truss panel, or edge walls **70** and **72** for the side wall panel **24** and may be maintained in open position during initial installation but closed after installation of the plumbing fixtures, electrical fixtures or the like. Further, as illustrated in FIG. **1**, two series of side abutting modular roof truss panels are positioned in end abutting, oppositely directed arrays, such that panel tabs **44** and **42** for respective panels abut each other at the center of the building and define a four-ply king post of high structural integrity in a position where the load acting on the roof is at a maximum, that is, between the points of suspension defined by spaced side walls **24**.

Referring again to FIG. **3**, the use of improved fasteners forms part of the present invention and is illustrated as being applied to a connection between flap **62** of a roof truss panel **28** and center wall **68** of side wall panel **24**. This connection is illustrated in FIG. **10** in terms of a pair of oppositely oriented and oppositely directed fasteners **110** formed from a strip of metal and each being provided with a barbed arrow projection or prong **112** and a specially formed opening **114** at identically spaced longitudinal positions as illustrated in FIGS. **9** and **10**. The metal strip, which may have a length equal to the longest dimension of either panel **28** or **24**, is provided at spaced longitudinal positions with struck out projections or barbed prongs **112** having pointed ends **116**, serrated edges defining barbs **118**, formed by right triangular teeth. The barbed prongs **112** project at right angles as indicated in FIG. **10**, while struck out resilient fingers **120** are oppositely directed and have triangular edges which define with the side wall an opening which is hexagonal in configuration and which permits entry of the barbed prong **112**, but during any attempt at retrograde movement causes the flexible fingers **120** to bind within the valleys defined by the serrated teeth to resist pull out. Thus, once force is applied in opposite directions as indicated by arrows **F1** and **F2**, in FIG. **3**, the multi-ply fiber board sections shown in dotted lines are urged towards each other and securely lock in planar abutting position. Preferably, epoxy adhesive or similar glue or the like (not shown) is liberally spread on the surfaces to be joined prior to use of the strip metal fastener **110** of the present invention. The projections **112** have sharply tapered ends **116** which readily penetrate the paper board and thus form holes by penetration during usage. Exact alignment of connector strips is not necessary and minor variations in alignment will still permit the projections **112** of the fastener strip **110** on one side to pass through the holes **114** on the opposite side and vice versa. The projections **112** may be covered by a large board **162**.

An alternate form of a fiberglass reinforced, paper board building of the present invention is illustrated in FIGS. **11** through **15** inclusive. While the end wall or side wall panels and the roof truss panels of the building are formed in a generally similar manner to that of the prior described embodiment, the principal structural distinction resides in the employment of a separate overhang panel which simplifies design and construction of the roof truss panel and insures a straighter overhang component. As may be appreciated, it is somewhat difficult when forming a roof assembly of from 18 to 30 or more 16 inch roof truss panels to perfectly align these panels as to facia and soffit and therefore this embodiment simplifies this task considerably.

In that regard, the building again consists of a preformed cast concrete foundation **10'** having an integral floor slab **12'** with the outside edges of the same recessed at **14'** and carrying a wooden mounting plate **16'** which again may be a 2 × 4 board or the like. A modified side wall panel **24'** is shown in FIG. **15** as resting on the plate **16'** and being coupled to the foundation in a somewhat similar manner to the previous embodiment. Further, each side wall panel **24'** supports, preferably of equal width, a roof truss panel **28'** which in this case does not terminate at its outer end in a box overhang, the building being provided with a specially formed and completely separate overhang panel **122.**

