



US 20170268218A1

(19) **United States**

(12) **Patent Application Publication**  
**HILTON**

(10) **Pub. No.: US 2017/0268218 A1**

(43) **Pub. Date: Sep. 21, 2017**

(54) **MODULAR, TRANSPORTABLE, INSULATED BUILDING, WITH WATER, AND FIRE RESISTANT FLOOR, WALL, AND ROOF PANEL, PRE-MANUFACTURED ASSEMBLIES**

*E04B 1/348* (2006.01)

*E04B 1/94* (2006.01)

(52) **U.S. Cl.**

**CPC** ..... *E04B 1/34384* (2013.01); *E04B 1/34321* (2013.01); *E04B 1/34815* (2013.01); *E04B 1/64* (2013.01); *E04B 1/72* (2013.01); *E04B 1/94* (2013.01); *E04H 9/04* (2013.01); *E04H 1/005* (2013.01); *E04B 1/948* (2013.01); *E04B 1/942* (2013.01); *E04B 1/7612* (2013.01); *E04B 1/98* (2013.01); *E04H 9/02* (2013.01); *E04H 9/028* (2013.01); *E04B 1/34347* (2013.01); *E04B 2001/925* (2013.01)

(71) Applicant: **HILTON ENGINEERING INC., SAINT GEORGE, UT (US)**

(72) Inventor: **RALPH MICHAEL HILTON, SAINT GEORGE, UT (US)**

(73) Assignee: **HILTON ENGINEERING INC., SAINT GEORGE, UT (US)**

(21) Appl. No.: **15/455,837**

(22) Filed: **Mar. 10, 2017**

**Related U.S. Application Data**

(60) Provisional application No. 62/310,601, filed on Mar. 18, 2016.

**Publication Classification**

(51) **Int. Cl.**

*E04B 1/343* (2006.01)

*E04B 1/64* (2006.01)

*E04B 1/72* (2006.01)

*E04H 9/02* (2006.01)

*E04H 9/04* (2006.01)

*E04H 1/00* (2006.01)

*E04B 1/76* (2006.01)

*E04B 1/98* (2006.01)

(57) **ABSTRACT**

A small, heavy duty, transportable building having pre-manufactured panel assemblies made out of magnesium oxide for the floor, wall and roof that are quickly fastened together, on site, using common metal screws. All building materials are inorganic for extreme mold and mildew resistance. Furthermore, the building panels are configured and fastened together for inherent insulative fire and flood resistant properties. Commercial metal strut forms an economic protective perimeter around the magnesium oxide surface panels, and offer a fastening means to adjoining panels. The uses of the building (bunker, enclosure, shelter, shed, little-house, etc. . . .) are myriad and not intended to be limited in usefulness. In addition, the building configurations and square footage options are limitless, single wide building ways, storied if desired. The design also allows manufacturing of the panel assemblies with common, hand tools, power tools, and welding equipment. No crane is needed for building erection.

