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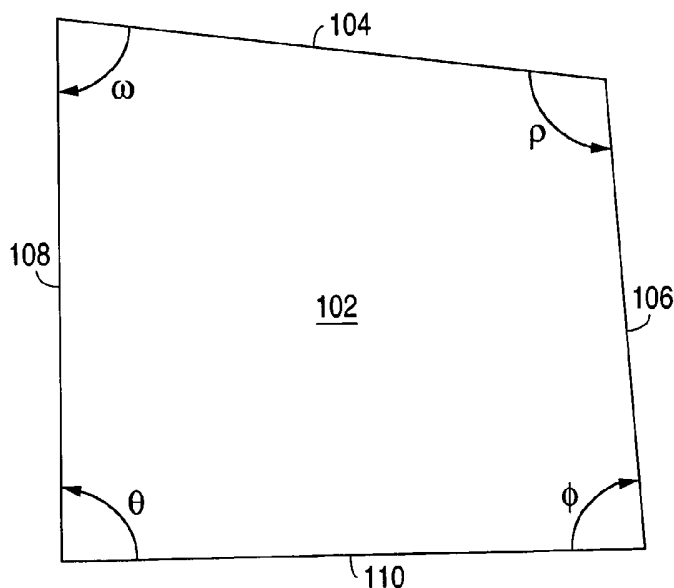
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(54) Title: PREFABRICATED PORTABLE FLAT PACK BUILDING



(57) Abstract: A prefabricated portable building that meets flat pack pallet standards of the North Atlantic Trade Organization (NATO) is provided. The prefabricated building, includes at least 2 end units, wherein each end unit includes an outer wall, an inner wall, a roof, and a floor, wherein the outer wall and the floor converge to form an edge having an angle of less than 90 degrees, and wherein the inner wall and the floor converge to form an angle of about 90 degrees.

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BACKGROUND OF THE INVENTIONTECHNICAL FIELD

The present invention generally relates to portable
5 buildings and, more particularly, to prefabricated portable
buildings that meet designated standards for flat pack
transportation

Discussion of Background

People typically use prefabricated portable buildings for
10 emergency situations. For example, the military may be in a
situation where it needs to construct a hospital in a matter
of hours. A permanent building structure would be
impractical. Consider a situation where hospital facilities
are needed in a desert of the Middle East. A building most
15 suitable for military purposes would likely be some type of
prefabricated portable building that can be quickly erected
with all the necessary hospital facilities.

Manufacturers prefabricate portable buildings in a
controlled factory environment and ship the building pieces to
20 the designated site for assembly. Users install these
portable buildings at the designated site for temporary, as
well as permanent, applications.

The industry has its beginnings in the post World War II
era, when the huge demand for housing for returning GI's
25 overwhelmed the construction industry's ability to deliver.
The U.S. developed prefabricated portable housing as a
solution to this demand. Other countries with severe

commercial building needs following the war, also developed
simplistic modular construction techniques. In the following
decades, technological advances have increased the quality of
those initial efforts, as well as opened the door to new
5 applications of modular construction.

Today, people use prefabricated construction in almost
every industry and walk of life, including construction
offices, educational facilities, medical facilities,
industrial uses, prison and correctional housing and
10 administration, branch financial offices, real estate offices,
government buildings, and general commercial offices.

Rapid Deployment Units have been designed for use in
applications where immediate shelter and protection for
persons and property is required and where a permanent
15 building structure would be impractical. Such applications
include disaster relief and resettlement efforts, schools,
hospitals and accommodation in economically disadvantaged
regions, military applications to house personnel and
equipment, gas, oil and minerals exploration accommodation,
20 temporary accommodation on construction sites, space for
special social events and exhibitions, shelter or breeding
facility for livestock, horses or pets, and the "home office"
concept where the building is set up in the external grounds
of a home.

25 The local conditions at deployment may be tough, such as
during or after war or a natural disaster such as a hurricane,

tornado, flood or volcanic eruption. The environment maybe extreme, such as arctic, desert or very wet conditions. In these cases, an insulated accommodation would then be advantageous.

5 The ground may be rough, stony and wet so keeping the floor or base of the unit off the ground is often necessary. Skilled labor to build accommodation is often scarce or non-existent. So simple construction methods are required. Space to erect the shelter may be tight, e.g. between trees or
10 on a major construction site.

 The infra-structure around the deployment site may be dangerous, remote and inaccessible, limiting the use of heavy transport and large cranes. So the use of bulk transport followed by light transport, e.g. helicopter, even mules may
15 be required. Therefore the units must be light, robust, be compatible with standard and military transport modes while being easily broken down to simplify final transportation to the deployment zone.

 Because humans prefer privacy and seek security, and
20 because many deployment situation require security for vital medical, food and water supplies and a place to store sophisticated military and IT equipment. Rapid Deployment Units are preferably hard sided, secure structures that can be safely locked up and armored.

25 Existing Rapid Deployment Units possess some of the following characteristics:

Soft-sided tent-type structures often having a frame structure of aluminum, steel or a composite material, sometimes hinged to facilitate deployment. The metal structure may be of ribbed, hooped or diamond beam pattern. The structure is covered with a fabric or textile, perhaps woven, for example, cotton, impregnated polyethylene with PVC or low density polyethylene. Although these structures work well for a period, they lack durability, are more susceptible to damage, are difficult to sanitize, they lack the desired security and armor protection requirements, require cleaner flatter, dryer ground and are more bulky to transport. Problems can exist in strong wind, driving rain and sand storm conditions. Human privacy is limited. Although insulated tent-type products exist, their insulation value and hence ability to control internal temperature and protect humans or property is limited.

Hard sided units exist and have the following characteristics:

ISO steel shipping containers are one solution. They are widely available by many companies servicing the deployable shelter market and relatively inexpensive. They offer security and are easily transported to sea ports. However, from a transportation viewpoint, they are a volumetric option and so the floor space or habitable or storage area per unit shipped is limited to around 15m². Shipping cost per usable floor space is expensive. Heavy transportation equipment is required to lift and locate the units for deployment. For

standard ISO sea containers, insulation does not exist unless pre-fitted.

Other hard sided shelters use metal or composite insulated sandwich elements which add strength, security, insulation, are tough, durable and lightweight. These units
5 can be armored. However the hard sided units differ in their ease of deployment and transportation and are expensive for large volume humanitarian aid use.

Some are assembled with adhesives and fasteners and are
10 deployed as a volumetric option with the corresponding problems of transportation cost, volume and deployment. Some of these units reduce the transportation issues by having designs that expand out of the base unit structure, improving floor space shipped by unit by up to 3-fold.

Other more modular designs have hinges that fold or
15 collapse the structure into flat pack units so that more units can be transported inside ISO sea containers, flat bed transport and military aircraft. However, some of these units require cranes and jacks to deploy the units while others
20 require 6 to 8 persons to deploy the units because of the large panel size and high panel weight.

Thus, there is a need for a truly lightweight, modular rapid deployment unit for any terrain that is cost effective to ship worldwide.

25

SUMMARY OF THE INVENTION

When users disassemble a prefabricated building, they often need to place the pieces of the building into a "flat-pack" pallet. The flat pack form of a portable building is basically the walls, floors, roofs, and fittings of the building broken down into their smallest portable package. A flat-pack pallet sets limits on the building's specifications, such as size, weight and strength. Moreover, the North Atlantic Trade Organization (NATO) has their own guidelines on the specifications of a standard flat-pack pallet. Thus, engineers are faced with the challenge of designing a structure that is not only portable, but is also compliant with NATO guidelines and any other guidelines.

It has been recognized that what is needed is a prefabricated flat pack building that meets flat pack pallet standards of the North Atlantic Trade Organization (NATO). Broadly speaking, the present invention fills this need by providing a fast response building, which is a building designed, among other things, to meet the flat pack standards of NATO. It should be appreciated that the present invention can be implemented in numerous ways, including as a process, an apparatus, a system, a device or a method. Several inventive embodiments of the present invention are described below.

In one embodiment, a prefabricated portable flat pack building that is a single unit building is described. The prefabricated building, comprises 2 end units, wherein each end unit includes an outer wall, an inner wall, a roof, and a

floor, wherein the outer wall and the floor converge to form an edge having an angle of less than 90 degrees, and wherein the inner wall and the floor converge to form an angle of about 90 degrees.

5 In another embodiment, a prefabricated portable flat pack building that is a multiple unit building is described. The prefabricated building comprises 2 end units, wherein each end unit includes an outer wall, an inner wall, a roof, and a floor, wherein the outer wall and the floor converge to form
10 an edge having an angle of less than 90 degrees, and wherein the inner wall and the floor converge to form an angle of about 90 degrees; and one or more intermediate units, wherein the one or more intermediate units share a same angle measurements of the 2 end units.

15 In still another embodiment, an end unit of a prefabricated portable flat pack building is described. The end unit comprises an outer wall; an inner wall; a roof; and a floor, wherein the outer wall and the floor converge to form an edge having an outer wall angle of less than 90 degrees,
20 and wherein the inner wall and the floor converge to form an inner wall angle of about 90 degrees.

Prefabricated portable flat pack buildings have many advantages. A significant advantage of prefabricated construction is time savings. Manufacturers may build
25 prefabricated flat pack buildings on a controlled timetable in a factory environment. On the other hand, site-built buildings are subject to weather conditions, subcontractor deals, waits for permits, and labor shortages. Prefabricated construction also provides cost savings due to standardization

of the engineering process, bulk purchase of building materials and the controlled factory construction environment. Users of portable buildings gain an additional advantage in the quality of construction. A standardized construction
5 method at the factory with skilled and knowledgeable labor means a building is not dependent on the vagaries and availability of the local labor market.

Another significant advantage of prefabricated portable flat pack buildings is economy of space. When disassembled in
10 their flat pack form, prefabricated portable flat pack buildings may be stored at any appropriate location, including a warehouse, outdoors, or any location that may be substantially smaller than the building in its assembled form. A prefabricated portable flat pack building according to the
15 present invention can be broken down into an economically small space for easy transport and storage.

The invention encompasses other embodiments of a system, a method, and an apparatus, which are configured as set forth above and with other features and alternatives.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be readily understood by the following detailed description in conjunction with the accompanying drawings. To facilitate this description, like
5 reference numerals designate like structural elements.

FIG. 1A and FIG. 1B show perspective views of a single fast response building (FRB), in accordance with an embodiment of the present invention.

FIG. 2 shows a side view of the end unit, in accordance
10 with an embodiment of the present invention.

FIG. 3 shows perspective views of segments of an FRB flat packed into a pallet, in accordance with an embodiment of the present invention.

FIG. 4A and FIG. 4B show perspective views of a multiple
15 unit FRB, in accordance with an embodiment of the present invention.

FIG. 5A and FIG. 5B show perspective views of a multiple unit FRB with a joining corridor, in accordance with an embodiment of the present invention.

20 FIG. 6 through FIG. 52 combine to show an assembly process of a multiple unit FRB with a joining corridor, in accordance with embodiment of the present invention.

FIG. 53 shows examples of the clips and pins used to join the panels of the FRB together, in accordance with an
25 embodiment of the present invention.

FIG. 54 shows an example of a clip component that is wired to the welded clip component with a wire, in accordance with an embodiment of the present invention.

FIG. 55 shows an example of a locking pin, in accordance
5 with an embodiment of the present invention.

FIG. 56 shows an example of a foot-type pin, in accordance with an embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

An invention for a prefabricated portable flat pack building is disclosed. Numerous specific details are set forth in order to provide a thorough understanding of the present invention. It will be understood, however, to one skilled in the art, that the present invention may be practiced without some or all of these specific details.

General Overview

Fast response buildings (FRB's) are prefabricated portable buildings designed to be transported in flat-pack pallets. An FRB takes only about 2 - 4 people fifteen to thirty minutes to construct into a rigid structure for immediate use. No screws, no nuts, no special tools and no ground preparation are needed. An FRB is fully insulated for use in extreme climatic conditions. The FRB system is economical to transport by air, sea, road or rail.

FRB units are made from individual lightweight sections which interlock to form a rigid structure. Individual components make it easy to handle and maneuver, allowing each unit to be constructed in the most difficult locations. FRB can be situated virtually anywhere, including forests, mountains, desert sand, snow, ice and most types of terrain. FRB units can be transported and positioned by helicopter, as flat pack system or a complete constructed unit. FRB units are compatible with any conventional cargo transportation

system. Specifically, FRB units can be configured to be compatible with International Standards Organization (ISO) sea containers, or with military Demountable Rack Off-load Pick-up System (DROPS). Alternatively, each individual section can be
5 carried to site and constructed.

Relocating without dismantling is achieved by 3 specially designed ski-bars (or "skids") located at the base of the unit. The base unit provides for 2 couplings (such as D rings), which can be attached to a tow-bar by rope or chain
10 allowing the building to slide and move in position. A vehicle such as a Land Rover is capable of achieving this sliding task on average ground conditions.

Two appliqué fitments can be added to act as rollers, facilitating loading the units into containers or aircraft
15 both as a pallet and when stacking to prevent damage. In addition, when the prefabricated portable flat pack building is erected it can have a geometry that allows high winds to create a down force which helps keep the building on the ground (i.e. similar to the effect of a rear spoiler on an
20 automobile).

FRB flexible and unique modular units can be used to construct anything, from a single leisure home or storage unit, to a large emergency hospital complex or emergency re-housing due to a disaster. Each unit can sleep up to 10
25 people. Principally designed for Emergency accommodation for Peace Keepers and Military requirements, an FRB's applications are endless.

Types Of Fast Response Buildings

FIG. 1A and FIG. 1B show perspective views of a single FRB, in accordance with an embodiment of the present invention. The single building comprises two end units 102, including an outer wall 106, an inner wall 108, and a roof 104, among other things.

FIG. 2 shows a side view of the end unit 102, in accordance with an embodiment of the present invention. The roof 104 and the base 110 (or floor) have the same dimensions. However, the outer wall 106 and the inner wall 108 do not have the same dimensions. The height of the inner wall 108 is slightly greater than the height of the outer wall 106. Angle θ is set to be about 90 degrees. While angle ϕ is set to be less than 90 degrees, specifically between about 86 degrees and 88 degrees. Accordingly, the outer wall 106 leans at a slight angle inward.

Established rules of trigonometry set limitations on allowable measurements for angles ω and ρ . Angle ω is accordingly less than 90 degrees, for example, between about 83 and 85 degrees. Angle ρ is accordingly greater than 90 degrees, for example, between about 98 and 100 degrees.

Important features of the FRB is the slight inward tilt of the outer wall 106, the height of the inner wall 108 being slightly greater than the height of the outer wall 106, and the equality in dimensions of the roof 104 and the base 110 (or floor). This combination creates unique building

measurements that allow the FRB to be disassembled neatly into a standard NATO flat pack pallet.

It should be noted, however, that the present invention is not limited to the specific measurements provided above.

5 The specific measurements provided above are primarily for exemplary purposes to show the inward lean of the outer wall
106.

By way of further example, an FRB unit can be constructed which can fit in a standard C130 cargo plane and have a 240m²
10 floor space when fully assembled. Similarly, a 227m² floor space building can be packed into a 40 foot ISO sea container.

Clips and Pins Assembly System

FIG. 53 shows examples of the clips 204 and pins 202 used
15 to join the panels of the FRB together, in accordance with an embodiment of the present invention. These clips and pins are unique to the system and replace bolts, nuts and screws. In the example of FIG. 53, the clips are welded and/or clipped to the respective panels and are extremely difficult to damage or
20 lose. In particular, the clips 204 and pins 202 lock the whole FRB together in a manner that is robust yet retains a degree of flexibility. Assembly of the FRB using clips 204 and pins 202 is less time consuming than assembly of a structure that uses conventional fixings, such as bolts, nuts
25 and screws.

As shown in FIG. 53, the pins 202 are inserted where required in order to prevent horizontal and vertical movement.

As such, the pins 202 are an integral part of the system. The pins 202 and clips 204 are used throughout the FRB structure to lock wall to wall, wall to gable, wall to roof, roof to gable, etc.

5 FIG. 54 shows an example of a clip component 302 that is wired to the welded clip component 204 with a wire 304, in accordance with an embodiment of the present invention. The wired clip component 302 locks the FRB superstructure in place.

10 FIG. 55 shows an example of a locking pin 402, in accordance with an embodiment of the present invention. This locking pin 402 with the locking feature is used to secure the probes (which connect the base sections together), the skids, the legs (when flat packed assembled), the veranda (or step)
15 and the mast stabilizer to the FRB. The locking pin 402 includes a washer 406 having a slot. To the fix the locking pin 402, the locking pin 402 is placed in the base runner using the handle 408 at the top of the locking pin 402. The locking pin 402 is maneuvered to allow the slot in the washer
20 406 to pass through the seg 404, which is attached to the base runner. When the handle is released the locking pin 402 turns and will not free itself. Note that the sizes and diameters shown here are for explanatory purposes, and may vary.

 FIG. 56 shows an example of a foot-type pin 502, in
25 accordance with an embodiment of the present invention. The foot-type pin is another way of locking components (e.g., gable, base, wall, and roof) of the FRB into place. The foot-

type pin 502 is maneuvered into the appropriate hole and slides into place. In this example, a wall is shown being locked to the base 110. Note that the sizes and diameters shown here are for explanatory purposes, and may vary.

5 FIG. 3 shows perspective views of segments of an FRB flat packed into a pallet, in accordance with an embodiment of the present invention. All of the component parts flat pack on to its own base 110 (or floor). The flat pack segments may then stack upon each other. Accordingly, when flat packet, one
10 half of the base 110 of the unit becomes the pallet. The components of the FRB are placed on top of that half of the base 110. The remaining half of the base 110 is stacked on top of the components with the leg sockets 602 of the top half of the base 110 situated to be in line with the leg sockets
15 602 of the bottom half of the base 110. The legs 604 are then inserted. The resulting box-like unit is locked together with the locking pins.

 FIG. 4A and FIG. 4B show perspective views of a multiple unit FRB, in accordance with an embodiment of the present
20 invention. The multiple unit building comprises 2 ends and the intermediate units 302 are inserted as required. FIG. 3 shows 4 intermediate units 302. However, the number of intermediate units 302 that can be inserted is, in theory, infinite. For example, an intermediate unit 302 may be about
25 2.25 m in length. These intermediate units 302 may be added such that the length of the FRB is a multiple of 2.25 m. Note that the present invention is not limited to these specific

dimensions, and other appropriate dimensions for intermediate units 302 may be used.

FIG. 5A and FIG. 5B show perspective views of a multiple unit FRB with a joining corridor, in accordance with an embodiment of the present invention. The multiple unit building with a joining corridor comprises 4 end units 102. The intermediate units 302 and corridors 402 are inserted as required. Note that segment walls, floors, and ceilings of all the FRB units have the same dimensions and will flat pack onto a NATO pallet for easy portability.

