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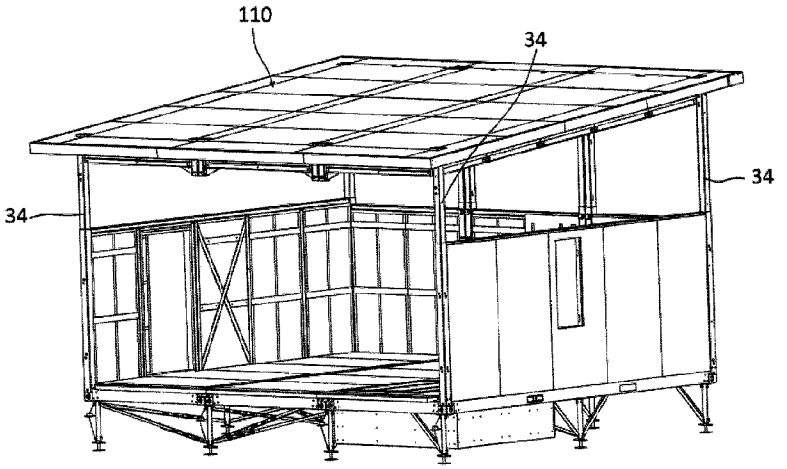


(57) Abrégé/Abstract:
A method, assembly and system of assembling and disassembling a shelter is provided. The method provided is configured to assemble a modular shelter in a hard to access location without heavy machinery. The assembly comprises a plurality of shipping modules having truss systems composed of beams and columns. The trusses may be connected to other trusses with the help of joint nodes. The truss system may be extended for sliding columns, may be connected to varying other trusses with varying joint nodes and may comprise connecting elements for angled connections. The assembly and the truss system are modular in that a plurality of the beams, columns and joint nodes may be removable.

## Abstract

A method, assembly and system of assembling and disassembling a shelter is provided. The method provided is configured to assemble a modular shelter in a hard to access location without heavy machinery. The assembly comprises a plurality of shipping modules having truss systems composed of beams and columns. The trusses may be connected to other trusses with the help of joint nodes. The truss system may be extended for sliding columns, may be connected to varying other trusses with varying joint nodes and may comprise connecting elements for angled connections. The assembly and the truss system are modular in that a plurality of the beams, columns and joint nodes may be removable.

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## Title of the Invention

METHOD, ASSEMBLY AND SYSTEM FOR ASSEMBLING AND DISASSEMBLING A SHELTER

## Cross-Reference to Related Applications

[0001] The present patent application claims the benefits of priority of United States Provisional Patent Application No. 63/126,768, entitled "Method, assembly and system for assembling and disassembling a shelter", and filed at the United States Patent and Trademark Office on December 17, 2021.

## Field of the Invention

[0002] The present invention generally relates to the field of modular buildings and methods of assembling/disassembling the same.

## Background of the Invention

[0003] Constructing buildings in remote locations has always been a challenge for various reasons, especially when it comes to the logistics of the construction, the methods and the associated building assemblies and systems used.

[0004] Building methods generally make use of typical construction materials, which are heavy and burdensome to transport to the building location. As such, carrying such construction materials generally requires heavy machinery or special vehicles.

[0005] In some instances, a building has to be built at a remote location, such as in the forest or jungle. Such remote locations are typically inaccessible by a vehicle. As such, the construction materials may be not carried using machinery or vehicle, thus limiting the weight and size of such construction materials.

[0006] It is quite apparent that setting up buildings in remote locations is not a task adapted to conventional buildings methods and systems. Accordingly, there is a need for a method and an assembly and system improving the construction of buildings in remote locations.



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## Summary of the Invention

[0007] The aforesaid and other objectives of the present invention are realized by generally providing a modular shipping module. The shipping module may be embodied as a container having a height of 20-foot. Such containers may be handled by a container bridge. In some embodiments, the container may be certified as a sea-freight container.

[0008] The structure of the shipping module may be foldable. The structure of the shipping module may further be foldable. As such, depending on the final site, the module may be divided into a plurality of subassemblies, each of such subassemblies may then be carried by hand. The modular building, also referred to as habitable modular shelter (HMS) or building, may fit various foundations configurations. The structure of the container may have an adjustable height. The adjustable height may be provided by one or more extending mechanisms. The HMS and its various components may be assembled/disassembled at will. The HMS may be disassembled in different parts, each part being carriable without use or with a limited use of machinery. The building may further comprise an identification number, which may allow tracking of all the materials and components used in the building, thus enabling repurposing or recycling of said materials and components. In some embodiments, the HMS may have custom configurations. Each custom configuration may comprise standardized joint nodes. The building may further comprise outside and inside cladding, such cladding may be adapted to the specific site and/or as desired by the end user. Adding or removing cladding is independent of the structure itself which remains unaffected.

[0009] The HMS may also provide off grid autonomy, with integrated monitoring of all functions for maintenance and energy consumption (electricity) as well as a CO2 footprint of inhabitants. The monitoring of all functions may thus be integrated and tracked into third-party systems, such as into an ERP system and into a booking system. In remote areas, the location of the building may be tracked in order to enable disaster recovery. A building may further be removed from the final assembly site without impact to the environment. Each component of the building may also be removable, including, in some embodiments, the foundation. The trusses may be a glued composite/aluminum design that is both structurally and thermally efficient. The weight of one empty shipping module may be



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2,500 kg. The building may further be assembled on site in 3 to 5 days, without the need of specialized workforce. All shipping modules may further be preassembled and quality tested.

[0010] In one aspect of the invention, an extendable truss structure for a modular building is provided. The system comprises a plurality of columns, at least one of the columns having an extendable length, each of the plurality of columns comprising a first end and a second end, a plurality of beams attached to at least two of the plurality of columns at an angle, two joint assemblies, each of the joint assemblies connecting the first or second end of one of the columns to a first or a second end of one of the beams.

[0011] At least one of the joint assemblies may be pivotally connected to the first or second end of one of the columns to a first or a second end of one of the beams. Each of the joint assemblies may comprise a connecting member pivotally connected to the first or the second end of one of the beams.

[0012] The beams may have an extendable length. The joint assembly may be connectable to a second of the beams. The first and second ends of the beam may comprise a recess portion, the connecting member of the joint assembly comprising a protuberant portion mating with the recess portion of the first and second ends of the beam. A first of the plurality of columns being extended at a first length being greater than a second length of a second of the plurality of columns.

[0013] In another aspect of the invention, a module for a modular building is provided. The module comprises a structural frame comprising at least one extendable truss structure as described herein. The module further comprises a floor detachably connectable to structural frame and a roof detachably connectable to structural frame.

[0014] The structural frame module comprising two extendable truss structures forming two opposite side walls. The structural frame module may further comprise a third extendable truss structure connecting the two opposed extendable truss structures.

[0015] A first of the extended columns of the opposed two extendable truss structures may have a length greater than a second of the extended columns of the extendable truss system.



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[0016] The module may comprise one or more roof supporting beams having a plurality of sections. The one or more roof supporting beams may comprise a plurality of connectors, each connector linking a first of the beam sections to a second of the beam sections. The module may comprise extendable legs supporting the structural frame. Each of the modules may be adjacent and secured to another of the modules. The module may comprise detachable panels covering the side walls.

[0017] The module may comprise a connector for receiving and securing an additional panel, the additional panel covering an extended section of the modular building created from the extension of the extendable truss system.

[0018] In yet another aspect of the invention, a method for assembling a modular building is provided. The method comprises positioning a structure of the building on a surface, vertically extending at least one column of the structure of the building to form extended structures and covering the extended structure of the building.

[0019] The method may further comprise extending four columns of the structure. The four columns of the structure may be extended for a roof of the structure to form an angle. The method may further comprise securing a second structure to the said structure of the building. The method may comprise removing adjacent panels of side wall structures of the secured structures.

[0020] The features of the present invention which are believed to be novel are set forth with particularity in the appended claims.

**Brief Description of the Drawings**

[0021] The above and other objects, features and advantages of the invention will become more readily apparent from the following description, reference being made to the accompanying drawings in which:

[0022] FIG. 1 is a perspective view of a shelter assembly in accordance with the principles of the present invention.

[0023] FIG. 2 is a perspective view of a shelter assembly in accordance with the principles of the invention in a folded mode.



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[0024] FIG. 3 is a perspective view of a shelter assembly of FIG. 2 shown in an unfolded mode.

[0025] FIG. 4 is a perspective view of an embodiment of a side wall section comprising trusses in accordance with the principles of the invention in a folded mode.

[0026] FIG. 5 is a perspective view of the side wall section of FIG. 4 shown in an unfolded mode.

[0027] FIG. 6 is an exploded view of an exemplary attachment system for a truss in accordance with the principles of the present invention.

[0028] FIG. 7 is a perspective view of the attachment system of FIG. 6.

[0029] FIG. 8 is an exploded view of a side wall section comprising a truss section with detailed views of node joints in accordance with the principles of the present invention.

[0030] FIG. 9 is a perspective view of a compressed extendable side column in accordance with the principles of the present invention.

[0031] FIG. 10 is a perspective view of the extendable side column of FIG. 9 now extended.

[0032] FIG. 11 is an exploded view of the extendable side column of FIG. 10.

[0033] FIG. 12 is a perspective view of another embodiment of a compressed extendable side column in accordance with the principles of the present invention.

[0034] FIG. 13 is a perspective view of the extendable side column of FIG. 12 now extended.

[0035] FIG. 14 is an exploded view of the extendable side column of FIG. 12.

[0036] FIG. 15 is a perspective view of sheltering system shown with a single shipping module in accordance with the principles of the present invention.

[0037] FIG. 16 is a perspective view of the sheltering system of FIG. 15 shown with two adjacent shipping modules.



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[0038] FIG. 17 is a perspective view of the sheltering system of FIG. 16 shown with three adjacent shipping modules.

[0039] FIG. 18 is a perspective view of the sheltering system of FIG. 17 shown with an unfolded roof structure and transportation walls removed in accordance with the principles of the present invention.

[0040] FIG. 19 is a perspective view of the sheltering system of FIG. 18 shown with installed front trusses.

[0041] FIG. 20 is a perspective view of the sheltering system of FIG. 19 shown with internal modules installed and doors installation in accordance with the principles of the present invention.

[0042] FIG. 21 is a perspective view of the sheltering system of FIG. 18 comprising front walls and connectors.

[0043] FIG. 22 is a perspective view of the sheltering system of FIG. 18 shown with an elevated roof section.

**Detailed Description of the Preferred Embodiment**

[0044] A novel method and system for assembling and disassembling a shelter will be described hereinafter. Although the invention is described in terms of specific illustrative embodiment(s), it is to be understood that the embodiment(s) described herein are by way of example only and that the scope of the invention is not intended to be limited thereby.