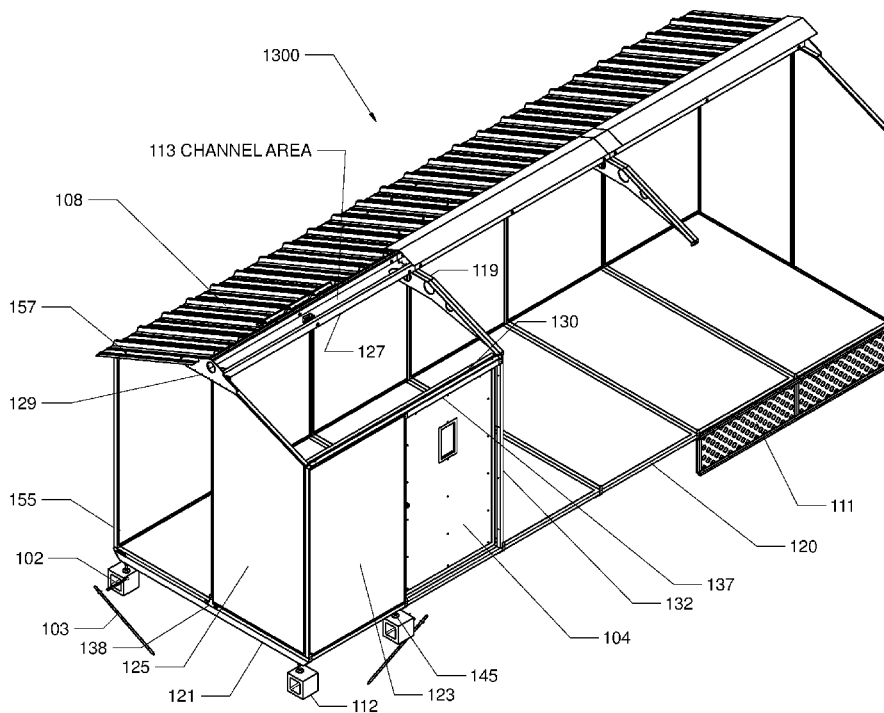


FIG 1