Assembly Process Of A Fast Response Building

The sequence FIG. 6 through FIG. 52 steps through an assembly process of a multiple unit FRB with a joining corridor, in accordance with embodiment of the present invention. The assembly process starts in FIG. 6 with a floor segment. The assembly finishes in FIG. 52 with a fully assembled multiple unit FRB with a joining corridor. Intermediate figures FIG. 6 through FIG. 51 sequentially step through the assembly of the multiple unit FRB.

Additional Features And Advantages Of A Fast Response Building

A fast response building (FRB) may be equipped to suit any environment. An FRB may be provided with added solar protection. An FRB may be equipped with added insulation. An FRB can also have nuclear biological and chemical (NBC) lining along its interior. An FRB may have mosquito or fly screens

for doors and windows. An FRB may have mast stabilizers for wind generators or aerials. An FRB may have rain water collection and storage mechanisms. In addition, an FRB may have structures for facilitating the removal of snow and sand.

5 An FRB may have ballistic protection, applique armor, up to, but not limited to, about 7.62 standard NATO ball. An FRB may have load spreader plates, to cater for dessert or wet ground. An FRB may have a multi solid fuel stove for cooking and heating.

10 FRB's have many advantages. FRB units are easily deployable. As can be seen in the sequence FIG. 6 through FIG. 52, FRB units are easily assembled on any type of terrain. Adjustable legs produce a level platform. FRB's can be erected quickly.

15 FRB's are mobile. FRB's are transported in flat pack pallets and can be moved by air, including by helicopter, sea, vehicle, on their own wheels or on ski-type skids. No significant wear and tear occurs during transport and assembly of the FRB pallets and FRB infrastructure because their made
20 of rugged steel. An FRB is designed to be stacked outside when not in use, and can withstand harsh weather conditions while stored outside. An FRB can be manufactured and repaired substantially anywhere, including countries having only low tech facilities. Even if a particular locale does not have
25 the necessary facilities and parts to repair the FRB locally, the particular locale can send out for spare parts without difficulty. Alternatively, parts of an FRB can be repaired

locally by using ordinary metallurgy techniques, for example, ordinary welding, rivets or adhesive techniques. Thus, if a part of an FRB fails, the user of the FRB does not have to idly wait around for a new FRB to arrive.

5 FRB's have many applications. FRB's can be used individually, and can be extended or interconnected to create field dressing stations, hospitals, workshops, command stations, administration buildings, classrooms and safe storage areas, as well as accommodations and a place to hold
10 livestock.

In the foregoing specification, the invention has been described with reference to specific embodiments thereof. It will, however, be evident that various modifications and changes may be made thereto without departing from the broader
15 spirit and scope of the invention. The specification and drawings are, accordingly, to be regarded in an illustrative rather than a restrictive sense.

CLAIMS

What Is Claimed Is:

1. A modular, hard-sided prefabricated portable flat pack
5 building, the prefabricated flat pack building being a
single unit building, comprising:

at least 2 end units, wherein each end unit includes an
outer wall, an inner wall, a roof, and a floor,
wherein the outer wall and the floor converge to
10 form an edge having an angle of less than 90
degrees, and wherein the inner wall and the floor
converge to form an angle of about 90 degrees.

2. The prefabricated flat pack building of Claim 1, wherein
15 component parts of the prefabricated flat pack building are
configured to be flat pack capable onto a base of the
prefabricated flat pack building, wherein the base acts as the
building's floor structure.

- 20 3. The prefabricated flat pack building of Claim 2, wherein
the component parts are sized and stackable upon each other
for maximum utility, modular flexibility, and cost effective
shipping, wherein the units fit efficiently into at least one
of a pallet standardized by the North Atlantic Trade
25 Organization (NATO), a standard International Standards

Organization (ISO) sea container, transport plane, enclosed truck and flat bed truck.

4. The prefabricated flat pack building of Claim 2, wherein
5 the building is compatible with the military Demountable Rack
Off-load Pick-up System (DROPS).

5. The prefabricated flat pack building of Claim 2, wherein
a 227m² floor space building can be packed into a 40 foot ISO
10 sea container.

6. The prefabricated flat pack building of Claim 2, wherein
a 240m² floor space building can be packed into a standard
C130 aircraft.
15

7. The prefabricated portable flat pack building of Claim 1,
further comprising at least one of:
solar protection;
insulation material;
20 nuclear biological and chemical (NBC) lining along
interior surfaces;
insect screens for doors and windows;
rain water collection and storage mechanisms;
ballistic protection, applique armor, up to about 7.62
25 standard NATO ball;

fully adjustable legs with load spread plates to cater
for unstable, wet ground, and any type of terrain
and slope; and

a multiple solid fuel stove for cooking and heating.

5

8. The prefabricated flat pack building of Claim 1, wherein
the prefabricated flat pack building includes component parts
that are easily locked together using no nuts, bolts, screws,
adhesives or special erecting equipment.

10

9. The prefabricated flat pack building of Claim 1, wherein
panels of the building are connected with a clip and pin
assembly system.

15

10. The prefabricated flat pack building of Claim 1, wherein
the prefabricated flat pack building includes component parts
that are can be ground skidded to a new position whether
assembled or flat packed using 3 ski-type skids with D rings.

20

11. The prefabricated flat pack building of Claim 1, wherein
the sloping back wall and roof allows rain collection and
reduces the accumulation of sand or snow.

12. The prefabricated flat pack building of Claim 1, further comprising adjustable legs that lock a palletized building together.

5 13. The prefabricated flat pack building of Claim 1, wherein two appliqué fitments act as rollers, facilitating loading in containers or aircraft both as a pallet and when stacking to prevent damage.

10 14. A prefabricated portable flat pack building, the prefabricated flat pack building being a multiple unit building comprising:

15 at least 2 end units, wherein each end unit includes an outer wall, an inner wall, a roof, and a floor, wherein the outer wall and the floor converge to form an edge having an angle of less than 90 degrees, and wherein the inner wall and the floor converge to form an angle of about 90 degrees; and one or more intermediate units, wherein the one or
20 more intermediate units share a same angle measurements of the 2 end units.

15. The prefabricated portable flat pack building of Claim 14, further comprising a clip and pin assembly for joining
25 panels of the building.

16. The prefabricated portable flat pack building of Claim
14, further comprising a joining corridor, wherein the joining
corridor is situated between two rows of the multiple unit
building, and wherein the joining corridor shares inner walls
5 with the two rows of the multiple unit building.

17. The prefabricated portable flat pack building of Claim
14, wherein when the building is erected it has a geometry
that allows high winds to create a down force which helps keep
10 the building on the ground.

18. An end unit of a prefabricated portable flat pack
building, comprising:

an outer wall;

15 an inner wall;

a roof; and

a floor, wherein the outer wall and the floor converge to
form an edge having an outer wall angle of less than
90 degrees, and wherein the inner wall and the floor
20 converge to form an inner wall angle of about 90
degrees.

19. The end unit of Claim 18, wherein the outer wall angle is
between about 86 degrees and 88 degrees.

25

20. The end unit of Claim 18, wherein the outer wall angle is a slight angle inward.

21. The end unit of Claim 18, wherein the outer wall and the
5 roof converge to form an edge having a roof-outer wall angle of between about 98 degrees and 100 degrees, and wherein the inner wall and the roof converge to form an edge having a roof-inner wall angle of between about 83 degrees and 85 degrees.

10

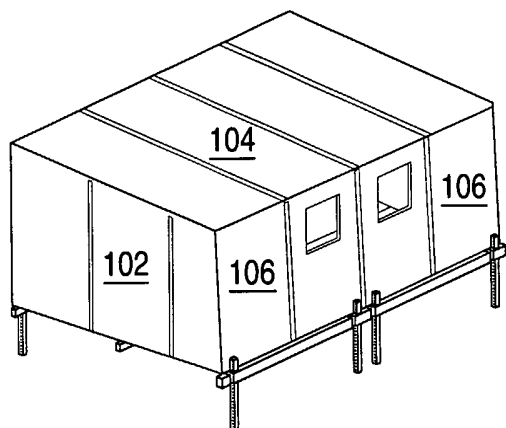


FIG. 1A

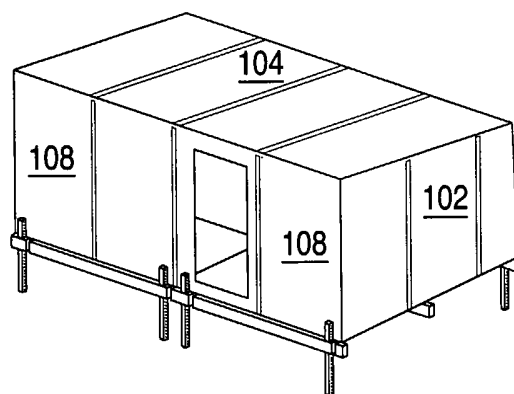


FIG. 1B

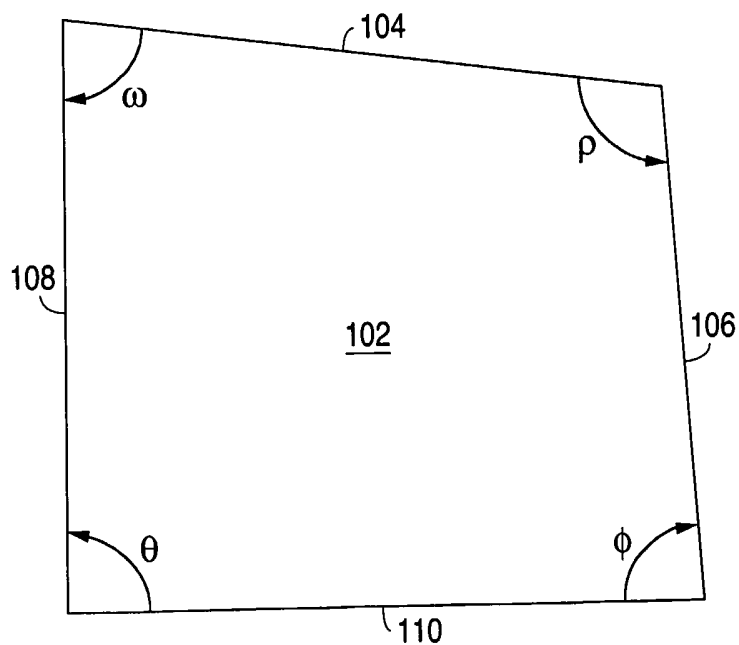


FIG. 2

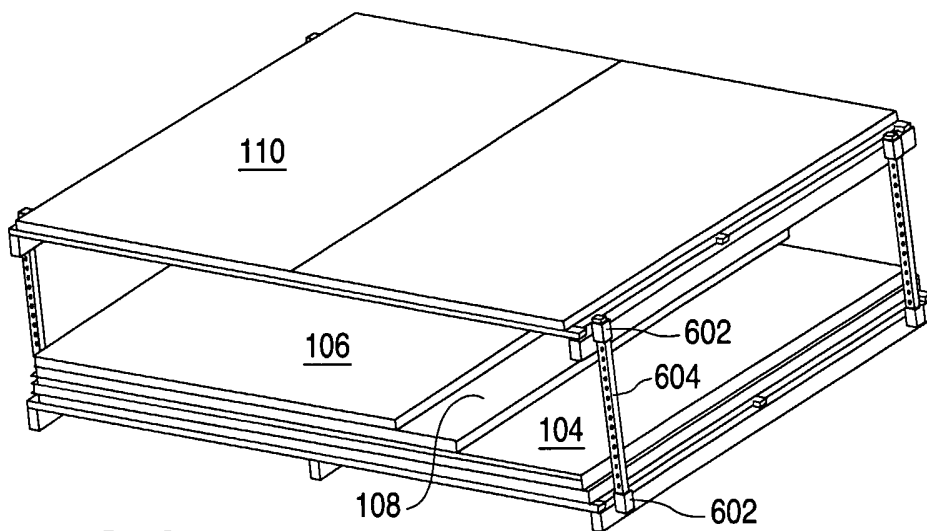


FIG. 3

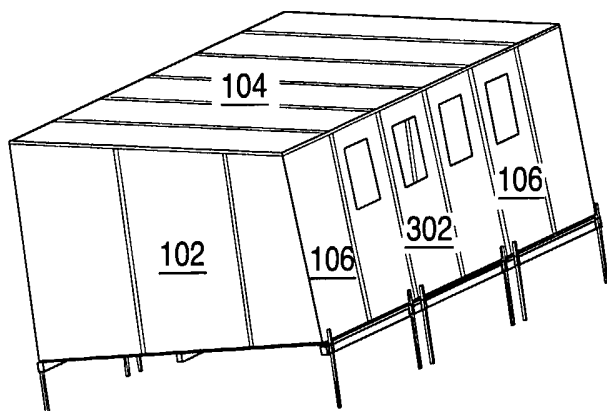
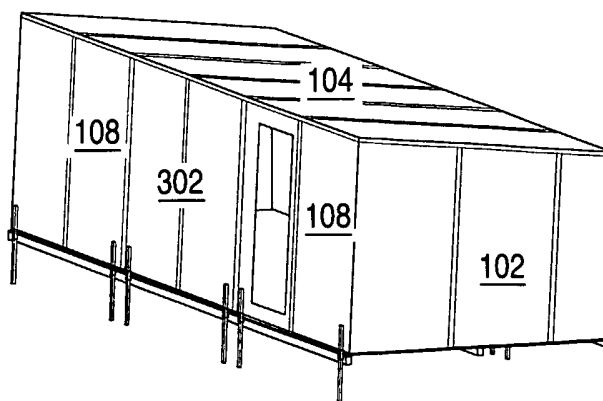


FIG. 4A

FIG. 4B



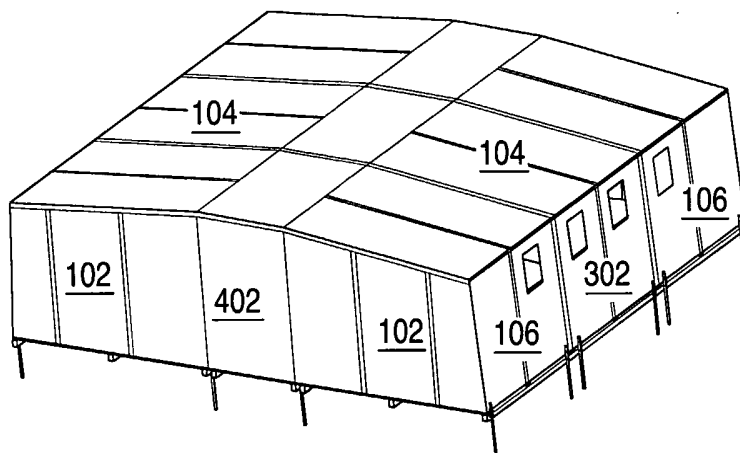


FIG. 5A

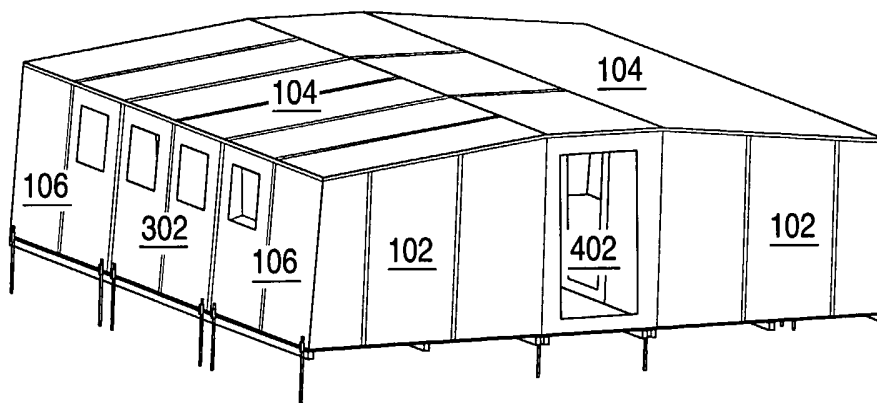


FIG. 5B

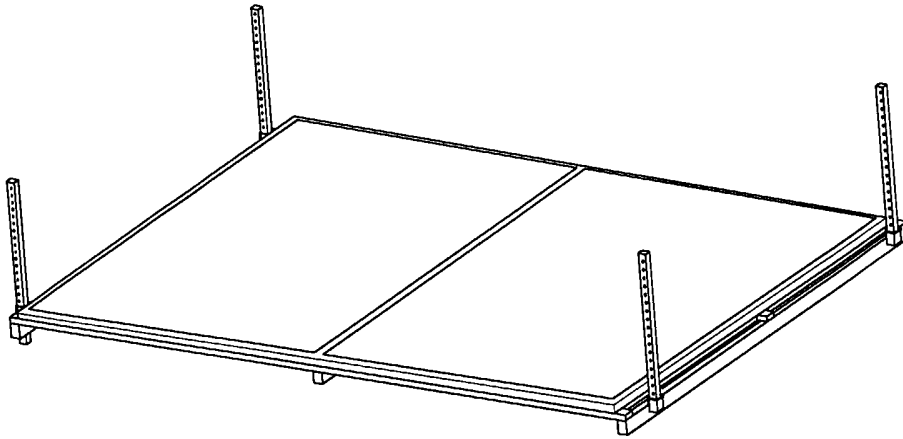


FIG. 6

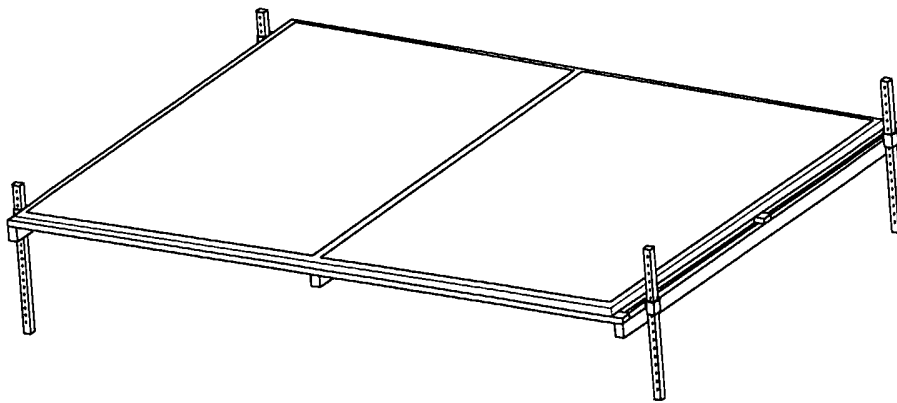


FIG. 7

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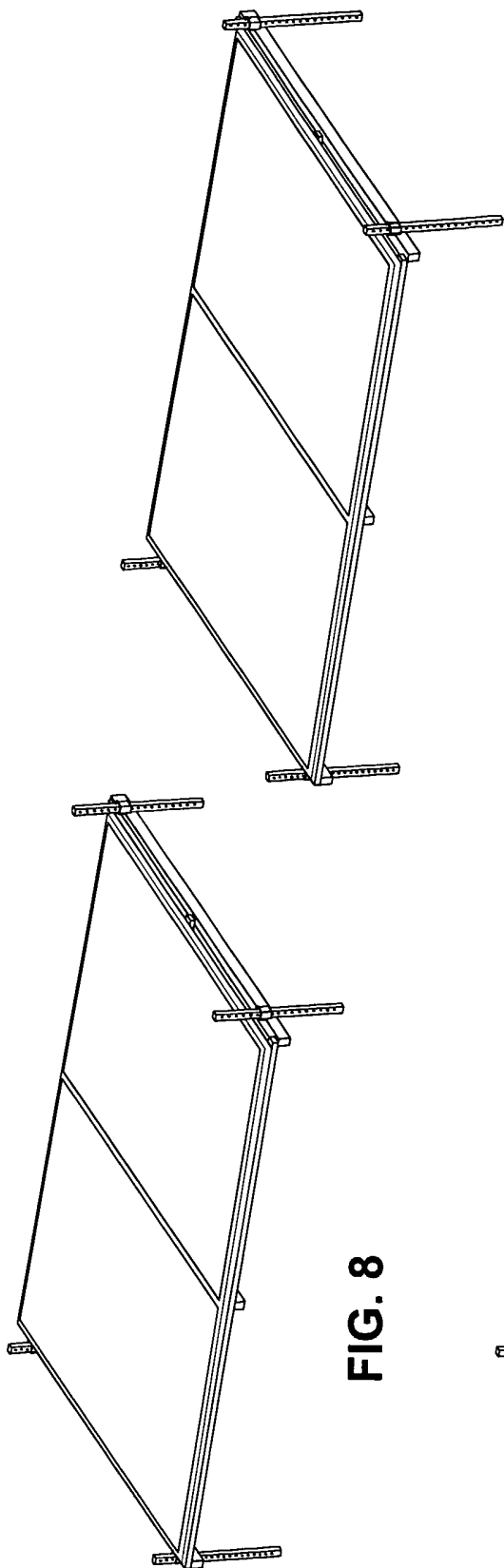