[0045] Referring first to FIGS. 15 to 22, a method **400** for assembling a shelter is illustrated. The method **400** may be used for assembling a modular building, such as but not limited to as shelter in a remote location. The method **400** may generally comprise a step for preparing a site for installation **410** of the modular building **100**. The method **400** further comprises installing the modular building **100** on the site **420**.

[0046] The step of preparing the site for installation may comprise analyzing or studying a site **412**, cleaning and preparing the site **414**, establishing a foundation on the site **416** and/or installing water installations **418**. The step of analyzing the site **412** may comprise



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analyzing different aspects of the terrain, such as but not limited to the topology, the hydrology, the fauna and flora and the quality of the soil. The step of cleaning and preparing the site **414** may comprise any tasks needed to establish a surface for installation of the building **100**, such as but not limited to removing unwanted materials and flattening the ground, if necessary. The step of establishing the foundation **416** generally aims at building or creating a solid anchor on the ground for the modular building **100**. Establishing the foundation **416** may comprise, but is not limited to, selecting the type of foundation to use, such as screw piles, EPS slabs, concrete blocks, concrete slab, or any other type of foundation, and installing the foundation, such as but not limited to digging a support hole, filling the support hole with concrete, and installing a top plate on the hardened concrete. The step of installing water installations **418** generally aims at providing water, drains and/or aqueduct to the modular building. The water installation connection **418** may comprise digging a well and installing related equipment and/or installing a water treatment installation, for example a septic tank.

[0047] The installation of one or a plurality of modular buildings **420** aims at building or assembling the modular building **100** on the site. The installation **420** may comprise the steps of transporting or moving at least one container or shipping module **20** to the closest possible drivable location of the site **421**, such as the end of the road. The installation **420** may further comprise emptying the shipping module **422** and/or disassembling the at least one shipping module **20** into a plurality of parts **423**. Dissembling the shipping module **20** generally includes separating the said shipping module **20** in a plurality of parts to a degree dictated by the available remaining path and means of transportation to the site. The installation may further comprise transporting the plurality of parts or the shipping module **20** to the site **424** using any means of transportation available on the path. In some embodiments, the means of transportation may comprise an ATV, side-by-side or four wheelers, horses or even by foot.

[0048] The container 20 or shipping module 20 is typically sized as a standard shipping container, which may be certified by a third-party organization. The container 20 is typically made of outer or inner side walls being foldable.



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[0049] Still referring to FIGS. 15 to 22, in some embodiments, the installation **420** may further comprise installing the one or more shipping modules **20** on the site **425**. As shown in FIG. 15, the shipping module **20** typically comprises a floor **26**, side walls **28** and a roof **24**. The shipping module **20** may further comprise legs **102**, generally adapted to level and maintain the shipping module on the ground. Understandably, the legs **102** may be vertically extendable to allow different heights to level the shipping module **20** and/or building **100**.

[0050] As shown in FIGS. 16 and 17, the installation **420** may further comprise installing and interconnecting a plurality of shipping modules **20**, **426**. In such embodiments, the shipping modules **20** are fixed or mounted one to another using any type of fastening means **104**. The shipping modules **20** are also typically leveled on the ground to form a uniform structure. Understandably, more than three shipping modules **20** may be attached to one another to form larger buildings or structures.

[0051] The installation **420** may further comprise removing unnecessary materials **427** from the at least one shipping module **20**, removing transportation walls **28** from the shipping module **20**, **428** leveling and/or controlling the at least one shipping module **20** to be installed **429**. In some embodiments, the removal of inner wall **428** may comprise using clips or quick fasteners **29** (as shown in FIG. 15) to easily detach the said transportation walls **28**. Transportation walls may further be used to build various appliances such as decks, space for a fireplace, space for a hot tub, etc.

[0052] The installation **420** may further comprise installing roof bridges **105**, **430**. The roof bridges **105** are typically installed or mounted over roof **24** of the shipping module **20**, as shown in FIG. 17. The roof bridges may further be attached to a roof structure **110**, shown in FIG. 18. The roof structure **110** may comprises an edge structure **111** surrounding the roof bridges **105.** The roof structure **110** may further comprise front wall **112** and side walls **113**. The side wall **113** and front wall **112** may further comprise windows or apertures **114**. The side wall **113** and front wall **112** are typically expandable to allow creating a slope in the bridge or for easily lifting the roof.



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[0053] Referring now to FIG 18, 21 and 22, the installation **420** typically comprises lifting the roof structure **110**, **431**. Once shipping modules **20** of a building **100** are assembled one to the other, corner posts of each shipping module **20** may be raised to a desired height for lifting the roof structure **110**. As shown in FIG. 22, the extendable vertical columns **34** at the front of the modules **20** are raised or extended. The extendable vertical columns **34** have thus a length greater than the length of the extendable vertical columns **34** at the rear portion of the modules **20**. As such, the roof may be angled to create different angles and/or shapes. Understandably, any of the vertical columns **34** may be extended at various heights, thus giving different angles or shapes of the roof structure **110**. The vertical columns **34** may be extended before installing connectors **122** and front **112** and side walls **113**. Understandably, in other embodiments, the extendable vertical columns **34** at the rear portion of the module **20** may be greater than the extendable vertical columns **34** at the front portion of the module **20** and/or than the vertical columns **34** at a side portion of the module **20**.

[0054] In yet other embodiments, a single column **34** may be extended at a one corner of the module **20**. In such embodiments, the horizontal or transversal columns **34** shall be pivotally attached to the vertical columns **34** and shall be extended as the created angle of the roof require a longer horizontal column **34** or to create a volume over the top portion of the module **20** in a shipping configuration.

[0055] In a typical embodiment, two extendable columns **34** at each corner of a side of the module **20**, such as the two corners of a side wall structure, a front wall structure or a rear wall structure, are extended at a similar height. In such embodiment, the roof is raised on one the said extended wall side while remaining un-extended on the opposite side, thus creating a roof at angle compared to a bottom portion of the module **20**. Understandably, in such embodiment, one side may comprise more than two vertical columns **34** to be extended, such as the rear portion of the module **20** shown at FIG. 22 having six (6) vertical columns **34**. In such illustrated embodiment, the vertical columns **34** at the front are also extended to form shorter columns than the vertical columns **34** at the rear side. As such, the roof **110** is raised over the structure **10** or module **20** while being angled.



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[0056] In another embodiment, each of the vertical columns **34** of the module or structure **20** may be extended at equal length. In such embodiment, the roof **110** is raised to form a generally flat roof **110** or an equal volume over the top portion of the structure **10** module **20** in a shipping configuration.

[0057] After raising the corner posts, various wall pieces may then be placed in the unfolded configuration. As an example, the corner posts of each shipping module **20** may be lifted to a predetermined height using a jack or any lifting mechanism. The remaining wall sections may be then folded. When the roof structure **110** is lifted, the building **100** is in unfolded mode. Referring now to FIG. 21, the lifting of the roof structure **110**, **431** may further comprise mounting a connector **122** for attaching the front wall **112**. The installation may comprise removing intermediate columns **120** and/or storage **432**,

[0058] Referring now to FIG. 19, the installation may further comprise installing front door structure **130**, **432**, such as a sliding door. The step **432** generally comprises attaching front trusses **132** adapted for receiving a sliding door or a window. The step **432** may further comprise installing sliding door structure **432** in between the trusses **131**.

[0059] Referring now to FIG. 20, the installation **420** may comprise placing or mounting various internal modules **140**, **433**. For example, internal modules **140** may comprise or form a lounge area. The internal modules **140** may be preassembled, and once on site, the floor structure may be opened to allow the installation of the internal modules **140**. Understandably, all floor elements used in the folded mode may also be used in the assembled mode.

[0060] Still referring to FIG. 20, the installation **420** may further comprise installing different finishes **433**. As example, the installation of finishes **433** may comprise, without limitations, installing windows **115**, placing a roof membrane (not shown) and installing or building a ceiling (not shown). The installation of finishes **434** may further comprise installing exterior skin and/or an interior skin or finish on walls, floor and/or ceiling. The installation **420** may further comprise installing any parts or elements removed from the at least one shipping module **20** before the at least one shipping module **20** is transported to the site **435**.



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[0061] It shall be understood for one skilled in the art that the order of the steps may be changed depending on the situation and that some steps may be required in some embodiments while optional in other embodiments.

[0062] A method for disassembling **500** the modular building **100** is provided. Broadly, disassembling an assembled shelter **100** uses similar steps of the above-mentioned method of installation **420** in a substantially reverse order. In the method of disassembly **500**, the different steps of installing and assembling are replaced with steps of uninstalling and disassembling, respectively.

[0063] Understandably, any step of the methods **(400, 500)** may be executed without the use of heavy machinery, or at least with a limited use of lightweight machines or vehicles. Furthermore, the methods **(400, 500)** may preferably be used on sites non accessible by usual transportation vehicles such as cars or trucks. Such sites may be forests, mountains, or any other remote area where roads are limited or non-existent.

[0064] Now referring to FIGS. 1 and 2, an exemplary sheltering assembly **100** is shown. The assembly **100** may be assembled or disassembled using in any of the above-described methods **400** and **500**. The assembly **100** generally comprises a structure **10**. The structure **10** may be configured as a grid pattern. The structure **10** may be formed by one or more shipping modules **20** and may be made out of any material known in the art, such as aluminum like T6061 aluminum. In some embodiments the shipping module **20** has a substantially rectangular prism shape. The shipping module **20** generally comprises a plurality of outer surfaces, such as three to four walls **22**, a roof **24** and a floor **26**. Understandably, other embodiments of the shipping modules **20** may have any other desired shape and may be made of any other number of surfaces.

[0065] In some embodiments, each of the components of the sheltering assembly **100** may comprise an identification number. The identification is typically used to maintain a registry of all components. The registry may further be used to ensure that all parts are recycled after the assembly **100** is disassembled or to track a missing component in the assembly process. Understandably, in some embodiments, each of the components may comprise a unique identification number which may be embodied as an identification tag



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using any type of codes such as alphanumeric or numeric characters, bar code, HR code or NFC or RFID devices.

[0066] In some embodiments, at least one of the surfaces (walls, roof, floor, etc.) is a detachable transportation wall **28**. In the embodiment shown at FIG. 1, the shipping module **20** comprises transportation walls **28** on both sides or on the front wall only, facing the exterior of the shipping module **20**. The transportation walls **28** generally aim at creating a closed enclosure within the shipping module **20** to ease the transport of the said shipping module **20** and its content. The walls **28** may further provide support when transporting said shipping module **20**.

[0067] The shipping module **20** typically comprises one or more trusses **30**, beams **32** and columns **34** forming the structure of the shipping module **20**. Understandably, any type of structural elements may be used to form the structure of the shipping module **20**. In some embodiments, the transportation walls **28** cover the structural elements.