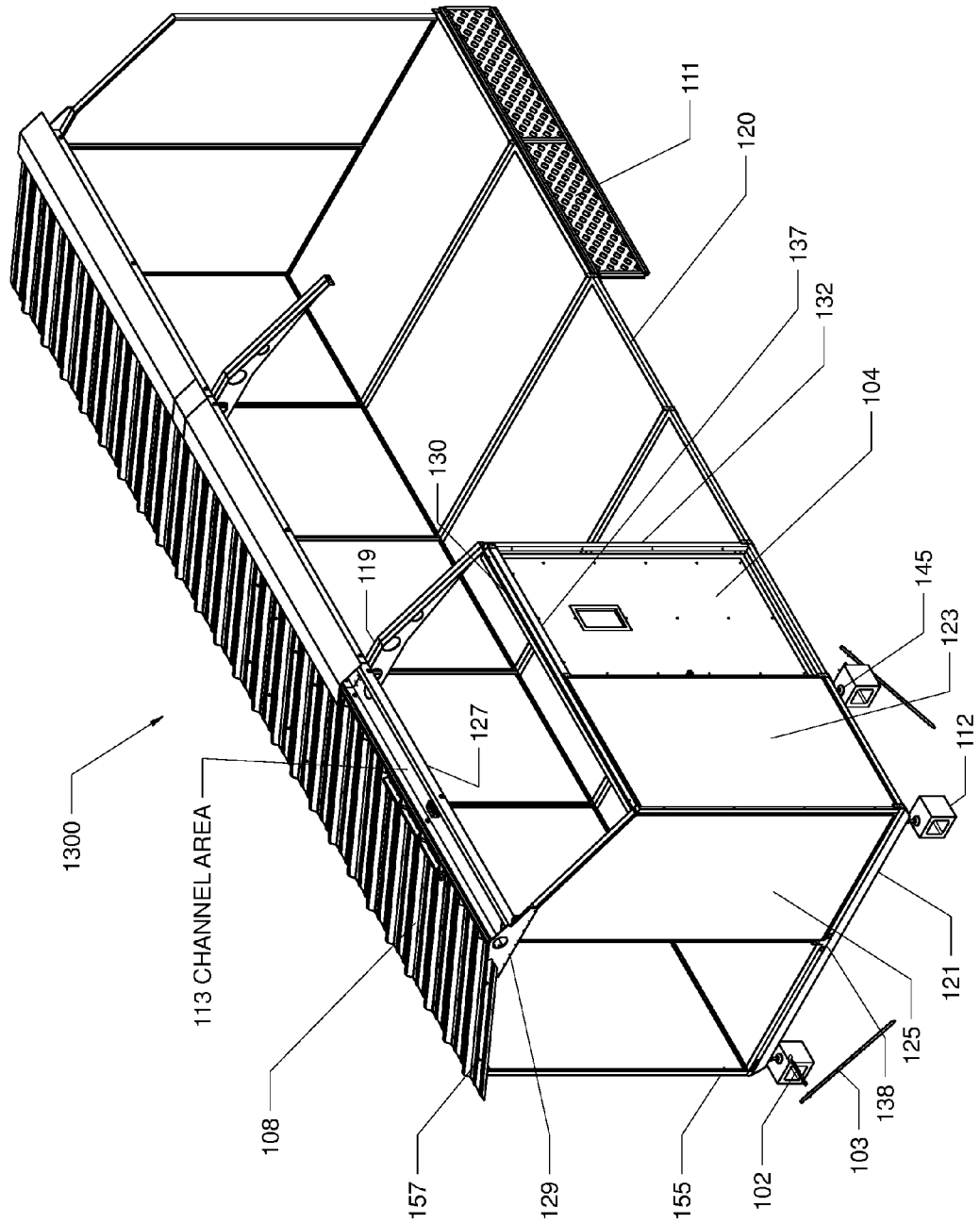


FIG 2

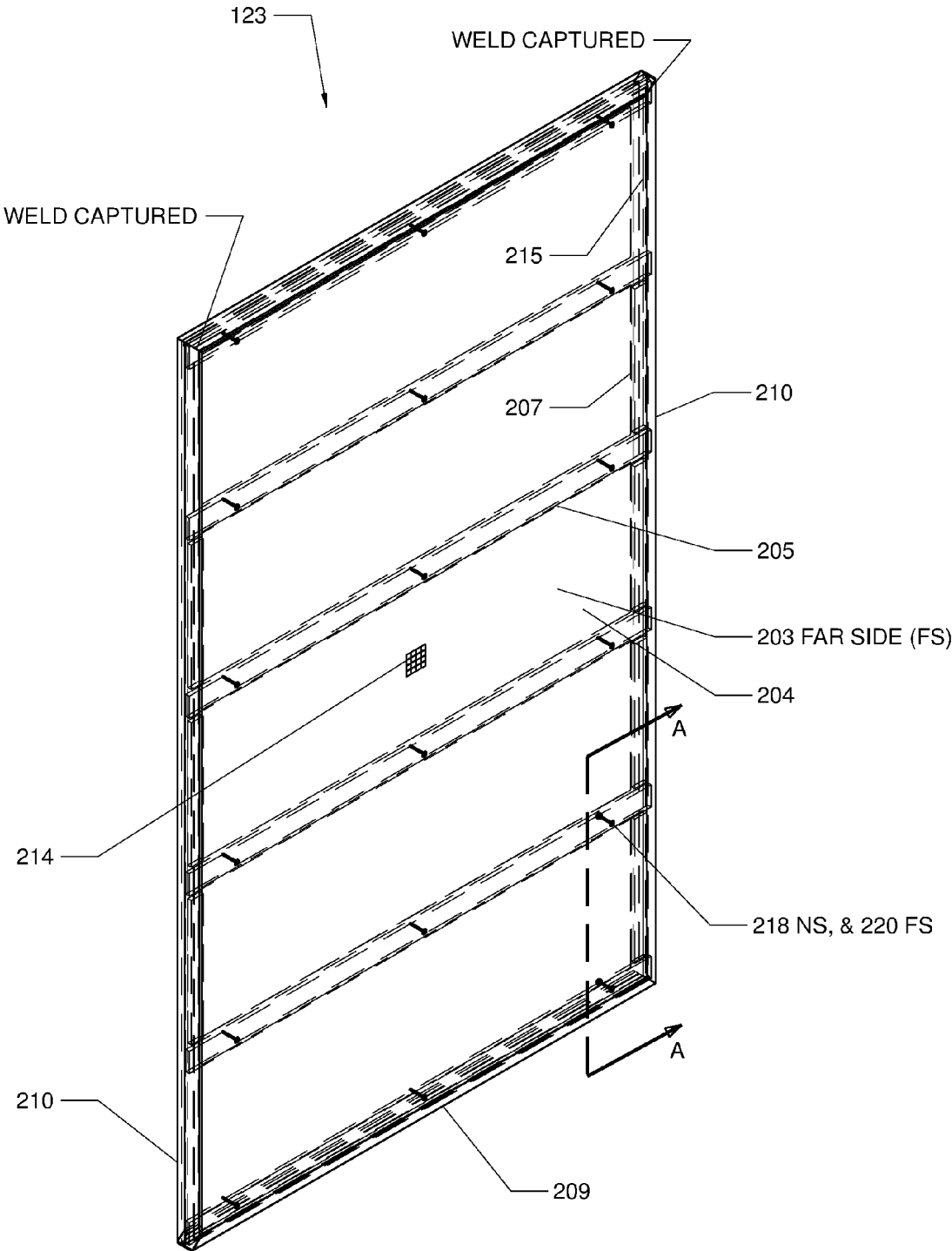