FIG. 8

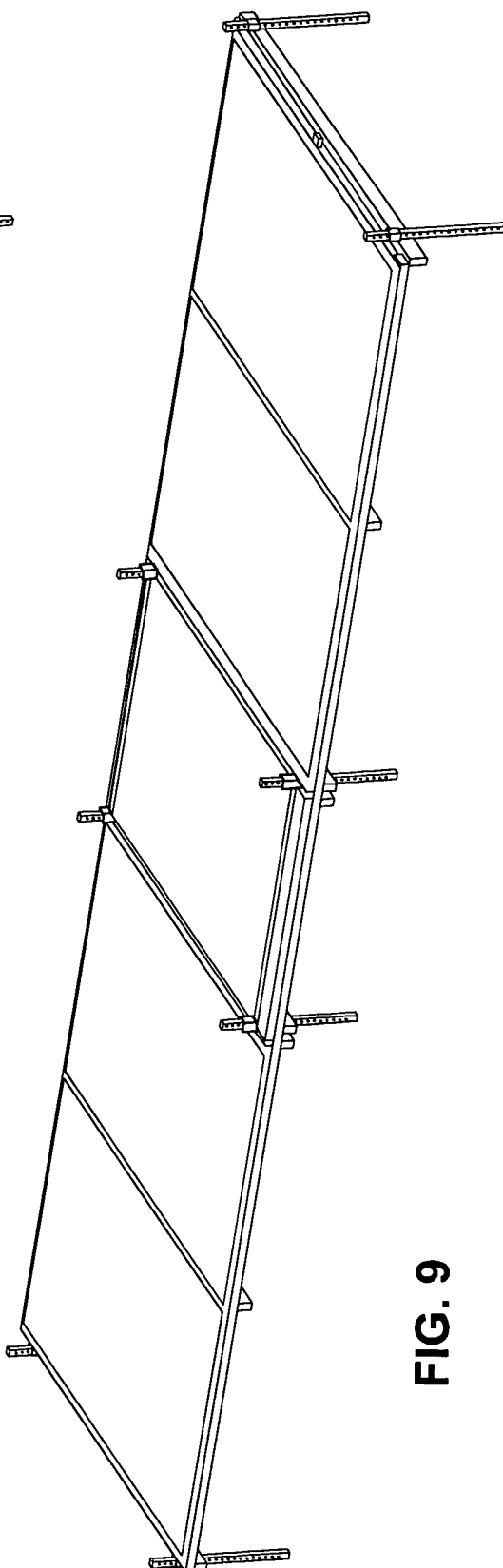


FIG. 9

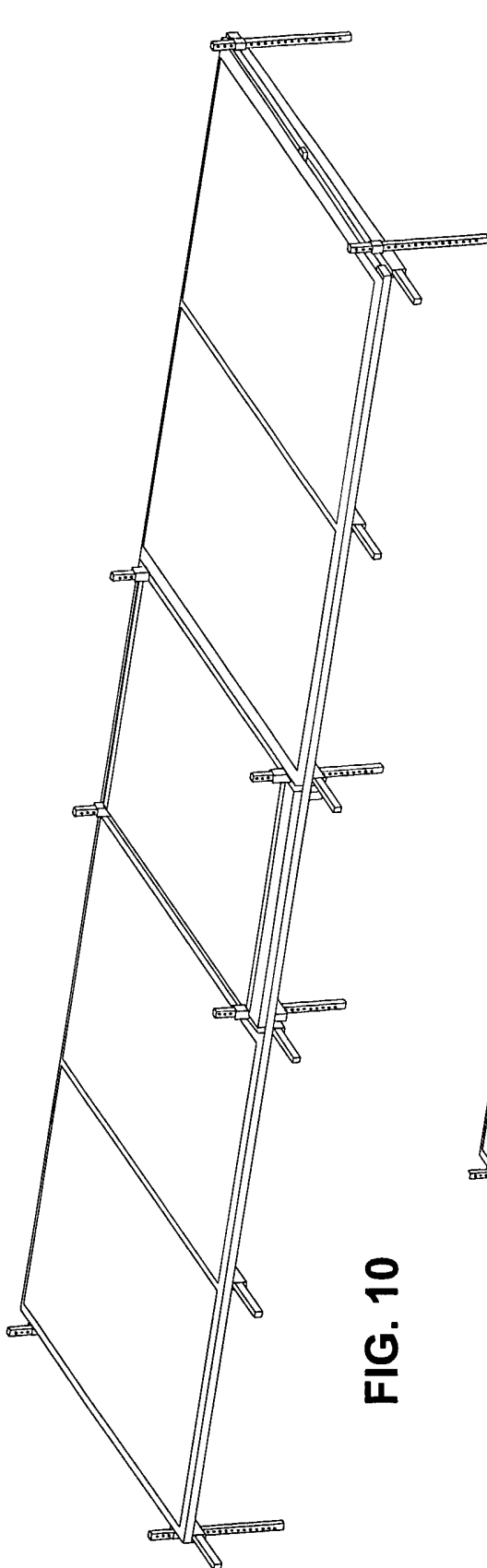


FIG. 10

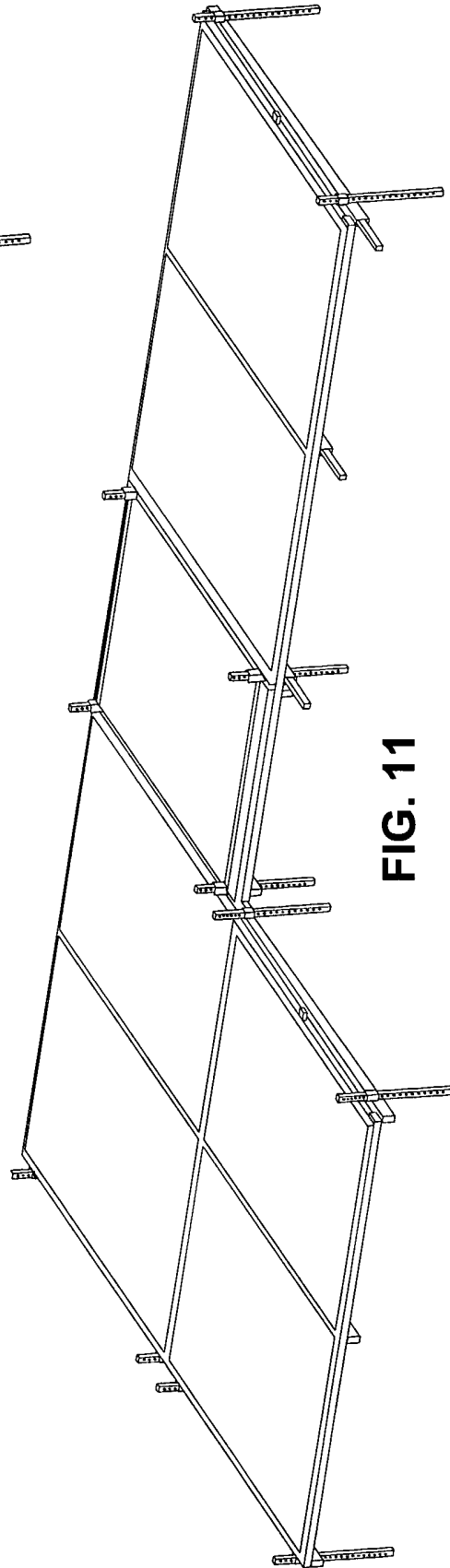


FIG. 11

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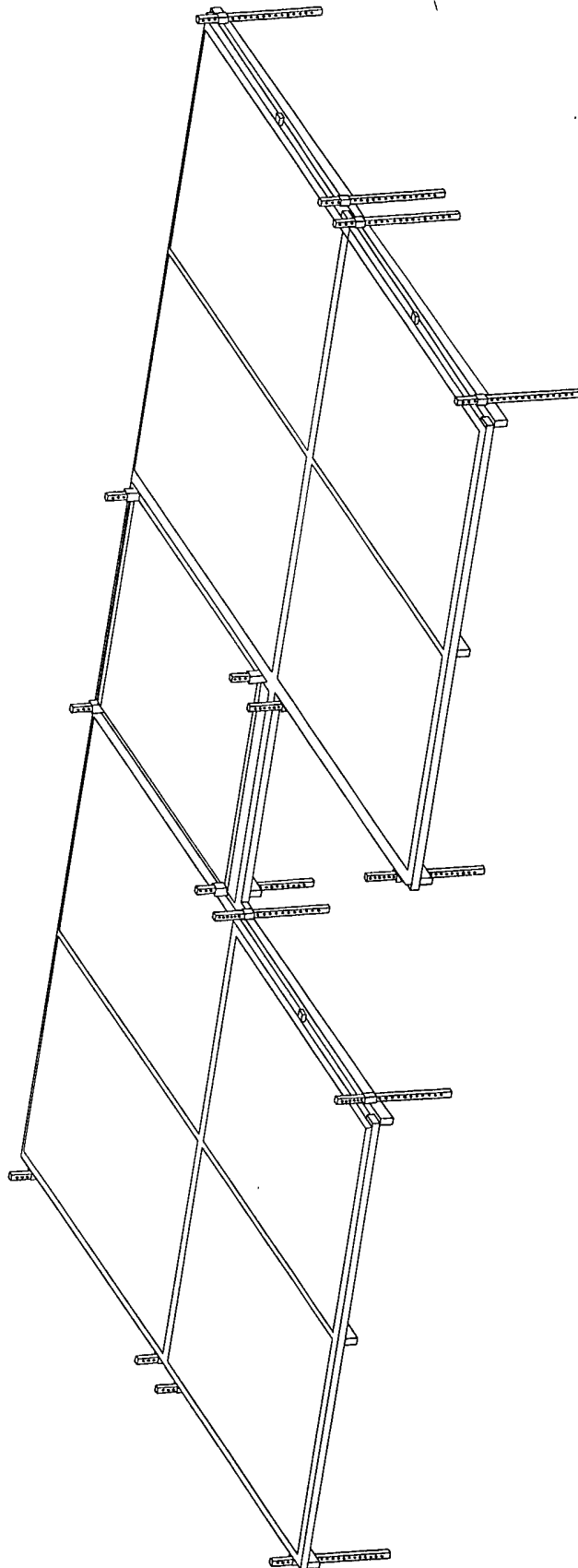


FIG. 12

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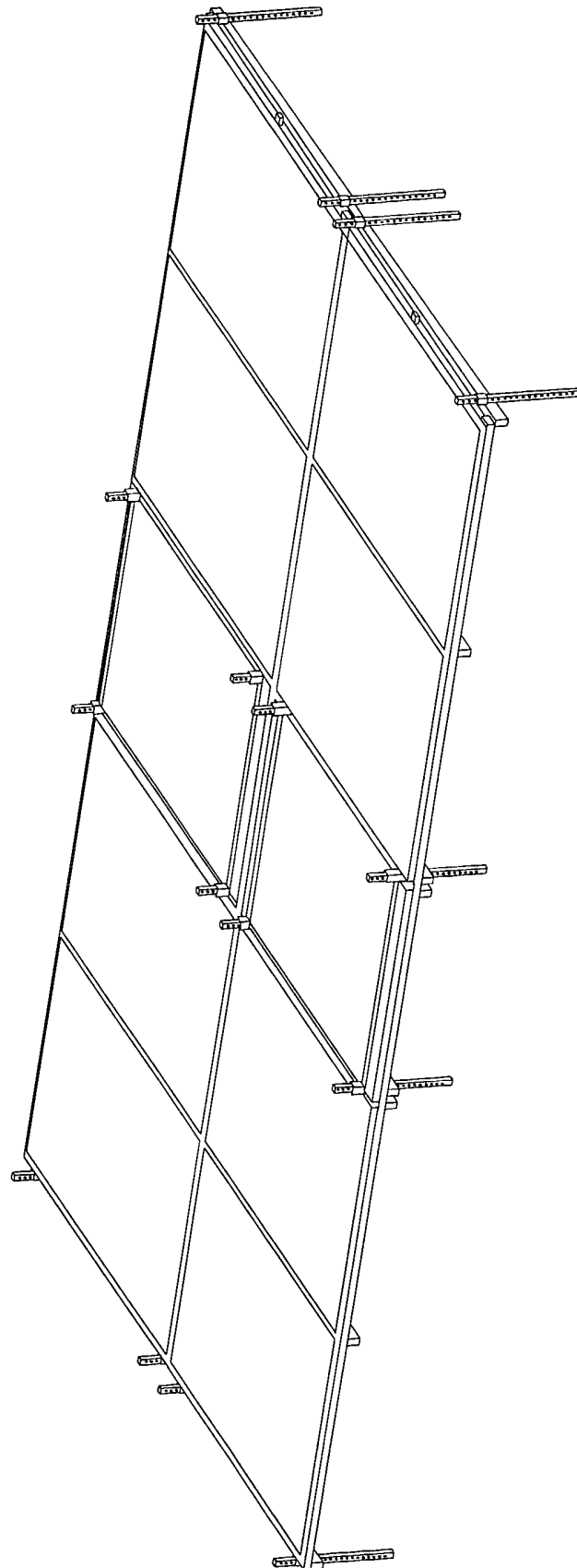


FIG. 13

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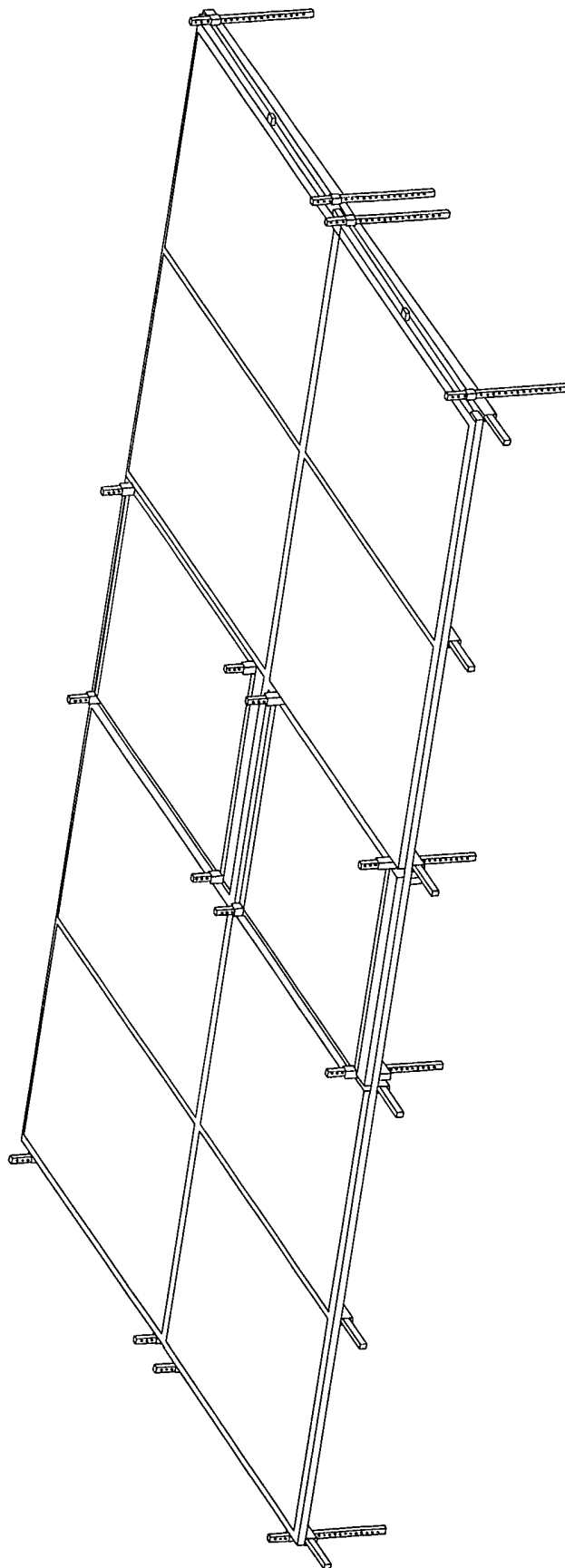