Turning to FIG. **11,** each modified roof truss panel, in this embodiment, is formed from a single sheet **34'** of specially treated fiber board and comprising in terms of scored fold lines as indicated by the dotted line in FIG. **11,** or a roof portion or center wall **36'** of rectangular configuration, with trapezoidal side walls **38'** and **40'** extending along respective sides of center wall **36'.** In this embodiment, the optional ceiling flap has been eliminated although of course one may be added thereto in the manner of FIG. **6.** At the right hand or inboard end of the roof truss sheet **34',** contiguous scored fold lines define integral tabs **44', 46'** and **48'** in identical fashion to the previous embodiment. The roof truss panel thus formed by sheet **34'** is modified at the left hand end, FIG. **11,** from the embodiment of FIG. **5,** in that scored fold lines define tabs **124** in conjunction with trapezoidal side walls **38'** and **40',** while the center tab **126** is an extension of the center wall or roof **36'.** Tab **126** therefore acts as an end wall for the panel **28'** formed thereby with tabs **124** being bent at right angles to respective side walls **38'** and **40'** and lying flush with and on the inside of end wall **126** as illustrated in FIG. **15.** Staples and waterproof epoxy cements or the like couple respective tabs together to form an open bottom roof truss panel **28'.**

To impart structural rigidity to the building and, in particular, to assist coupling of roof truss panel **28'** to underlying vertically oriented side wall panel **24',** a specially formed roof panel and wall panel connector of U-shaped configuration, is employed as illustrated perspectively in FIG. **14.** This connector **128** which may be formed of fiberglassed fiber board or metal, is U-shaped in configuration consisting of a base **130** and right angle end walls **132,** the end walls being coupled respectively to side walls **38'** and **40'** of the roof truss panel **28',** while the base **130** in this case is fixed to the upper end of side wall panel **24',** FIG. **15.**

The side wall panel **24'** is of modified form and, again, is formed of fiberglass reinforced, resin-impregnated or coated paper board and reference to FIG. **12,** illustrates a sheet of this material carrying the score lines as indicated by the dotted lines prior to set up, but after machine stamping or cutting. The sheet **66'** of paper board is precut with the scored fold lines defining a center or side wall **68'** which faces the exterior of the building and having edge walls **70'** and **72'** on either side thereof, forming stud flanges with, in this case, optional interior wall flap **74'** being provided, in the same manner as the previous embodiment. At the upper end of the sheet **66',** there is defined by scored fold lines center wall extension portions **134** and **136** in that order. The extension portion **136** also is provided with integral tabs **138** on either side thereof. When wall portion **134** is bent at right angles, it defines the top end or upper end wall of the side wall panel **24',** while center wall extension portion **136** is bent at right angles to wall portion **134** while the tabs **138** carried thereby are bent at right angles and inwardly of panel wall extension portion **136** and are fixedly attached to the stud flanges or edge wall **70'** and **72'** as readily seen in FIG. **15,** such coupling being achieved by waterproof epoxy cement and/or staples or the like. When the interior wall flap **74'** is bent into a position at right angles to the stud flanges **70'** and **72',** and overlies center wall extension portion **136,** this completes a box like side wall panel of high structural integrity.

At the bottom of panel **24',** sheet **66'** is scored and cut to form a center wall extension portion or flap **140** and the panel side walls **70'** and **72'** are provided with tabs **142** to effect insofar as the corners of the box panel **24'** is concerned, overlapping or multilayer base portions to permit fastening of the side wall panels **24'** to mounting plate **16'** in a manner somewhat similar to the prior embodiment. Anchor bolts **86',** FIG. **15,** extend upwardly above the upper edge of plate **16'** with the ends of the anchor bolts being buried in the foundation side walls **22'.** Again, the threaded ends pass through, at least, the side wall panel center wall extension **140** and also through a transversely extending mounting board **144.** Coupling is completed by means of a threaded nut **88'** and the underlying washer **90'.** Since there may be difficulty in bending the fiberglass, resin impregnated or coated paper board sheet at angles greater than 90° without weakening the wall portion in the areas of the score lines, the embodiment of FIG. **15** may be employed rather than the 180° reverse turn provided by the embodiment illustrated in FIG. **4.** Resin impregnated reinforced fiberglass mat **91** spans the joint and covers the wall plate **14** and is affixed in the field to insure a watertight, weathertight seal.