[0068] The transportation walls **28** are typically removable to allow connection of the shipping module **20** to an adjacent shipping module **20**. As such, two adjacent shipping modules **20** may be connected to one another. In a typical embodiment, the adjacent sides, such as side walls **22**, or adjacent structure elements are connected or mounted to one another to form a single structure. The same may be repeated with further shipping modules to form larger structures or buildings **100**. The assembly of connected shipping modules **20** may thus form the structure **10**.

[0069] It may be appreciated that any of the trusses **30**, beams **32** and/or columns **34** may be replaced with alternatives structures. The said trusses **30**, beams **32** and/or columns may be removed from the structure **10** before and/or after connecting the shipping modules **20** if required. For example, beams **32** found within a transportation wall **28** placed between two shipping modules **20** may be removed to create a bigger room inside the two shipping modules **20**. Referring now to FIG. 3, an embodiment of the sheltering assembly **100** is shown wherein columns **34** in the middle and front of the assembly have been removed as compared to the embodiment of FIG. 2.



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[0070] Now referring to FIGS. 4 and 5, an exemplary truss section **50** is shown. The truss section **50** may be located within a wall surface of a shipping module **20** or structure **10**. Trusses **30** and truss sections **50** of a given structure **10** may comprise a plurality of beams **32**, columns **34**, joint nodes (**40, 240**) and fasteners. The truss section **50** may comprise columns **34** on each side. In some embodiments, as shown, the truss section **50** is rectangular. The truss section **50** may comprise a plurality of inner beams and columns **32**. The inner beams and columns **32** are typically of smaller proportions than the outer columns **34**. The inner beams and columns **34** may be positioned as a grid pattern and may support the outer beams and columns **34**. Understandably, other embodiments may comprise any other pattern for the arrangement of the inner beams and columns **32**.

[0071] The vertical columns **34** may be extendable. In some embodiment, each vertical column **34** comprises an extending/collapsing mechanism **52** allowing the extension and collapsing of a side of the truss section **50**. As shown in FIGS. 4 and 5, as an example, the truss section **50** comprises a top section slidingly inserted in a side column **34**. The top section comprises side columns having a cross-section **54** being smaller than the cross-section **56** of the other column section **34**. Accordingly, FIG. 4 shows the truss section **50** being collapsed wherein FIG. 5 shows the truss section **50** being extended. When a side column **34** is extended, additional supporting beams **32** may be mounted within the newly created space **58**. It may be appreciated that trusses **30** may be collapsed when transported and extended to set up the structure **10**.

[0072] Now referring to FIGS. 6 and 7, an attachment system **60** for trusses **30**, beams **32** and/or columns **34** is shown. In such an embodiment, the attachment system **60** comprises an elongated connecting element **62**, two trusses **30** and fasteners, not shown. The elongated connecting element **62** is shaped to slide within a recess portion **66** of a first truss **30** at one end and to slide within a recess portion **66** of a second truss **30** at another end. In some embodiments, the recess portion **66** is a narrow extrusion **66** having a thickness allowing the connecting element **62** to snugly fit within the recess portion **66**. In yet another embodiment the connecting element **62** may comprise a slit **68** adapted to fit in the recess. In another embodiment not shown, the trusses **30** may each have a narrow slit or protuberance **68** adapted to snugly fit in a recess of the connecting element **62**.



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[0073] In some embodiments, both the trusses **30** and the connecting element **62** may have a plurality of holes **70** located at predetermined locations so that fasteners may be slid into each of the plurality of holes or apertures **70** used for securing the trusses **30** to the connecting element **62**. Each truss **30** may also comprise holes **70** located at surfaces in contact with surfaces of the other adjacent truss **30** for additional securing between the two trusses **30**. It may be understood that, in other embodiments, trusses **30** may be replaced with beams **32** or columns **34**. It may further be appreciated that the attachment system **60** provided allows connecting to adjacent trusses **30**, beams **32** or columns **34** without requiring heavy or special machinery while maintaining a sufficient rigidity. In an embodiment, the attachment system **60** may be configured to be used in a modular roof system wherein the roof height and angle may be varied by adding a plurality of trusses **30** connected to each other's with attachment systems **60.**

[0074] Now referring to FIG. 8, embodiments of node joints **(40, 240)** are shown. Node joints **(40, 240)** are typically adapted to connect a structure to another type of structure, such as a column **34** to a beam **32**. In some embodiments, a first type of node assembly **200** is shown for securing two trusses **30**, beams **32** or columns **34** together is illustrated. The present embodiment uses columns **34**, though it may be appreciated that other embodiments may comprise trusses **30** or beams **32**. The node joint **40** may be used in parallel with each of the columns **34** or, as shown, with each of the columns or beam **34** perpendicular to other beam or columns **34**. Understandably, the node joints 40 may connect at least two columns or beams 34 at any other angles. Each column or beam **34** may comprise a hollow section **42** at its extremity **35**. The hollow section **42** is adapted to receive a connecting member **44** or an extrusion/protuberance **46** of the node joint **40**. In other embodiments not shown, the columns **34** may have extrusions **46** at their extremity wherein the node joint **40** and the connecting member **44** may have a hollow section **42**. The node joint **40** may thus be connected to a column **34** by sliding the extrusion **46** into the hollow or recess section **42** of the column **34** and may be connected to the connecting member **44** through a joint **45**, such as a knuckle joint. The connecting member **44** may then be connected to the associated column or beam **34** by sliding the extrusion **46** of the connecting member **44** into the hollow section **42** of the column **34**. Understandably, any other type of joint **45** may be used for the connecting member **44**.



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[0075] In the embodiment shown at FIG. 8, the connecting member **44** comprises a pivoting connector **47** mating with a pivoting connector **49** of the node joint **40**. The pivoting connector **47** may be embodied as an aperture or passage adapted to receive a lock pin. The lock pin secured in the passage provides a pivot point or a freedom of rotation of one degree to angle the roof **110** of the module **20**.

[0076] By using a joint **45** for connecting the connecting member **44** to the node joint **40**, at least a rotational degree of freedom is allowed from the assembly which may be useful when parts of the structure **10** are connected to other parts of the structure **10** at any angle other than perpendicular, such as but not limited to raising the roof **110** of the structure **10**. For example, having a connecting member **44** with joints **45** at each extremity **35** of the top horizontal column **34** of the structure **10** may allow for one vertical side column **34** to be longer than the other vertical side column **34** of the same structure **10**, thus allowing for an angled roof. In some embodiments, the node joint **40** may be secured to more than two columns or beams **34**. The node joints **40** may also have tabs **48** for connecting with another column **34**, not shown. The embodied tabs **48** may guide the extremity **35** of a column **34** having holes of a similar shape and may thus provide additional structural stabilization to the structure **10**. Each of the node joints **40**, columns or beams **34** and connecting members **44** may have holes **70** located at predetermined locations relative to holes **70** of the other parts to secure the structure **10** with fasteners. It may be appreciated that the node joints **40** provided may allow a securing of the trusses **30**, beams **32** or columns **34** without requiring heavy or special machinery.

[0077] In a second embodiment, a node assembly **300** comprising a node joint **240** is illustrated. This embodiment is configured to be secured to three columns, beams **34** and/or trusses **30**. Accordingly, the node joint **240** comprises three extrusions **246** each configured to be slid in a hollow section **42** of a column or beam **34**. The node joint **240** further comprises fastening holes **270** for the installation of fasteners **80**, not shown, when inserted into columns or beams **34** for securing the assembly **300**. Understandably, any other type of connection to columns or beams **34** as presented in the embodiment described above may be used. The node joint **240** may further be configured to be secured to more than three columns **34** with the appropriate number of connecting parts.



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[0078] The beams **32** of the structure **10** located between the side, top and bottom columns **34** may be secured to other trusses **30**, beams **32** or columns **34** by extrusions **46** inserted into hollow sections **42**, with connecting members **44** and/or fasteners.

[0079] Now referring to FIG. 9 to 11, exemplary extendable side column **34** connected to node joints (**40, 240**) are shown in the collapsed state (FIG. 9) and extended state (FIG. 10). Referring to FIG. 11, an exploded view of the side column **34** is shown.

[0080] Now referring to FIG. 12 to 14, exemplary extendable side column **34** connected to node joints **(40, 240**) are shown in the collapsed state (FIG. 12) and the extended state (FIG. 13). Referring to FIG. 14, an exploded view of the extendable side column **34** is shown. It may be appreciated that both the smaller and larger cross-sections **(54, 56)** of the side column or beam **34** may have varying length. Furthermore, there may be more than two sections for each side column **34** in order to increase expansion of the columns or beams **34** compared to having a single extendable mechanism **52**.

[0081] While illustrative and presently preferred embodiment(s) of the invention have been described in detail hereinabove, it is to be understood that the inventive concepts may be otherwise variously embodied and employed and that the appended claims are intended to be construed to include such variations except insofar as limited by the prior art.



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## Claims

1) An extendable truss structure for a modular building, the structure comprising:

   a plurality of columns, at least one of the columns having an extendable length, each of the plurality of columns comprising a first end and a second end;

   a plurality of beams attached to at least two of the plurality of columns at an angle; and

   two joint assemblies, each of the joint assemblies connecting the first or second end of one of the columns to a first or a second end of one of the beams.

2) The structure of claim 1, at least one of the joint assemblies being pivotally connected to the first or second end of one of the columns to a first or a second end of one of the beams.

3) The structure of claim 2, each of the joint assemblies comprising a connecting member pivotally connected to the first or the second end of one of the beams.

4) The structure of claim 2 or 3, the joint assembly being connectable to a second of the beams.

5) The structure of any one of claims 2 to 4, the first and second ends of the beam comprising a recess portion, the connecting member of the joint assembly comprising a protuberant portion mating with the recess portion of the first and second ends of the beam.

6) The structure of any one of claims 2 to 5, a first of the plurality of columns being extended at a first length being greater than a second length of a second of the plurality of columns.

7) The structure of any one of claims 1 to 6, the beams having an extendable length.

8) A module for a modular building, the module comprising:

   a structural frame comprising at least one extendable truss structure of any one of claims 1 to 7;

   a floor detachably connectable to structural frame; and



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a roof detachably connectable to structural frame.

9) The module of claim 8, the structural frame comprising two extendable truss structures forming two opposite side walls.

10) The module of claim 9, the structural frame further comprising a third extendable truss structure connecting the two opposed extendable truss structures.

11) The module of claim 10, a first of the extended columns of the opposed two extendable truss structures having a length greater than a second of the extended columns of the extendable truss structures.

12) The module of any one of claims 8 to 11, the module comprising one or more roof supporting beams having a plurality of sections.

13) The module of claim 12, the one or more roof supporting beams comprising a plurality of connectors, each connector linking a first of the beam sections to a second of the beam sections.

14) The module of any one of claims 8 to 13, comprising extendable legs supporting the structural frame.

15) A modular building comprising at least two of the modules of any one of claims 8 to 14, each of the modules being adjacent and secured to another of the modules.