FIG. 14

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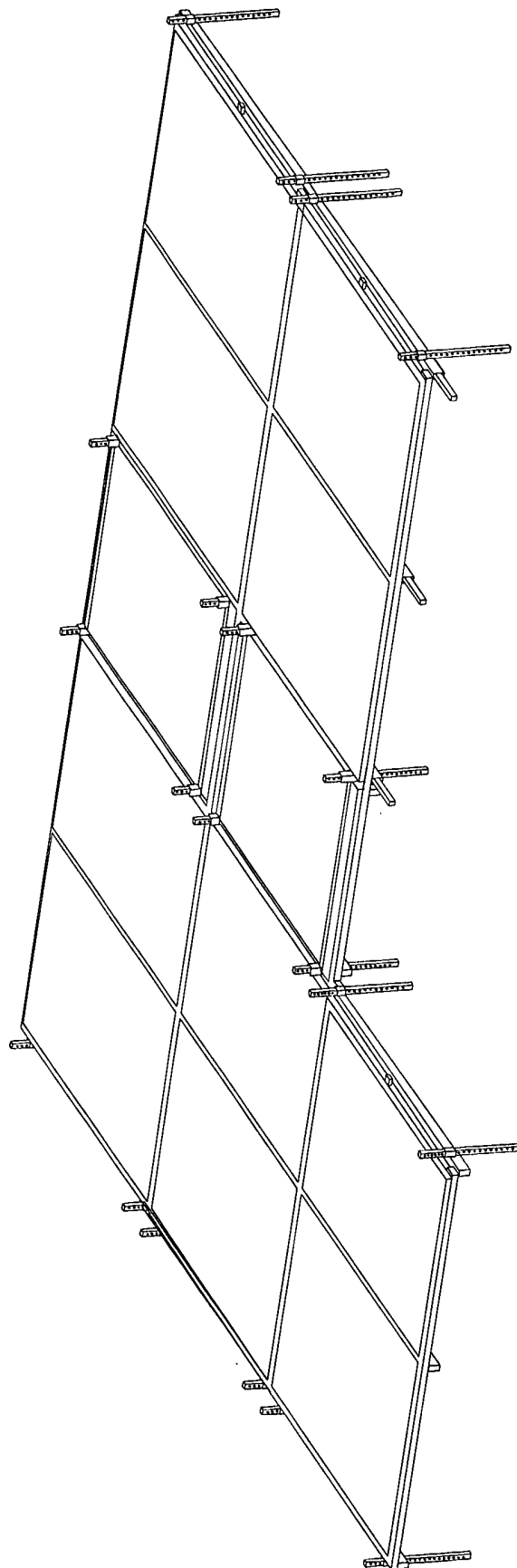


FIG. 15

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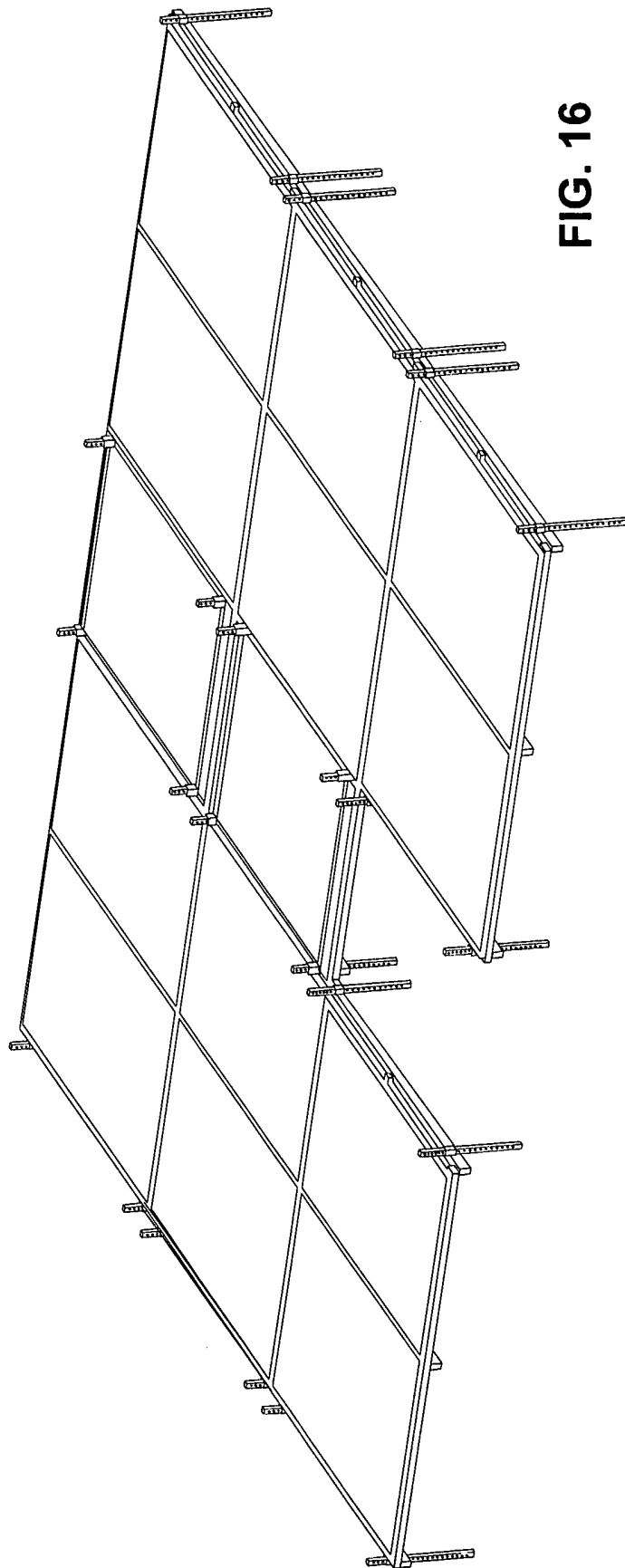


FIG. 16

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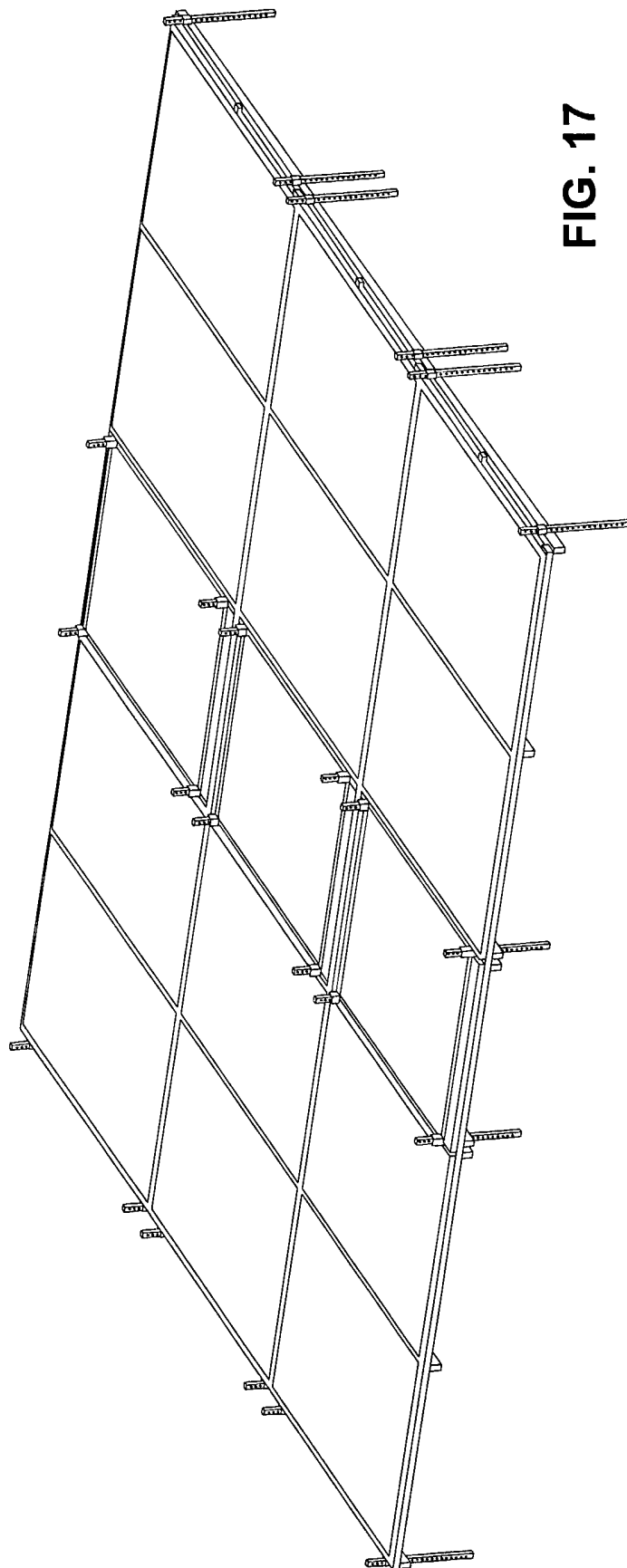


FIG. 17

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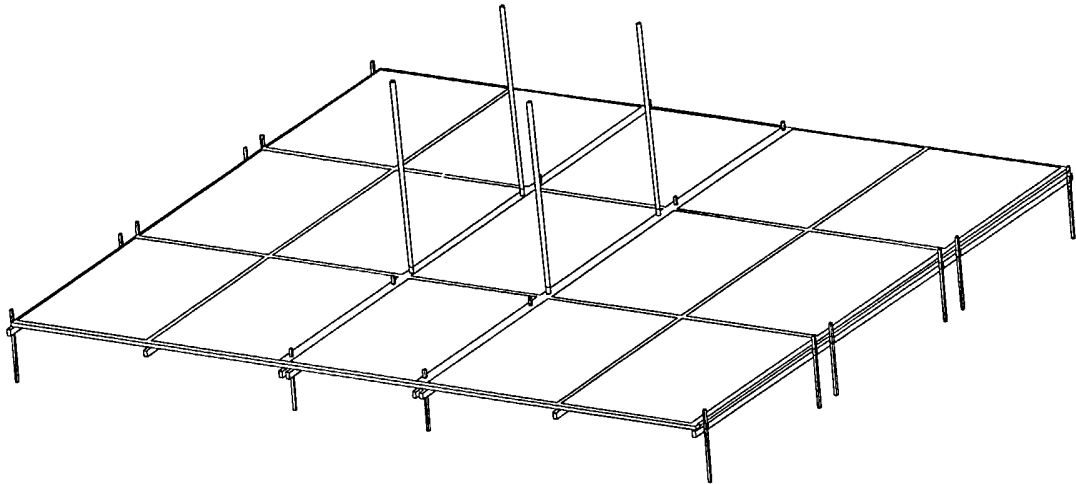


FIG. 18

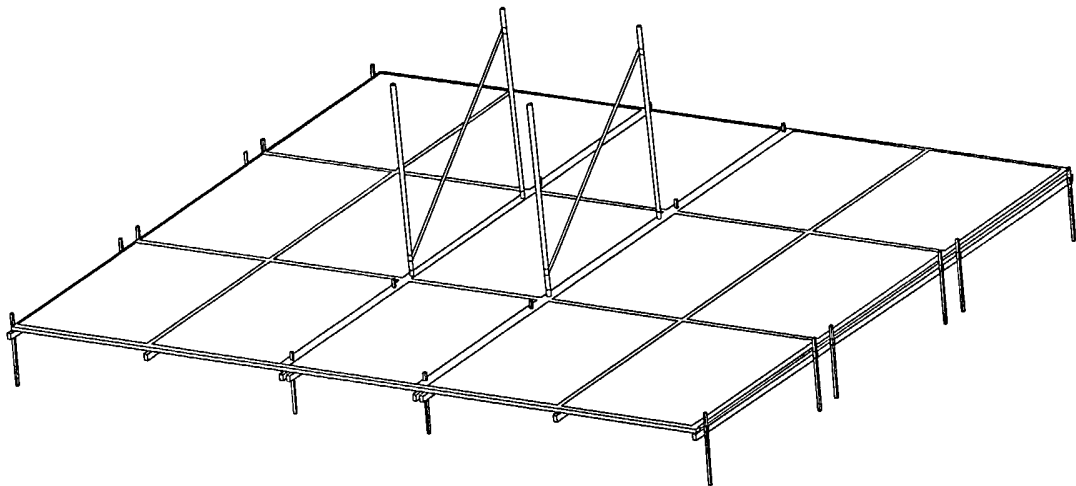


FIG. 19

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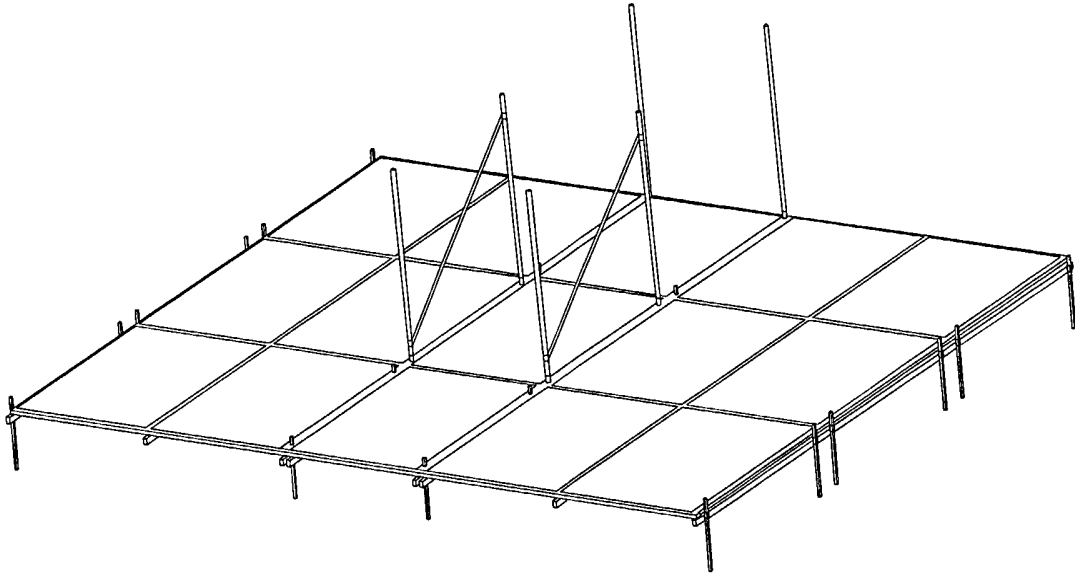