The second embodiment of the present invention is highlighted by the employment of a single, unitary overhang panel **122** which is formed from a precut or configured paper board sheet **147,** FIG. **13,** which is also prescored in the manner indicated. The overhang panel is generally rectangular in form and consisting of a top or center wall **148,** side walls **150** and **152.** A bottom wall or soffit **154** and a ceiling attachment flap **156.** The ends of sheet **146** carry tabs **158** for side walls **150** and **152** and have at each end a center flap or extension **160.** Two such panels form, appropriately, soffit overhang panels at opposite sides of the building. When overhang panel is attached to the building as illustrated in FIG. **15,** after set-up, side wall **150** is fastened by staples, specially formed fasteners **110,** and/or by means of waterproof epoxy adhesives or the like to end wall **126** of the roof truss **28',** while panel portion **150** acts as an extension to the roof center panel **36'.** End wall **152** extends the length of the building to define the facia while panel wall portions **154** which act as a soffit, has tab **156** at the inboard end of the same affixed to the upper end of side wall panel **24'.** Alternatively, staples or fasteners **110** may be employed for this purpose, and it is covered with a large board **162.** In other respects, this embodiment is similar to the earlier described embodiment.

Front and rear panels are identically formed and moved into position once the roof truss panels are flush mounted to form the four-ply king post **98** as evidenced in FIG. **1** and the interior panel walls which are hinged

to the side walls or edge walls of the same may be selectively moved into parallel position with respect to the exterior wall after suitable electrical wiring and plumbing have been completed and after insulation has been placed within the wall cavity of the panels if insulation is desired or necessary. It is evident that a building may be readily constructed in this manner in which the major components of both the roof and the side walls are in sheet form, precut and set up on the site to reduce the expense of shipping the material, since in prefabricated building construction, the side and roof panels which are shipped set up are rather bulky, take an excessive amount of space and are therefore highly costly to ship in preassembled form. On site construction can be made by persons of limited skill for added savings in the construction of commercial and residential buildings. The sheet material forming the panels may be treated after die cutting to insure that the panels are weather resistant, fireproof or fireresistant, and may have the exterior surfaces precoated or otherwise treated, so that no exterior finishing is required once the panels are set up and assembled in serial abutting fashion.

Yet another form of a fiberglass reinforced, paper board building of the present invention is illustrated in FIGS. **16, 17** and **18.** Contrary to the prior embodiments, both the side wall panels and the roof panels are identical in all respects, allowing maximum simplicity in design without compromise with the necessity of the panels themselves properly supporting loads at the load centers defined by the end abutting connections between the individual panels. A pre-formed cast concrete foundation **110** carries at each edge, wooden mounting plates **116,** which may consist of 2×4 boards or the like. Side wall panels **124** are edge coupled to each other in side abutting fashion to form a series of side walls which in turn support identically configured but oppositely oriented roof panels **128,** the series of side wall and roof panels being end to end, butt connected to form, with the exception of the building end walls, a complete building structure.

In this regard, each of the panels **124** and **128** are identical, and for illustrative purposes, the panel shown in FIG. **18,** which is designated as a side wall panel **124,** is formed from a single sheet **134** of specially treated fiber board which is fiberglass reinforced and resin impregnated or treated, sheet **134** comprising in terms of scored fold lines indicated in dotted line fashion, of a center wall **136** of rectangular configuration and being provided with trapezoidal side walls **138** and **140** which extend along respective sides of the center wall **136.** At each end of center wall **136,** there are provided center wall tabs **126** and **128** which are rectangular in configuration as defined by scored fold lines, while at respective ends of the side walls **138** and **140,** there are provided trapezoidal tabs as defined by scored fold lines which extend inwardly of the right angle fold lines for the center wall **136,** thus tabs **142** and **146** are integral with side wall **138,** while tabs **144** and **148** are integral with side wall **140.** Tabs **142** and **144** are of a length one-half the width of the center wall tabs, such that, when the side walls **138** and **140** are folded at right angles to the center wall **136** and in the same direction, while the tabs are all folded at right angles to their walls, the tabs **142** and **144** lie flush with tab **126** which overlaps the same, and with the ends of the tabs in abutment as illustrated in FIG. **18** to produce essentially a two-ply end wall of increased strength, imparting structural rigidity to the building illustrated in FIG. **16,** especially when the panels of the individual series are fastened to each other in end abutment as illustrated. The fastening techniques employed in the previously described embodiments are employed in the construction of the building partially illustrated in FIG. **16.**

