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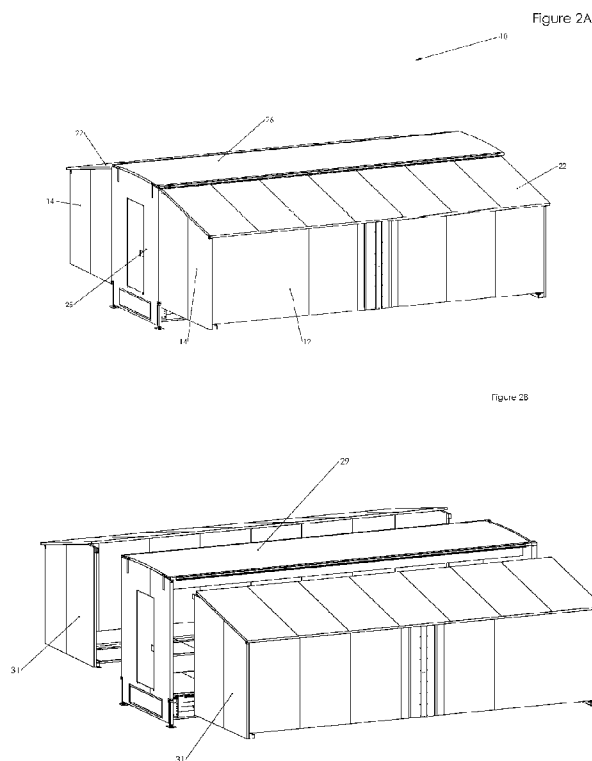
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(54) Title: PORTABLE ASSEMBLY CONVERTABLE BETWEEN A SHIPPING UNIT AND A BUILDING UNIT



(57) Abstract: A portable expandable facility is provided comprising: a core including: a top, a bottom substantially parallel to the top, a first end and a second end substantially parallel to the first end, four corner posts and optionally a first side; and an expandable portion including: at least two end walls, each end wall pivotally attached to the corner post with an at least one hinge and connected to an at least one end wall actuator extending from a frame member under the bottom to the end wall in a vicinity of a bottom of the end wall; an at least one roof panel, the at least one roof panel pivotally attached to the top with an at least one roof hinge; an at least one side wall, the at least one side wall hinged to a folding floor at a first end of the folding floor in a vicinity of a bottom of the side wall and connected to an at least one side wall actuator, the at least one side wall actuator extending from a frame member under the bottom, wherein the at least one folding floor, the at least two end walls, the at least one roof panel and the at least one side wall form an at least one side substantially normal to the ends in a contracted state to provide, within the fixed portion, a container having an unencumbered inner space.

PORTABLE ASSEMBLY CONVERTABLE BETWEEN A SHIPPING UNIT AND A BUILDING UNIT

CROSS REFERENCE TO RELATED APPLICATIONS

This application is related to, and claims the benefit of, U.S. Provisional Patent Application No. 61976992, filed April 8, 2014. The above-identified priority patent application is incorporated herein by reference in its entirety.

FIELD

The present technology relates to an expandable and compactable mobile facility. More specifically, the technology is a container that can be transported to a site and automatically or semi-automatically deployed to provide a building, which, when not needed, can be easily and quickly contracted back to the transportable container.

BACKGROUND

There are numerous mobile facilities that can be of service for numerous commercial, personal or institutional uses and activities. These range from mobile homes, to recreational vehicles to containers that in one way or another open up into buildings. These can be used as mobile command centers, dormitories, offices, workshops, classrooms, field research laboratories, cinemas, catering kitchens, accommodation facilities, retail stores, event marketing trailers, entertainment venues, medical facilities, cafes, and the like.

US Patent No. 5,345,730 discloses an expandable structure that has a core structure that may be expanded on a selected side into a composite structure incorporating the core structure and a contiguous expanded section. The selected sidewall of the core structure rotates up to become the roof of the expanded section. The sidewall, endwalls and floor section of the expanded section are hinged to the frame of the core structure and stacked vertically against the selected sidewall/roof but do not take up significant floor space within the core section. Expansion is accomplished by power beams housed

within the roof and subflooring of the core structure. The sequence of expansion includes the steps of (a) rotating the selected sidewall/roof to a horizontal position as the roof of the expanded section by power beams housed within the roof of the core section; (b) driving the sidewall of the expanded section outwardly by power beams housed within the subflooring of the core structure; (c) driving the endwalls outwardly; and (d) rotating the floor of the expanded section downwardly to form an extension of the floor of the core section. The power beams include hydraulic rams and manually operated screw drives, both connected to telescoping members. This structure requires a large number of power beams to expand it, and thus, a significant amount of power to drive the power beams. The larger the number of moving parts, the more likely there will be equipment failures. Further, the walls and roof to be expanded are attached to the outside of the core structure. This could increase the potential for damage to the walls and roof used in expanding the structure.

US Patent No. 5,761,854 discloses a structure that combines the advantages of frame structures and tents in a portable collapsible shelter by modifying standard shipping container structures to provide fold-down side walls which extend the floor space of the container and are provided with a retractable fabric cover to enclose the extended space. This provides a small structure that utilizes the sidewalls as the floor of the expanded structure. As the walls and the roof of the expanded structure are fabric, there is little potential for insulating the expanded structure. This limits its practical utility to warmer climates.

US Patent No. 8,166,715 discloses another containerized portable shelter that is small and light. This is designed to be small enough for helicopter transport but which can also travel through container channels and has increased expandability of the floor space. It has a fraction (e.g. one-half) the standard ISO width, so that a plurality of modular units can be joined to form a standard ISO container. Two or more modular units can be joined side-by-side and/or end-to-end to form a compound shipping

container preferably having ISO freight container characteristics. This is not a self contained unit and requires the assistance of a crane to expand and contract it.

5 US Patent No. 6345471 discloses an expandable mobile accommodation structure comprising a central structure provided with floor, roof, and end walls and two longitudinal side walls, at least one of which is movable outwards together with outwardly pivotal floor and roof sections. The roof and floor sections comprise a rigid panel, and are pivoted to the side wall and the floor and roof edges of the central structure such that in a non-expanded state the roof panel and the side wall are permitted to hang down double-folded outside the folded up floor panel. The structure is characterized in that an actuating means is arranged to act between the central structure and the roof panel for swinging the roof panel up and down supported by a draw rope that is acting between the upper part of the central structure and the outermost part of the floor panel. As the leveraged weight to be acted on by the hydraulic rams in this design would be extremely large, it would require large rams and associated motors. Further, the walls, floor and roof to be expanded are attached to the outside of the core structure. This could increase the potential for damage to the walls and roof used in expanding the structure.

10 US Patent No. 7828367 discloses a mobile facility that has a fixed frame, an expandable roof section, an expandable floor section, and an expandable side section. Interior space within the mobile facility is expanded by expanding the expandable roof section, the expandable floor section and the expandable side section. Extensive hydraulic systems are needed to move the expandable sections, adding weight and cost to the facility. Additionally, an accordion system is used to deploy the expandable floor section, again adding weight and cost

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20 US Patent No. 7,418,802 discloses a side expandable shelter system having a transport mode in which a side expandable section(s) is completely nested within an (ISO-style) main shelter section, and a deployment mode in which the side expandable section is completely protracted from the main shelter section. The side expandable shelter system comprises a flooring structure for the side expandable section provided by a

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hinged flooring panel assembly consisting of at least two floor panels hinged together so that they can be stacked compactly in a vertical direction when the side expandable section is retracted within the main shelter section, in a nested manner, so as to be completed contained therewithin its transport mode, and extended in horizontal direction when the side expandable section is projected from the main shelter section during the deployment mode. Both single and double side expandable shelter systems are provided. This is not a self-contained unit as it does not include any means for expanding the structure. It would be presumed therefore, that rams or cranes or the like would have to be employed on site in order to expand and contract the structure.

US Patent Nos. 8,347,560 and 7,882,659 disclose a modular assembly capable of converting from a shipping container configuration into a building unit, and from a building unit into a shipping container configuration. From the shipping container configuration, a plurality of frame panels and unit panels moveably connected to a frame of the modular assembly are selectively positioned to form the floors, walls, and ceilings of the building unit configuration thereby forming a living and/or commercial structure complete with electrical, water and sewage connections. The assembly may include an automated erection system, which may include a system of electric motors, gears, pulleys, cables, automated mechanical arms and electronic controls, located within the container structure of the modular assembly, and which interact with a plurality of frame panels and unit panels to deploy and retract the plurality of frame panels and unit panels for constructing the shipping container configuration and building unit configuration. Although much of the erection is automated, the initial steps require a user, working with hydraulic rams or jacks to manually place the entry panels. Any potential storage space is taken up with the automated erection system, which is extensive.

US Patent No. 8,650,806 discloses a thermally isolated portable expandable shelter that may include a frame substantially similar in configuration to a shipping container and a

movable portion comprising a plurality of rigid panels. The shelter may be movable between a stowed state and a fixed state, wherein the plurality of panels is folded into the frame in the stowed state and fold out during deployment. In some embodiments the plurality of panels may comprise structural insulated panels so that an interior defined by the expandable shelter is thermally isolated from an exterior. The portable expandable shelter is provided only with a winch for the floor and it is envisioned that personnel would erect the various components. Thus, either a number of people or use of actuators that are not supplied as part of the structure would be needed to expand the structure.

While many systems contract into a shipping container, others fold flat for shipping. For example, US Patent No. 8,613,166 discloses a collapsible temporary housing system including a base, four walls being connected along each respective edge extending between at least two of the four corners, the walls being pivotally connected along the edges of the base so that when the walls are pivoted into a collapsible configuration each wall is laid upon a previously collapsed wall creating a nearly horizontal surface extending across a top surface area of the base, and a flat roof, the flat roof being detached from the four walls while the four walls are pivoted into an erected position, secured to the walls once the walls are erected, and set upon the nearly horizontal surface when the walls are pivoted into a collapsible configuration, wherein a plurality of other temporary housing systems may be stacked where a lean of the stacked housing systems which could result in the stacked housing systems falling over is not present. The interior space of the core could not be used for permanent storage space.

US Publication No. 20130305626 discloses a method for rapidly deploying and erecting a Department of Housing and Urban Development (HUD)-certified structure includes providing an International Organization for Standardization (ISO)-certified container. The container includes a container frame including a horizontal floor section, an opposed horizontal roof section and first and second opposed vertical end sections, and

a pair of opposed vertically-disposed floor panels. The container frame and the opposed floor panels define an interior cavity with a plurality of dwelling members disposed therein. The method further includes transporting the ISO-certified container to a desired location and forming a HUD-certified structure at the desired location, including manipulating at least some of the dwelling members. The roof panels are stacked in the middle of the core structure, thereby limiting permanent storage space. This is not a self contained unit as there are no actuators provided.

US Publication No. 20130291449 discloses an expandable and contractible, transforming habitable structure, ISO-certified container designed as a single unit with all primary components contained within, to be easily transported by water, air or land (truck and rail) in stacked configurations. The unit of fold-down floors, easy swing-out interior and exterior walls, and an inter-locking roof system, rapidly expands using: specially designed and engineered "box hinges" and "pivot pins." When expanded, the unit is structurally secured via especially designed and engineered "spring bolts" requiring little construction knowledge or tools, into HUD-approved, habitable, family friendly structure for emergency and temporary individual, or single-family use, and can be combined in multiples for various field functional applications. The design and engineering of floor, wall and roof (stored for transport within the container) components allow for their simple maintenance by the removal and replacement of some bolts or specially designed and engineered "spring-loaded hinges." This is not a self-contained structure as it requires cranes or rams that are not part of the system.

What is needed is a self-contained, easily expanded and easily compacted mobile facility. It would preferably have a limited number of actuators and those actuators being located so as not to obstruct the walls. Further, it would be preferable if the movement of one component could effect the movement of another component. Still further, it would be preferable if the facility could provide an inner space for storage of articles that do not have to be removed as the facility is expanded and contracted.

SUMMARY

The present technology provides for a self-contained mobile facility that can be erected and compacted by one person. This is, in part, because of the interactive movement of parts. For example, movement of one or more selected walls causes the roof panels to be lifted into place. Also, when the facility is being contracted, a wall actuator retracts the wall and at the same time actuates an arm that in turn actuates a lifter that initiates lifting of the bi-fold floor so as to allow inward movement of the floor. The actuators are below the floor, thereby providing unobstructed walls. This is particularly useful in that a lower center of gravity aids in better towing characteristics and it is easier to create a more consumer friendly visual appeal. The hidden actuators also free up the external wall areas for use in installing entry doors and windows. Another advantage of this design is that a relatively small number of actuators are required to expand and compact the unit thereby reducing construction and maintenance cost and weight. The facility provides a permanent inner space that can be used for storage in each of the expanded and contracted positions.

In one embodiment, an expandable facility is provided comprising: a core including: a top, a bottom substantially parallel to the top, a first end and a second end substantially parallel to the first end, and optionally a first side; and an expandable portion including: a first end wall pivotally attached to the first end with an at least one hinge and connected to an at least one end wall actuator; optionally, a second end wall pivotally attached to the second end with an at least one hinge and connected to an at least one end wall actuator, each at least one end wall actuator attached to and extending from a frame member under the bottom to the end wall in a vicinity of a bottom of the end wall; an at least one roof panel, the at least one roof panel pivotally attached to the top with an at least one roof hinge; an at least one side wall, the at least one side wall hinged to a folding floor at a first end of the folding floor in a vicinity of a bottom of the side wall and connected to an at least one arm and side wall actuator combination

comprising an arm and an actuator, the at least one arm and side wall actuator combination attached to and extending from a frame member under the bottom, wherein the folding floor, the two end walls, the at least one roof panel and the at least one side wall form an at least one side substantially normal to the ends in a contracted state to provide a container having an unencumbered inner space.

In the expandable facility there may be four end walls, two side walls and two roof panels that form two substantially parallel sides in the contracted state.

The expandable facility may further comprise a floor lifter mechanism connected to the arm and side wall actuator combination and configured to lift the folding floor at a pivot point during contraction of the facility.

In the expandable facility each end wall may be configured such that a top of the end wall abuts an underside of the roof panel at a contact point to raise and lower the roof panel during expansion and contraction.

In the expandable facility the contact point may be at least about 12 inches from the at least one roof hinge.

In the expandable facility an upper corner of the end wall may comprise a wheel or slider.

In the expandable facility, the end wall may further comprise a slide on a bottom plate, and the foldable floor may be in slidable engagement with the slide.