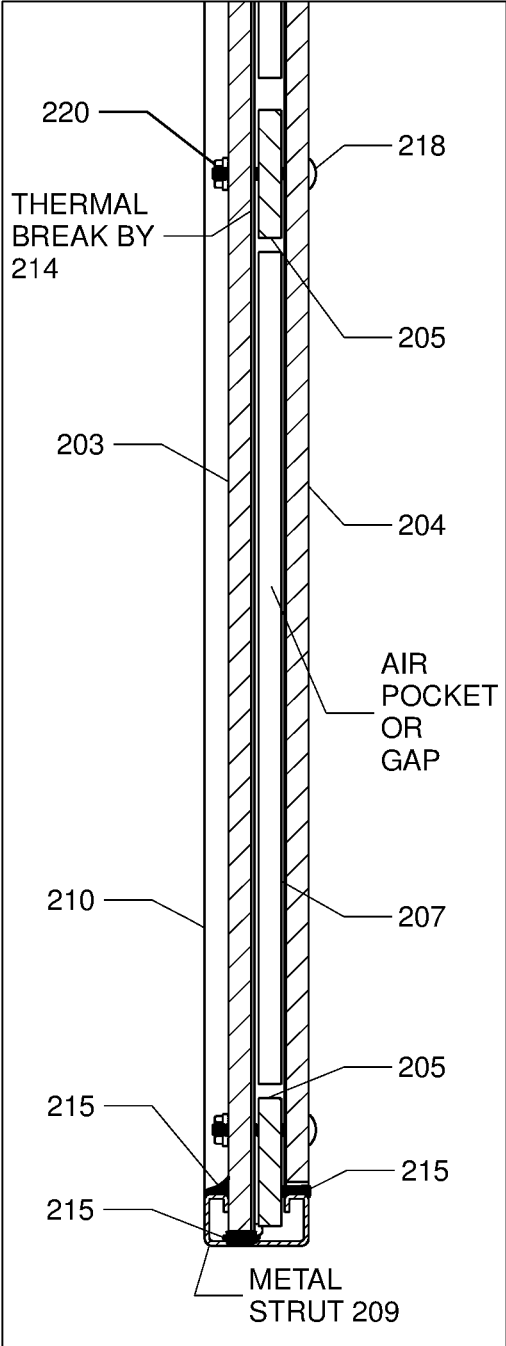