It is to be especially noted that since the side walls **138** and **140** are identically configured, but oppositely trapezoidal, there is produced for each panel a large end and a small end. Further, in the construction of the building of the type illustrated in FIG. **16,** the large ends of the side wall panel are fastened in abutment to the large ends of one of the roof panels **128,** while the small ends of the roof panels are fastened together to define the center line of the roof. Further, the small ends of the side wall panels are fastened to the mounting plates **114** forming a portion of the horizontal support surface defined by the cast concrete base or foundation **110.** Since the ends of all panels are two-ply for structural ridigity, and since further the large ends of the series of abutting panels **124** and **128** abut each other, there is formed a girt connection at **150,** these connecting areas forming load centers of maximum structural integrity at their areas of need. The lighter loads at the center of the building are well taken care of by the roof panel center line connection **152.**

A further embodiment is illustrated in FIGS. **19–22,** which is highlighted by the employment of identical side wall and roof panels. In this case, two series of side wall panels **224** cooperate with a series of roof panels **228** to form a basic building structure completed at the ends by appropriate rectangular or modified rectangular front and rear panels **260,** or the like. A preformed, cast concrete foundation **210** having an integral floor slab **212** carries along the outside edges, wooden mounting plates **216.** Side wall panels **224** have one end resting on the plate **216** and are suitably coupled thereto while opposite ends are fastened in abutting fashion to the inclined ends of the similar roof panels **228.** The length of each roof panel **228** may be the same, or longer than that of the side wall panels **224** to which it is attached. Of course, a series of side to side abutting, end fastened side wall panels **224** cooperate with a series of roof panels similarly coupled to form the roof and side walls of the building. In that respect, reference to FIG. **20** shows a single sheet **234** of specially treated fiber board, preferably fiberglass and resin coated or resin treated to impart weather and water resistance necessary to extended use of the building under adverse weather conditions. The single sheet **234** of fiber board is cut to the configuration shown and is provided with scored fold lines as indicated by the dotted lines to define a roof portion or center wall **236** for the panel, of rectangular configuration, trapezoidal side walls **238** and **240** extending along respective sides of center wall **236** and an optional ceiling flap or side wall panel inner wall flap **242** of rectangular configuration and integrally joined to the outside edge of side wall **240.** Both ends of center wall **236** are provided with integral tabs **244** of rectangular configuration, while the side walls **238** and **240** are provided, at each end, with trapezoidal tabs **246.** The configuration of tabs **244** and **246** and their method of being folded at right angles in mutually overlapping fashion are in all respects identical to the arrangement illustrated in the

embodiment of FIGS. 16 – 18, the inclination of the scored fold lines defining tabs 240 being such as to define angularly inclined end walls to create an elevational configuration as seen in FIG. 19 when two series of end wall panels 224 are joined by a series of horizontal roof panels 228 in end to end abutting fashion.

To complete the structure, the front and rear of the building are provided with rectangular or modified rectangular panels 260 which are formed from flat sheets illustrated in FIGS. 21 and 22.

The interior wall 242 is bent at right angles along the score line separating the side wall 240 and wall 242 with the edge 248 of this wall extending beyond a free edge of side wall 230 after bending and connecting the tabs 244 and 246 together so as to define a completely boxed panel either as a roof panel 228 or side wall panels 224.