The expandable facility may further comprise an at least one expanding floor joist configured to abut the underside of the folding floor in the expanded position.

The expandable facility may further comprise a cushion mechanism on the slide.

In the expandable facility the arm may be an articulating arm or a telescoping arm extending between the frame member of the bottom and the side wall in the vicinity of the bottom of the side wall.

5 In the expandable facility, the lifter mechanism may comprise a slider block slidably disposed on a distal region of a proximal section of the articulating arm and pivotally linked to the lifter, a biasing member extending between the slider block and a hinge that pivotally attaches the distal section to the proximal section and a sleeve slidably
10 disposed on the proximal section of the articulating arm proximal to the slider block and linked to the lifter.

In the expandable facility, the lifter mechanism may be disposed on the telescoping arm and comprise an actuator mount affixed to a locking plate, the actuator mount and locking plate slidably engaged with an intermediate track and an outer track, the outer
15 track including a travel slot and a locking guide, a lifter arm plate biased against the actuator mount, a lifter pivotally attached to the lifter arm plate and a lifter fulcrum arm, the lifter fulcrum arm pivotally mounted to the outer track.

In the expandable facility, the lifter mechanism may further comprise an outboard gear cog rotatably mounted on an outboard gear rack, the outboard gear rack attached to the outer track, an inboard gear cog rotationally mounted on an inboard gear rack, the
20 inboard gear rack affixed to an external housing, the outboard gear cog and inboard gear cog rotationally linked.

In another embodiment, an expandable facility is provided comprising: a core including: a top, a bottom substantially parallel to the top, a first end and a second end substantially parallel to the first end, and optionally a first side; and an expandable
25 portion including: an at least two end walls, each end wall pivotally attached to a respective end with an at least one hinge and connected to an at least one end wall actuator, the at least one end wall actuator attached to and extending from the core to

the end wall; an at least one roof panel, the at least one roof panel pivotally attached to the top with an at least one roof hinge; an at least one folding floor, the folding floor comprising an at least one pair of floor panels, a first floor panel pivotally attached to a second floor panel with an at least one hinge; an at least one side wall, the at least one side wall hinged to an outer end of the folding floor in a vicinity of a bottom of the side wall and connected to an at least one arm and side wall actuator combination, the at least one arm-side wall actuator comprising an arm and an actuator, the at least one arm and side wall actuator combination extending from a frame member under the bottom to the side wall in the vicinity of the bottom of the side wall; and a floor lifter mechanism, the floor lifter mechanism attached to and actuated by the arm and side wall actuator combination and configured to pivot the folding floor upward about the folding floor hinge during contraction of the facility.

In the expandable facility the floor lifter mechanism may comprise a lifter adjacent an underside of the folding floor, the lifter configured to pivot upward above a level of the floor only during contraction of the facility.

The expandable facility may further comprise an at least one articulating floor joist configured to abut the underside of the folding floor in the expanded position.

In the expandable facility, the articulating floor joist may comprise a pair of struts and a vertical support pivotally attached to each of the folding floor at a floor hinge with an upper hinge and to the struts with a lower hinge disposed between the struts.

The expandable facility may further comprise an at least one slide on an underside of the floor panels for slidably engaging the articulating floor joist, the slide having a proximal stop and a distal stop.

In the expandable facility, the arm may be an articulating arm or a telescoping arm extending between the frame member of the bottom and the side wall in the vicinity of the bottom of the side wall.

5 In the expandable facility, the lifter mechanism may be for use with the telescoping arm and comprise an actuator mount affixed to a locking plate, the actuator mount and locking plate slidably engaged with an intermediate track and an outer track, the outer track including a travel slot and a locking guide, a lifter arm plate biased against the actuator mount, a lifter pivotally attached to the lifter arm plate and a lifter fulcrum arm, the lifter fulcrum arm pivotally mounted to the outer track.

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In the expandable facility, the lifter mechanism may further comprise an outboard gear cog rotatably mounted on an outboard gear rack, the outboard gear rack attached to the outer track, an inboard gear cog rotationally mounted on an inboard gear rack, the inboard gear rack affixed to an external housing, the outboard gear cog and inboard gear cog rotationally linked.

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In the expandable facility, the lifter mechanism may comprise a slider block slidably disposed on a distal region of a proximal section of the articulating arm and pivotally linked to the lifter, a biasing member extending between the slider block and a hinge that pivotally attaches the distal section to the proximal section and a sleeve slidably disposed on the proximal section of the articulating arm proximal to the slider block and linked to the lifter.

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25 In the expandable facility, the expandable facility may be a monocoque structure.

In another embodiment, an initiator for use with a folding structure is provided, the folding structure comprising a hinged pair of panels, the initiator for urging the folding structure to pivot about a hinge point, thereby initiating contraction of the folding

structure, the initiator comprising an arm for extending between a static member and a contractible member and for locating in a vicinity of the hinge point; an actuator for extending between the arm and the static member; and a lever mechanism, the lever mechanism including a lever pivotally attached to the arm and configured to pivot outward from the arm during contraction of the contractible member.

In the initiator the arm may be an articulating arm or a telescoping arm.

The initiator may further comprise a slider block slidably disposed on a distal region of a proximal section of the articulating arm and pivotally linked to the lever, a biasing member extending between the slider block and a hinge that pivotally attaches a distal section of the articulating arm to the proximal section of the articulating arm and a sleeve slidably disposed on the proximal section of the articulating arm proximal to the slider block and linked to the lever.

In the initiator the lever mechanism may be attached to the telescoping arm and further comprise an actuator mount affixed to a locking plate, the actuator mount and locking plate slidably engaged with an intermediate track and an outer track, the outer track including a travel slot and a locking guide, a lever arm plate biased against the actuator mount, a lever pivotally attached to the lever arm plate and a lever fulcrum arm, the lever fulcrum arm pivotally mounted to the outer track.

In the initiator, the lever mechanism may further comprise an outboard gear cog rotatably mounted on an outboard gear rack, the outboard gear rack attached to the outer track, an inboard gear cog rotationally mounted on an inboard gear rack, the inboard gear rack affixed to an external housing, the outboard gear cog and inboard gear cog rotationally linked.

In yet another embodiment, a portable expandable facility is provided comprising: a core including: a top, a bottom substantially parallel to the top, a first end and a second

end substantially parallel to the first end, four corner posts and optionally a first side;
and an expandable portion including: at least two short folding walls, each short folding
wall including a first panel pivotally attached to the corner post with an at least one
vertically disposed hinge and at least a second panel pivotally attached to the first panel
with an at least one vertically disposed hinge and connected to an at least one end wall
actuator, the at least one end wall actuator extending from a frame member under the
bottom; an at least one roof panel, the at least one roof panel pivotally attached to the
top with an at least one roof hinge; an at least one side wall, the at least one side wall
hinged to the short folding wall at an outer end of the short folding wall with an at least
one vertically disposed hinge; an at least one floor; and an at least one floor mover for
moving the floor from a contracted position to an expanded position, wherein the at
least one floor, the at least two short folding walls, the at least one roof panel and the at
least one side wall form an at least one side substantially normal to the ends in a
contracted state to provide, within the fixed portion, a container having an
unencumbered inner space.

In the portable expandable facility, the side wall may be configured such that a top of
the side wall abuts an underside of the roof panels at a contact point to provide a ratio
of roof panel supported to roof panel levered of about 1:3 during expansion and
contraction.

In the portable expandable facility, the contact point may be at least about 12 inches
from the at least one roof hinge.

In the portable expandable facility, the side wall may further comprise a slide on a
bottom plate, the short folding wall in slidable engagement with the slide.

The portable expandable facility may further comprise an at least one expanding floor
joist configured to abut the underside of the floor in the expanded position.

The portable expandable facility may further comprise an initiator configured to pivot the short folding wall outward about a pivot point during contraction of the facility.

5 In the portable expandable facility the initiator may comprise the side wall actuator, an articulating arm extending between a framing member of the floor and the side wall in the vicinity of the bottom of the side wall and a lever adjacent the at least one vertically disposed hinge between the short folding wall panels, the lever pivotally attached to the articulating arm and configured to pivot outward during contraction of the facility.

10 In yet another embodiment, a method of expanding the portable expandable facility described above is provided, the method comprising an at least one user actuating the at least one end wall actuators and actuating the at least one side wall actuators, thereby expanding the portable expandable facility.

The method may further comprise articulating an articulating arm extending between a frame member under the bottom to the at least one side wall.

15 The method may further comprise articulating an at least one articulating floor joist.

In the method a single user may expand the portable expandable facility.

20 In yet another embodiment, a method of contracting the portable expandable facility described above is provided, the method comprising an at least one user retracting the side wall actuator, thereby articulating the side wall arm, causing the floor lifter to urge the folding floor upwards, and retracting the end wall actuator, thereby contracting the portable expandable facility.

25 In yet another embodiment, a portable expandable facility is provided comprising a core including: a top, a bottom substantially parallel to the top, a first end and a second end

substantially parallel to the first end, four corner posts and optionally a first side; and an expandable portion including: an at least two end walls, each end wall pivotally attached to the corner post with an at least one hinge and connected to an at least one end wall actuator extending from a frame member under the bottom to the end wall in a vicinity of a bottom of the end wall; an at least one roof panel, the at least one roof panel pivotally attached to the top with an at least one roof hinge; and an at least one side wall, the at least one side wall hinged to a folding floor at a first end of the folding floor in a vicinity of a bottom of the at least one side wall, wherein the at least one folding floor, the at least two end walls, the at least one side wall and the at least one roof panel form an expanded facility.

In yet another embodiment, a portable expandable facility is provided comprising a core including: a top, a bottom substantially parallel to the top, a first end and a second end substantially parallel to the first end, four corner brackets and optionally a first side; and an expandable portion including: an at least two end walls, each end wall pivotally attached to a bracket with an at least one hinge and connected to an at least one end wall actuator extending from a frame member under the bottom to the end wall in a vicinity of a bottom of the end wall; an at least one roof panel, the at least one roof panel pivotally attached to the top with an at least one roof hinge; an at least one side wall, the at least one side wall hinged to the at least two end walls and slidably engaging the at least two end walls, a floor hinged to the at least one side wall and a cable and pulley operatively connected to the floor, wherein the floor, the at least two end walls, the at least two end walls, the at least one side wall and the at least one roof panel form an expanded facility.

In the portable expandable facility the at least two end walls may be bifold walls.

FIGURES

Figure 1 is a cross sectional view of the present technology in the expanded mode.

Figure 2A is a perspective view of the long side of the present technology.

Figure 2B is an exploded view of the present technology.

5 Figure 3 is a cross sectional view of the present technology in the contracted mode.

Figure 4A is a top view of the actuator and articulating arm combination of the present technology.

10 Figure 4B is a top view of the actuator and telescoping arm combination of the present technology.

Figure 5A is a side view of the floor lifting mechanism of the present technology.

15 Figure 5B is a side view of an alternative embodiment of the floor lifting mechanism of the present technology.

Figure 6 is a side view of the lifter of Figure 5A raising the floor.

20 Figure 7 is a side view of the floor and articulating trusses in the contracted state.

Figure 8 is a detailed view of the articulating trusses.

Figure 9 is a side view of the floor and articulating trusses in the extended state.

25 Figure 10 is a perspective view of the end walls as the facility expands.

Figure 11 is a view of the end walls.

Figure 12 is a view of the underside of a roof panel.

Figure 13 is a side view of the container to be removed from a truck.

5 Figure 14 is a perspective view of an alternative embodiment.

Figure 15 is a perspective view of the actuator and articulating arm of the alternative embodiment of Figure 14.

10 Figure 16 is a view of an alternative embodiment of the technology of Figure 1.

Figure 17 is a view of the sliding end wall of yet another embodiment.

Figure 18 is a view of the sliding roof of the embodiment of Figure 17.

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Figure 19 is a view of the folding end wall of another embodiment.

Figure 20 is a cross sectional view of a wall and roof panel.

20 Figure 21 is a block diagram showing the steps to erect the facility.

Figure 22 is a block diagram showing the steps to contract the facility.

25 Figure 23 is a block diagram showing the new steps to erect an alternative embodiment of the facility.

Figure 24 is a block diagram showing the new steps to contract the alternative embodiment of the facility.

Figure 25 is a block diagram showing the new steps to erect another alternative embodiment of facility.

Figure 26 is a block diagram showing the new steps to contract the other alternative embodiment of the facility.

Figure 27A is a side view of an initiator of the present technology.

Figure 27B is a side view of an alternative embodiment of an initiator of the present technology.

Figure 28 is a side view of the cushioning assembly of the present technology.

DESCRIPTION

Except as otherwise expressly provided, the following rules of interpretation apply to this specification (written description, claims and drawings): (a) all words used herein shall be construed to be of such gender or number (singular or plural) as the circumstances require; (b) the singular terms "a", "an", and "the", as used in the specification and the appended claims include plural references unless the context clearly dictates otherwise; (c) the antecedent term "about" applied to a recited range or value denotes an approximation within the deviation in the range or value known or expected in the art from the measurements method; (d) the words "herein", "hereby", "hereof", "hereto", "hereinbefore", and "hereinafter", and words of similar import, refer to this specification in its entirety and not to any particular paragraph, claim or other subdivision, unless otherwise specified; (e) descriptive headings are for convenience only and shall not control or affect the meaning or construction of any part of the specification; and (f) "or" and "any" are not exclusive and "include" and "including" are not limiting. Further, the terms "comprising," "having," "including," and "containing" are

to be construed as open-ended terms (i.e., meaning "including, but not limited to,")
unless otherwise noted.

To the extent necessary to provide descriptive support, the subject matter and/or text
of the appended claims is incorporated herein by reference in their entirety.

5 Recitation of ranges of values herein are merely intended to serve as a shorthand
method of referring individually to each separate value falling within the range, unless
otherwise indicated herein, and each separate value is incorporated into the
specification as if it were individually recited herein. Where a specific range of values is
provided, it is understood that each intervening value, to the tenth of the unit of the
10 lower limit unless the context clearly dictates otherwise, between the upper and lower
limit of that range and any other stated or intervening value in that stated range, is
included therein. All smaller sub ranges are also included. The upper and lower limits of
these smaller ranges are also included therein, subject to any specifically excluded limit
in the stated range.

15 Unless defined otherwise, all technical and scientific terms used herein have the same
meaning as commonly understood by one of ordinary skill in the relevant art. Although
any methods and materials similar or equivalent to those described herein can also be
used, the acceptable methods and materials are now described.