FIG 2A



SECTION A-A

**MODULAR, TRANSPORTABLE, INSULATED  
BUILDING, WITH WATER, AND FIRE  
RESISTANT FLOOR, WALL, AND ROOF  
PANEL, PRE-MANUFACTURED  
ASSEMBLIES**

REFERENCES CITED

[0001]

| U.S. Patent Documents |                |                 |
|-----------------------|----------------|-----------------|
| 5,678,384             | October 1997   | MAZE            |
| 6,460,297             | October 2002   | BONDS et al.    |
| 8,925,255 B1          | January 2015   | HAUN et al.     |
| 9,115,504 B2          | August 2015    | WALLACE         |
| 9,121,168 B2          | September 2015 | LEVY et al.     |
| 9,212,485 B2          | December 2015  | WOLYNSKI et al. |

BACKGROUND

[0002] A need exists for small economic, rugged, insulated, transportable, fire and water resistant, buildings, for security of persons and/or property.

[0003] A further need exists for flexible building configurations designed in modular lengths to allow for custom solutions to meet additional owner requirements.

[0004] An additional need exists that these buildings may be quickly erected manually, on site, without the need of mixed and cured concrete using common hand tools.

[0005] The present flexible embodiments meet these needs.

BRIEF SUMMARY OF INVENTION

[0006] The present embodiments generally relate to floor, wall, roof, and pre-manufactured building structures resistant to abnormal or extreme external or internal conditions. The structures of the present invention are useful in applications where a transportable, building requires a high degree of fire, mold, termite, and water resistant performance.

[0007] Furthermore, the building design is economic, simple, rugged, and provides security. It can be assembled with 2 persons, without a crane on site and no mixed concrete is required for installation.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] The detailed description will be better understood in conjunction with the accompanying drawings as follows:

[0009] FIG. 1 depicts a building (partially shown for structural clarity) formed according to one embodiment. Other embodiments have a similar gable end width, but different lengths and door and window penetrations determined by end user.

[0010] FIG. 2 depicts a sidewall assembly (without window perforation) according to one or more embodiments. End wall assembly panels are similar, and in one embodiment, the design has a slope and plateau upper edge section (s). Sliding doors are made in a similar manner.

[0011] FIG. 2A depicts a vertical side section of a sidewall or door assembly according to one or more embodiments showing the metal strut cross section, weld captivating feature, at least one or more commercially available layered

glass reinforced MGO boards. Also shown are the air gaps and metal screen thermal break surface.

[0012] The present embodiments are detailed below with reference to the listed Figures.

DETAILED DESCRIPTION OF THE  
EMBODIMENTS

[0013] Before explaining the present design in detail, it is to be understood that the enclosure is not limited to the particular embodiments and that it can be practiced or carried out in various ways.

[0014] In an embodiment of the invention, pre-fabricated multi-layered, MGO wall panel assemblies' (or structures) are joined side to side on top of level adjusted subfloor panel assemblies, finished floor concrete, or concrete walls (block or poured). Fasteners can join the adjoining metal perimeter edges together. Multiple wall panels can be straight or at various angles, that can be joined to form the outer walls of a building.

[0015] The building can include single story and second story wall structures. For single story building embodiments, the design and construction is seismic and wind resistant to a maximum wind gust of 156 MPH (CATAGORY 4 HURRICANE 130-156 MPH).

[0016] In another embodiment of the invention that forms the basic protective shell, all electrical conduit, supply plumbing, and other human conveniences may be installed on the inside surface of the wall(s) and or roof truss(es).

[0017] A building exhaust vent or vents may be installed in the center roof support structure and can exhaust out the ends of the gables. The design allows for 3" type B, double walled, gas vent that has a maximum OD of up to 4". The inner area of the roof support channel(s) may be used as a combination space for electrical cables, wires, water and gas piping, air ducting for HVAC purposes and insulation.

[0018] A door or double doors can be inserted in place of one or two of the wall panels respectively, creating an easy ingress or egress to the building where needed.

[0019] The building has an all-metal skeletal frame construction in combination with high heat resistant layered glass reinforced MGO boards for fire resistance in the case of an adjacent burning building or other burning fuel source.

[0020] The building, in all embodiments, will survive at least 3 feet of wet snow on the roof, providing a strong building for shelter against the heaviest snow and ice accumulations.

[0021] Single level building embodiments, will survive a category 4 hurricane when secured to 36" deep set stakes at all designed locations or securely fastened to a concrete foundation.

[0022] An assembled 8'x12' building (or smaller) can be quickly airlifted, via a 3" pipe (or 4" tube) through the gable vent holes, to a site of a natural disaster and set in place and serve as a triage location for victims of a mudslide, tornado or earthquake stricken area.

[0023] The 8'x12' building (or smaller) is economical to move, with easy wide span (>4'-6")x9' long forklift access for lifting of the entire building without disassembly if desired.