The small rectangular panels 226 appearing immediately above the windows 268 and door 270 in the embodiment of FIG. 19 are formed in a similar manner to the prior described panels from a single sheet 274 of fiber board and comprise in terms of scored fold lines of a center wall 276 and identical, rectangularly configured side walls 278 and 280; the center wall 276 provided with rectangular tabs 284 at each end defined by scored fold lines while contiguous scored fold lines define trapezoidal tabs 282 at respective ends of side walls 278 and 280. The side walls 278 and 280 are bent in the same direction at right angles to center wall 276 along the fold line, while tabs 284 and 282 are also bent at right angles to respective panel walls 276 and 278 and the mutually overlapping tabs are fastened to each other to form multi-ply ends assisting in the structural integrity of the completed building of FIG. 19. Again, windows 268 and their method of attachment to the end wall and the mounting of door 270 are conventional and form no part of the present invention. Because end walls 224 are inclined, it is necessary to modify the structure of front and rear panels 260, evidenced by panels 262 and 264, panels 262 being trapezoidal in elevation, while panels 264 are triangular in elevation. In fact, the panels 262 and 264 may be formed by appropriately configuring and cutting a single sheet such as sheet 290 illustrated in FIG. 22. The sheet includes longitudinal score lines 292 defining side walls 294 and 296 for panel 262 and a side wall 298 for panel 264, at the same time defining center wall portions 300 and 302 for panels 264 and 262 respectively. Irregular, oblique cutting lines 304 and 306 permit severance of the sheet into two portions, the right hand portion forming panel 262 and the left hand portion forming panel 264. In each case, tabs 308 and 310, similar to tabs 280 in the FIG. 21 panels, and tab 312 for panel 264 and 314 for panel 262 are formed as extensions of the side walls of these respective panels. The folding of the side walls and the tabs at the bottom ends of panels 262 and 264 may be readily envisioned by reference to the prior embodiments. Panels 226 are formed by diagonally slicing a panel 260, forming duplicate halves. It is sufficient to state that the tabs 314, for instance, are connected in overlapped face to face fashion to impart increased structural rigidity to the front and rear panels forming portions of the building of FIG. 19. In like manner to the previous embodiments, the material forming the modular panels 224 and 226 as well as the front and rear wall panels as at 260, 262, 264 and 267, may consist of a corrugated board formed of paper or the equivalent, suitably waterproofed as being fiberglassed and resin impregnated or resin coated or by other similar means. In the illustrated embodiment in FIG. 19, the end wall series of panels allow the panels 224 to employ multi-ply ends which abut and are fastened to the foundation 210, in particular the upper surfaces of the plates 216. Further, a four-ply connection occurs between the inclined ends of the roof panels 228 and the upper ends of the horizontally positioned roof panels 228 where they meet the abutting inclined edge of the side wall panels 224. Since natural load centers occur at the junction of these panels the structural integrity of the completed building is assured, while the multi-ply panel ends further assist in retention of the fastener means coupling the ends of respective panels. The interior wall 242 may be readily folded into position and fastened after plumbing, electrical wiring or other elements necessary to the completion of the building are installed within the ceiling and side wall panels. The coupling of respective side wall panels to each other and to the foundation are in terms previously described with respect to the other embodiments of the invention, although the free ends of the triangular and trapezoidal panels underlie the side walls 238 for instance of panels 224 and are directly stapled thereto.

It is, however, intended that the various changes and modifications may be made within the scope of the invention as defined in the appended claims.

What is claimed is:

1. In a building structure formed of a plurality of prefabricated, abutting paper board panels having their abutting panel sides fastened together to form a complete building side wall and their lower ends fastened to a building foundation in the form of an upwardly facing longitudinally extending mounting plate forming exposed intersecting vertical and horizontal panel mounting surfaces, the improvement wherein: each side wall panel is formed of a single paper board sheet and comprises at least one side wall, hinged end walls integral therewith on respective sides thereof and defining stud flanges, said panel side wall including a portion extending beyond one end of the same and bearing three fold lines defining three side wall extension portions in that order, said first two wall portions being of equal dimensions in the direction along the length of said panel and being folded back on themselves to form a two-ply end wall, said third wall extension portion acting as an extension of said side wall, being coplanar therewith and extending outwardly beyond the end of said panel to facilitate fastening of said panel to the intersecting panel mounting surfaces of said mounting plate in mutually distinct right angle planes and to seal the edge of said panel to said plate.