20 Definitions:

Unencumbered inner space – in the context of the present technology, an
unencumbered inner space is an interior space that is free of actuators, jacks, and other
mechanisms used to expand and contract the facility.

Permanent inner space – in the context of the present technology, a permanent inner
25 space is an inner space that is available for permanently mounting of structures, or

storage of supplies and materials. The components that are used for expansion (rams, jack and the like, walls, floors and roof) do not impinge on the permanent inner space.

Permanent inner area – in the context of the present technology, a permanent inner area is the inner floor area that available for permanently mounting of structures, or storage of supplies and materials. The components that are used for expansion (rams, jack and the like, walls, floors and roof) do not impinge on the permanent inner area.

An expandable and contractible mobile facility, generally referred to as 10, is shown in Figure 1 in its expanded mode. The facility 10 has two side walls 12, four end walls 14, a floor 16 and a roof, generally referred to as 18, in its fully expanded mode. For each side wall 12, there may be one or two end walls 14. In the expanded mode 10, the facility provides about two or three times and up to ten times the amount of useable floor area that it had in the contracted mode 30, depending on whether one or both of its long sides were to be expanded. For example, in one size of the facility 10, if both sides are expanded, the floor area is about 17' to about 32' wide, more specifically, 22' wide by 23' long as compared to 8'6" wide before expansion. The roof 18 is composed of roof panels 22 and a top 26. Roof trusses or joists 136 extend longitudinally to support the top 26. Figure 2A is a perspective view of the facility 20 in the expanded position. The ends 25 and end walls 14 can be seen in the expanded position. Figure 2B is an exploded view showing the core 29, which is the non-expanding or fixed portion, and the expanding portions 31.

As shown in Figure 3, in its contracted mode, the container, generally referred to as 30 has on one or more sides, generally referred to as 20, one roof panel 22 adjacent two end walls 14 and a side wall 12 adjacent the end walls 14 – in other words, the end walls 14 are sandwiched between one side wall 12 and the roof panel 22 and the roof panel functions as the side 20. The end wall 14 and roof panels 22 are latched into the compacted position with a sliding or rotating latch 23 fixed to the lower, outer surface of the end walls 14. An inner space 24 is defined by the sides 20, the first and second

ends 25 (see Figure 2), the top 26, the bottom 28, and, in their contracted position, the two side walls 12, the four end walls 14, and the floor 16. The resultant container 30 optionally meets the International Organization for Standardization (ISO) standards for shipping containers or is provided as an ISO “high cube” container version (9.5’ tall x 8’ wide x 20’ / 30’ / 40’ / 45’ long). It may also be designed as a higher and wider unit not conforming to ISO container standards. It may also be designed as, for example, but not limited to, a truck or bus body, motor home, or modular building.

The inner space 24 allows for cargo, such as, but not limited to tools and furniture to be stowed and fixtures and equipment to be permanently installed. This space is therefore the permanent inner space 24. The container 30 may be configured as a shipping container; a truck mounted body; a bumper pull style trailer; a fifth wheel style trailer; an independent unit carried on a trailer or a truck or by train, helicopter or airplane or any combination of such vehicles.

Figure 4A and B shows an actuator 50, which is preferably a hydraulic ram that extends between and is attached to the frame member, which may be a floor truss or a floor joist 52 supporting the bottom 28 of the container 30 and an arm, generally referred to as 54. The actuator 50 projects out perpendicularly to the container 30. The combination of the arm and the side wall actuator is the arm and side wall actuator combination 51. The arm and side wall actuator combination 51 deploys the floor 16 and side wall 12.

In Figure 4A, the arm 54 is an articulating arm 55. The articulating arm 55 has a proximal section 56 and a distal section 58 that are pivotally attached by a hinge pin 60. The proximal section 56 is pivotally attached to the floor joist 52. The arm 55 has a vertical column 126 affixed to the end of its distal section 58 which holds the side wall 12 upright at all times. Either the vertical column 126 is rotationally connected to the articulating arm 55, or it is rotationally connected to the side wall 12. The distal section

58 has a sleeve 62 that is slidably disposed on it. The actuator 50 is pivotally attached to this sleeve 62. There may be one or more actuator-arm pairs.

5 In Figure 4B, the arm 54 is a telescoping arm 57. The arm 57 either has a vertical column 126 that is affixed to the end of the distal section 58, or the vertical column may be part of the wall framing. There is no need for either the vertical column 126 to rotate in the framing of the side wall 12 or the arm 57 to rotate about the vertical column 126. The vertical column 126 functions to hold the side wall 12 upright. The proximal section 56 is attached to the floor joist 52. The telescoping arm 57 is mounted
10 on the hydraulic ram 50 with a floor lifter mechanism, generally referred to as 59.

The floor lifter mechanism, generally referred to as 59, is shown in Figure 5A and B. In one embodiment, shown in Figure 5A, the lifter mechanism is used with the articulating arm 55. Proximate to the hinge pin 60 of the articulating arm 55 is a slider block 64 that
15 is slidably disposed on the distal section 58. The slider block 64 is biased towards the proximal end 66 with a spring 68 that extends between a pin 70 on the distal section 58 and a pin 72 on the slider block 64. A linkage 74 pivotally attaches a lifter 76 to the slider block 64 and the sleeve 62. The lifter 76 is disposed on an upper surface 78 of the slider block 64 and is flush with the upper surface 80 of the sleeve 62. The slider block
20 64 abuts a distal end 82 of the proximal section 56 of the articulating arm 55. The lifter 76 remains below floor level until it is actuated. The floor 16 with its floor panels 104 that are attached to one another with a hinge 102 can be seen above the lifter mechanism 59.

25 In another embodiment, shown in Figure 5B, the lifter mechanism 59 is used with the telescoping arm 57. The actuator 50 is affixed to an actuator mount 402. The actuator mount 402 is slidably engaged with an intermediate track 404 and an outer track 406. A sliding pin locking plate 408 is affixed to the actuator mount 402. The outer track 406 has a travel slot 412 and a locking guide 414. A spring 68 is attached to a lifter arm

plate 410 and the actuator mount 402. A lifter 76 is pivotally attached to both the lifter arm plate 410 and a lifter fulcrum arm 414, which in turn is pivotally mounted to the outer track 406. Outboard gear cog 420 is rotatably mounted on outboard gear rack 422. The outboard gear rack 422 is attached to the outer track 406. Outboard gear cog 420 and inboard gear cog 424 are rotationally linked by a chain. Inboard gear cog 424 is rotationally mounted on inboard gear rack 426, which is fixed to the external housing 428. The ratio of the gear/cogs is set to create the appropriate relation between the extended position of the actuator which is preferably a hydraulic ram 50 and the desired total extension that is required for a given width of floor. The maximum length of the entire compacted assembly, in the closed position is defined by the maximum room available, for the width of a given size of compacted unit. The maximum length of the actuator 50, in closed position, is the length of the closed assembly, minus the room required for the mounts and related hardware.

Figure 6 shows the position of the components as the lifter 76 that functions with the articulating arm 55 lifts the floor 16. A hinge 102 can be seen between the floor panels 104.

In general, during the outward movement of the arms 55, 57 the lifter mechanism 59 is inactive and configured not to interfere with the floor 16. At the beginning of inward movement of the side wall 12 and floor 16 the lifter mechanism 59 initiates the action by redirecting the forces to push between the arm 54 and the underside of the floor 16. At a certain point the action ceases and the inward moving forces transfer back to pulling on the floor 16 and side wall 12. The lifter 76 of the lifter mechanism 59 is configured to drop down out of the way during the remaining cycle. The difference in the two systems is that the articulating arm cycle works with the actuator 50 changing position by about 85 degrees throughout the cycle (if you were to view it from above) whereas in the telescoping arm cycle the actuator 50 remains positioned perpendicular to the floor joist 52.

As shown in Figure 7, the floor 16 is pivotally attached to the edge 100 of the bottom 28 at one end and pivotally attached to the side wall 12 at the other end. Hinges 102 between the floor panels 104 create a folding floor, for example, but not limited to a bi-fold or a tri-fold.

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As shown in Figure 8, articulating floor trusses, generally referred to as 106, support the floor 16. A vertical member 110 is pivotally attached to each of the floor 16 at the floor hinge 102 with an upper hinge 112 and to struts 114 with lower hinges 116. The underside 118 of the floor panels 104 are provided with a slide 120 that has a proximal stop 122 and a distal stop 124. Figure 9 shows the floor in its extended position.

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As shown in Figure 10, in one embodiment, the end walls 14 are pivotally attached to corner posts 132 of the container 30 with hinges 134. The corner posts 132 have leveling legs 138 which can be hydraulic, pneumatic, rack and pinion or scissor jacks, or the like. The bottom plate 139 is wider on the inner side 140 than the remainder of the framing. A slide or rail or roller 141 is disposed on at least a portion of the bottom plate 139 to slidably mate with a track, slide or roller 143 on the end walls 14. Note that the slide or rail or roller 141 can be disposed on the end wall 14 and the track, slide or roller may be on the bottom plate 139. The end walls 14 are provided with stabilizers 142, which can be hydraulic, pneumatic or scissor jacks or manually secured telescopic tubing. The top 144 of the end wall 14 is sloped from the hinged end 152 to the outside end 154 at a slope of about 1:3 to about 1:5, to about 1:8, and all ranges therebetween. The slope angle can be about 5 degrees or about 7 degrees or about 11 degrees or about 12 degrees or about 18 degrees and all slopes therebetween. A higher slope angle can also be used within practical limitations, as would be known to one skilled in the art.

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As shown in Figure 11, each end wall 14 has an actuator 143 preferably located at or below floor level that is attached to the end 25 and the end wall 14 and extends through the floor joist 52. The top 144 of the end walls 14 has a roller or wheel or a slider 146.

In some embodiments, there may only be one end wall 14 per side wall 12, or there may be only one end wall 14 with an actuator 143 per side wall 12. In these embodiments, the roof 18 is lifted by the end wall 14 with the actuator 143 and the other end wall 14, if present, is manually positioned after the roof 18 is positioned.

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As shown in Figure 12, the roof panel 22 has a contact point 156 on the underside 148 of the roof panel 22 about twelve inches or eighteen inches or any distance therebetween down from the hinged end 158 (the pivot point) between the top 26 and the roof panel 12, leaving about seventy-two inches of roof to lever up to the height of the initial contact point. This leverage ratio may be varied according to the design requirements, but is preferably no less than about 12 inches down from the hinged end 158 leaving 78-102 inches of roof to lever up, more preferably no less than about 18 inches down from the hinged end 158 leaving 72-96 inches of roof to lever up, hence a ratio of about 1:5, or about 1:8 or about 1:4 or about 1:3 and all ratios therebetween.

The arc 160 that the roof panel 22 and end wall 14 scribe is shown in Figure 12.

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In an alternative embodiment, especially suited to smaller units, only one end wall 14 need be deployed to push up the roof panel 22. In this case, only one end wall 14 is provided with an actuator 143. The other end wall can be extended manually. This reduces cost and weight.

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As shown in Figure 13, lifting and leveling jacks 170 are built into the expandable and contractible mobile facility 10 to raise it off its trailer 172 or truck frame or deck such that the trailer or truck may be removed and the facility 10 subsequently lowered to a chosen floor height. The jacks 170 are used again to raise and reload the facility onto the trailer 172 or truck frame or deck. Alternatively, the mobile facility 10 may be permanently mounted on the vehicle 172 or may be integral with the vehicle 172.

In an alternative embodiment, as shown in Figure 14, the end walls 14 have vertical hinges 180 to provide a folded end wall, for example, but not limited to bi-fold end walls 14. These are attached to the side wall 12 with hinges 182.

As shown in Figure 15, in an alternative embodiment, the floor 16 is a single panel with a cable and winch 184. Movement of the side wall 12, which is powered by the movement of the bi-fold end walls 14, exerts the lifting force on the roof panel 22 needed to radially lift the roof panel 22. The geometric relationship between the side wall 12 and the roof panel 22 is the same as described above for the end wall 14 and the roof panel 22. The end wall 14 is drawn into place by the movement of the side wall 12.

In an alternative embodiment, shown in Figure 16, a monocoque container 700 has end walls 702 pivotally attached to brackets 704 on one or more end 706 and a floor 708 pivotally attached with hinges 710 to the bottom 28 of the core structure 30. The details described above are the same in this embodiment with the exception that there are no corner posts.

In an alternative embodiment of the design of Figure 16, especially suited to smaller units, only one end wall 702 need be deployed to push up the roof panel 22. In this case, only one end wall 14 is provided with an actuator 143 and a roller or wheel or a slider 146. The other end wall can be extended manually. This reduces cost and weight.

As shown in Figure 17, in an alternative embodiment, the side walls 12 are provided with a slide 192 that is wider than the rest of the framing. A slider 198 on the end wall 14 engages the slide 192.

As shown in Figure 18, the roof panel 22 is similarly provided with a slide 200 or a roller 202 on the underside 148 of the roof panel 22 for slidably engaging the side wall 12.

As shown in Figure 19, in an alternative embodiment, the end walls 14 are bifold walls with a vertically disposed hinge 250 between the panels. The bifold walls are also pivotally attached to the side walls 12 with a hinge 252. An actuator 254 urges the end walls 14 into the expanded position, pushing the side walls 12 into place and causing the roof panels 22 to rise into place. The corner post 132 can be seen in the figure.

As shown in Figure 20, the walls 12, 14 and roof 18, 22 are composed of bonded composite sheets 270 on a frame, generally referred to as 272 of hollow, tubular metal. The bonded composite panels (sandwich panels) may have outer skins of sheet aluminum, sheet steel, or sheet composite material such as glass reinforced plastic bonded to a core material such as polystyrene and may additionally have an internal metal tubular metal frame. A rubber or polymeric seal 274 is on one side of each joint.

The strengths involved are high enough to allow an increase to the span of the expanding part of the container 30. The roof panel 22 is about 9.5' wide and the floor 16 is about 9' (giving a projection of over 8' on each side). A double sided unit is about 25.5' wide and could even be slightly wider if the height were to be pushed to the legal maximum for road travel.

The same technology can be used to produce a narrow unit in which the center fixed floor is only about two or about three feet wide. The permanent storage area could be, for example, about 40 sq ft or about 60 sq ft (3' x 20' long).

The same technology can be used as units that are to be towed by medium or heavier duty trucks. An example is a unit that is a fixed three axle (single wheels) (non-removable chassis) unit, with double 28' x 9' fold outs. It typically would be registered as a 21,000 GVWR and be pulled by a medium duty truck.