16) The modular building of claim 15, the modular building comprising detachable panels covering the side walls.

17) The modular building of claim 15, comprising a connector for receiving and securing an additional panel, the additional panel covering an extended section of the modular building created from the extension of the extendable truss structure.

18) A method for assembling a modular building, the method comprising:

positioning a structure of the modular building on a surface;

vertically extending at least one column of the structure of the modular building to form extended structures; and

covering the extended structures of the building.



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19) The method of claim 18, the method further comprising extending four columns of the structure.

20) The method of claim 19, the four columns of the structure being extended for a roof of the structure to form an angle.

21) The method of any one of claims 18 to 20, the method further comprising securing a second structure to the structure of the building.

22) The method of claim 21, the method comprising removing adjacent panels of side wall structures of the secured structures.

*  *  *



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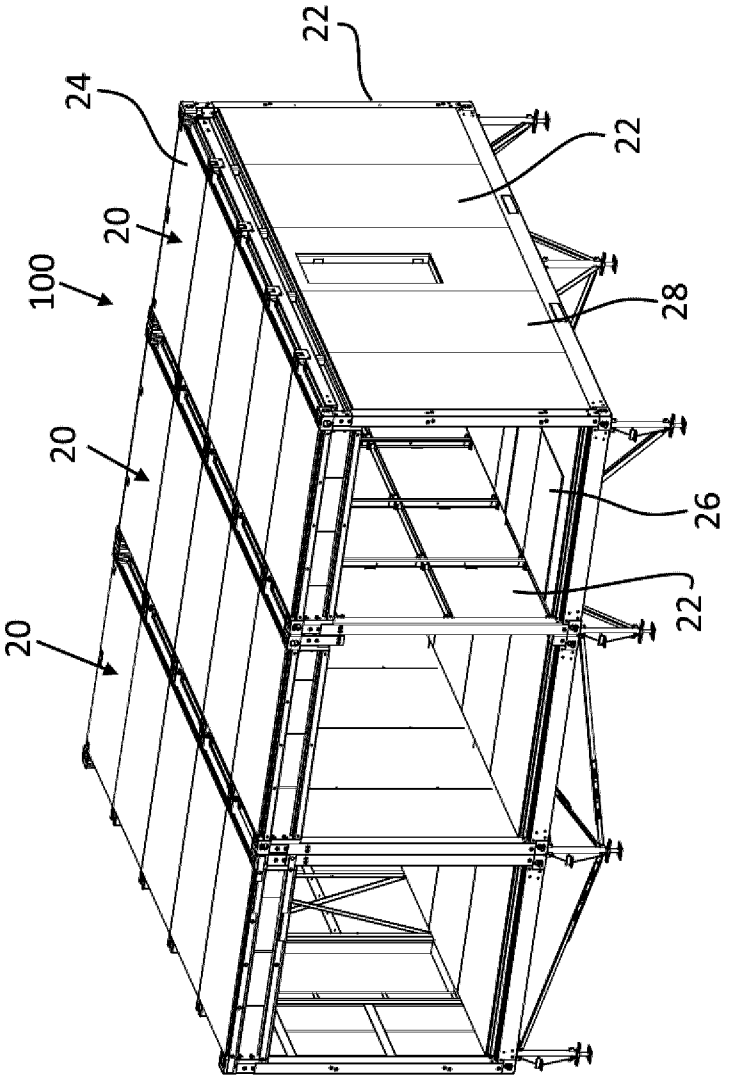


FIG. 1

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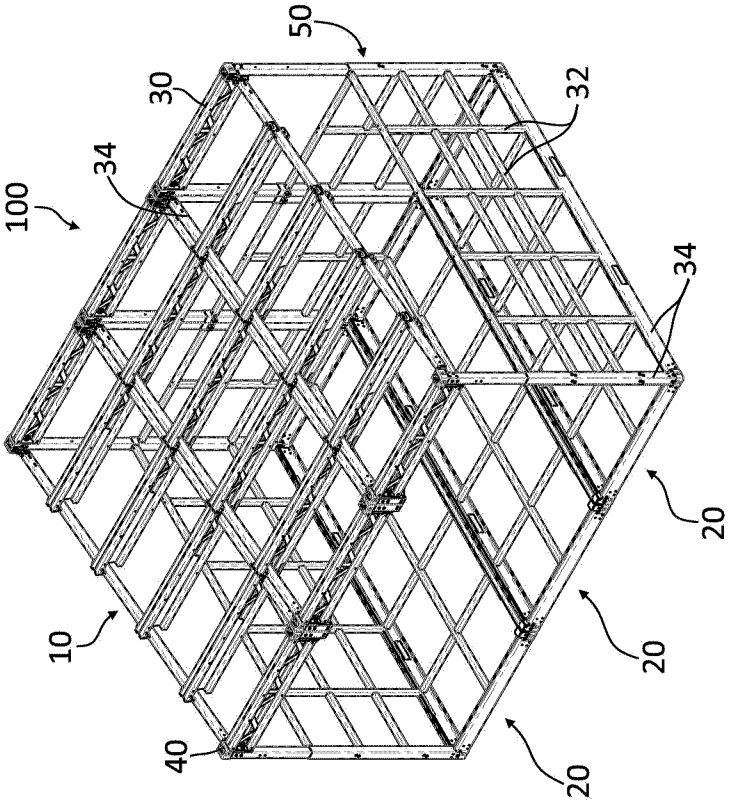


FIG .3

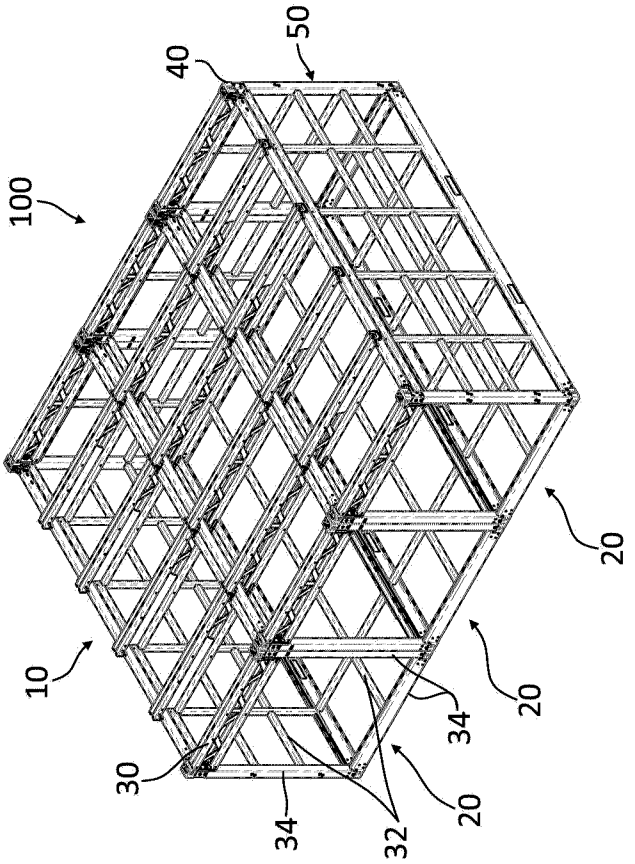


FIG. 2

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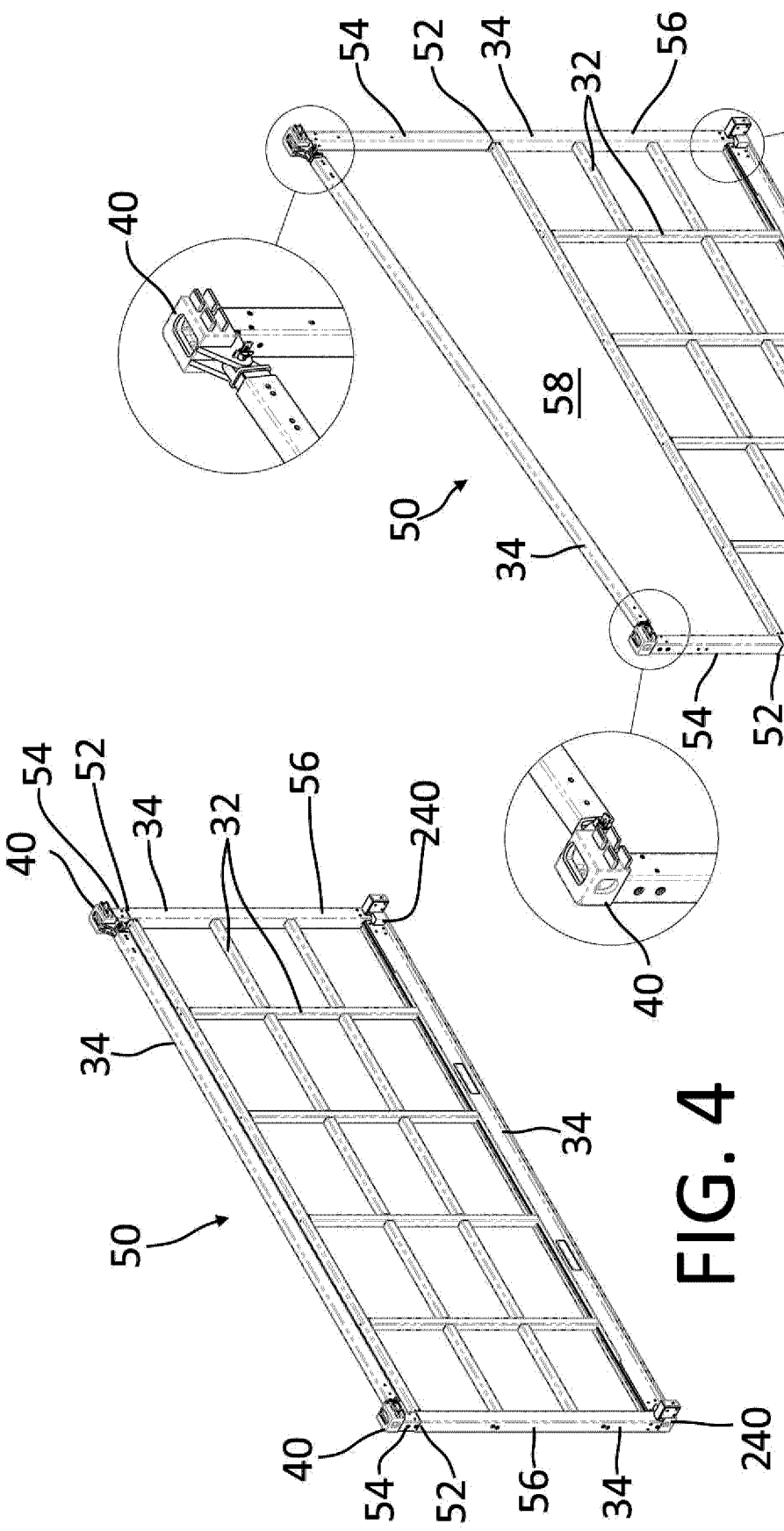