[0024] In various embodiments, the building may be assembled, before delivery to the end user with various optional electrical and plumbing enhancements, thus allowing the building to be in a more advanced finished state, verses an onsite-erected building from a palletted kit.

[0025] The bare 8'x8' building weighs approximately 2,100 lbs, and can be quickly deployed as an emergency shelter(s) after a natural disaster, using helicopter air lift or pickup truck transport directly to the site(s) of greatest need.

[0026] Various embodiments may be optionally outfitted with basic utilities and fixtures to meet international codes for safe human habitation. An egress-sized window (or smaller) may be installed in any vertical wall in the building. An outer building perimeter, semi vented, skirt required by many local codes protects the sub floor area water lines from freezing damage.

[0027] Simple expansion in predesigned configurations of initial floor space configuration is allowable based on future need. Alternately, contraction of floor space future requirements is similarly possible.

The Following Definitions are Used Herein.

[0028] The term "door" as used herein can refer to a conventional sliding or pivoting door to the building.

[0029] The term "fasteners" as used herein can refer to rivets, bolts, staples, as well as screws.

[0030] The term "filleted" as used herein can refer to corners that are cut to a rounded or chamfered edge.

Turning Now to the Figures for Detail Explanation;

[0031] FIG. 1 depicts a building 1300 with some roof panels 108 and side panels 123 removed for structural clearness, formed according to one embodiment. Other embodiments can have a similar gable end width defined by end panels 125, but different lengths.

[0032] At a minimum, one door 104 and window penetration is installed in door.

[0033] The present shown building 1300, embodied is a dash 06 configuration, nominally measuring 24' in length, representing the width of six 4' wide floor panels 120 and side panels 123 along the length. The allowable straight length is not limitless. It can meet performance specifications if a longer length is wanted only if the building is shaped like an "L" with the short leg being two panels wide. Then the structure may be continued for up to an additional six panels in length. Continue this pattern, building to either side, up to a maximum of six panels in length allowing foot print configurations that are unlimited. Building to the side is necessary to support lateral high wind loads or seismic loads.

[0034] The embodiment shows some of the required levelers 145 at the ends of linear floor support 121 to allow the floor to be adjusted plum flat to an uneven ground placed, Concrete Masonry Unit 112 (CMU 112) supporting surface. Anchor stakes 103 can be driven into undisturbed or compacted soil at all building corners at a minimum. Holddown means may be accomplished with chain and turnbuckles 102. For maximum wind and seismic load resistance, install anchor stakes 103 and filleted holdowns at all leveler 145 support points. An outer building perimeter, semi vented, skirt 111 protects the sub floor area water lines from freezing damage. The PVC skirt 111 also blocks animals from intrusion into the subfloor area and provides some insulation.

[0035] The building can be stacked one level up (not shown). This allows an upper second story configuration to support the concept of modular building design.

[0036] Multiple drill point screws 155 can be drilled into the end panels 125 through clearance holes on the side panels 123. Embodied additional screws fasten the end floor panel 120 to end panels 125 through a T bracket 138. Steel holddown straps can be welded to floor beam support 121 and can be screwed into floor panels 120, side panels 123 and corner column strut 132 where a door exists.

[0037] Multiple drill point screws 157 can then drill down through the metal roofing and MGO structural insulated panel assembly into steel supporting structure underneath, such as the vented C roof support 127 and the truss assembly 119.

[0038] Shown in the current embodiment is a door panel 104 that opens to the side on embodied overhead ball bearing rollers. A door header 137 can be utilized to complete the structural opening.

[0039] Structurally connecting the side panels at the top can be a roof drill plate 130 into which the roof screws 157 can be drilled into and affixed to.

[0040] The embodied building design can be airlifted, as an entire assembled structure, with some interior payload, up to an 8'>12' (or dash -03 configuration). The process can begin by removing the vent covers or exhaust plumbing from the side pick plates 129 and thread a 14' schedule 40, aluminum, 3½" pipe, through the 2 holes. Then the pipe can be secured from sliding longitudinally, with a couple of hose clamps. Then a helicopter may lift the building to a remote location. Re-level the floor and use the building.