Method 1:

The method of erecting the facility is shown in Figure 21. The cargo need not be removed to expand or compact the mobile facility 10. The container 30 is delivered 300 to the site. Jacks 170 are employed to lift 302 the container 30 and the delivery vehicle 172 moves 304 away. The container 30 is then lowered 306 into place. Once in position, the container 30 is unlatched 308 for operation. The actuators 142 for the end walls 14 apply 310 force to the end walls 14 on one or two sides 20 of the container 30. The end walls 14 pivot 320 outward and contact 322 the underside 148 of the roof panel 22 at the contact point 156. The end walls 14 simultaneously apply 324 force to the underside 148 of the roof panel 22 (which has functioned as the side 20 of the compacted facility 10) and the roof panel 22 and top 144 of the end wall 14 slide 326 to pivot 328 the roof panel 22 out from the container 30 to become 330 the roof 22 of the deployed facility 10 on that same side. The geometry of the end wall 14 in relation to the pivoting wall/roof structure allows this movement to take place. Stabilizer 142 for the end walls 14 are lowered 340 to contact the ground. In the next step of the deployment the actuator 50 for the side wall 12 applies 342 force to the articulating arm 54. The slider block 64 on the articulating arm 54 is held 344 back before the actuator applies force. When the force is applied 346 the actuator pushes 348 the side wall 12 out from the container 30. It slides 350 along the frame of the two end walls 14, which were previously deployed. As the articulating arm 54 is extended the slider block 64 is pushed 352 distally by the distal end 82 of the proximal section 56 and the sleeve 62 similarly moves 354 distally in response to the articulating arm 54 straightening out. As a consequence, the lifter 76 remains 356 adjacent the upper surface 78 of the slider block 64. The side wall 12 carries 374 the folded floor 16, which unfolds 376. The action of the floor unfolding actuates 378 the floor trusses 106 from the under the folding floor 16 and the trusses 106 unfold 380 and are stopped 382 by the stops 122, 124. The roof panels 22 and the walls 12, 14 are clamped 386. The joints between the outer surfaces are sealed 388 by the continuous rubber or plastic polymer seal 204.

The method of contracting the facility is shown in Figure 22. When the facility 10 is to be contracted, the roof panels 22 and the walls 12, 14 are unclamped 440. The seal on the joints between the outer surfaces are broken 442. The actuator 50 for the side wall 12 retracts 450 the articulating arm 54. The slider block 64 remains 452 in the distal position and the sleeve 62 moves proximally. This causes the lifter 76 to lift 454 and in doing so it pushes 456 the folding floor 16 upward thereby allowing it to retract 458 as the side wall 12 retracts 460. This happens because the inside, spring retained slider block has been forced forward, against spring tension, by a fixed protrusion at the articulating arm elbow joint. When the arm compacts a certain amount, then the spring is able to retract the inside slider thereby allowing the outside slider to be in the pulled back position with the lifter arm no longer in the raised position so it will not interfere with the floor in compact position. In other words the lifter arm is defeated from working in all positions except when the articulating arm is in a substantially deployed position. The side wall then slides 462 along the slide 120 of the two end walls 14. The side wall 12 carries 464 the folded floor 16, which folds 466. Simultaneously the floor trusses 106 fold 470.

Once the side walls 12 and floor 16 are retracted, stabilizers 142 for the end walls 14 are raised 472. The actuators 142 for the end walls 14 draw 480 the end walls 14 in on one or both sides 20 of the container 30. The end walls 14 pivot 482 inward. Concurrently, the roof panel 22 and top 144 of the end wall 14 slide 484 to pivot 486 the roof panel 22 back to the container 30.

The container 30 is then latched 488. Jacks 170 are employed to lift 490 the container 30 and the delivery vehicle 172 moves 492 into place. The container 30 is then lowered 494 onto the vehicle 172 in preparation for being moved. A single operator is able to expand and contract the facility.

Method 2:

The method for expanding the embodiment of Figure 14 is shown in Figure 23. As the method only differs from method 1 in the deployment of the side walls 12, end walls 14 and the floor 16, only that part of the method will be described. The end walls unfold
5 500 under the force of the actuators. This pushes 502 the side walls 12 outward. As the end walls move outward this exerts 504 the lifting force on the roof panel 22 needed to radially lift the roof panel 22. The roof panel 22 therefore is lifted 506. The floor 16 extends 508 under the power of a cable and winch 184.

10 The method for contracting the embodiment of Figure 14 is shown in Figure 24. As the method only differs from method 1 in the contraction of the side walls 12, end walls 14 and the floor 16, only that part of the method will be described. The floor 16 is retracted 550 under the power of a cable and winch 184. The end walls 14 fold 552 drawing 554 the side wall 12 inward. This releases 556 the lifting force on the roof
15 panel 22 and the roof panel 22 therefore is lowered 558.

Method 3:

20 The method for expanding the embodiment of Figure 16 is shown in Figure 25. As the method only differs from method 1 in the deployment of the side walls 12, end walls 14 and the floor 16, only that part of the method will be described. The side wall 12 moves 600 outward under the force 602 of the end walls. The end walls slide 604 on the slide 192 on the bottom plate 194 of the side wall 12, and are guided by a similar slide at the top of the side wall 12. At the same time as the end wall 14 is sliding into
25 position, it is sliding 606 on the slide 200 of the roof panel 22, hence the roof panel 22 is being pushed up 608 by both the end wall 14 and the side wall 12.

The method for contracting the embodiment of Figures 17 and 18 is shown in Figure 26. As the method only differs from method 1 in the contraction of the side walls 12, end

walls 14 and the floor 16, only that part of the method will be described. The side wall 12 is drawn 650 inward by the end walls 14. The end walls slide 652 on the slide 192 on the bottom plate 194 of the side wall 12, and are guided by a similar slide at the top of the side wall. The end wall 14 is drawn 654 back into position by the actuator. At the same time as the end wall 14 is sliding into position, it is sliding 656 on the slide 200 of the roof panel 22, hence the roof panel 22 is being lowered 658 by both the end wall 14 and the side wall 12.

Method 4:

The end walls, which are bifold, each have an actuator on their inner panel. The outward opening of these bifold panels takes the side wall with them while simultaneously lifting the roof. After this the single floor panel is lowered into the opening onto a ledge at the bottom of the walls.

Example 1:

In one example expandable and contractible mobile facility, the facility is about 24 feet long. There is an additional small triangular section that sits above the trailer tongue area and is about 30" long. The height from the bottom of the facility frame to the top of the roof is about 124". The overall exterior width is no more than 102" to conform to most North American road travel regulations. The overall length of the unit could vary from 16 feet to 54 feet. Heavy duty units are anticipated to be possible when heavy duty trucks are deemed practical. In such cases the allowable overall weight of a unit and cargo exceeds 44,000 pounds so the components can then be upsized to achieve longer unit lengths, additional height and additional expanded widths. The overall height including chassis in all cases should remain below 13'6," but the unit height can be increased to a maximum of 11'6" with a 2' high low bed (double drop, extendable) trailer chassis.

The roof panel weighs about 1.7 pounds per square foot. It is about 24 feet long and 90 inches wide for a total weight of about 300 pounds. This is lifted at the two contact points.

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An initiator, generally referred to as 900 is shown in Figure 27A and B. The initiator 900 includes the actuator 50, the arm 54, and a lever mechanism 902. It is for use with a folding structure, generally referred to as 904, having a pair of panels 906 that are hinged 908 to urging the folding structure 904 to pivot about the hinge 908 to initiating contraction of the folding structure 904. The arm 54 extends between and is attached to a static member 910 and the contractible member 912, which is the folding structure 904. The actuator 50 extends between and is attached to the arm 54 and the static member 910 and the lever mechanism 902. In one embodiment, as described in Figures 4A and 5A, the arm is an articulating arm 55 and the lever mechanism 902 is slidably attached to the arm 55. The details of the lever mechanism are as for Figure 5A. Proximate to the hinge pin 60 is a slider block 64 that is slidably disposed on the distal section 58. The slider block 64 is biased towards the proximal end 66 with a spring 68 that extends between a pin 70 on the distal section 58 and a pin 72 on the slider block 64. A linkage 74 pivotally attaches the lever 902 to the slider block 64 and the sleeve 62. The lever 902 is disposed on an upper surface 78 of the slider block 64 and is flush with the upper surface 80 of the sleeve 62. The slider block 64 abuts a distal end 82 of the proximal section 56. In another embodiment, as shown in Figure 27B, the arm is a telescoping arm 57 and the lever mechanism 902 slidably attached to the arm 54. As shown in Figures 4B and 5B, the actuator 50 is affixed to an actuator mount 402. The actuator mount 402 is slidably engaged with an intermediate track 404 and an outer track 406. A sliding pin locking plate 408 is affixed to the actuator mount 402. The outer track 406 has a travel slot 412 and a locking guide 414. A spring 68 is attached to a lever plate 410 and the actuator mount 402. A lever 76 is pivotally attached to both the lever arm plate 410 and a lever fulcrum arm 414, which in turn is pivotally mounted

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to the outer track 406. Outboard gear cog 420 is rotatably mounted on outboard gear rack 422. The outboard gear rack 422 is attached to the outer track 406. Outboard gear cog 420 and inboard gear cog 424 are rotationally linked by a chain. Inboard gear cog 424 is rotationally mounted on inboard gear rack 426, which is fixed to the external housing 428. The ratio of the gear/cogs is set to create the appropriate relation between the extended position of the actuator 50 and the desired total extension that is required for a given width. The maximum length of the entire compacted assembly, in the closed position is defined by the maximum room available, for the width of a given size of compacted unit. The maximum length of the actuator 50, in closed position, is the length of the closed assembly, minus the room required for the mounts and related hardware.

A cushioning assembly, generally referred to as 430 is shown in Figure 28. The cushioning assembly 430 is to control the expansion of the floor, by slowing the fall of the floor panels 104, when using the articulating arm 55. The floor panels 104 have a stopper flange 432 and an engagement flange 434 at their distal end 435. The engagement flange 434 is slidably engaged a bottom slider 436 that is slidably mounted in the slide 192 on the bottom plate 194. Attached to the bottom slider 436 and retained by the bottom plate 184 is a shock body 438 housing a shock absorber 439. The bottom slider 436, shock body 438 and shock absorber 439 are located on the slide 192 relatively close to the distal end (furthest from the core of the structure) of the slide 192.

Advantages of the exemplary embodiments described herein may be realized and attained by means of the instrumentalities and combinations particularly pointed out in this written description. It is to be understood that the foregoing general description and detailed description are exemplary and explanatory only and are not restrictive of the claims below. While example embodiments have been described in detail, the foregoing description is in all aspects illustrative and not restrictive. It is understood that

numerous other modifications and variations can be devised without departing from the scope of the example embodiment. For example, for longer units additional articulated arms each with their own actuator may be used to move the wall/floor assembly out to its deployed position and back into its compacted position. The facility has an optional adjustable trailer chassis in which the relative hitch weight to axle weight can be easily adjusted. Further, the facility may be permanently or semi-permanently mounted on a truck, rail car, bus, recreational vehicle, van or trailer chassis or the like. Further, the technology underlying the expanding facility may be incorporated into the fixed structure of truck bodies, buses, rail cars, recreational vehicles, vans, trailers, modular buildings, or the like.

CLAIMS

- [Claim 1] An expandable facility comprising: a core including: a top, a bottom substantially parallel to the top, a first end and a second end substantially parallel to the first end, and optionally a first side; and an expandable portion including: a first end wall pivotally attached to the first end with an at least one hinge and connected to an at least one end wall actuator; optionally, a second end wall pivotally attached to the second end with an at least one hinge and connected to an at least one end wall actuator, each at least one end wall actuator attached to and extending from a frame member under the bottom to the end wall in a vicinity of a bottom of the end wall; an at least one roof panel, the at least one roof panel pivotally attached to the top with an at least one roof hinge; an at least one side wall, the at least one side wall hinged to a folding floor at a first end of the folding floor in a vicinity of a bottom of the side wall and connected to an at least one arm and side wall actuator combination comprising an arm and an actuator, the at least one arm and side wall actuator combination attached to and extending from a frame member under the bottom, wherein the folding floor, the two end walls, the at least one roof panel and the at least one side wall form an at least one side substantially normal to the ends in a contracted state to provide a container having an unencumbered inner space.
- [Claim 2] The expandable facility of claim 1, wherein there are four end walls, two side walls and two roof panels that form two substantially parallel sides in the contracted state.
- [Claim 3] The expandable facility of claim 1 or 2, further comprising a floor lifter mechanism connected to the arm and side wall actuator combination and configured to lift the folding floor at a pivot point during contraction of the facility.
- [Claim 4] The expandable facility of any one of claims 1 to 3, wherein each end wall is configured such that a top of the end wall abuts an underside of the roof panel at a contact point to raise and lower the roof panel during expansion and contraction.
- [Claim 5] The expandable facility of claim 4, wherein the contact point is at least about 12 inches from the at least one roof hinge.

- [Claim 6] The expandable facility of any one of claims 1 to 5, wherein an upper corner of the end wall comprises a wheel or slider.
- [Claim 7] The expandable facility of any one of claims 1 to 6, the end wall further comprising a slide on a bottom plate, the foldable floor in slidable engagement with the slide.
- [Claim 8] The expandable facility of any one of claims 1 to 7 further comprising an at least one expanding floor joist configured to abut the underside of the folding floor in the expanded position.
- [Claim 9] The expandable facility of claims 7 or 8, further comprising a cushion mechanism on the slide.
- [Claim 10] The expandable facility of any one of claims 1 to 9, wherein the arm is an articulating arm or a telescoping arm extending between the frame member of the bottom and the side wall in the vicinity of the bottom of the side wall.
- [Claim 11] The expandable facility of any one of claims 3 to 10, the lifter mechanism comprising a slider block slidably disposed on a distal region of a proximal section of the articulating arm and pivotally linked to the lifter, a biasing member extending between the slider block and a hinge that pivotally attaches the distal section to the proximal section and a sleeve slidably disposed on the proximal section of the articulating arm proximal to the slider block and linked to the lifter.
- [Claim 12] The expandable facility of any one of claims 3 to 10, the lifter mechanism disposed on the telescoping arm and comprising an actuator mount affixed to a locking plate, the actuator mount and locking plate slidably engaged with an intermediate track and an outer track, the outer track including a travel slot and a locking guide, a lifter arm plate biased against the actuator mount, a lifter pivotally attached to the lifter arm plate and a lifter fulcrum arm, the lifter fulcrum arm pivotally mounted to the outer track.
- [Claim 13] The expandable facility of claim 12, the lifter mechanism further comprising an outboard gear cog rotatably mounted on an outboard gear rack, the outboard gear rack attached to the outer track, an inboard gear cog rotationally mounted on an inboard

gear rack, the inboard gear rack affixed to an external housing, the outboard gear cog and inboard gear cog rotationally linked.