FIG. 20

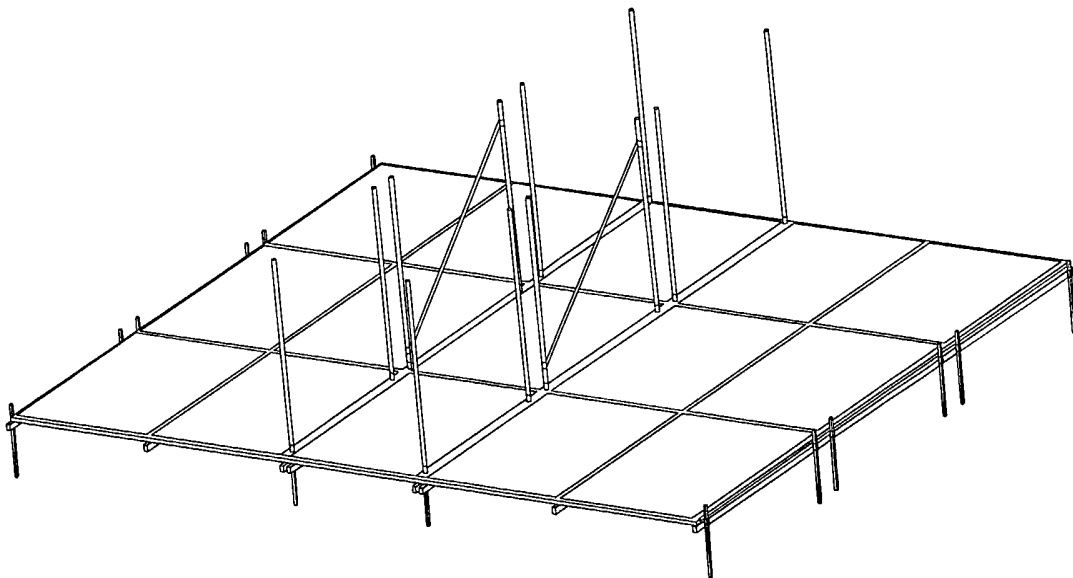


FIG. 21

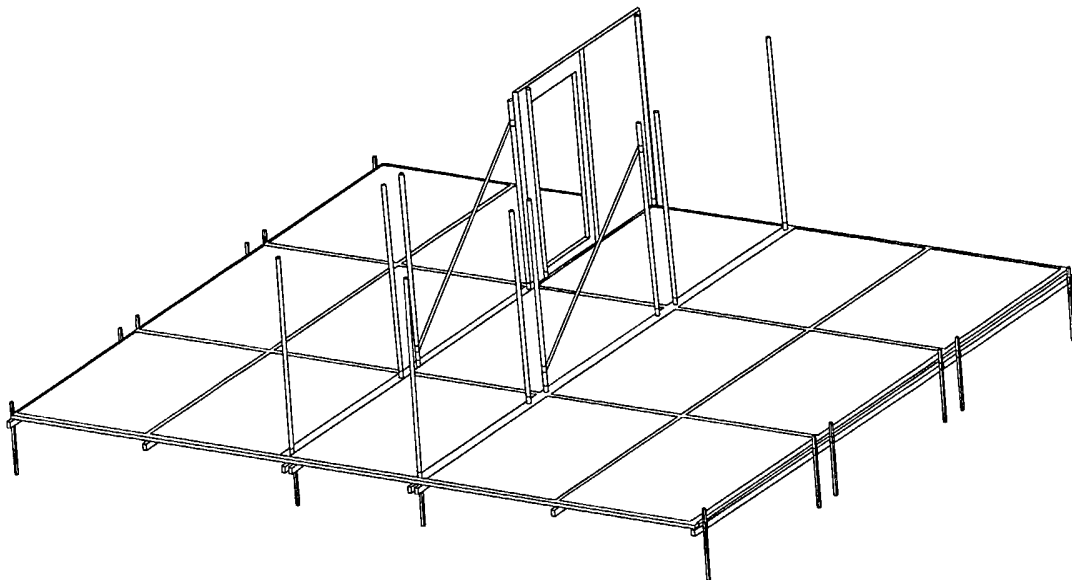


FIG. 22

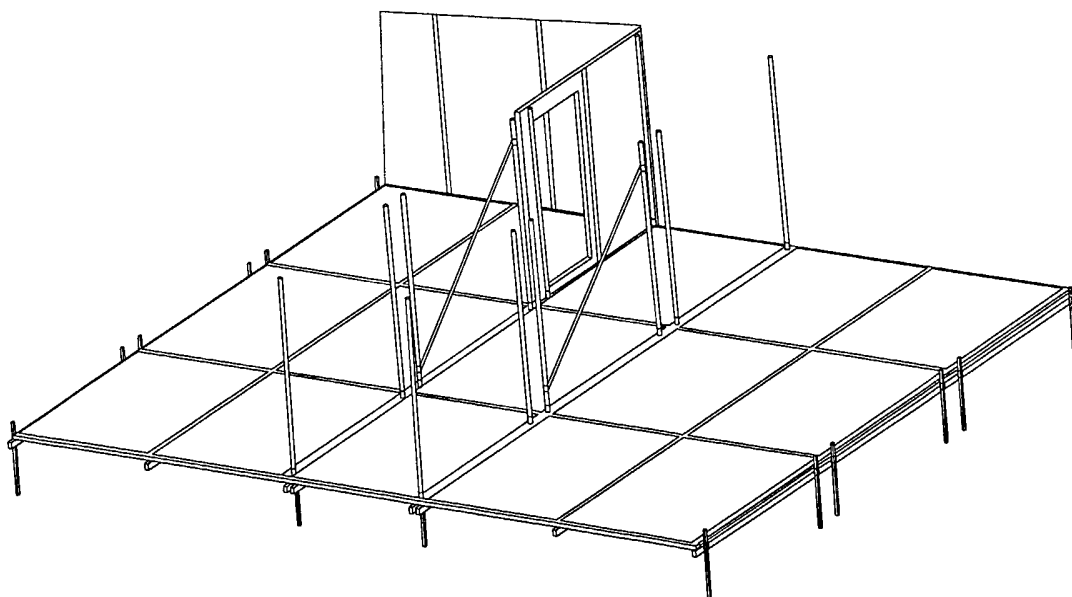


FIG. 23

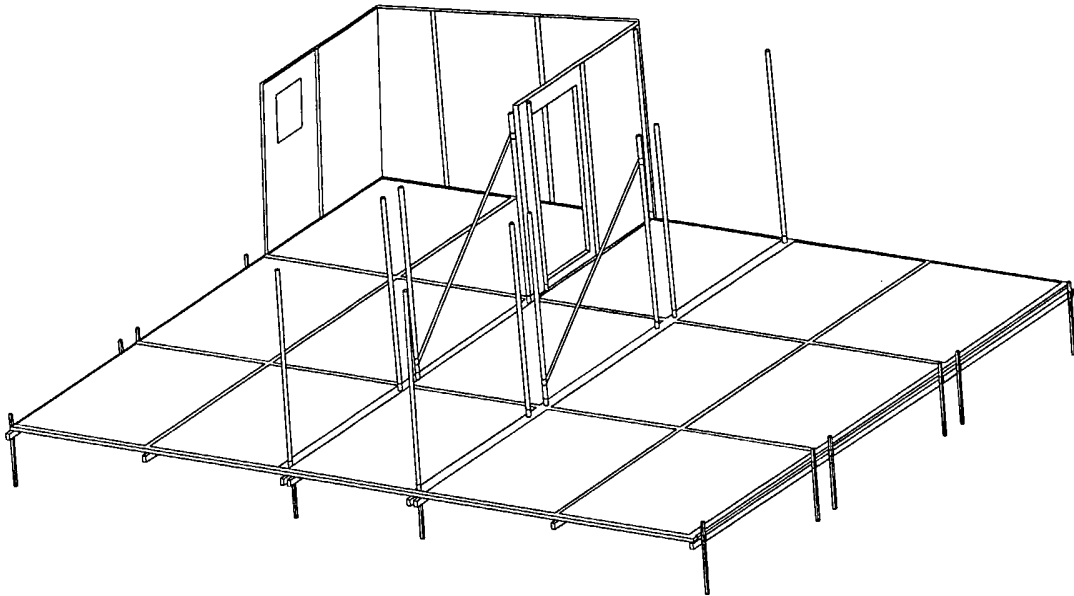


FIG. 24

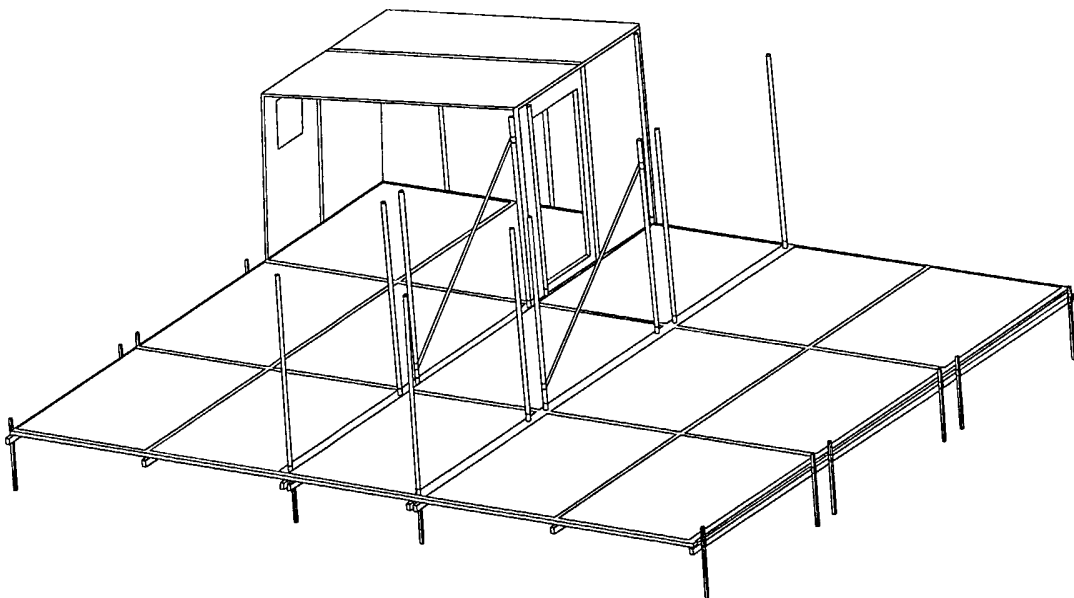


FIG. 25

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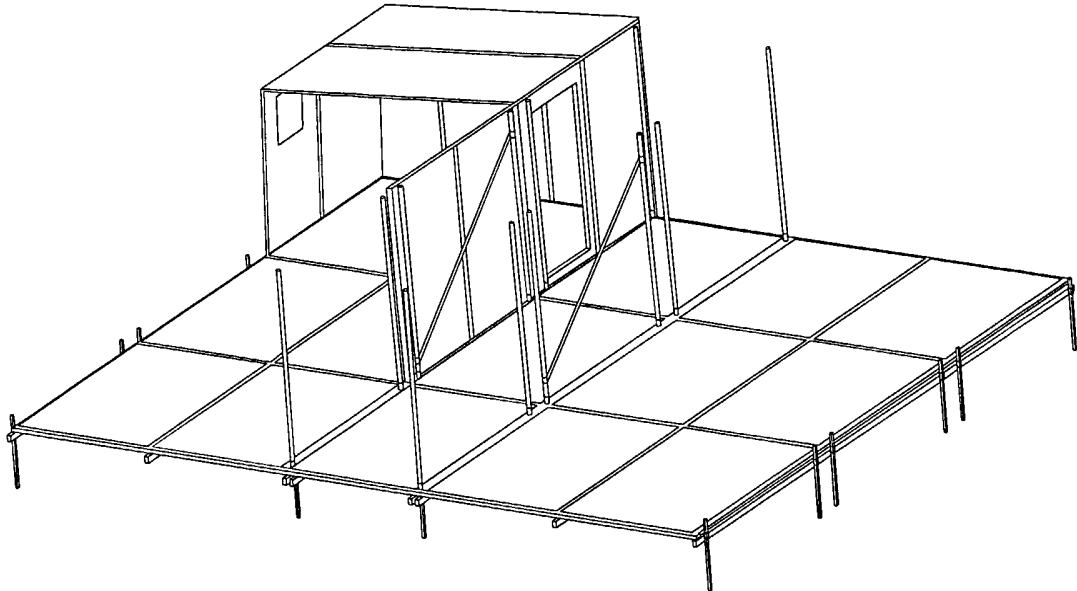


FIG. 26

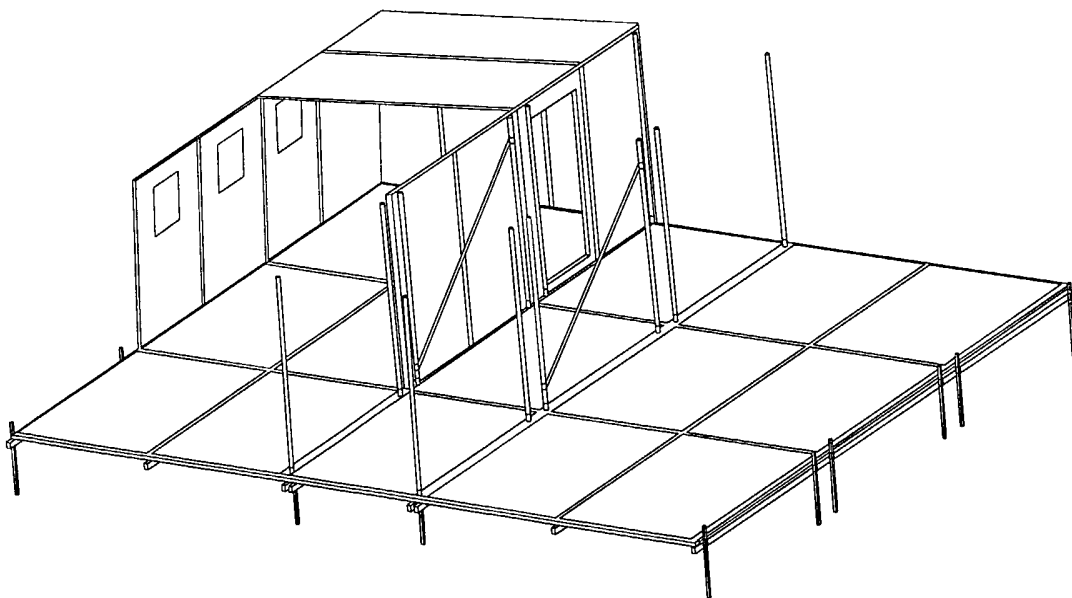


FIG. 27

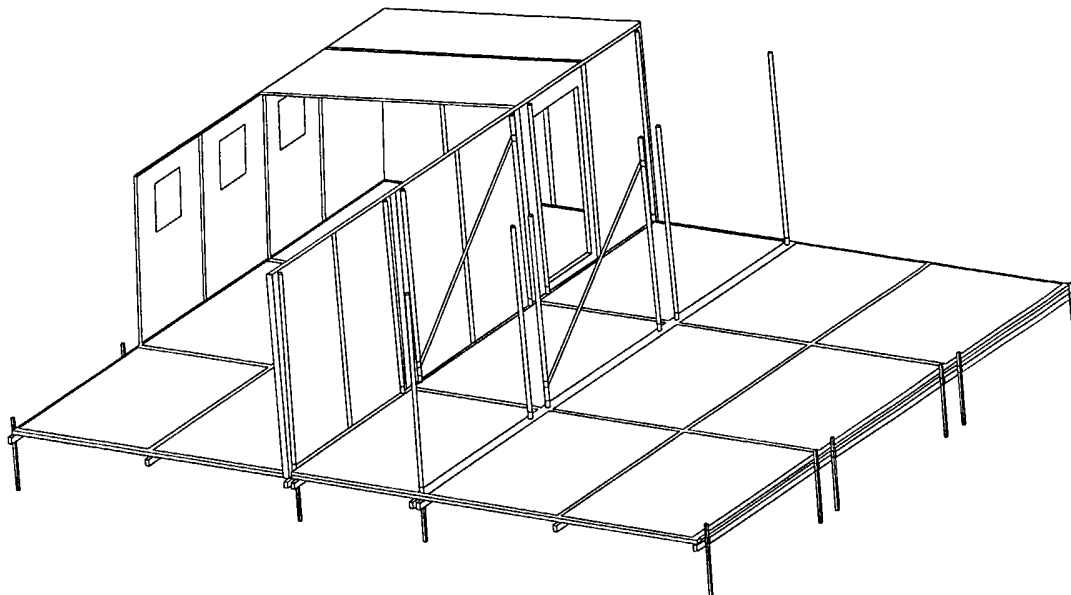


FIG. 28

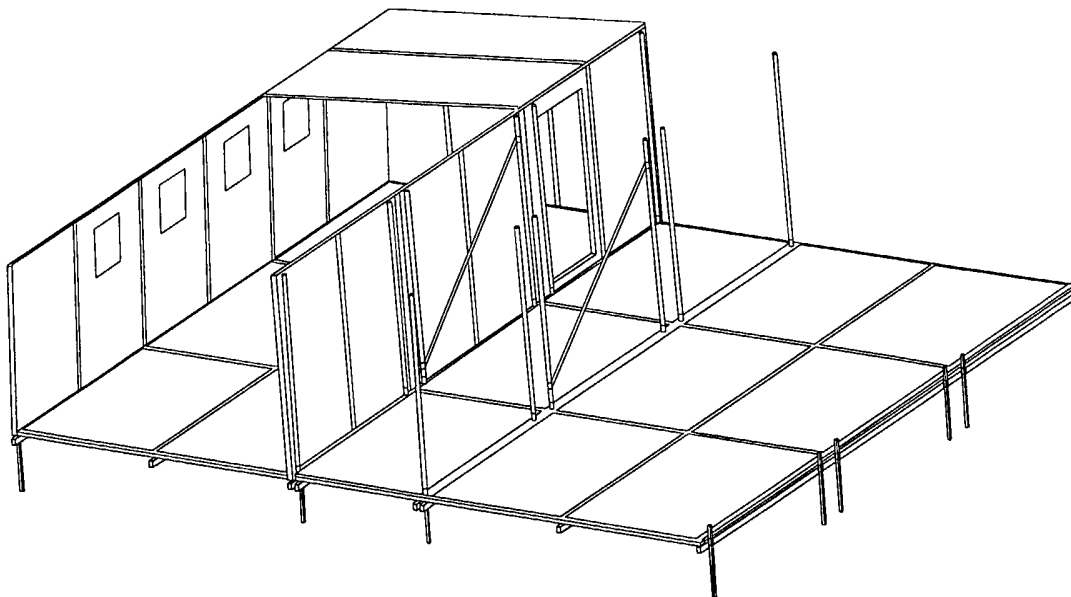


FIG. 29

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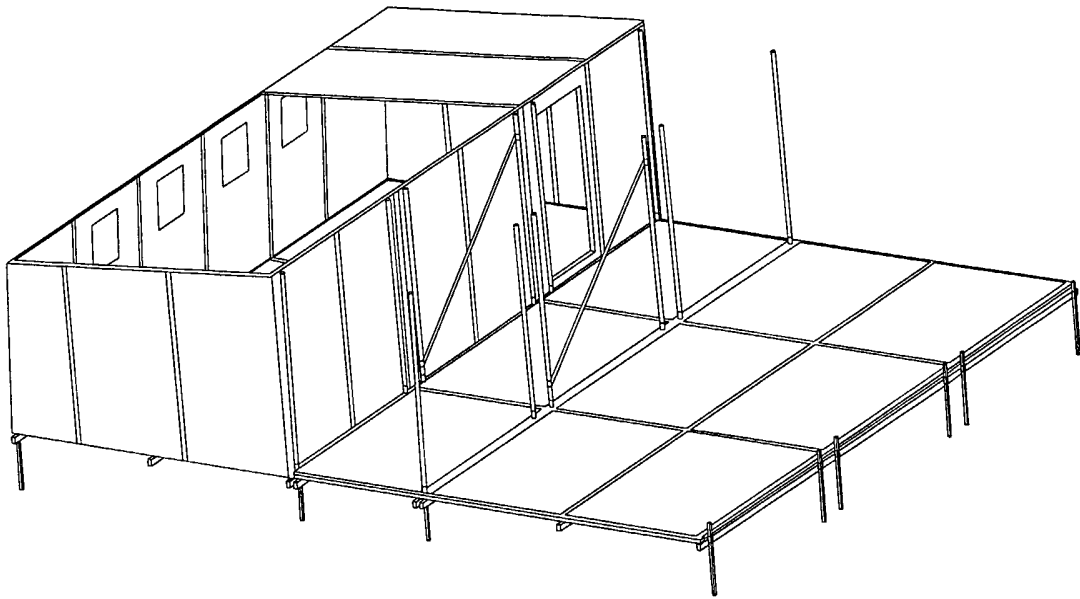


FIG. 30

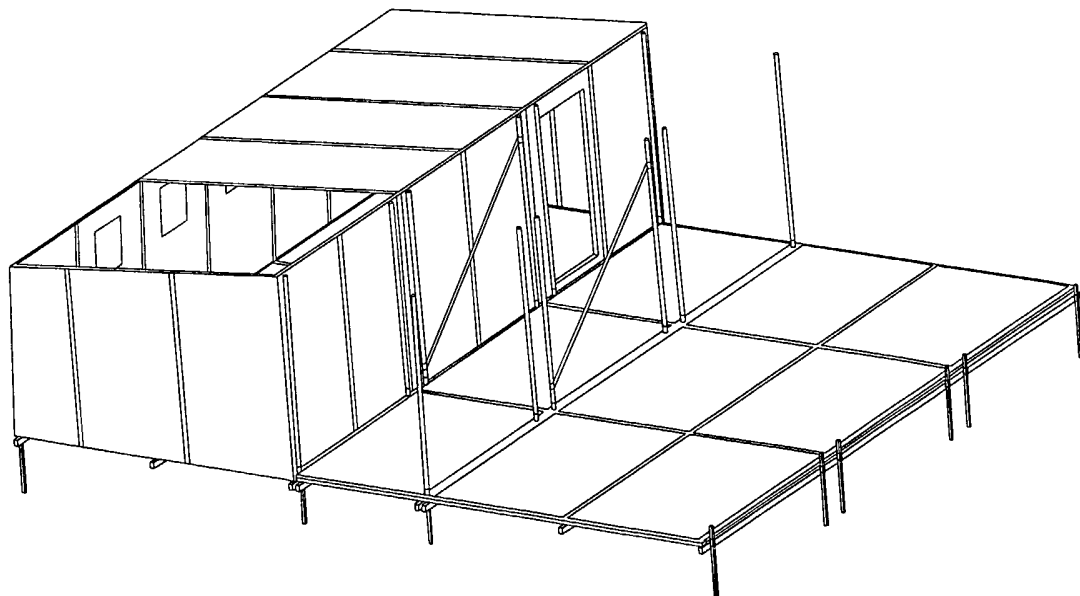


FIG. 31

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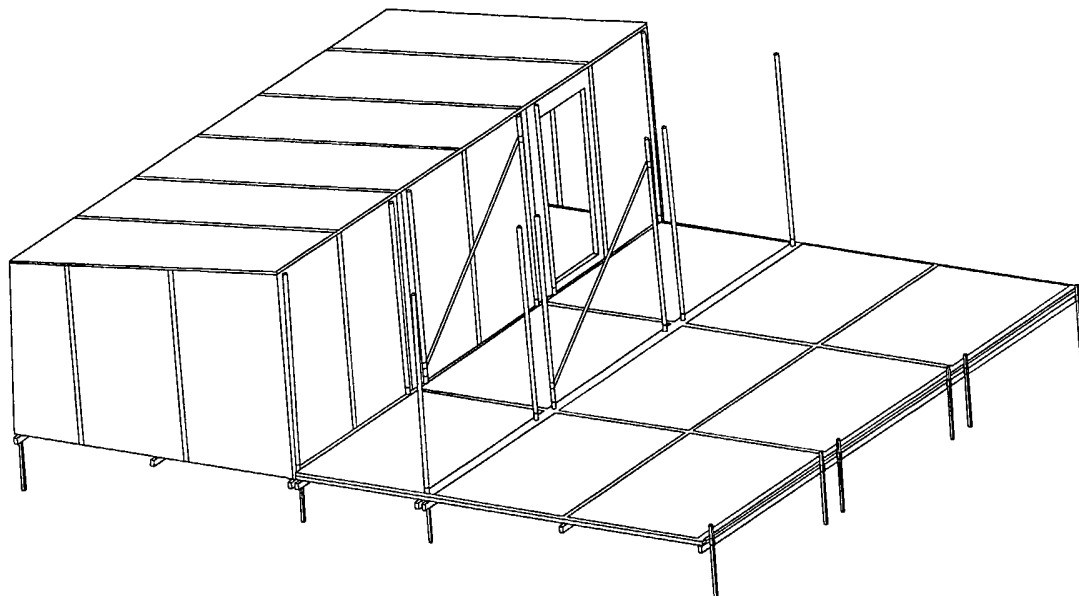