[0041] In embodiments, a quick release pin with a combination or keyed lock can be used for securing the door from the outside. The quick release pin can be used to secure the door from the inside.

[0042] In embodiments, extra thermal insulation may be added to the underside of the vaulted ceilings. The thickness of the extra insulation material can be up to 1½" thick and still allow plenum room for a 36" fan (not shown) surface mounted under the central C roof support 127.

[0043] The inner area 113 of the central C roof support channel(s) may be used as a combination space for vents, electrical cables, wires, water and gas piping, air ducting for HVAC purposes and insulation.

[0044] All panel to panel abutting joints interior and exterior can be silicon caulked for weather sealing. Sliding doors are sealed with nylon brush seals on top and sides. Bottom seal is a commercially available threshold type seal.

[0045] FIG. 2 depicts a sidewall panel 123 assembly (without window perforation) according to one or more embodiments. End wall assembly panels 125 can be similar, and in one embodiment design, the end wall panel has a slope and plateau upper edge section(s).

[0046] In this embodiment, strut edge 209 and dual strut edges 210 are miter joint welded together on 3 sides. Then the inner layered glass reinforced MGO board 203 can be slide inserted from the open end with the thermal break screen 214. Due to the fire resistant nature of the MGO board, then a top strut edge 209 can be welded in place, capturing MGO board 203. This process is critical in creating an extremely fire resistant panel assembly. MGO cross studs 205 and MGO backer strips 207 can then be added with a paste like adhesive 215 to wedge MGO board 203 in place. At this construction point, additional adhesive 215 is spread on outer surfaces of MGO cross studs 205 and MGO

backer strips **207** and the outer MGO board **204** is set in place, drilled and mechanically fastened together. Grind all miter joint welds flush.

**[0047]** In one embodiment, stainless steel (SS) screws **218** can be inserted in the drilled holes from the outside, and tightened in place with a SS flanged nut **220**.

**[0048]** Four drilled vent holes in the strut edge corners allow sealing inner and outer perimeter joints between MGO board and steel strut with adhesive **215**. Applying primer paint to all sides can finish the panel assembly **123**. Final paint coats can be applied after field assembly of the building.

**[0049]** This described process can provide rugged edge protection of MGO boards from flaking and breakage, and provide strong fastening surfaces to adjacent panels and roof structures.

**[0050]** Similar fabrication techniques are employed for the door and floor panel assemblies.

**[0051]** Panel assemblies made in this manner are inherently resistant to shear forces or compressive forces parallel to the surface plains of the panels.

**[0052]** FIG. 2A depicts a vertical side section detail of a sidewall panel assembly **123** according to one or more embodiments.

**[0053]** In this embodied detail, common, commercially available steel (or stainless steel) strut edge **209** and dual vertical strut edges **210** of the same material, are miter joint welded together on 3 sides. Then the inner glass reinforced MGO board **203** can be slide inserted from the open end with the thermal break screen **214**. Then due to the fire resistant nature of the MGO board, a top strut edge **209** (not shown) can be welded in place capturing the inner MGO board **203** and thermal break screen **214**. MGO board **203** cannot then be removed from within the strut edges at this point unless one breaks the board. MGO cross studs **205** and MGO backer strips can then be added on top of screen **214** with a paste like adhesive **215** to wedge MGO board **203** in place. Additional adhesive **215** can be spread on outer surfaces of MGO cross studs **205** and MGO backer strips **207** and the outer MGO board **204** is set in place, match drilled and fastened together.

**[0054]** In one embodiment, stainless steel (SS) screws **218** can be inserted in the drilled holes from the outside, and tightened in place with a SS flanged nut **220**.

**[0055]** This described process can provide inherent highly thermally insulated panels due to the inefficiencies of passing conducted heat through screen. Inserted screen **214** decreases heat transfer and can provide future spacing for sheets of Kevlar and/or steel (bullet resistant panel), Polyurethane (blast resistant panel), very fine wire cloth (electromagnetic resistant panel if properly grounded), and/or lead (radiation resistant panel). Other attractive properties can be achieved or enhanced with other inserted material embodiments.