FIG. 4

FIG. 5

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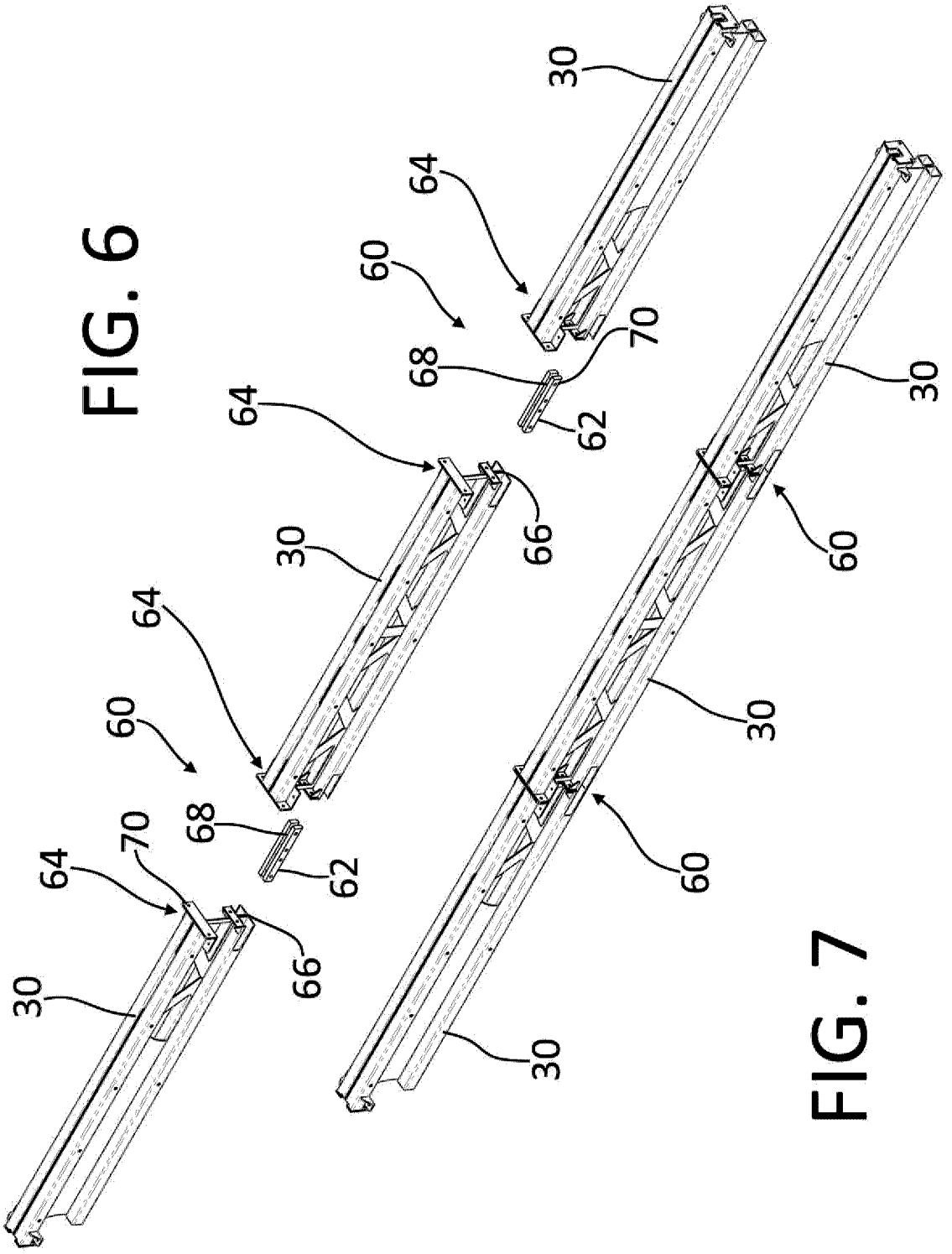


FIG. 6

FIG. 7

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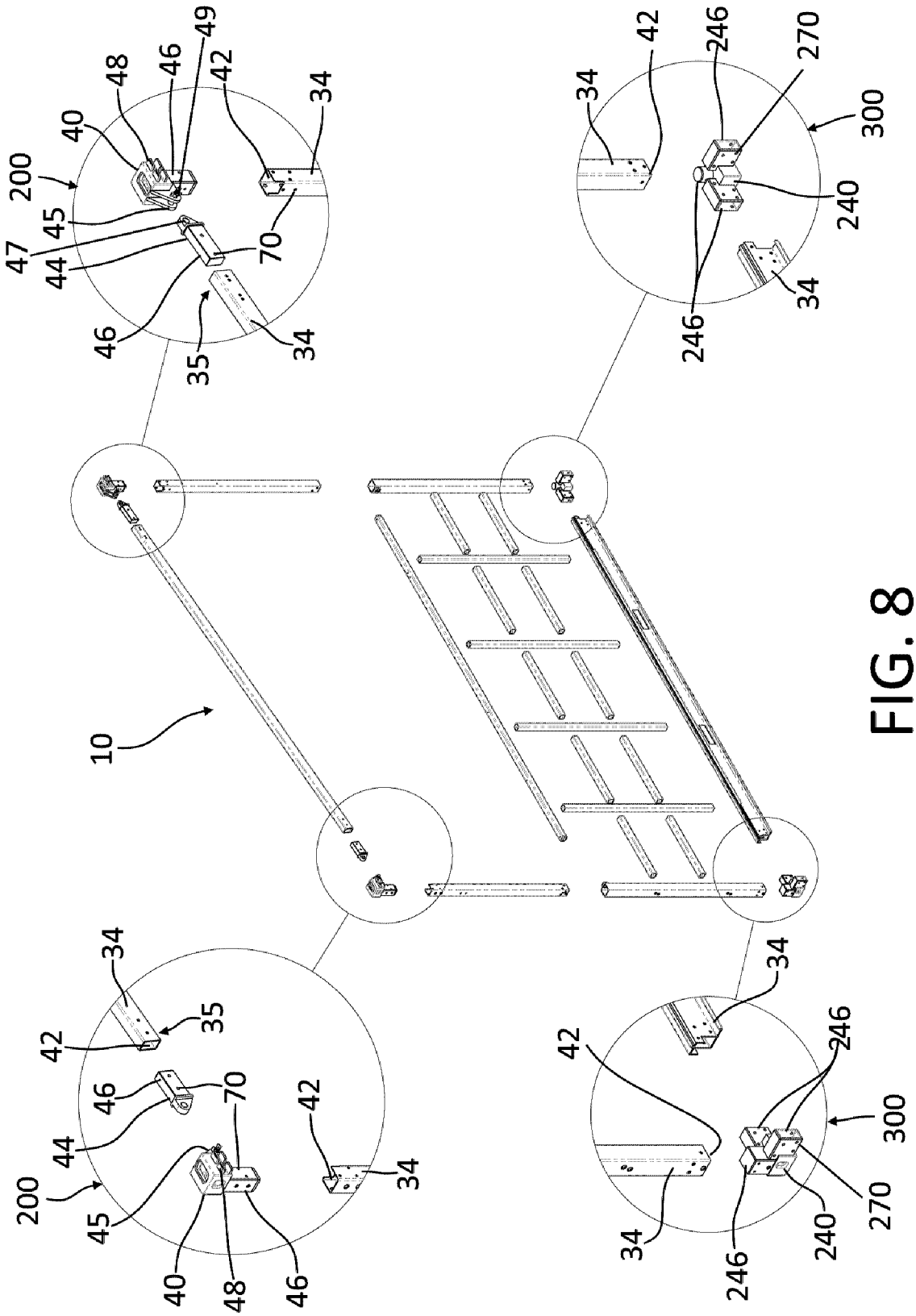


FIG. 8

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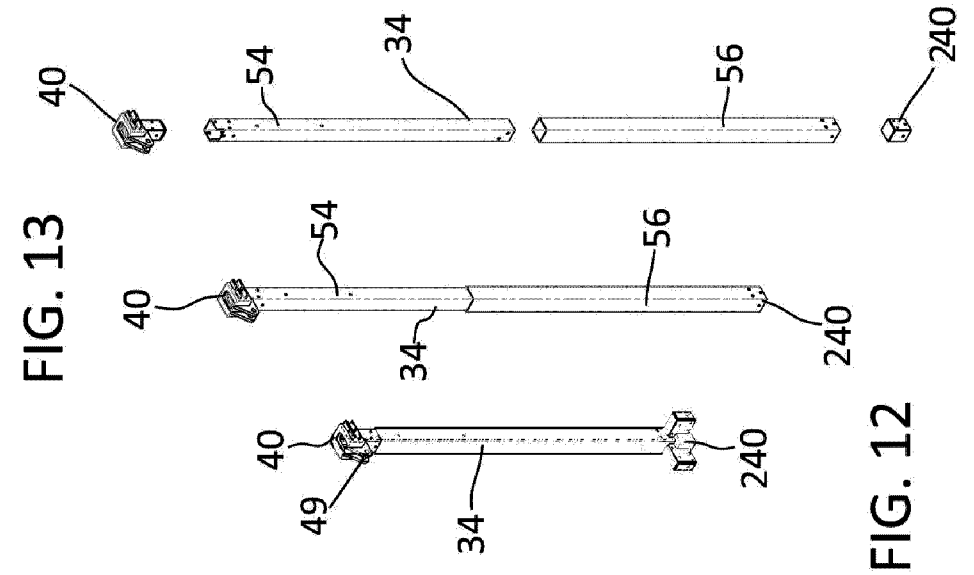