[Claim 14] An expandable facility comprising: a core including: a top, a bottom substantially parallel to the top, a first end and a second end substantially parallel to the first end, and optionally a first side; and an expandable portion including: an at least two end walls, each end wall pivotally attached to a respective end with an at least one hinge and connected to an at least one end wall actuator, the at least one end wall actuator attached to and extending from the core to the end wall; an at least one roof panel, the at least one roof panel pivotally attached to the top with an at least one roof hinge; an at least one folding floor, the folding floor comprising an at least one pair of floor panels, a first floor panel pivotally attached to a second floor panel with an at least one hinge; an at least one side wall, the at least one side wall hinged to an outer end of the folding floor in a vicinity of a bottom of the side wall and connected to an at least one arm and side wall actuator combination, the at least one arm-side wall actuator comprising an arm and an actuator, the at least one arm and side wall actuator combination extending from a frame member under the bottom to the side wall in the vicinity of the bottom of the side wall; and a floor lifter mechanism, the floor lifter mechanism attached to and actuated by the arm and side wall actuator combination and configured to pivot the folding floor upward about the folding floor hinge during contraction of the facility.

[Claim 15] The expandable facility of claim 14, wherein the floor lifter mechanism comprises a lifter adjacent an underside of the folding floor, the lifter configured to pivot upward above a level of the floor only during contraction of the facility.

[Claim 16] The expandable facility of claim 14 or 15 further comprising an at least one articulating floor joist configured to abut the underside of the folding floor in the expanded position.

[Claim 17] The expandable facility of claim 16, wherein the articulating floor joist comprises a pair of struts and a vertical support pivotally attached to each of the folding floor at a

floor hinge with an upper hinge and to the struts with a lower hinge disposed between the struts.

[Claim 18] The expandable facility of claim 17 further comprising an at least one slide on an underside of the floor panels for slidably engaging the articulating floor joist, the slide having a proximal stop and a distal stop.

[Claim 19] The expandable facility of any one of claims 14 to 18, wherein the arm is an articulating arm or a telescoping arm extending between the frame member of the bottom and the side wall in the vicinity of the bottom of the side wall.

[Claim 20] The expandable facility of claim 19, the lifter mechanism for use with the telescoping arm and comprising an actuator mount affixed to a locking plate, the actuator mount and locking plate slidably engaged with an intermediate track and an outer track, the outer track including a travel slot and a locking guide, a lifter arm plate biased against the actuator mount, a lifter pivotally attached to the lifter arm plate and a lifter fulcrum arm, the lifter fulcrum arm pivotally mounted to the outer track.

[Claim 21] The expandable facility of claim 20, the lifter mechanism further comprising an outboard gear cog rotatably mounted on an outboard gear rack, the outboard gear rack attached to the outer track, an inboard gear cog rotationally mounted on an inboard gear rack, the inboard gear rack affixed to an external housing, the outboard gear cog and inboard gear cog rotationally linked.

[Claim 22] The expandable facility of claim 18, the lifter mechanism comprising a slider block slidably disposed on a distal region of a proximal section of the articulating arm and pivotally linked to the lifter, a biasing member extending between the slider block and a hinge that pivotally attaches the distal section to the proximal section and a sleeve slidably disposed on the proximal section of the articulating arm proximal to the slider block and linked to the lifter.

[Claim 23] The expandable facility of any one of claims 14 to 22, wherein the expandable facility is a monocoque structure.

[Claim 24] An initiator for use with a folding structure, the folding structure comprising a hinged pair of panels, the initiator for urging the folding structure to pivot about a hinge

point, thereby initiating contraction of the folding structure, the initiator comprising an arm for extending between a static member and a contractible member and for locating in a vicinity of the hinge point; an actuator for extending between the arm and the static member; and a lever mechanism, the lever mechanism including a lever pivotally attached to the arm and configured to pivot outward from the arm during contraction of the contractible member.

[Claim 25] The initiator of claim 24, wherein the arm is an articulating arm or a telescoping arm.

[Claim 26] The initiator of claim 25 further comprising a slider block slidably disposed on a distal region of a proximal section of the articulating arm and pivotally linked to the lever, a biasing member extending between the slider block and a hinge that pivotally attaches a distal section of the articulating arm to the proximal section of the articulating arm and a sleeve slidably disposed on the proximal section of the articulating arm proximal to the slider block and linked to the lever.

[Claim 27] The initiator of claim 25 the lever mechanism attached to the telescoping arm and further comprising an actuator mount affixed to a locking plate, the actuator mount and locking plate slidably engaged with an intermediate track and an outer track, the outer track including a travel slot and a locking guide, a lever arm plate biased against the actuator mount, a lever pivotally attached to the lever arm plate and a lever fulcrum arm, the lever fulcrum arm pivotally mounted to the outer track.

[Claim 28] The initiator of claim 27, the lever mechanism further comprising an outboard gear cog rotatably mounted on an outboard gear rack, the outboard gear rack attached to the outer track, an inboard gear cog rotationally mounted on an inboard gear rack, the inboard gear rack affixed to an external housing, the outboard gear cog and inboard gear cog rotationally linked.

[Claim 29] A portable expandable facility comprising: a core including: a top, a bottom substantially parallel to the top, a first end and a second end substantially parallel to the first end, four corner posts and optionally a first side; and an expandable portion including: at least two short folding walls, each short folding wall including a first panel

pivotally attached to the corner post with an at least one vertically disposed hinge and at least a second panel pivotally attached to the first panel with an at least one vertically disposed hinge and connected to an at least one end wall actuator, the at least one end wall actuator extending from a frame member under the bottom; an at least one roof panel, the at least one roof panel pivotally attached to the top with an at least one roof hinge; an at least one side wall, the at least one side wall hinged to the short folding wall at an outer end of the short folding wall with an at least one vertically disposed hinge; an at least one floor; and an at least one floor mover for moving the floor from a contracted position to an expanded position, wherein the at least one floor, the at least two short folding walls, the at least one roof panel and the at least one side wall form an at least one side substantially normal to the ends in a contracted state to provide, within the fixed portion, a container having an unencumbered inner space.

[Claim 30] The portable expandable facility of claim 29, wherein the side wall is configured such that a top of the side wall abuts an underside of the roof panels at a contact point to provide a ratio of roof panel supported to roof panel levered of about 1:3 during expansion and contraction.

[Claim 31] The portable expandable facility of claim 29 or 30, wherein the contact point is at least about 12 inches from the at least one roof hinge.

[Claim 32] The portable expandable facility of any one of claims 29 to 31, the side wall further comprising a slide on a bottom plate, the short folding wall in slidable engagement with the slide.

[Claim 33] The portable expandable facility of any one of claims 29 to 32 further comprising an at least one expanding floor joist configured to abut the underside of the floor in the expanded position.

[Claim 34] The portable expandable facility of any one of claims 29 to 33, further comprising an initiator configured to pivot the short folding wall outward about a pivot point during contraction of the facility.

[Claim 35] The portable expandable facility of claim 34, wherein the initiator comprises the side wall actuator, an articulating arm extending between a framing member of the

floor and the side wall in the vicinity of the bottom of the side wall and a lever adjacent the at least one vertically disposed hinge between the short folding wall panels, the lever pivotally attached to the articulating arm and configured to pivot outward during contraction of the facility.

[Claim 36] A method of expanding the portable expandable facility of claim 1, the method comprising an at least one user actuating the at least one end wall actuators and actuating the at least one side wall actuators, thereby expanding the portable expandable facility.

[Claim 37] The method of claim 36, further comprising articulating an articulating arm extending between a frame member under the bottom to the at least one side wall.

[Claim 38] The method of claim 37, further comprising articulating an at least one articulating floor joist.

[Claim 39] The method of claim 38, wherein a single user expands the portable expandable facility.

[Claim 40] A method of contracting the portable expandable facility of claim 14, the method comprising an at least one user retracting the side wall actuator, thereby articulating the side wall arm, causing the floor lifter to urge the folding floor upwards, and retracting the end wall actuator, thereby contracting the portable expandable facility.

[Claim 41] A portable expandable facility comprising a core including: a top, a bottom substantially parallel to the top, a first end and a second end substantially parallel to the first end, four corner posts and optionally a first side; and an expandable portion including: an at least two end walls, each end wall pivotally attached to the corner post with an at least one hinge and connected to an at least one end wall actuator extending from a frame member under the bottom to the end wall in a vicinity of a bottom of the end wall; an at least one roof panel, the at least one roof panel pivotally attached to the top with an at least one roof hinge; and an at least one side wall, the at least one side wall hinged to a folding floor at a first end of the folding floor in a vicinity of a bottom of the at least one side wall, wherein the at least one folding floor, the at least two end

walls, the at least one side wall and the at least one roof panel form an expanded facility.

[Claim 42] A portable expandable facility comprising a core including: a top, a bottom substantially parallel to the top, a first end and a second end substantially parallel to the first end, four corner brackets and optionally a first side; and an expandable portion including: an at least two end walls, each end wall pivotally attached to a bracket with an at least one hinge and connected to an at least one end wall actuator extending from a frame member under the bottom to the end wall in a vicinity of a bottom of the end wall; an at least one roof panel, the at least one roof panel pivotally attached to the top with an at least one roof hinge; an at least one side wall, the at the at least one long hinged to the at least two end walls and slidably engaging the at least two end walls, a floor hinged to the at least one side wall and a cable and pulley operatively connected to the floor, wherein the floor, the at least two end walls, the at least two end walls, the at least one side wall and the at least one roof panel form an expanded facility.

[Claim 43] The portable expandable facility of claim 42, wherein the at least two end walls are bifold walls.

Figure 1

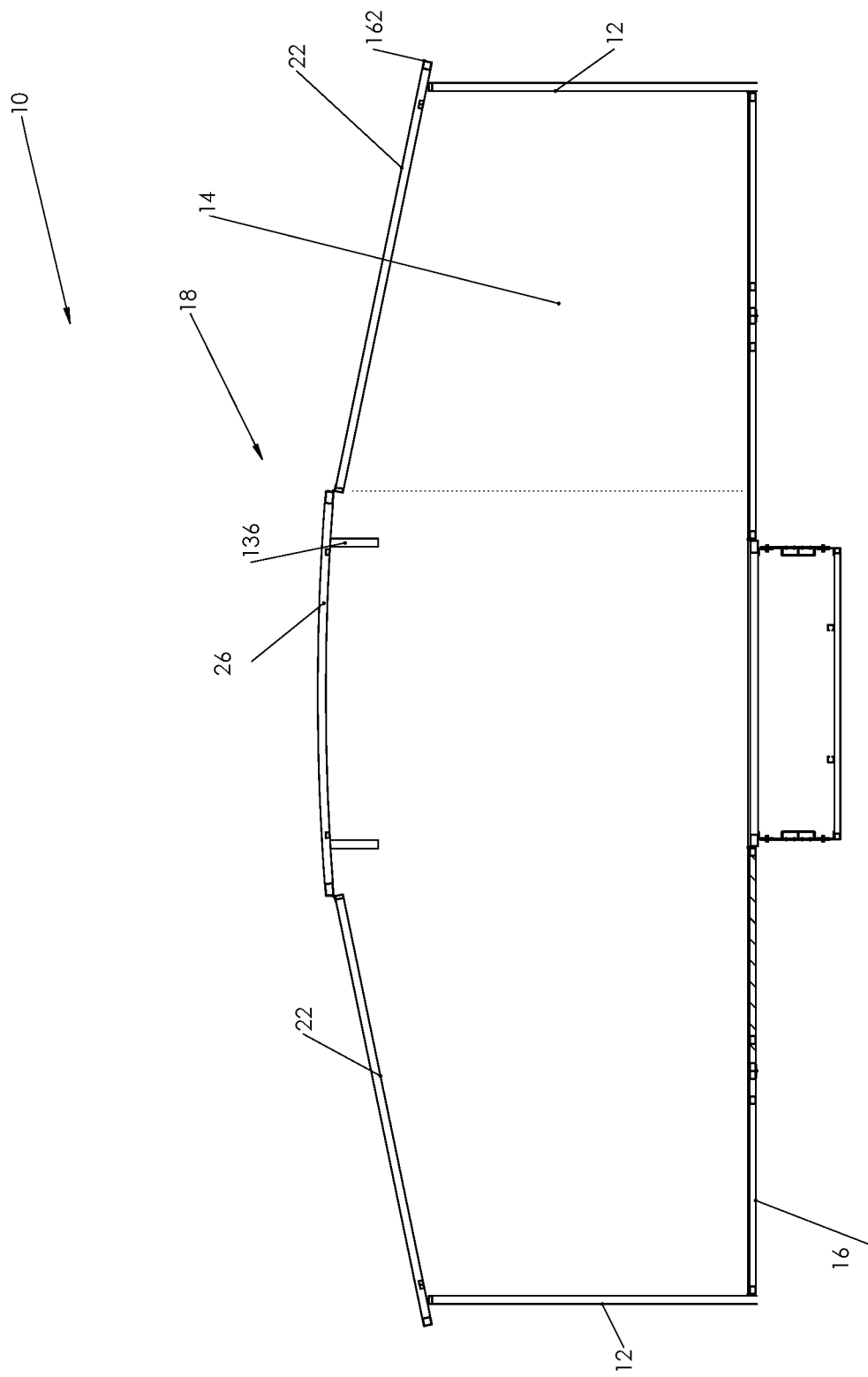
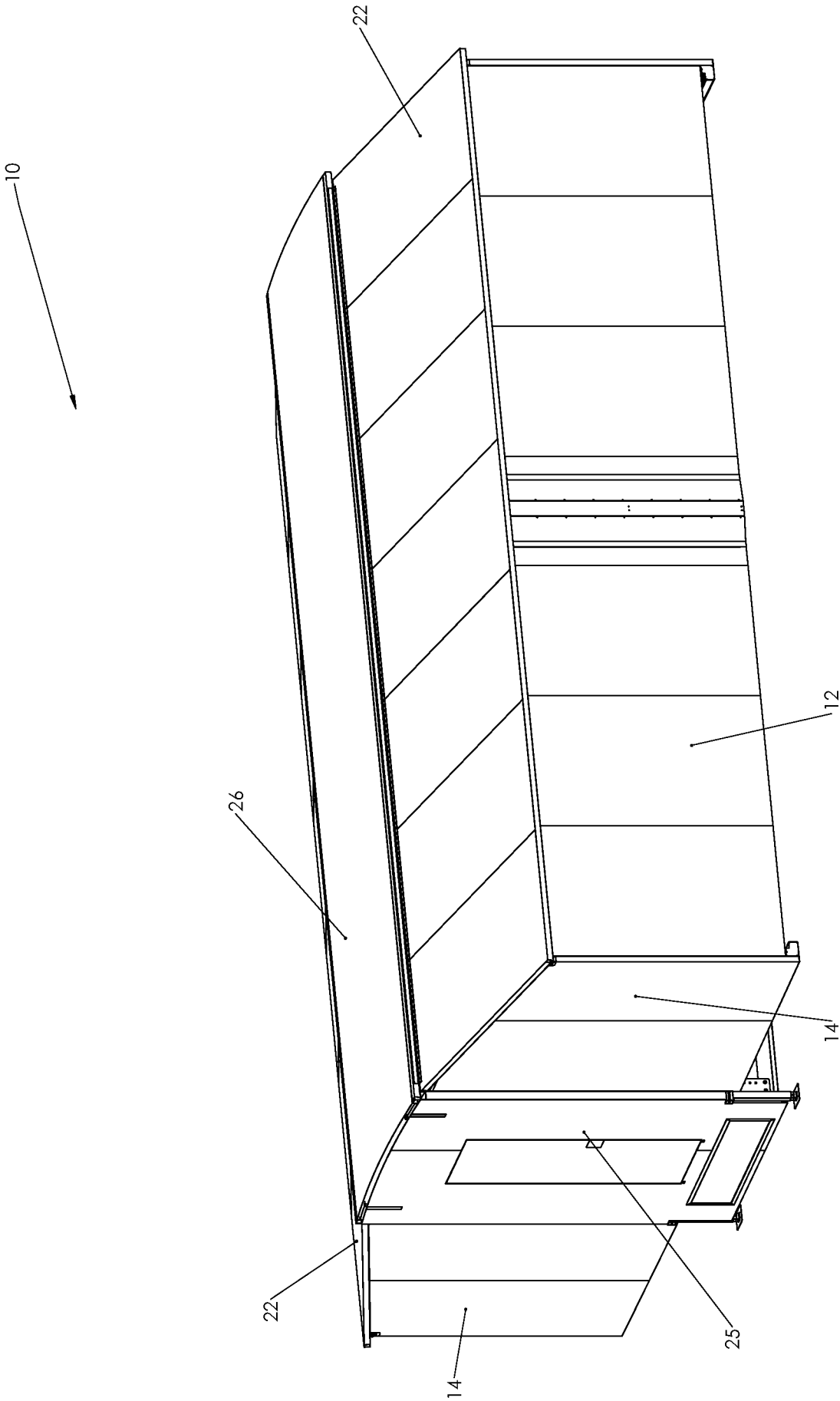