2. The side panel as claimed in claim 1, wherein one of said two side wall extension portions include two tabs extending outwardly therefrom at right angles to the longitudinal axis of the panel and means for fastening said tabs in mutually overlapped fashion to said edge walls to rigidly locate said edge walls at right angles to said side wall and to the two-ply end wall adjacent thereto.

3. A paper board boxed end truss panel of generally triangular configuration for use in forming a roof truss assembly consisting of two series of side-to-side abutting, end-to-end fastened, oppositely directed truss panels with the outer ends of respective truss panels

fastened to the upper ends of corresponding side panels; each truss panel being formed of a single sheet of paper board material being cut, and including fold lines defining a rectangular center wall forming a portion of the roof, two side walls of trapezoidal configuration extending along respective sides of said center wall, contiguous tabs extending from coextensive ends of said center and side walls with the length of said center wall tab being less than the full width of one of said side wall tabs and said other side wall tab extending from its outer edge a length equal to the difference between its end dimension and the length of the center wall tab to form half of a four-ply king post, the other end of said center wall being extended beyond the ends of said side walls and having fold lines defining three contiguous center wall extension portions in that order, the first wall extension portion having a length equal to the end dimension of said side walls and forming the end wall of the truss panel, said second center wall extension portion forming a bottom wall for the boxed end of the truss panel, said third wall extension portion outwardly away from said bottom wall and at right angles thereto to facilitate fastening of said third wall extension portion to the outside wall of its respective side panel at the upper end thereof.

4. The boxed end truss panel as claimed in claim **3**, further comprising a ceiling flap of rectangular configuration extending along the outside edge of said side wall a distance less than the full length of the side wall and center wall by a distance defined by the length of said bottom wall and the thickness of the side panel coupled thereto and a plurality of longitudinally spaced reinforcing beams extending between said side wall panels flush with the ceiling wall on the inside thereof and affixed thereto.

5. In a building structure formed of a plurality of prefabricated abutting fiberglass reinforced, resin treated paper board side wall panels having the sides of the abutting panels fastened together to form a completed building side wall and being fixed at their lower ends to an upwardly facing, longitudinally extending mounting plate forming intersecting right angle vertical and horizontal panel mounting surfaces, and a plurality of prefabricated boxed end roof truss panels of generally triangular configuration in elevation in the form of two side abutting series, oppositely directed and fastened end to end to define the roof of said building spanning spaced apart building side walls, and fixed to the upper ends of said side walls, the improvement wherein: each side wall panel is formed of a single sheet of paper board material being configured and having fold lines defining at least one center wall, hinged walls along respective sides thereof to define stud flanges and bent inwardly, in the same direction and at right angles to the plane of the center wall, said panel center wall including an extension portion bearing three fold lines defining three center wall extension portions in that order, said first two center wall extension portions being of equal dimensions in the direction along the length of said side panel and being folded back on themselves to form a two-ply end wall, said third center wall extension portion acting as an extension of said center wall and being coplanar therewith and extending outwardly beyond the two-ply end wall to facilitate fastening of said panel to the base of said building in mutually distinct right angle planes and to seal the edge of the panel to said base, each boxed end roof truss panel being formed of a single sheet of paper board material and being configured and including fold lines defining a rectangular center wall, two side walls of trapezoidal configuration extending along respective sides of said center wall, tabs extending from coextensive ends of said center and side walls with the length of the center wall tab being less than the full width of one of said side wall tabs and the other side wall tab extending from its outer edge a length equal to the differnce between its end dimension and the length of the center wall tab to form half of a four-ply king post when said roof truss panels are oppositely fastened end-to-end, the other end of said truss panel center wall extending beyond the ends of said trapezoidal side wall and having fold lines defining three contiguous center wall extension portions in that order, the first center wall extension portion having a length equal to the end dimensions of said side wall and forming the end wall of the truss panel, said second center wall extension portion forming a bottom wall for the boxed end of said truss panel, said third center wall extension portion projecting outwardly away from said bottom wall at right angles thereto and being fastened to the upper end of a respective side panel.