FIG. 32

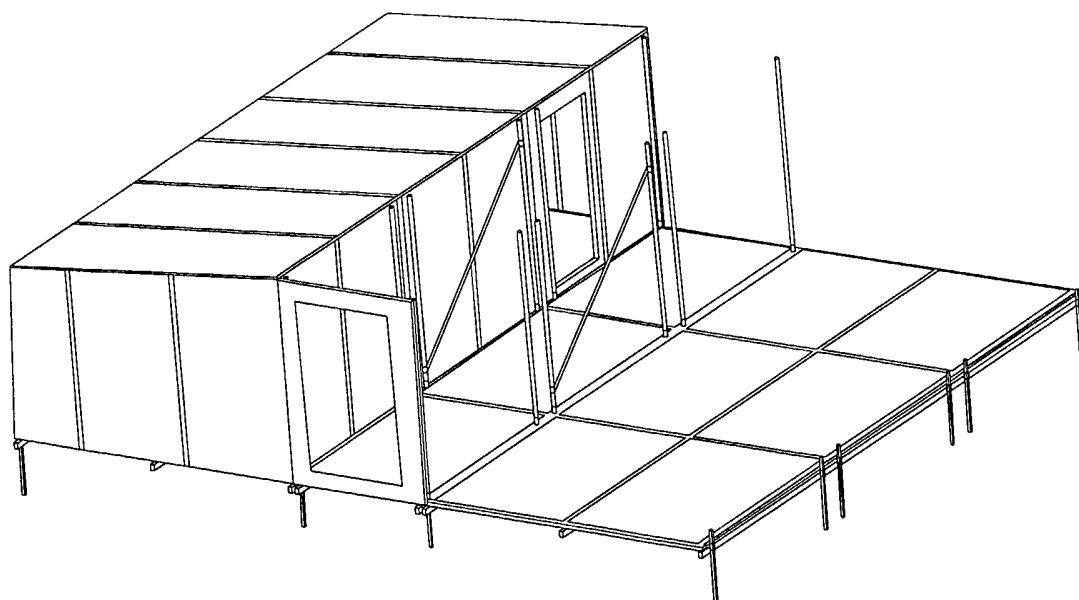


FIG. 33

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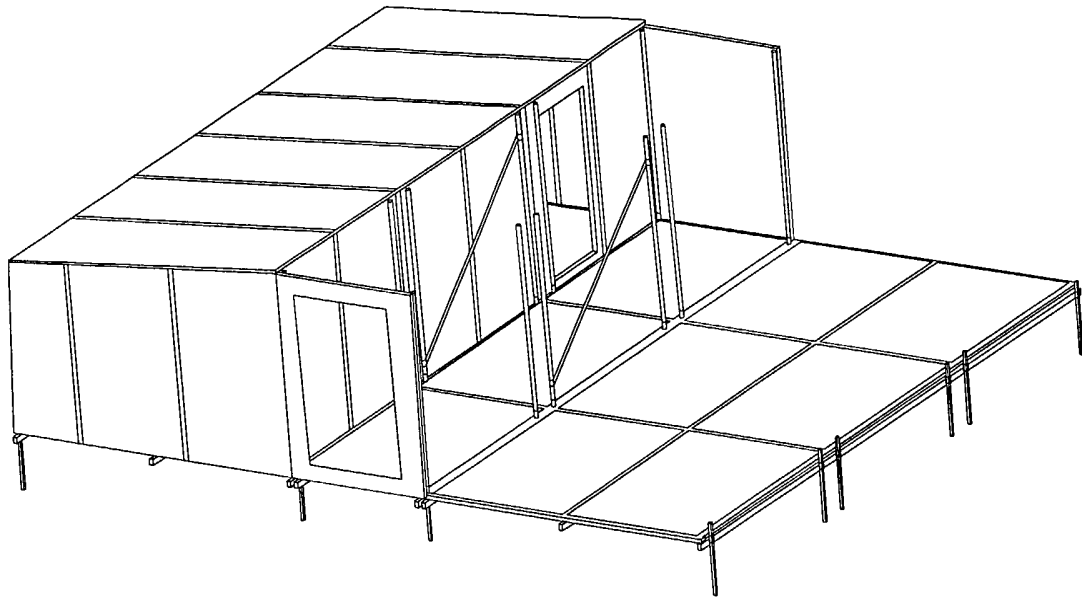


FIG. 34

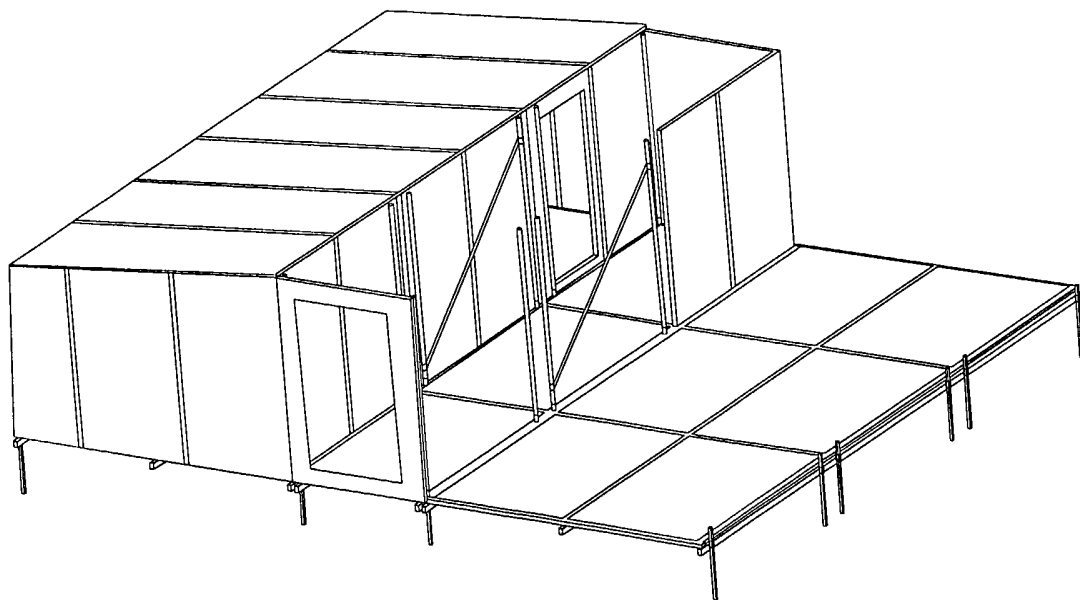


FIG. 35

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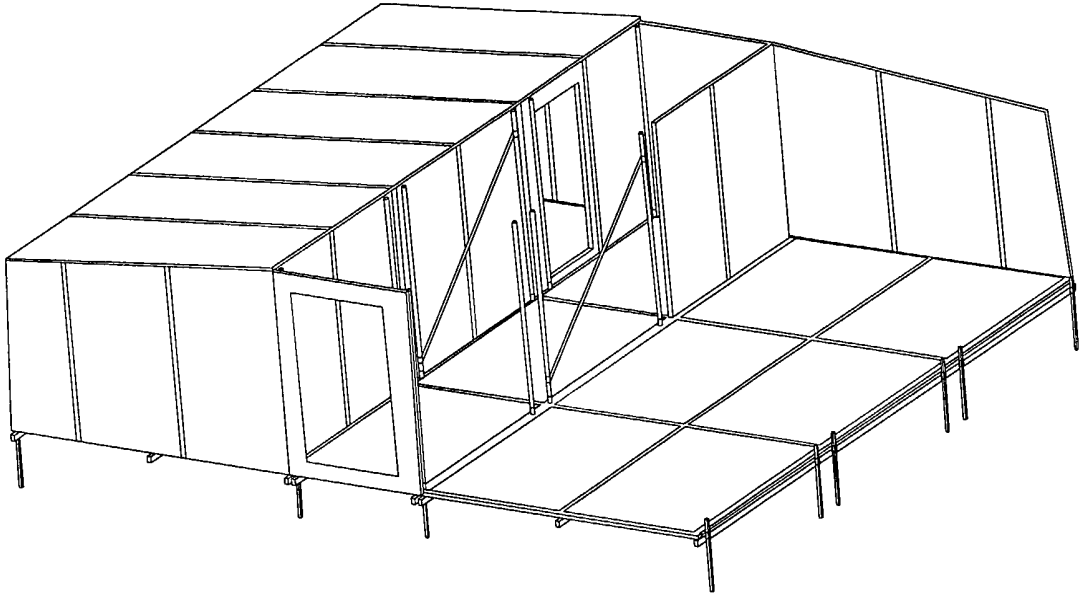


FIG. 36

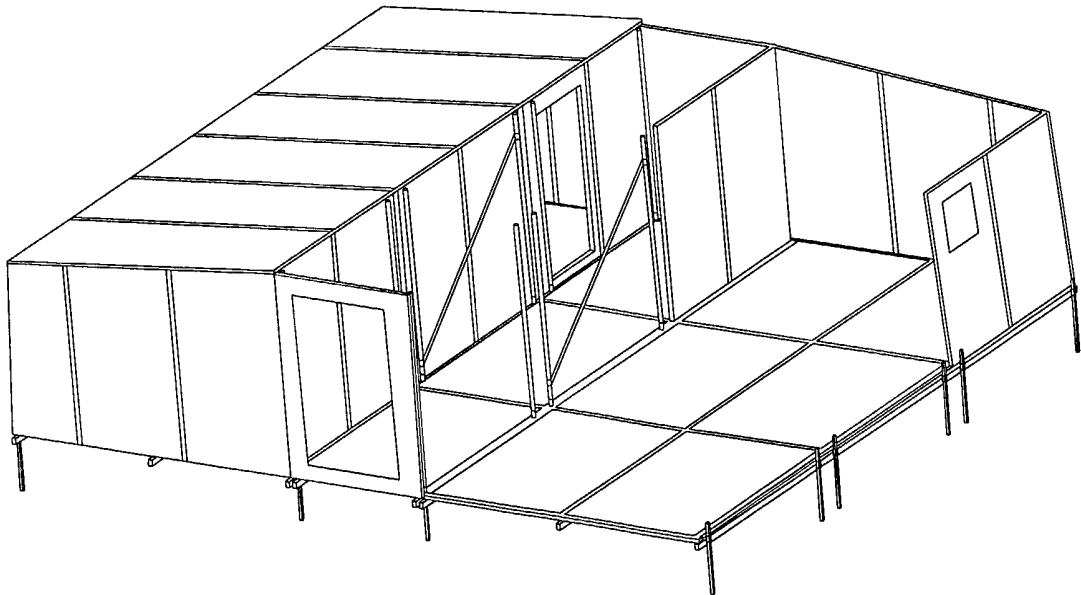


FIG. 37

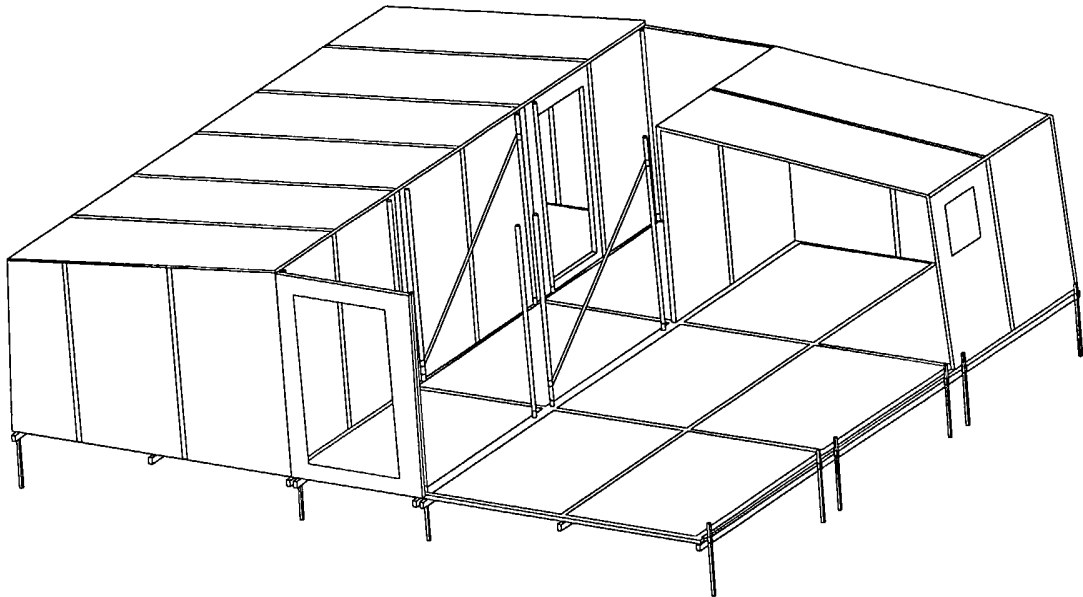


FIG. 38

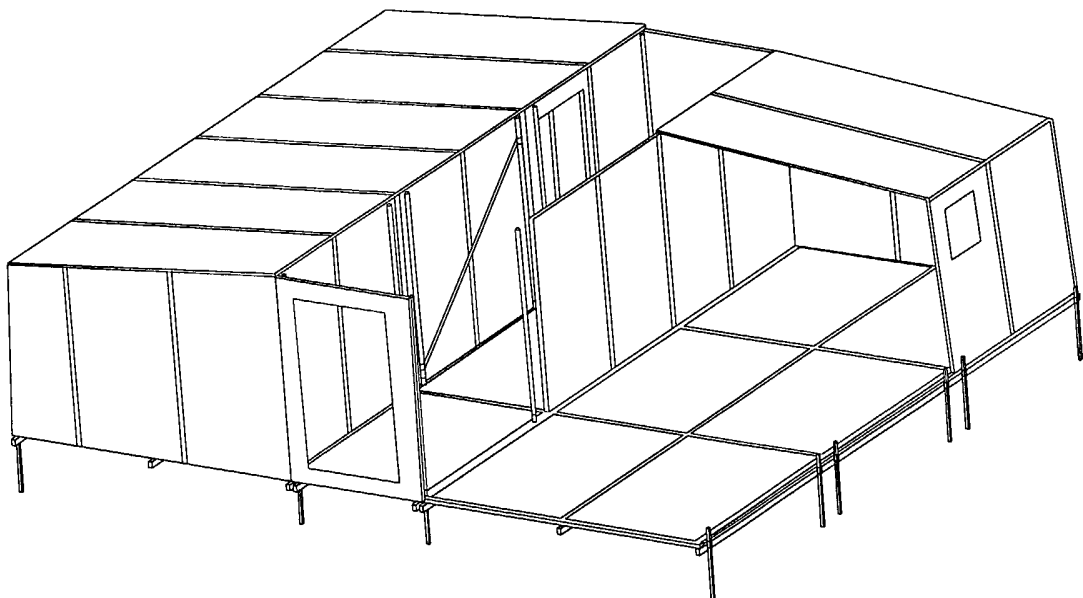


FIG. 39

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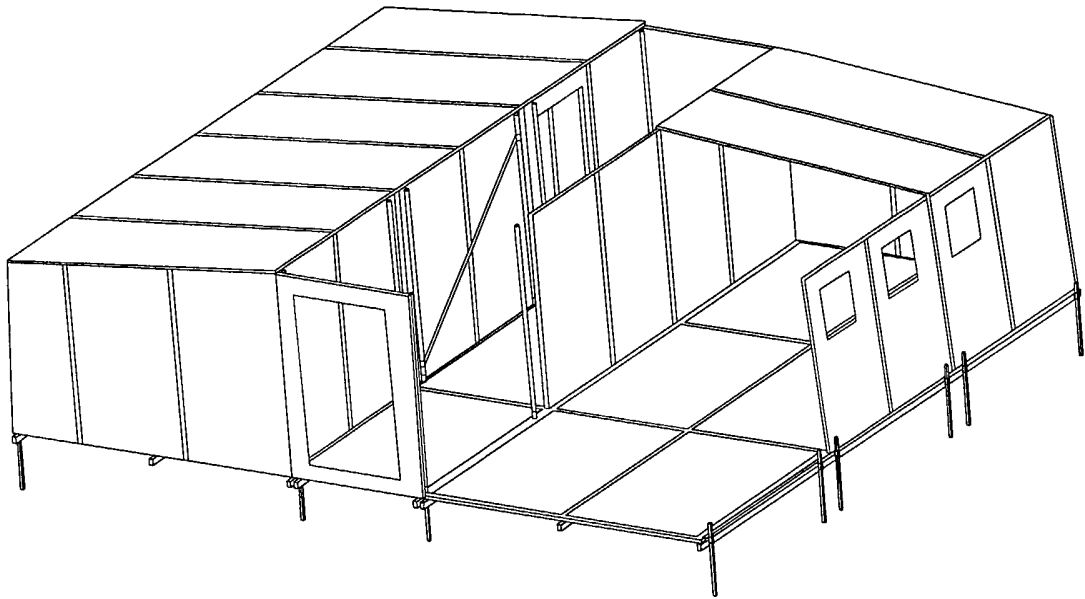