Figure 2A



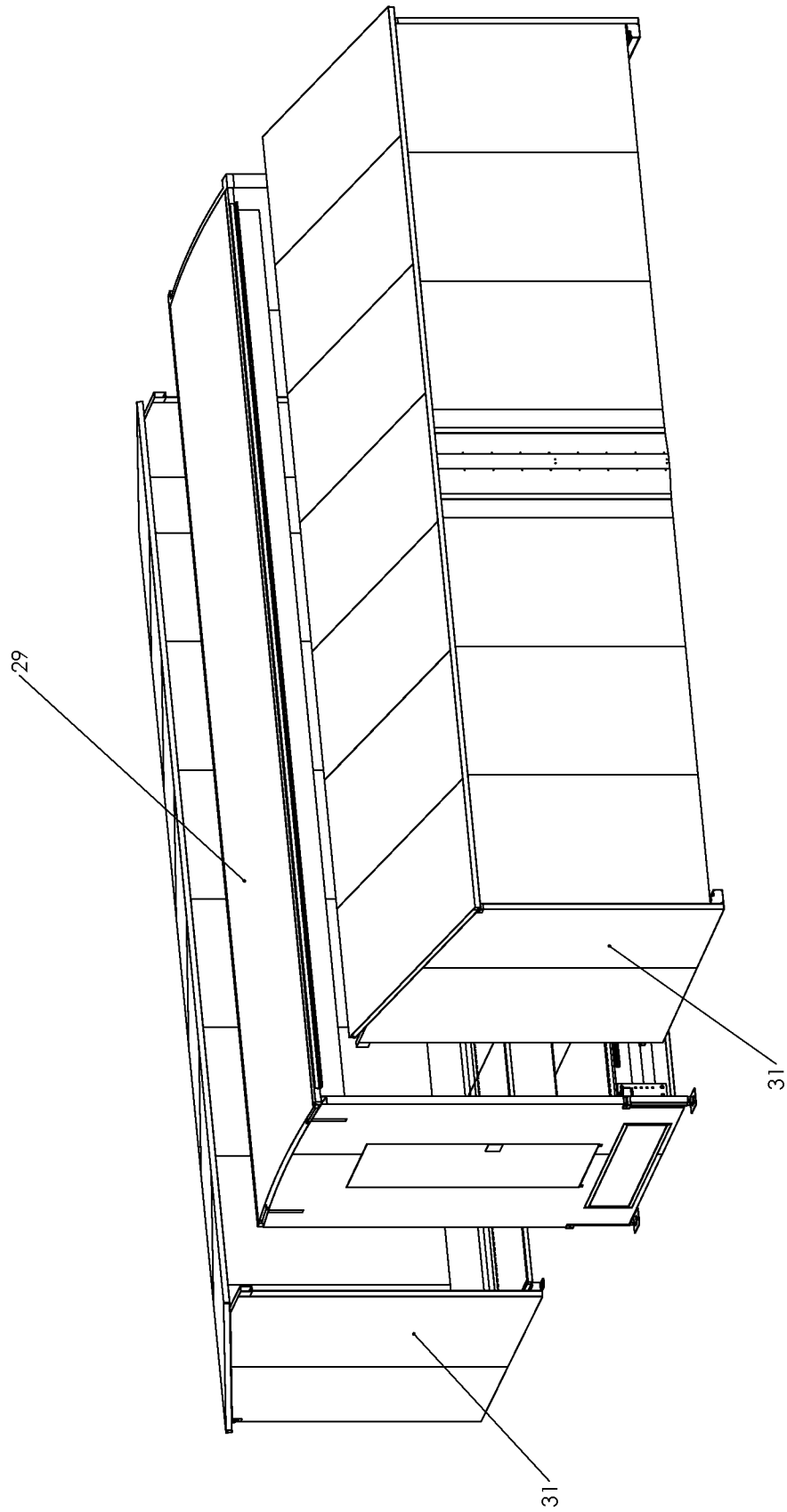


Figure 3

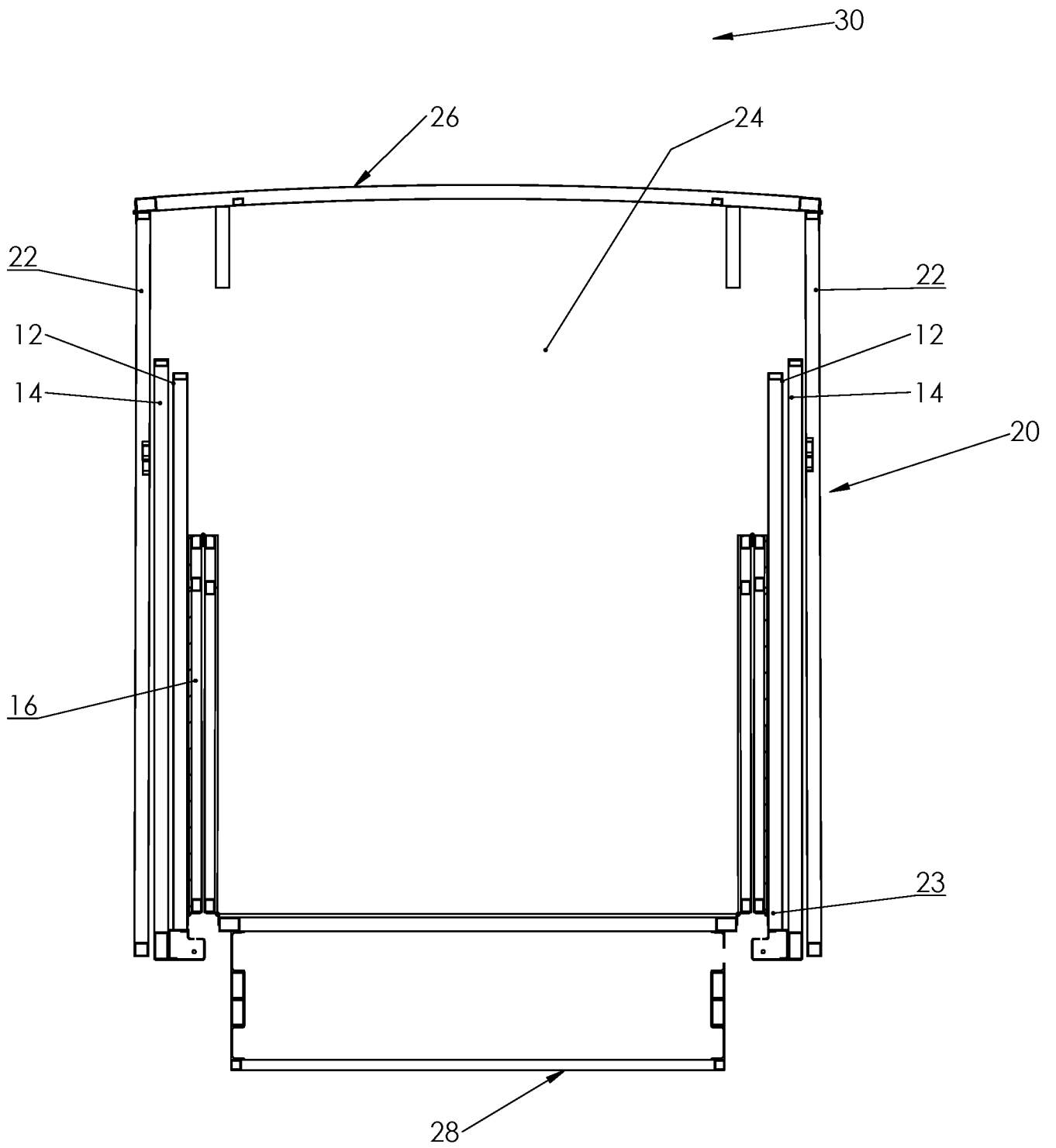
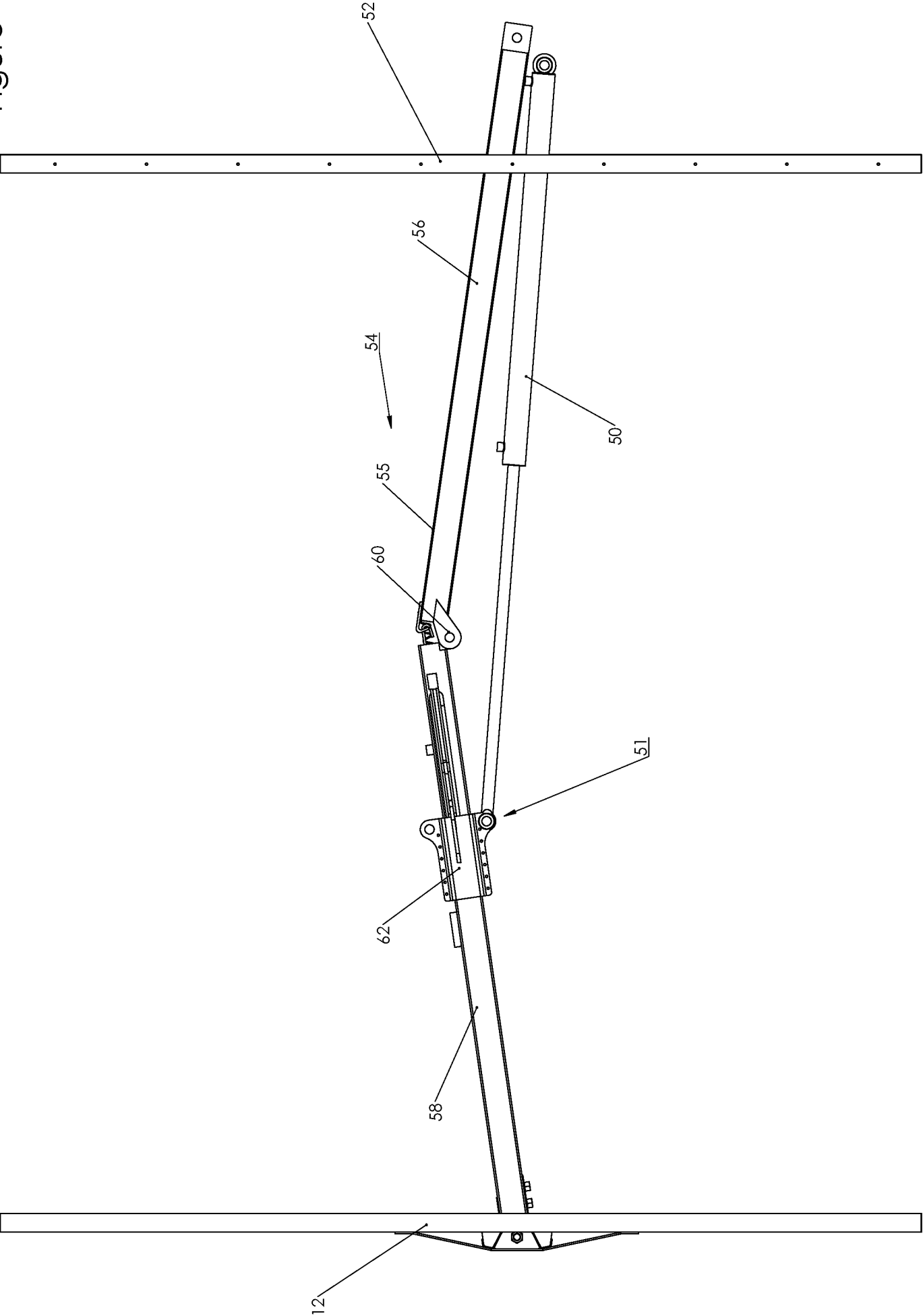