FIG. 13

FIG. 14

FIG. 12

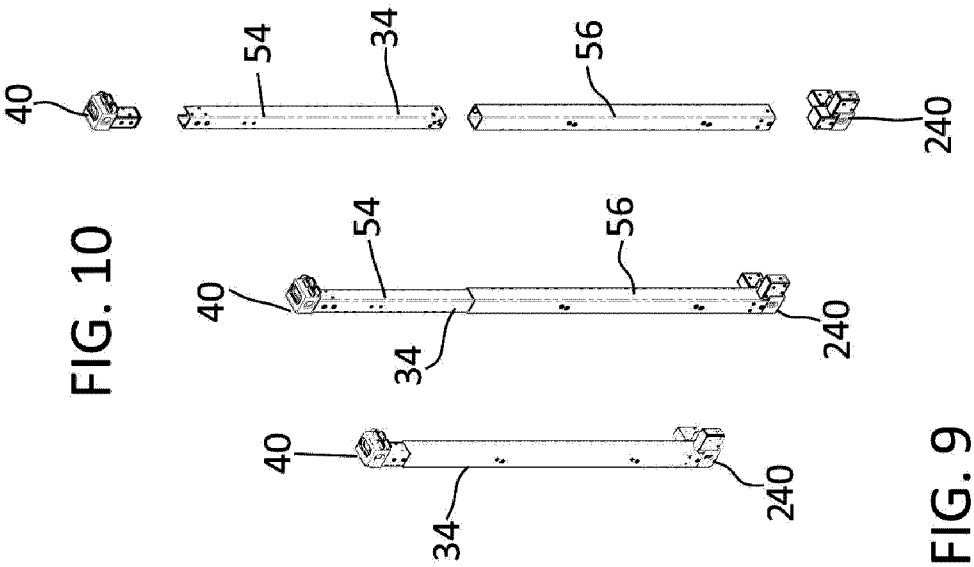


FIG. 10

FIG. 11

FIG. 9

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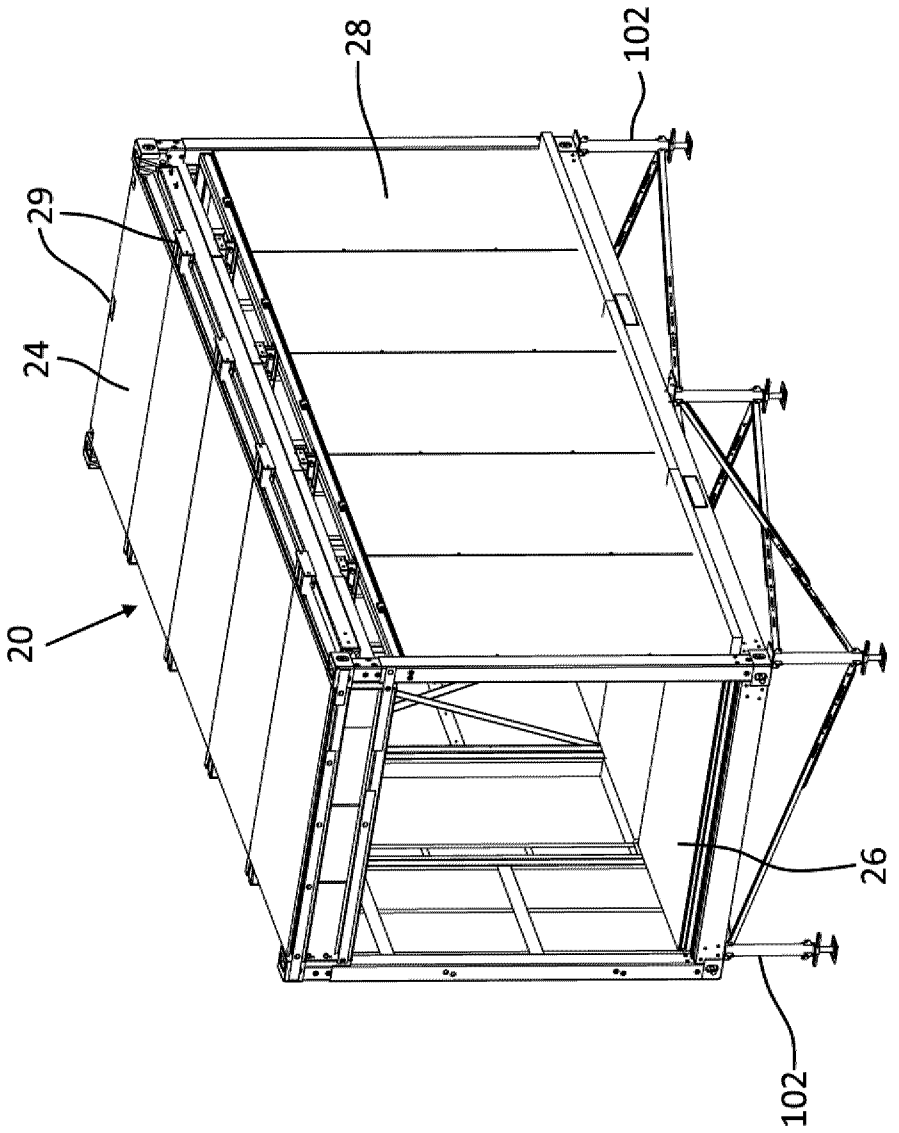


FIG. 15

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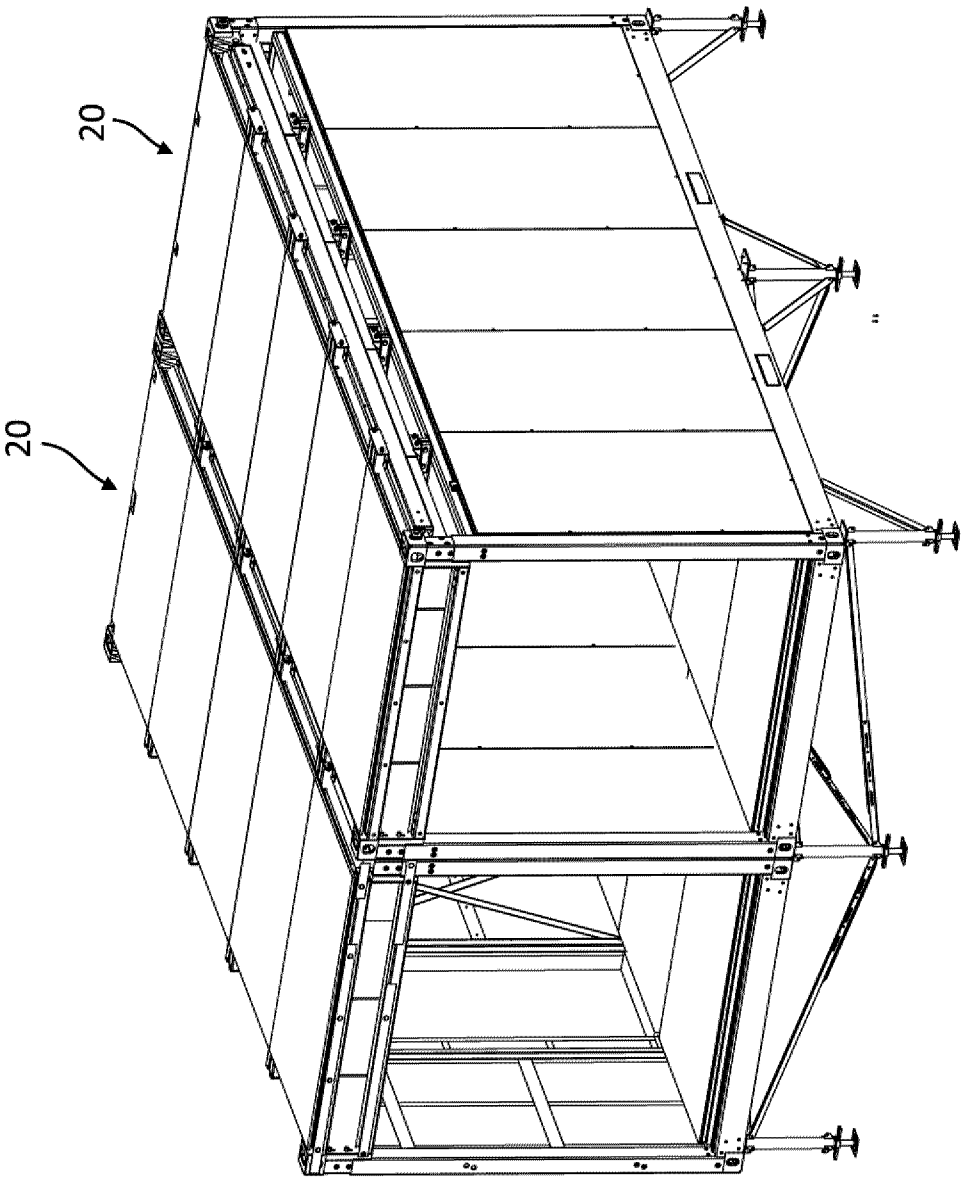


FIG. 16

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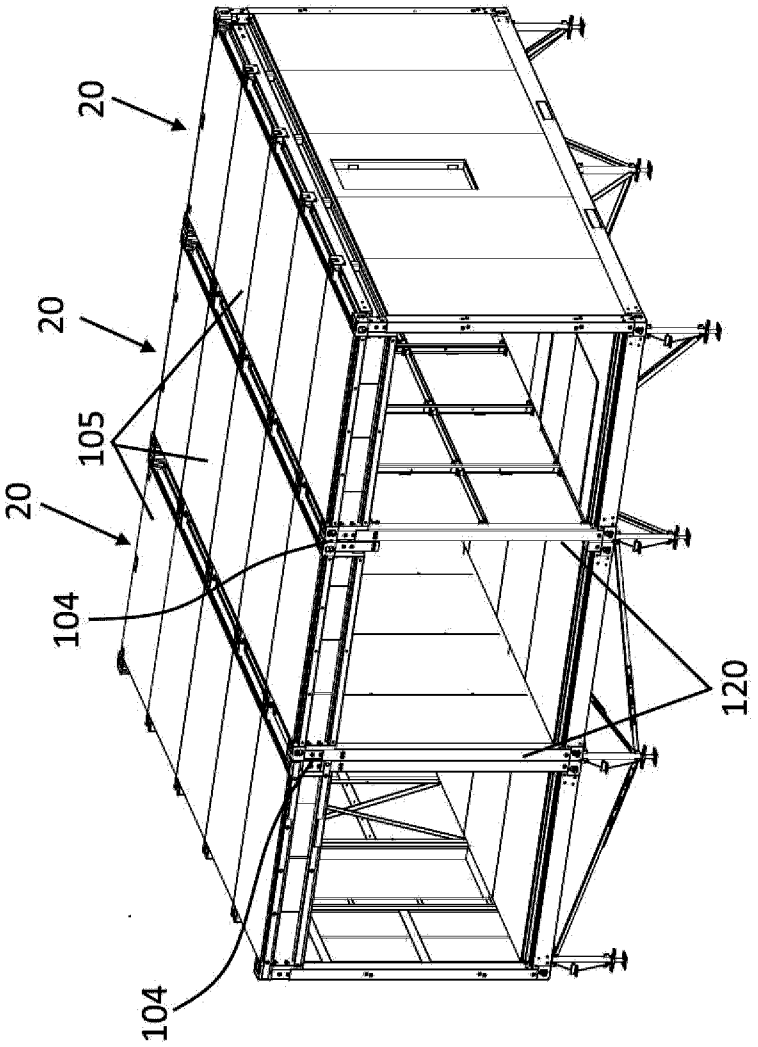