FIG. 40

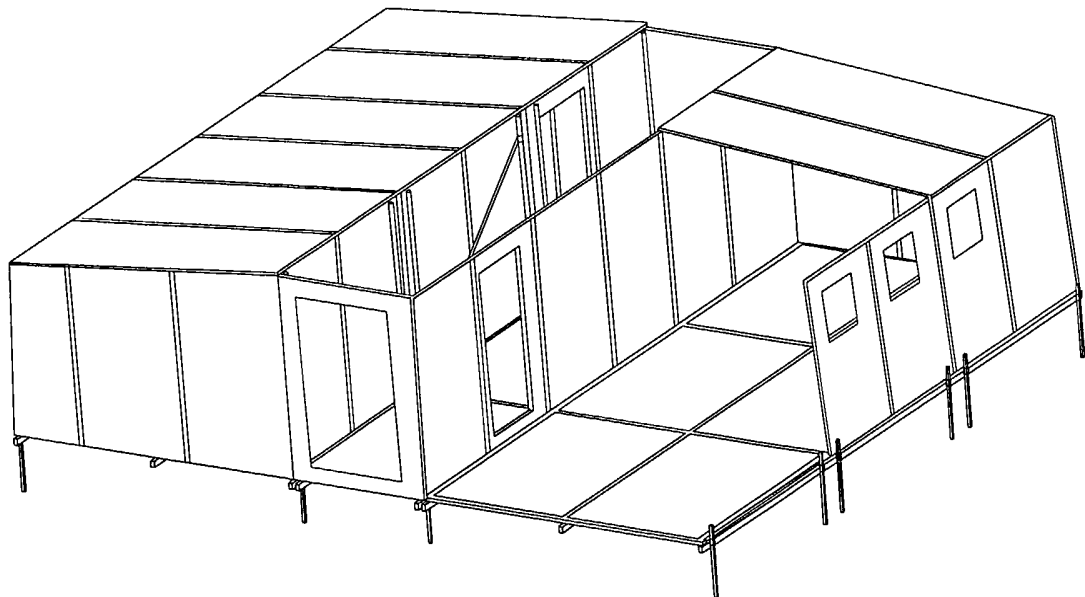


FIG. 41

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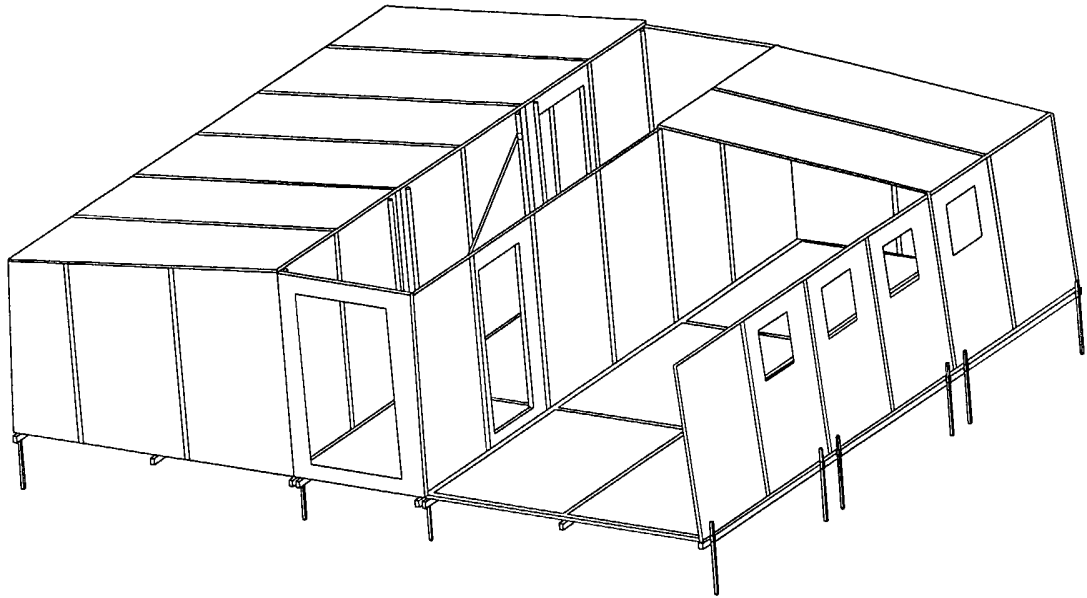


FIG. 42

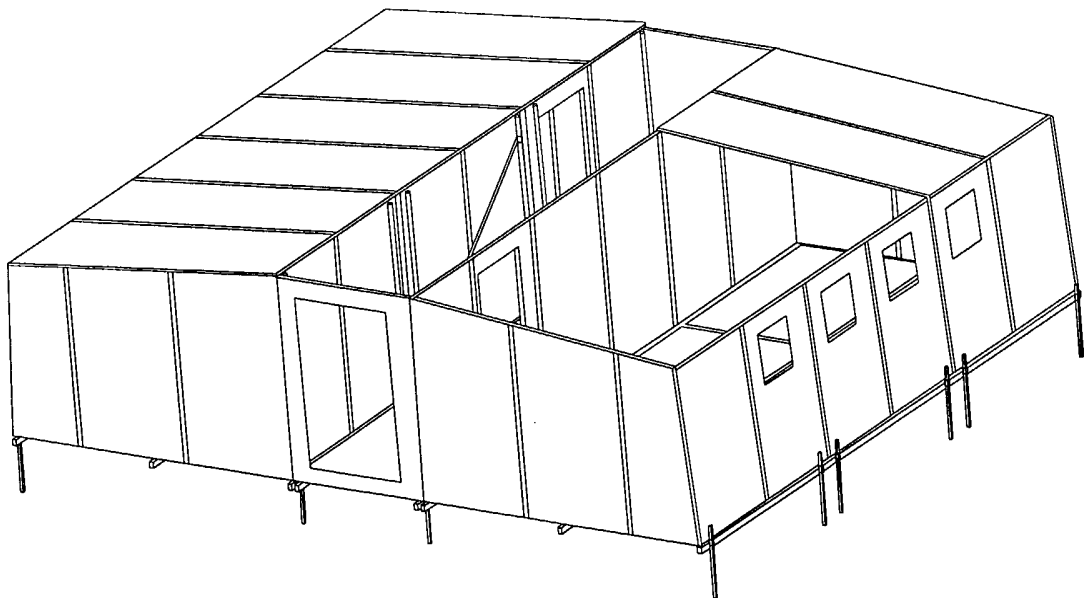


FIG. 43

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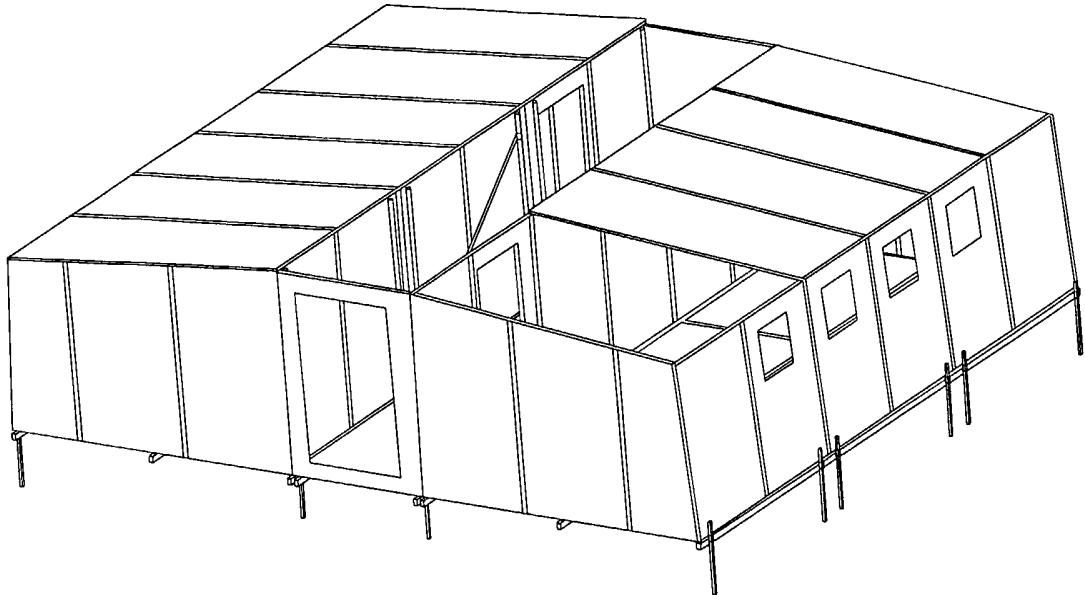


FIG. 44

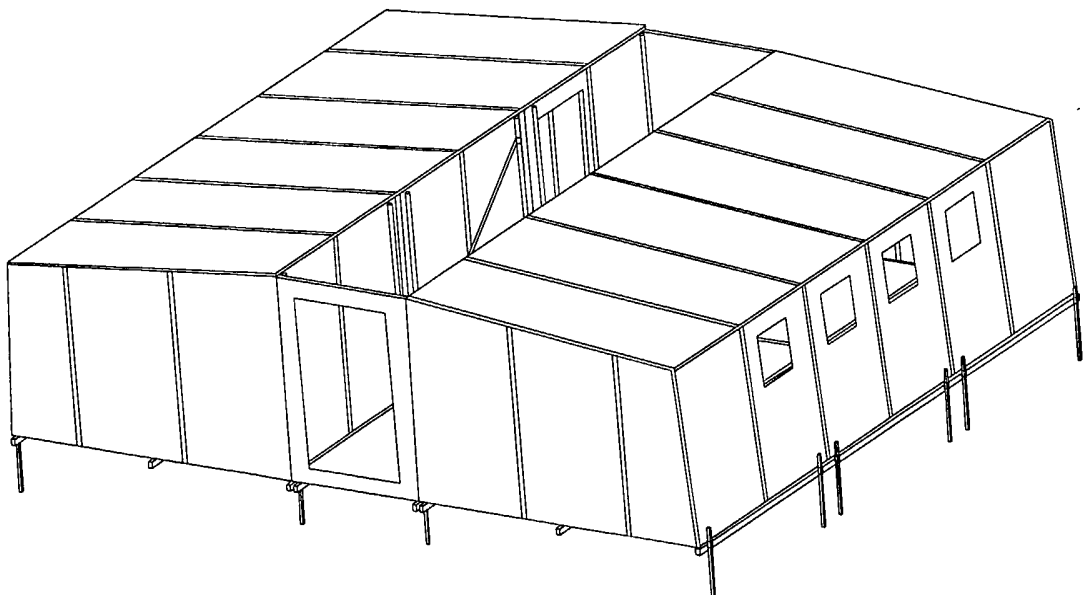


FIG. 45

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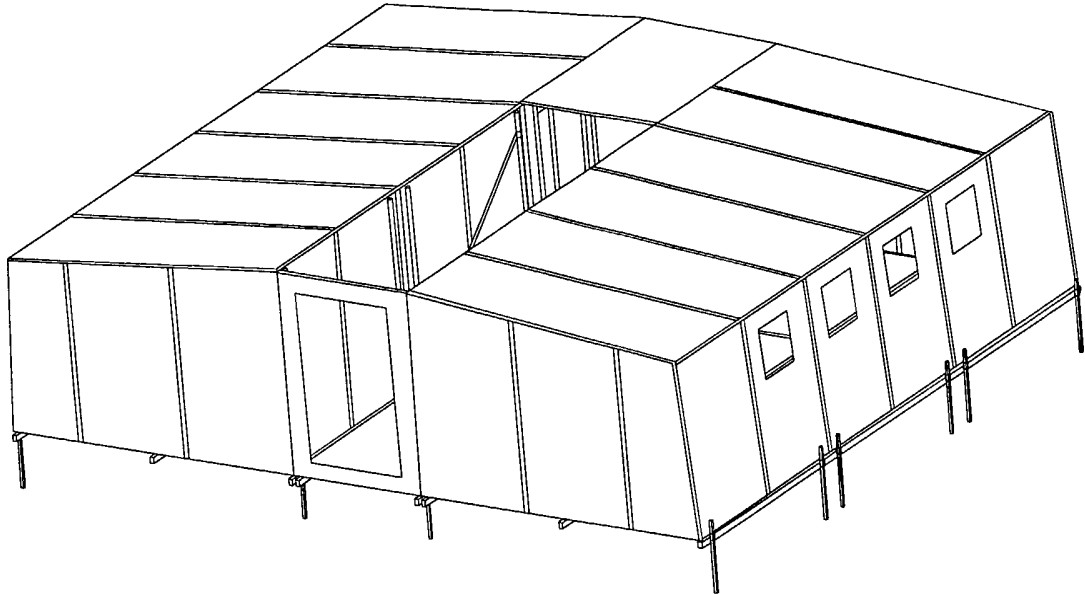


FIG. 46

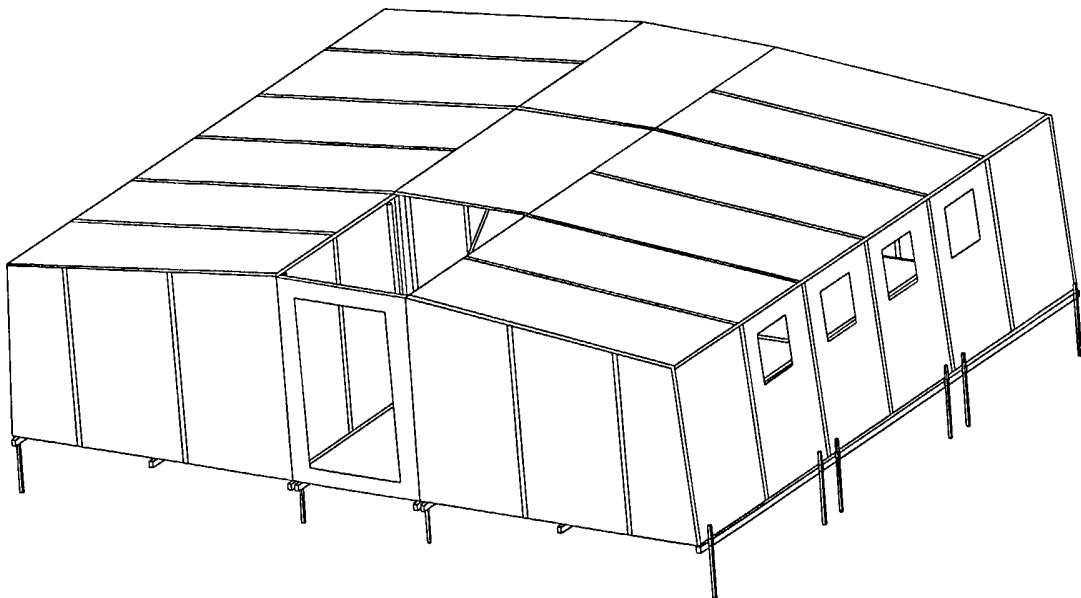


FIG. 47

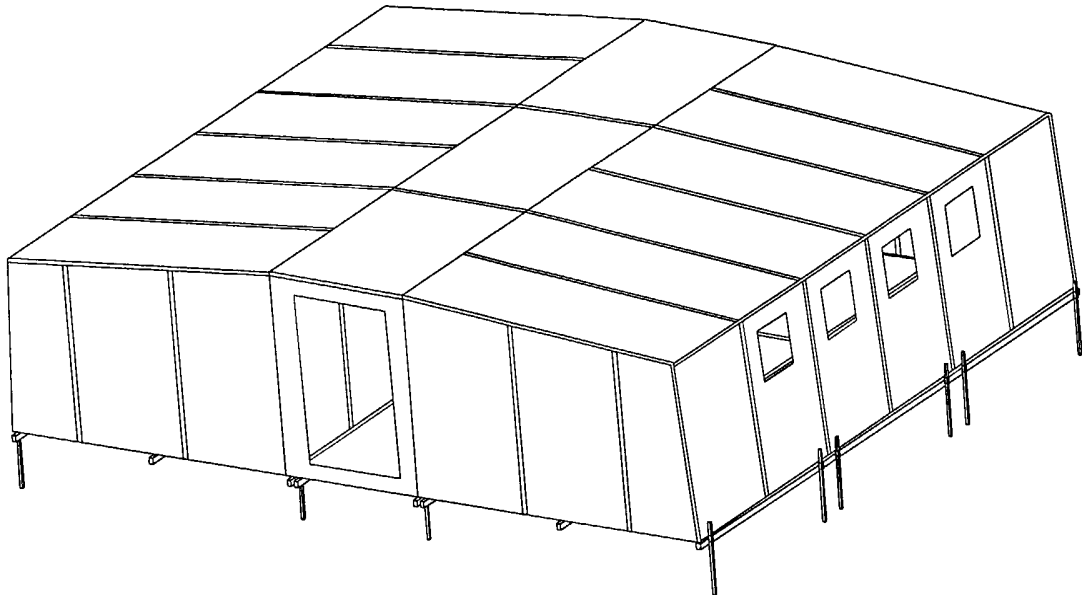


FIG. 48

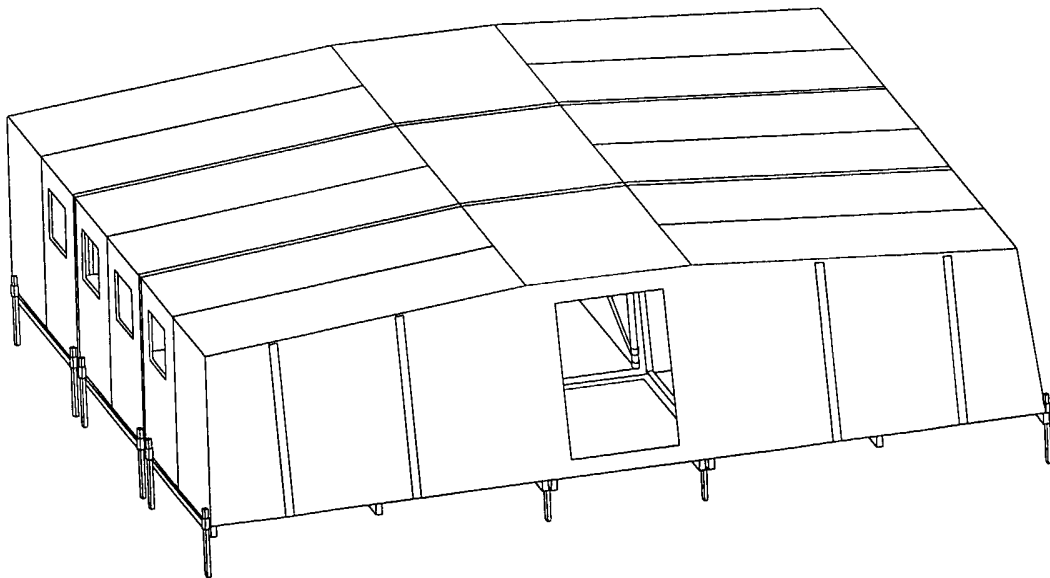


FIG. 49

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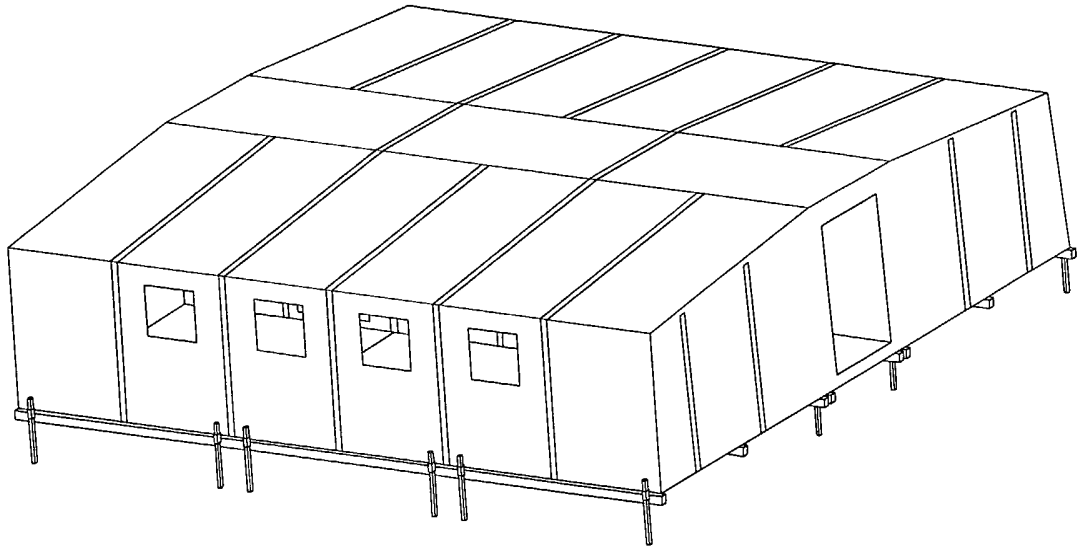