Figure 4A



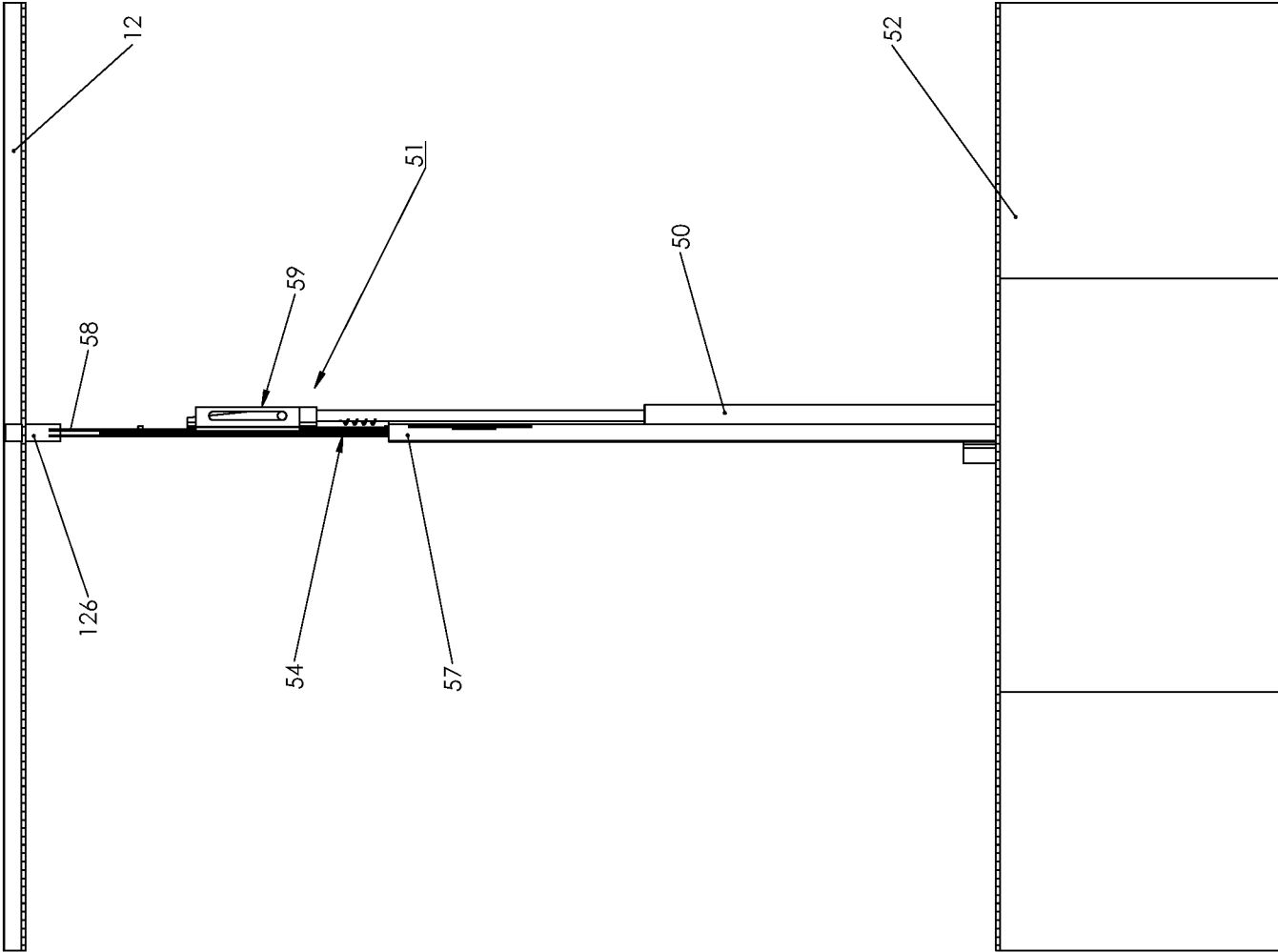


Figure 5A

WO 2015/155695

PCT/IB2015/052528

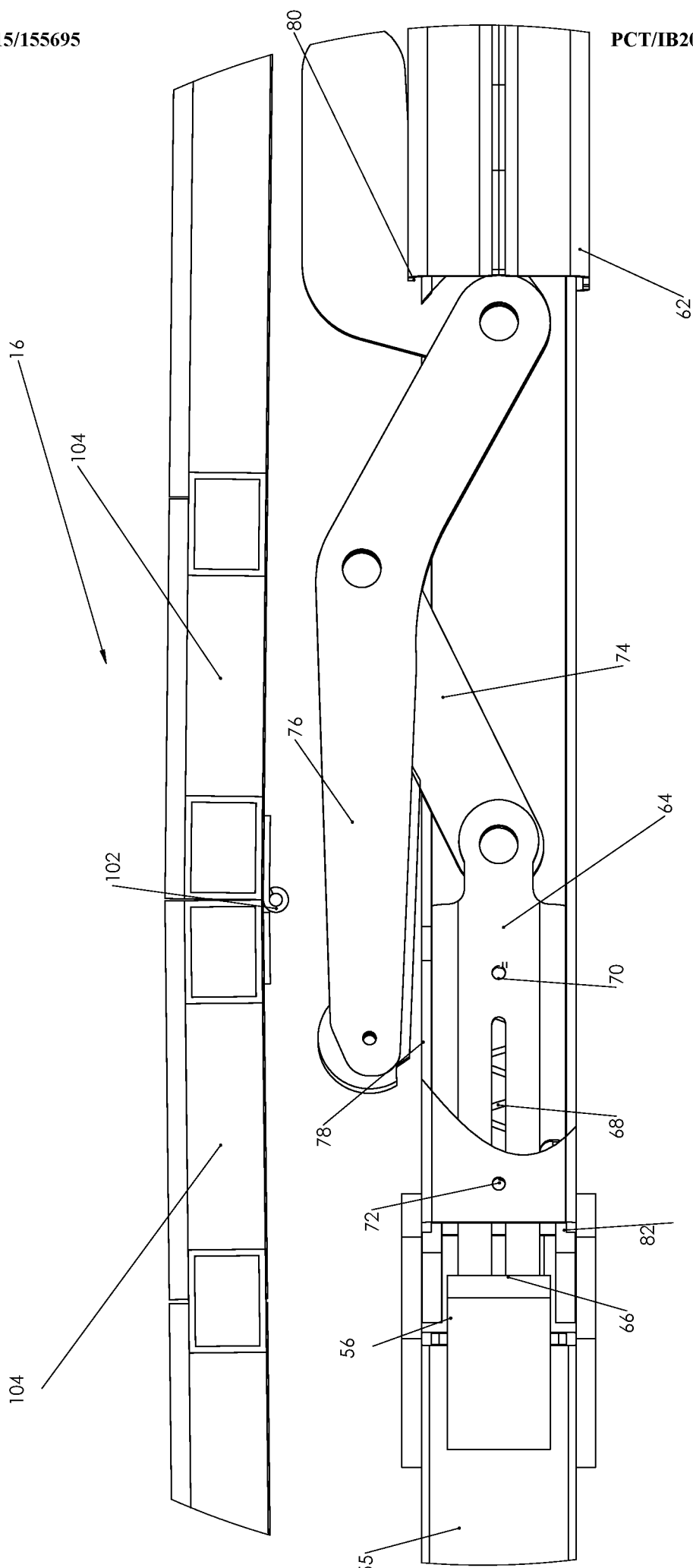


Figure 5B

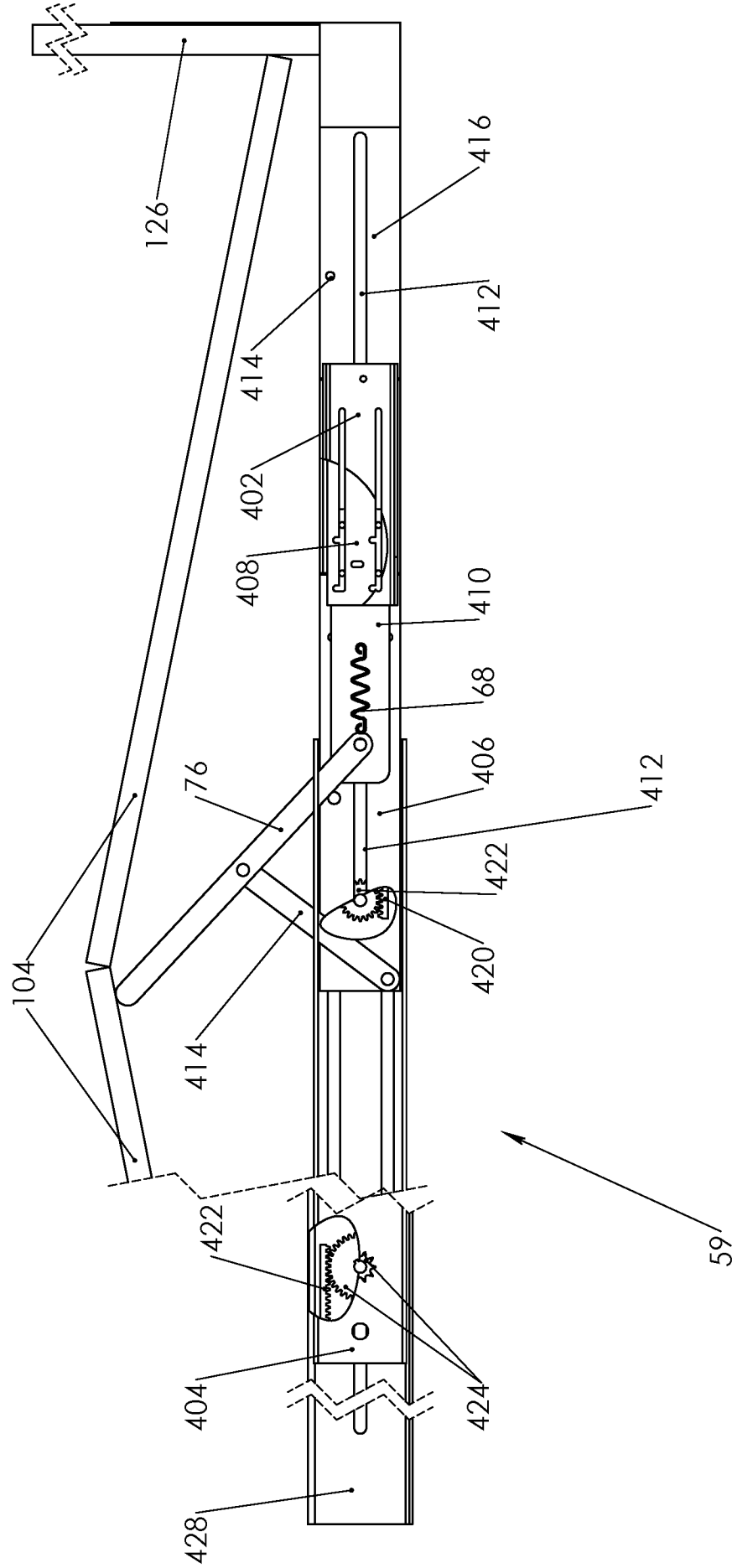


Figure 6

WO 2015/155695

PCT/IB2015/052528