6. The building structure as claimed in claim **5**, wherein each roof truss panel further comprises a ceiling flap of rectangular configuration extending along the outside edge of one of said roof truss panel side walls a distance less than the full length of the side wall and the center wall by a distance defined by the length of said bottom wall and thickness of the side panel coupled thereto with the ceiling wall being affixed thereto and parallel to the center wall.

7. In a building structure formed of a plurality of prefabricated, abutting fiberglass reinforced, resin treated paper board panels including a plurality of side wall panels with the sides of abutting side wall panels fastened together to form a completed building side wall and a plurality of prefabricated roof truss panels of generally triangular configuration in elevation in the form of two side abutting series, of oppositely directed panels fastened end to end to define the roof of said building spanning spaced apart building side walls, said building structure including an upwardly facing longitudinally extending mounting plate defining intersecting right angle vertical and horizontal panel mounting surfaces along opposed edges of said building for supporting the lower end of said side wall panels, with the upper ends of said side wall panels being fixed to the outer end of the oppositely directed roof truss panels, the improvement wherein:

each side wall panel is formed of a single sheet of fiberglass reinforced, resin treated paper board being configured and having fold lines defining at least one center wall, hinged edge walls along respective sides thereof defining stud flanges and bent inwardly in the same direction and at right angles to the plane of the center wall, said panel center wall including an extension portion bearing two fold lines defining first and second center wall extension portions in that order, said first center wall extension portion forming an upper end wall and being bent in the same direction as the hinged end walls, said second center wall extension portion extending inwardly of said end wall at right angles thereto, tabs extending laterally from said second center wall extension portion and being folded at

right angles to said second center wall extension portion and lying flush with said stud flanges and being fixed thereto to form a rigid hollow panel structure, an interior wall flap integral with and extending from one of said hinged stud flange walls and being coextensive with the same, said flap extending parallel to said center wall and being fixed to said center wall extension portion to form an essentially closed, hollow panel, a third center wall extension portion extending beyond the bottom of said center wall, defined by a transversely extending fold line, end flaps carried at the same end of said panel by said stud flange hinged walls, said tabs and said third center wall extension portion being folded inwardly at right angles in mutually overlapping fashion and fastened to each other to form a relatively rigid base for supporting said side wall panel and fixed to said horizontal mounting surface of said mounting plate,

each roof truss panel further being formed of a single sheet of fiberglass reinforced, resin treated paper board material, being configured and having fold lines defining a rectangular center wall, two side walls of trapezoidal configuration extending along respective sides of said center wall, tabs extending from both ends of said center and side walls, the length of the center wall tab at one end being less than the full width of one of said side wall tabs at the same end and the other side wall tab extending from its outer edge a length equal to the difference between its end dimension and the length of the center wall tab at that end to form half of a four-ply king post when said roof truss panels are oppositely fastened, end to end, the tabs at the other end of said truss panels being folded at right angles to center and side walls and being positioned in mutually overlapping fashion and fastened together to form a hollow open bottom roof truss,

the building structure further including overhang panels extending longitudinally and coupled to the neds of the roof truss panels of each series at the outside edge of the same, said overhang panels each being formed of a single sheet of fiberglass reinforced, resin treated paper board material, being configured and having fold lines defining a center wall, hinged side walls extending coextensively along each side of said center wall, a soffit integral with and hinged to one of said side walls and an attachment flap hinged to said soffit, and extending downwardly therefrom and fastened to the outside center wall of said abutting side wall panel with the coplanar overhang panel side wall being attached to the outer end wall of said series of roof truss panels.

8. The building structure as claimed in claim **7**, further comprising: a U-shaped roof panel to wall panel connector including a base and right angle end walls, said connector end walls being fixed to spaced apart side walls of the roof truss panel and being positioned internally within the same, and means for fastening the base of said connector to the upper end wall of a respective underlying side wall panel to ridigly position the roof assembly, spanning the side wall panel on opposite sides of said building structure.

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