FIG. 50

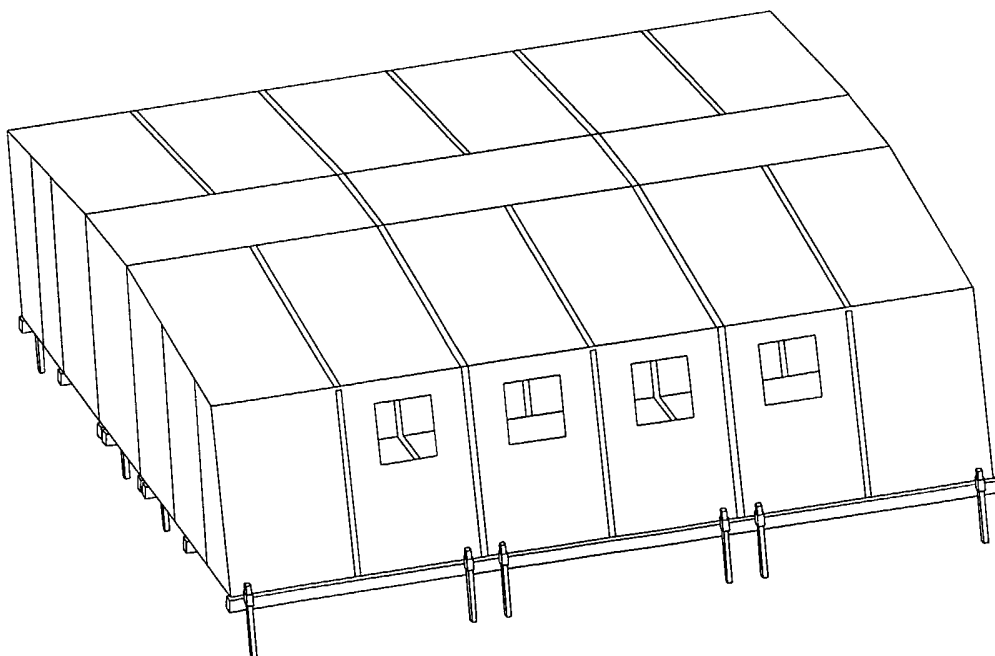


FIG. 51

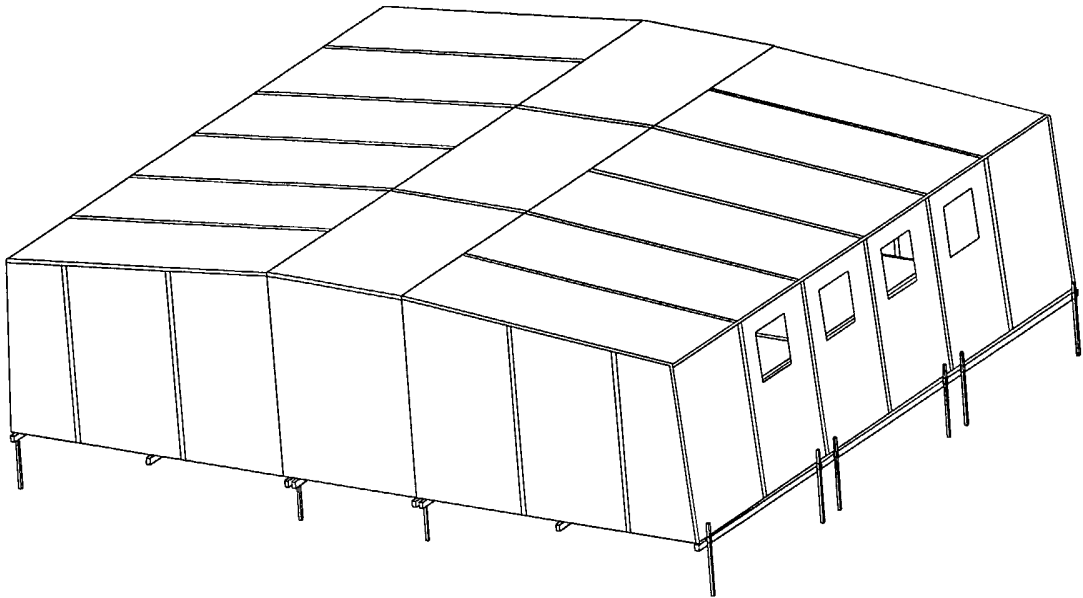


FIG. 52

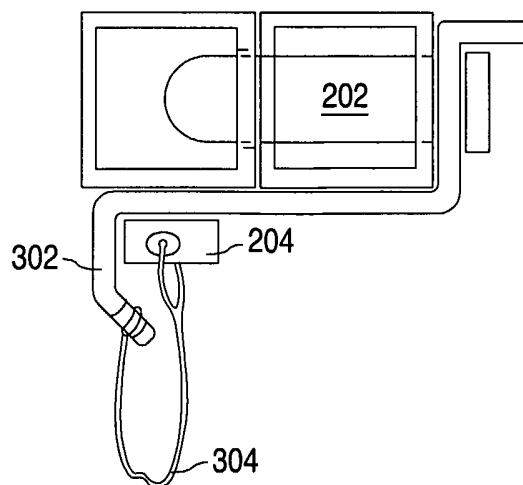


FIG. 54

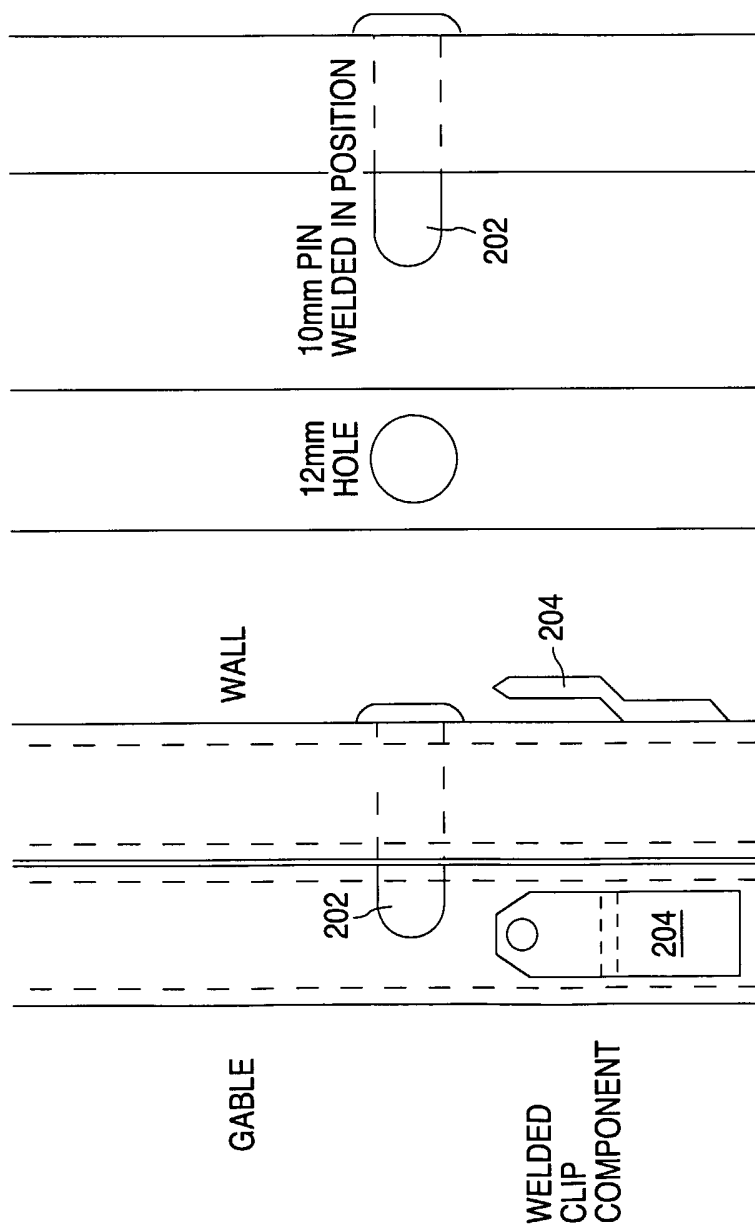


FIG. 53

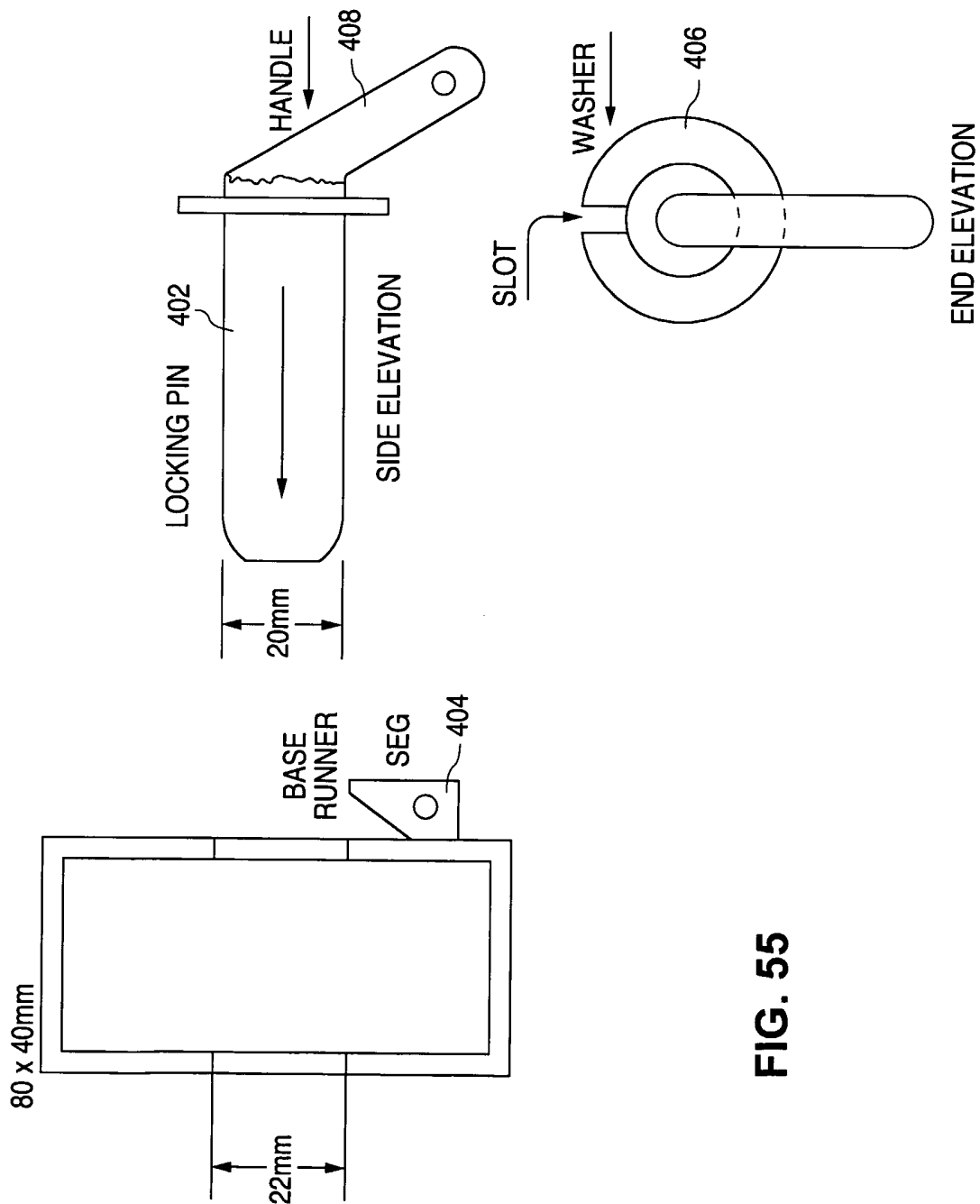


FIG. 55

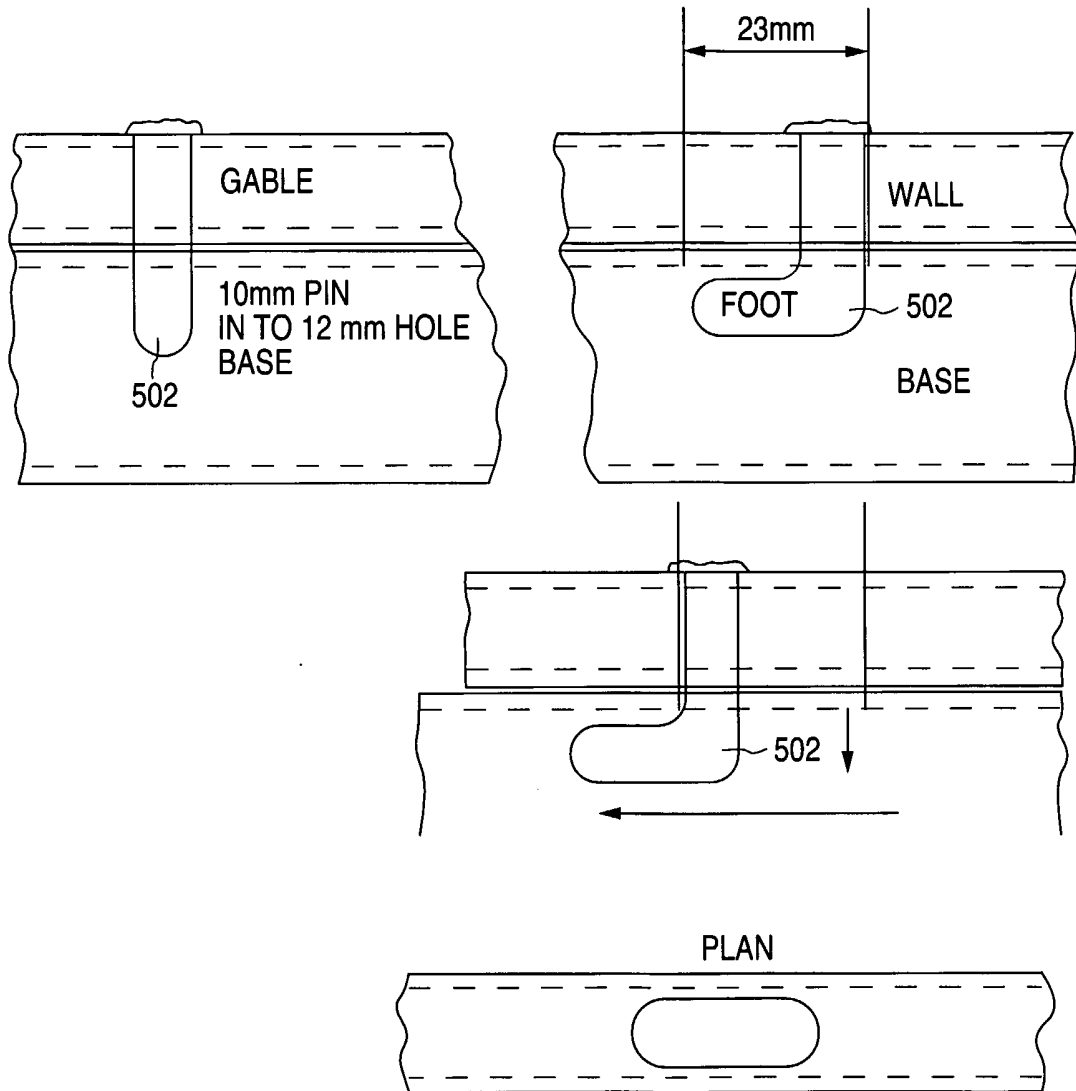


FIG. 56

INTERNATIONAL SEARCH REPORT

onal Application No

IB2004/001767

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 E04B1/343

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 E04B F16B E05C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 1 156 168 A (GARBUGLIO PAOLA ; COLOMBO ALESSANDRO (IT)) 21 November 2001 (2001-11-21) the whole document	1-8, 11, 13, 14, 16-21
Y	----- the whole document	9, 10, 12, 15
Y	WO 98/44211 A (PDQ EMERGENCY HOMES LIMITED ; MACWATT DAVID M (GB)) 8 October 1998 (1998-10-08) the whole document	10, 12
A	----- the whole document	1-9, 14, 15, 18
Y	US 4 454 694 A (DAVANTURE ROBERT) 19 June 1984 (1984-06-19) column 4, line 30 - line 32 ----- -/--	9, 15

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

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Date of the actual completion of the international search

30 September 2004

Date of mailing of the international search report

07/10/2004

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6 253 498 B1 (GORMAN JAMES J ET AL) 3 July 2001 (2001-07-03) column 1, line 53 - column 4, line 65; figures -----	1,7,11, 13,14, 17-20
A	FR 2 090 404 A (DUFOR PAUL; SOUCHET MAURICE) 14 January 1972 (1972-01-14) the whole document -----	1-8,11, 14,17-21
A	EP 0 039 592 A (PORTAKABIN LTD) 11 November 1981 (1981-11-11) the whole document -----	1-10,12, 14,15,18
A	AU 53440 69 A (C&I PORTABLE BUILDINGS PTY. LTD.) 18 June 1970 (1970-06-18) the whole document -----	1,8,9, 14,15,18

INTERNATIONAL SEARCH REPORT

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International Application No

IB2004/001767

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