**[0056]** The air pockets shown can be partially filled with other insulative materials as desired, like Reflectix™ radiant barrier laminate roll.

**[0057]** While these embodiments have been described with emphasis on the embodiments, it should be understood that within the scope of the appended claims, the embodiments might be practiced other than as specifically described herein.

What is claimed is:

1. A modular designed, screw together, semi-permanent, pre-manufactured transportable building (or bunker, enclosure, shed, shelter, little-house, tiny-house, etc. . . .), designed, exclusively using non-combustible building materials, made primarily (by weight) of glass reinforced Magnesium Oxide (MGO) board, used in its construction, incorporating steel framed, wall, door and floor panel assemblies, thus allowing simple onsite assembly, disassembly, and transport of said building.

2. An improved modular building as in claim 1 wherein the pre-manufactured panel assemblies all weigh less than 200 lbs allowing site erection without the use of a crane.

3. An improved modular building as in claim 1 wherein the foundation can be concrete masonry blocks directly laid on undisturbed, organically cleaned, bare soil at different heights within a range of 2½".

4. An improved modular building as in claim 1 wherein the subfloor may be adjusted to a horizontal plane by the use of common swivel foot levelers.

5. An improved modular building as in claim 1 wherein a 2nd story may be added to the building layout.

6. An improved modular building as in claim 1 wherein simple expansion is allowable in predesigned configurations, of the initial floor space configuration, based on future need.

7. An improved modular building as in claim 1 wherein the bare interior surfaces and materials are as fire, water and mold resistant as the exterior surfaces.

8. An improved modular building as in claim 1 wherein the fully assembled building, (less than 100 SF in size), may be air lifted via helicopter suspended from the vent holes at the top center of the end gables.

9. An improved modular building as in claim 1 wherein the panel assemblies have a minimum 1½ hr fire resistance rating as per ASTM E119.

10. An improved modular building as in claim 1 wherein the shipping design for the floor and wall panel assemblies may be pancake stacked, up to 25 high, without damage.

11. Floor and wall panel assemblies of multi layered, glass reinforced Magnesium Oxide (MGO) boards, glued and mechanically fastened together (with screws, bolts, rivets, staples . . . etc), and at least one MGO panel is weld captured in a metal frame.

12. An improved panel assemblage as mentioned in claim 11 wherein the metal edge frame wraps around at least one MGO board and is for the edge protection of said boards

13. An improved panel assemblage as mentioned in claim 11 wherein the plain metal edge is match drilled and screwed together via brackets to adjacent panel assemblies using common drill point screws.

14. An improved panel assemblage as mentioned in claim 11 wherein at least ¼ of the resisting structural strength against normal vectored physical loads (wind, seismic, riot, flood, etc. . . .) is derived by separating two MGO sheathing boards by short span, cross slats, of the same thickness MGO sheathing material, sandwiched, glued and fastened together.

15. An improved panel assemblage as mentioned in claim 11 wherein the panels have no bio-originated materials in their assembly, yielding a mold resistant, termite resistant, and water resistant panel.

16. Using an assemblage of glass reinforced Magnesium Oxide (MGO) boards that are designed by their separation, in combination with at least one sandwich layered coarse

metal screen acting as a thermal conductive brake, and including at least 2 boards, separated by multiple horizontal air pockets for the default design configuration to produce a highly thermally insulating panel for the given thickness.

**17.** An improved thermal panel assemblage as mentioned in claim **16** wherein common, commercially available, metal “strut” is used for the panel perimeter edge protection and is a component of the overall exoskeletal structure of a building.

**18.** An improved thermal panel assemblage as mentioned in claim **16** wherein at least one sandwich layered coarse metal screen thickness may be substituted with insertion of other materials to enhance other (than thermal) desired properties like additional structural stiffness, bullet resistance, blast resistance, electromagnetic resistance, radiation resistance etc.

\* \* \* \* \*