FIG. 17

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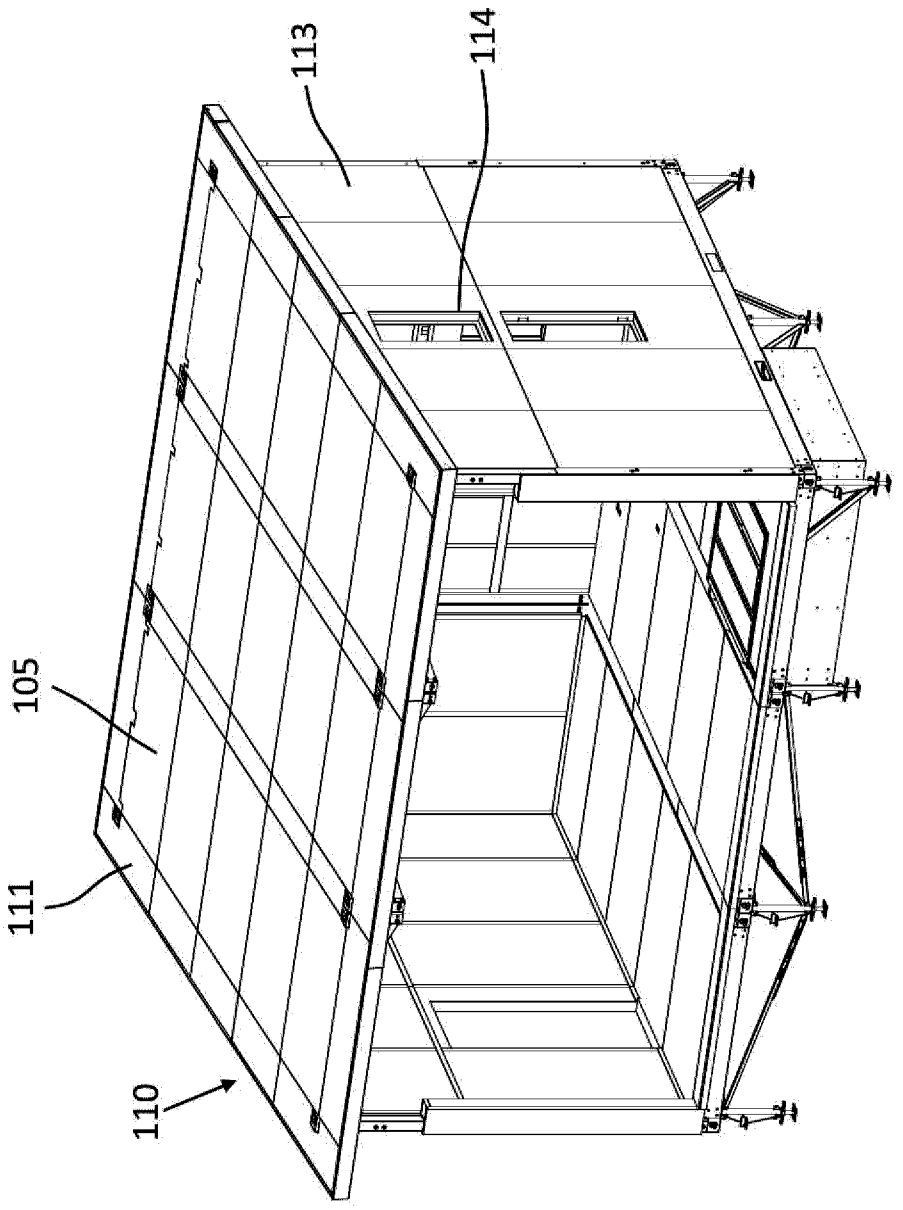


FIG. 18

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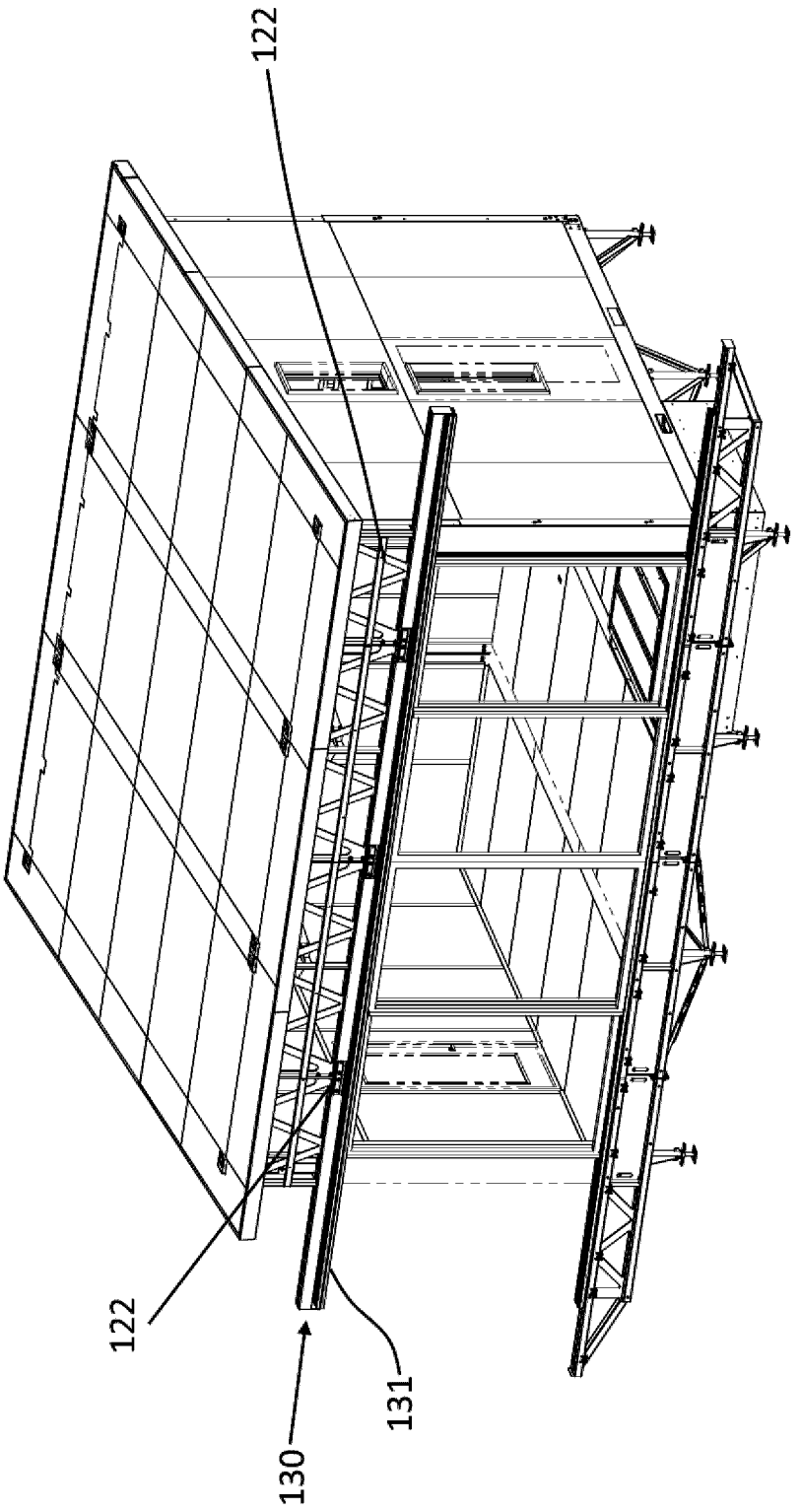


FIG. 19

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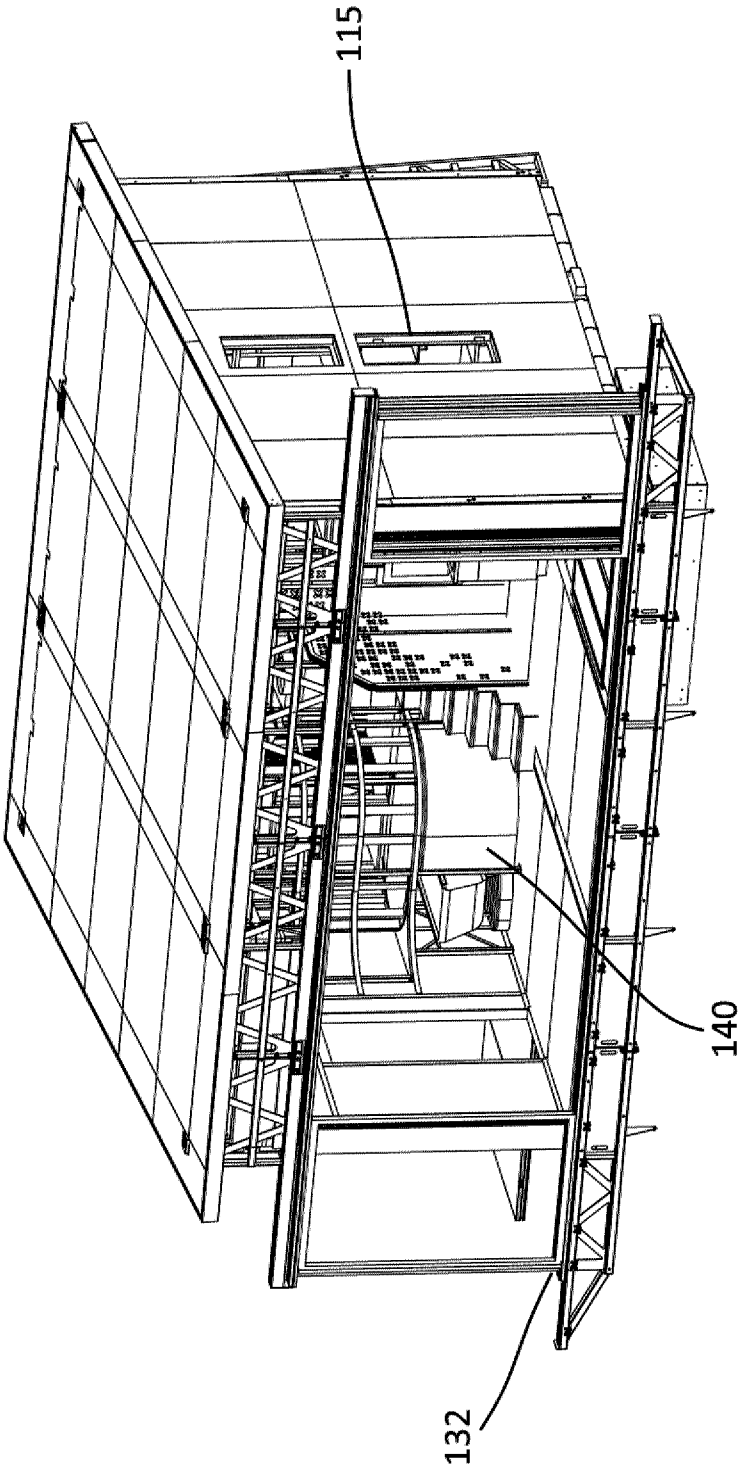


FIG. 20

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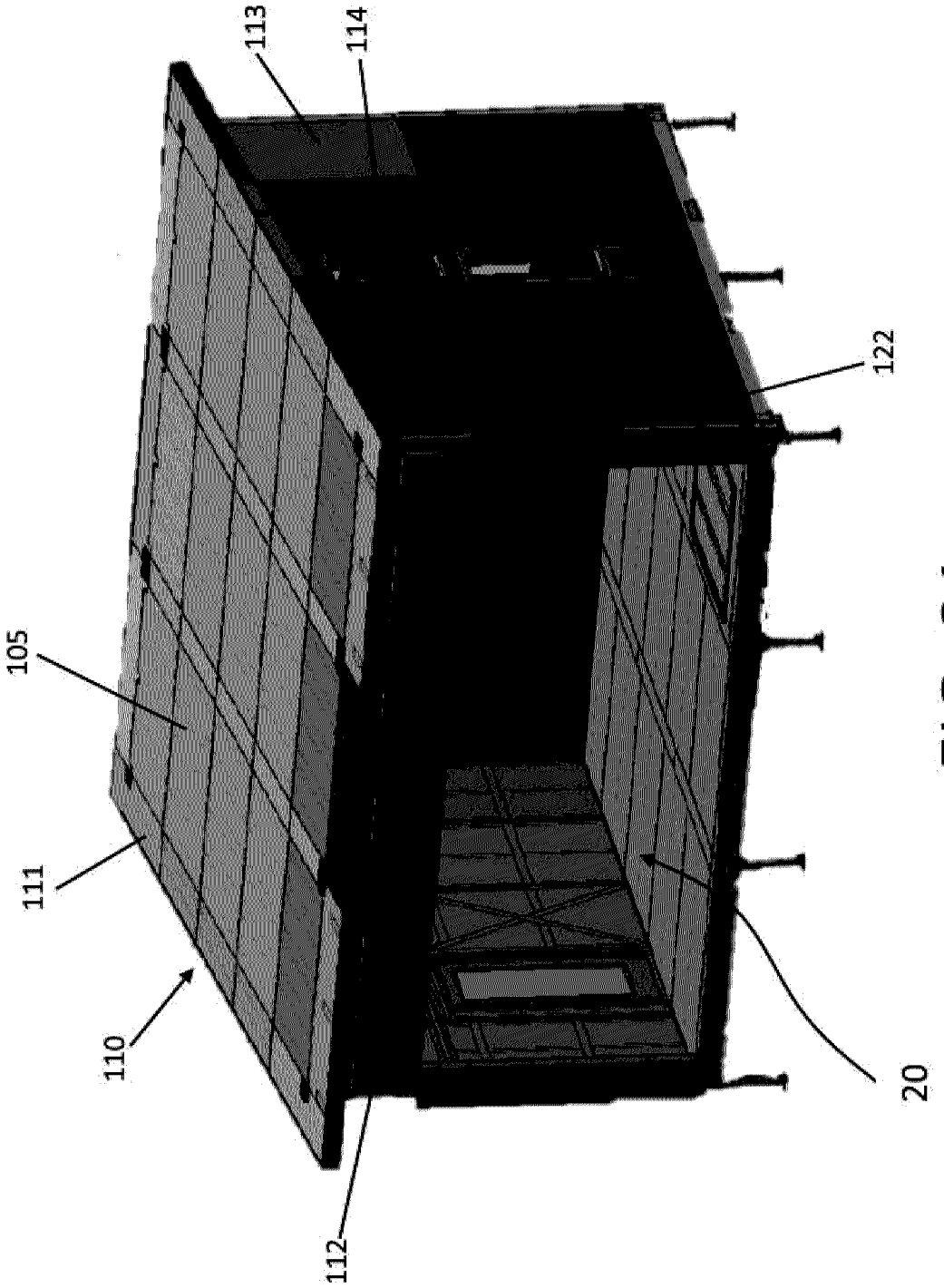


FIG. 21

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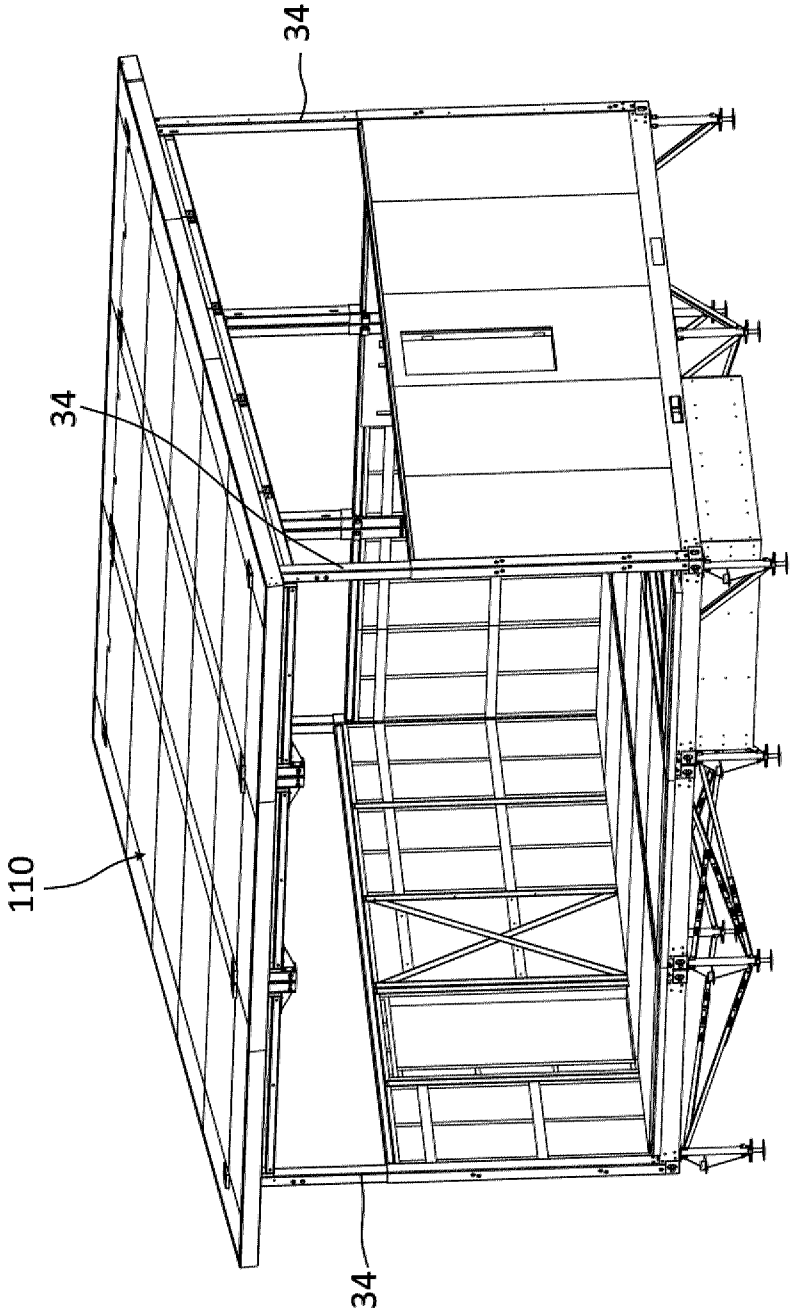


FIG. 22

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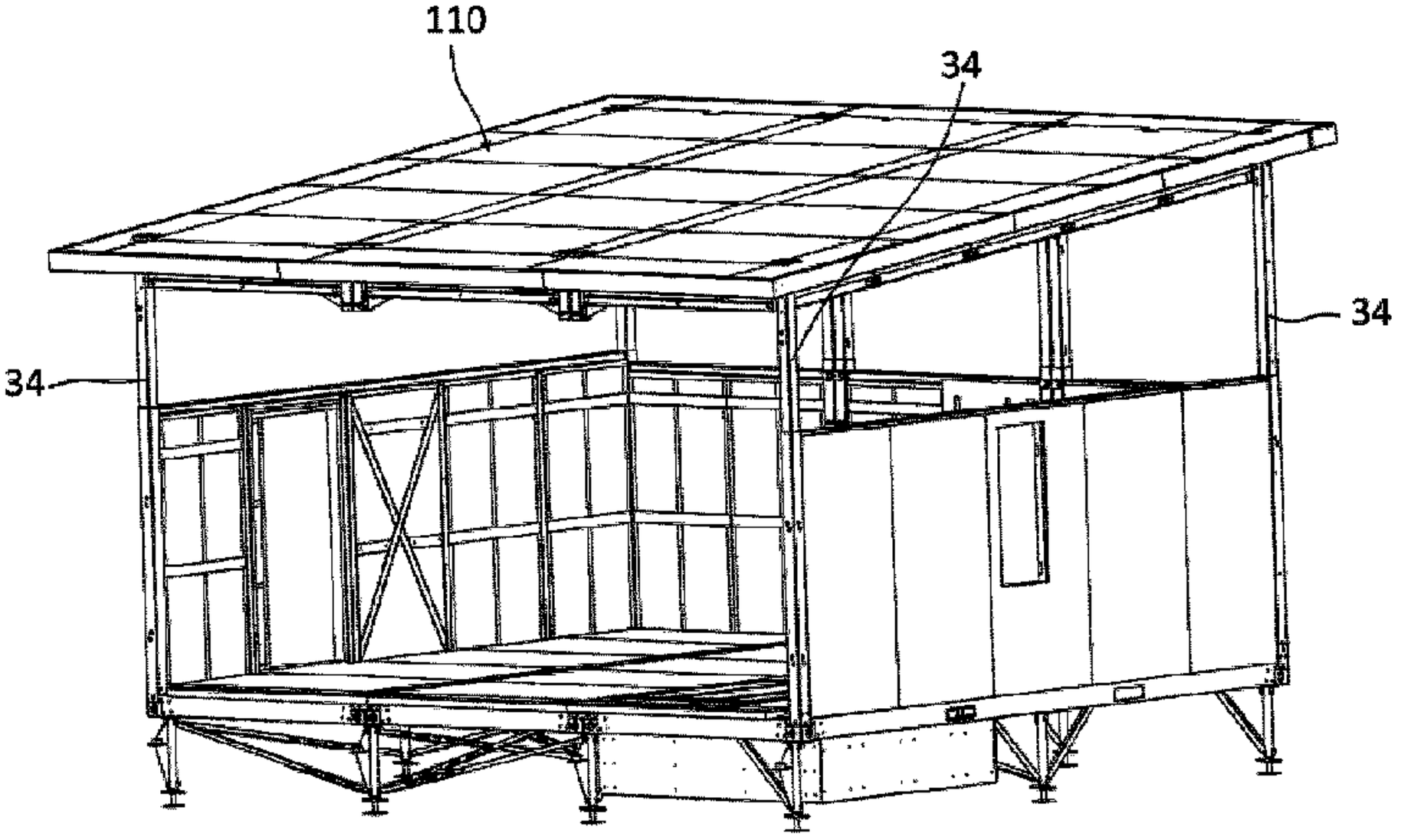
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