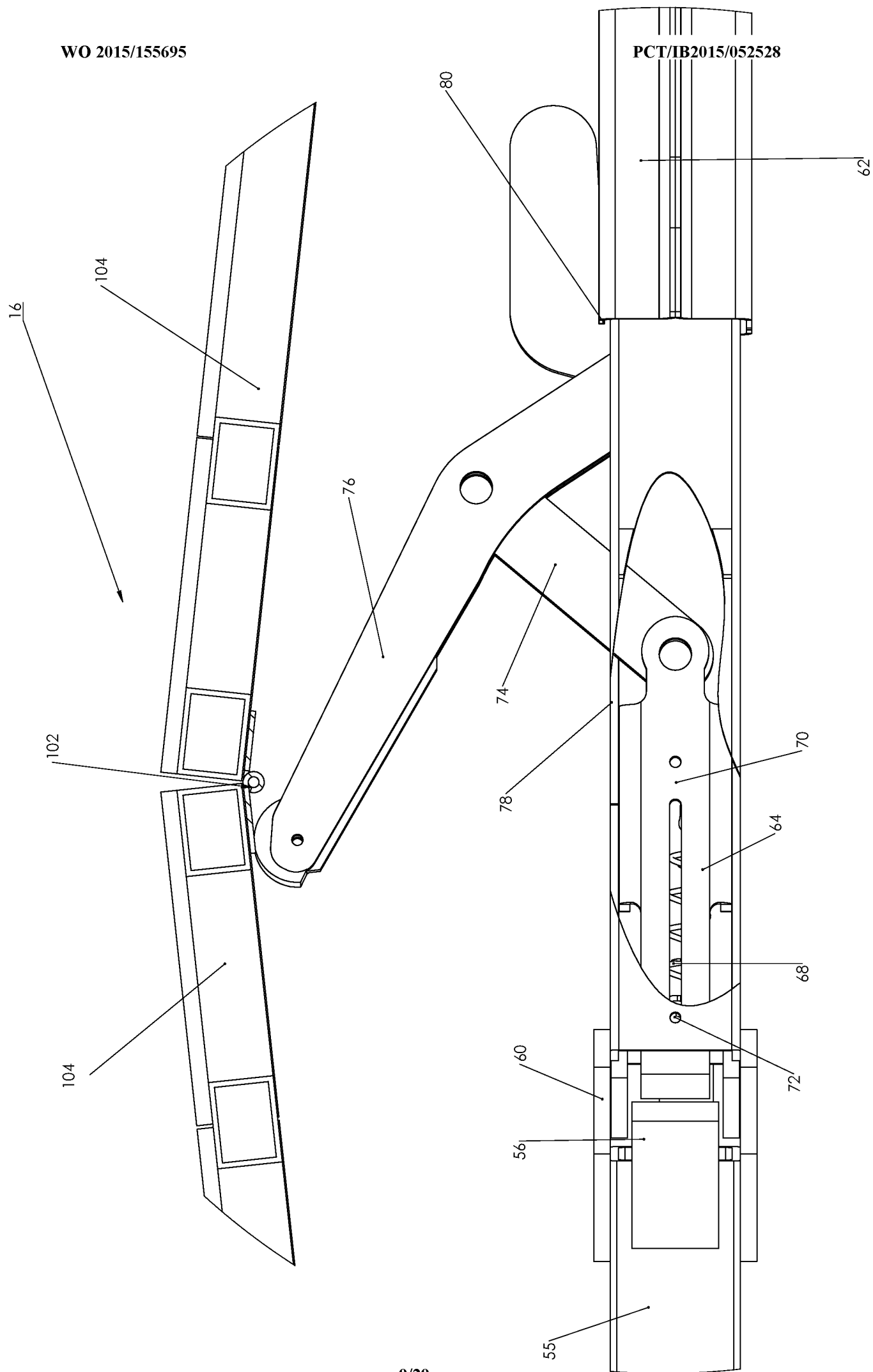


Figure 7

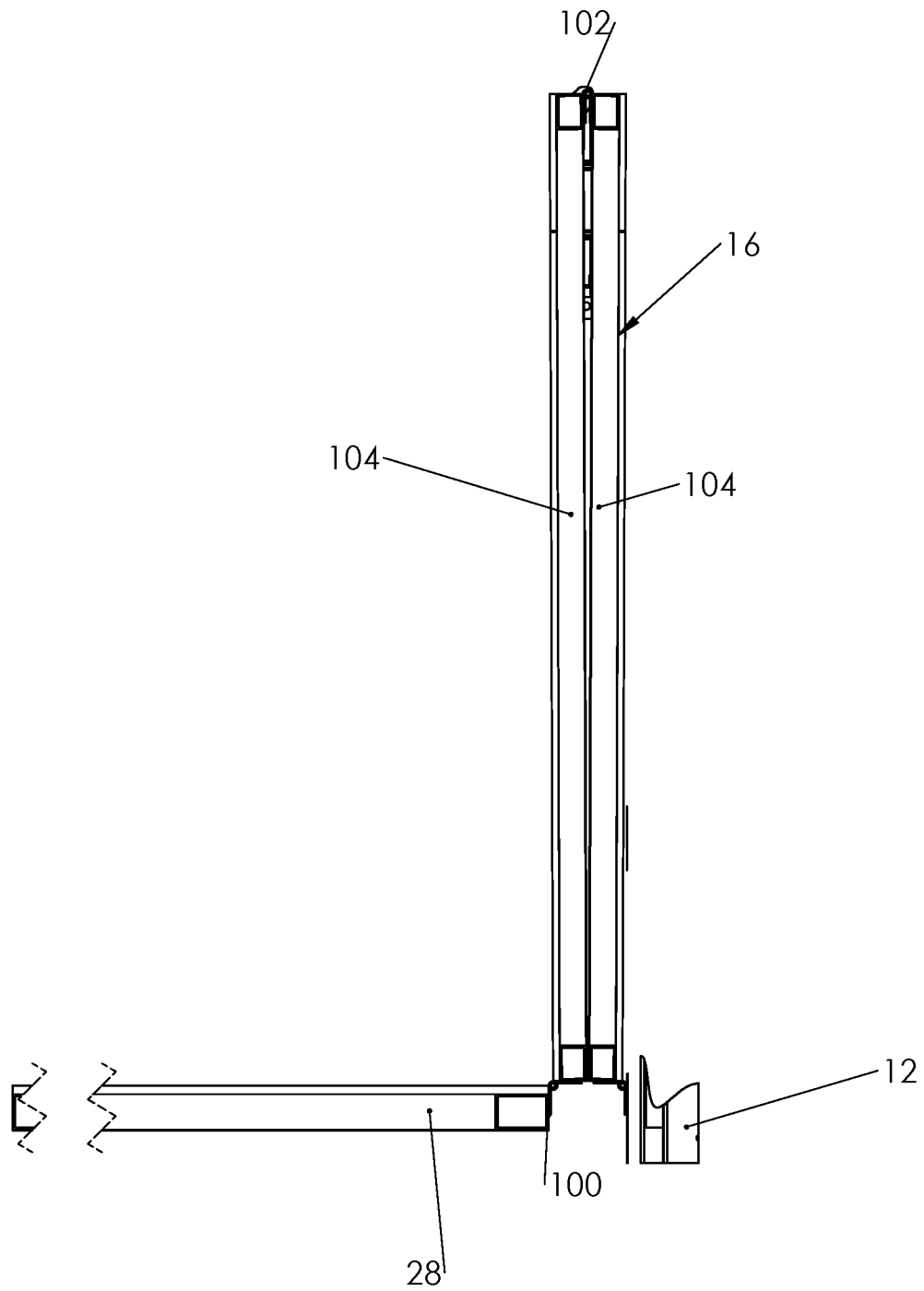


Figure 8

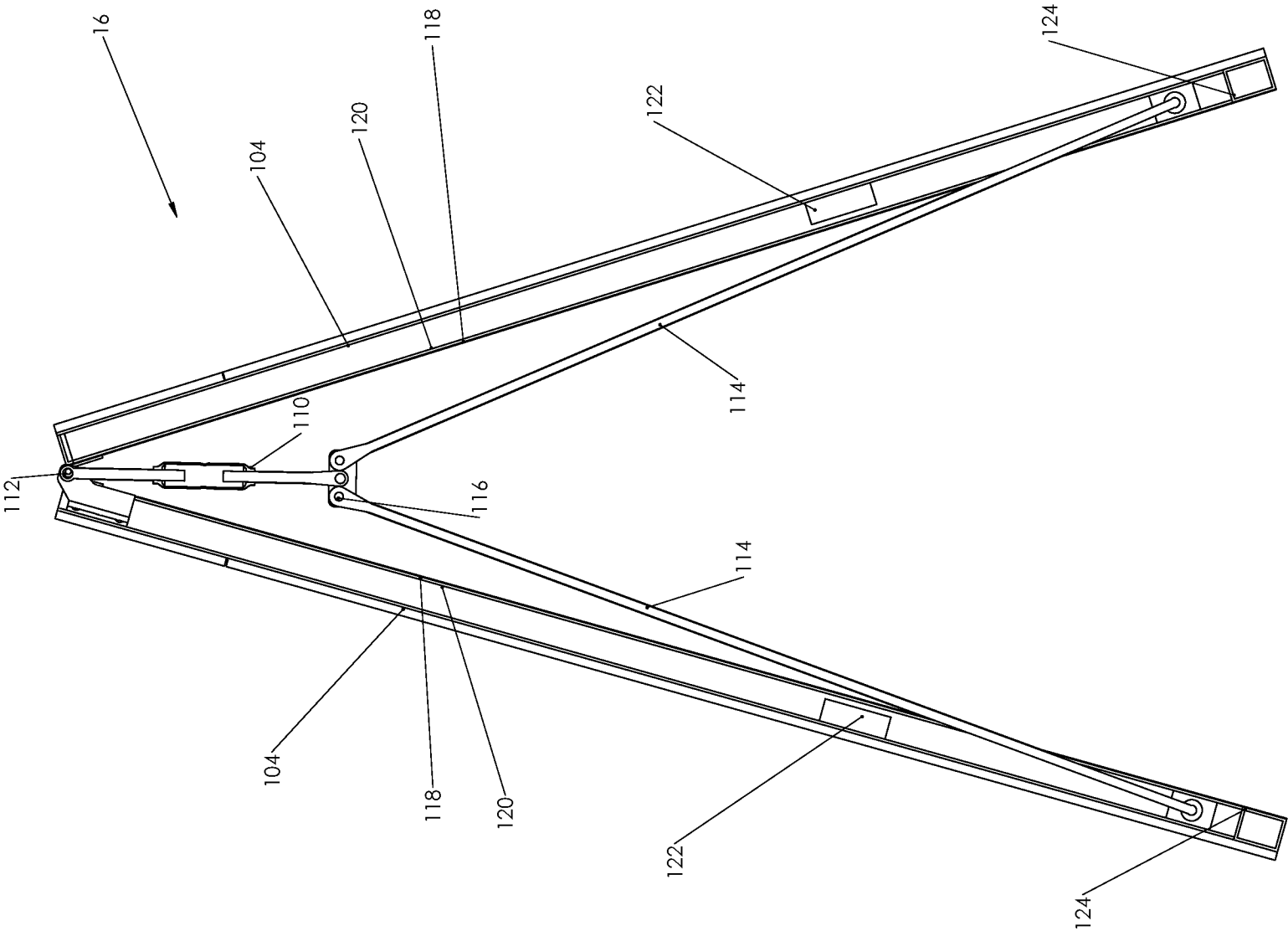


Figure 9

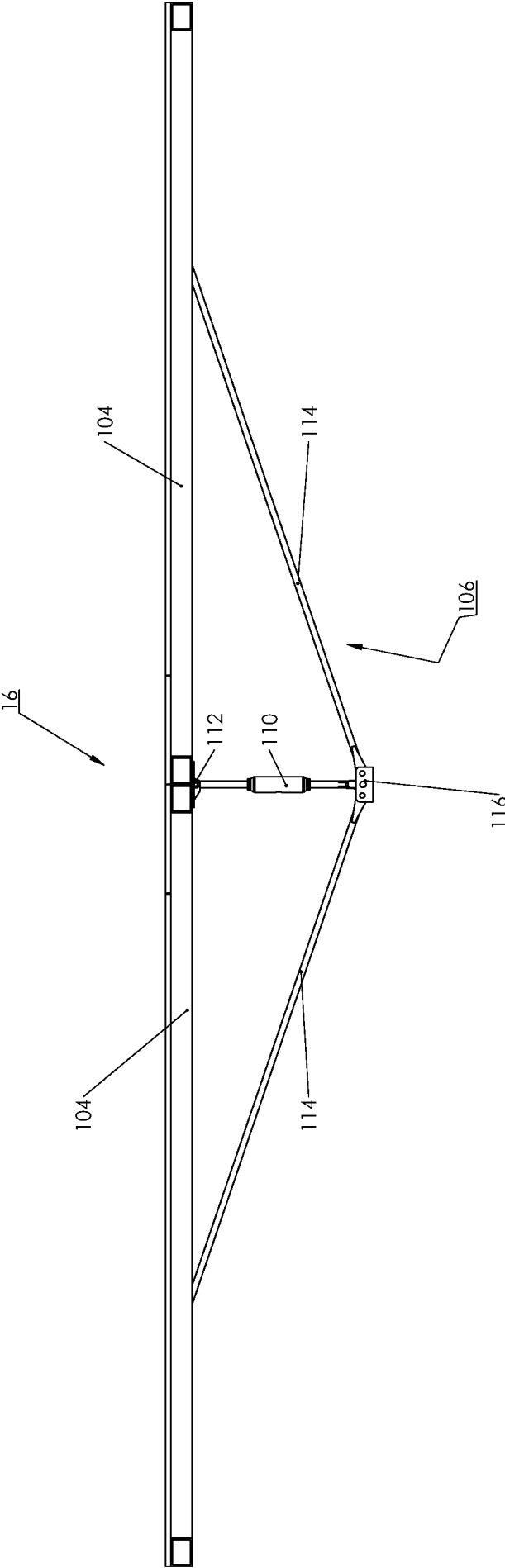


Figure 10

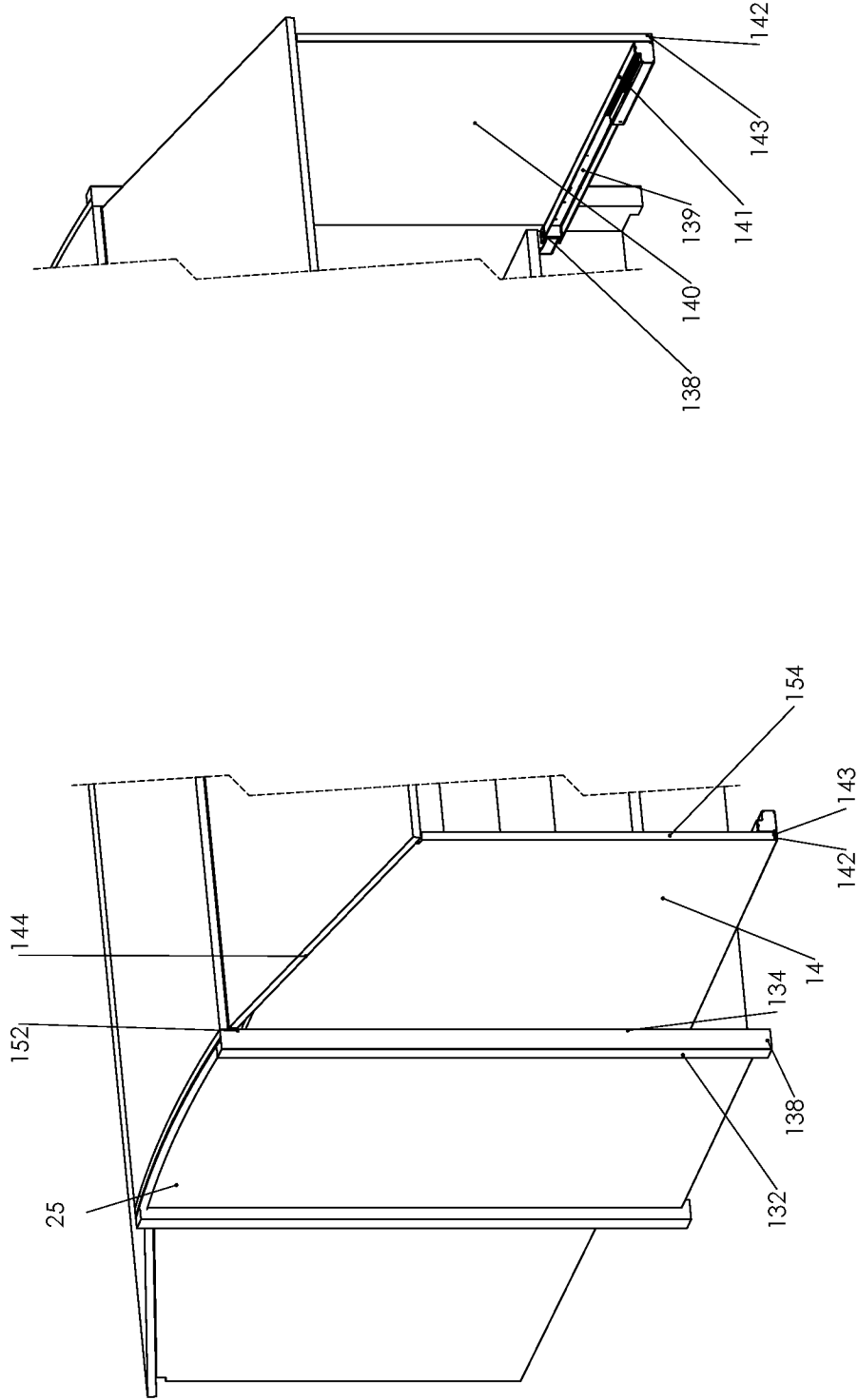


Figure 11

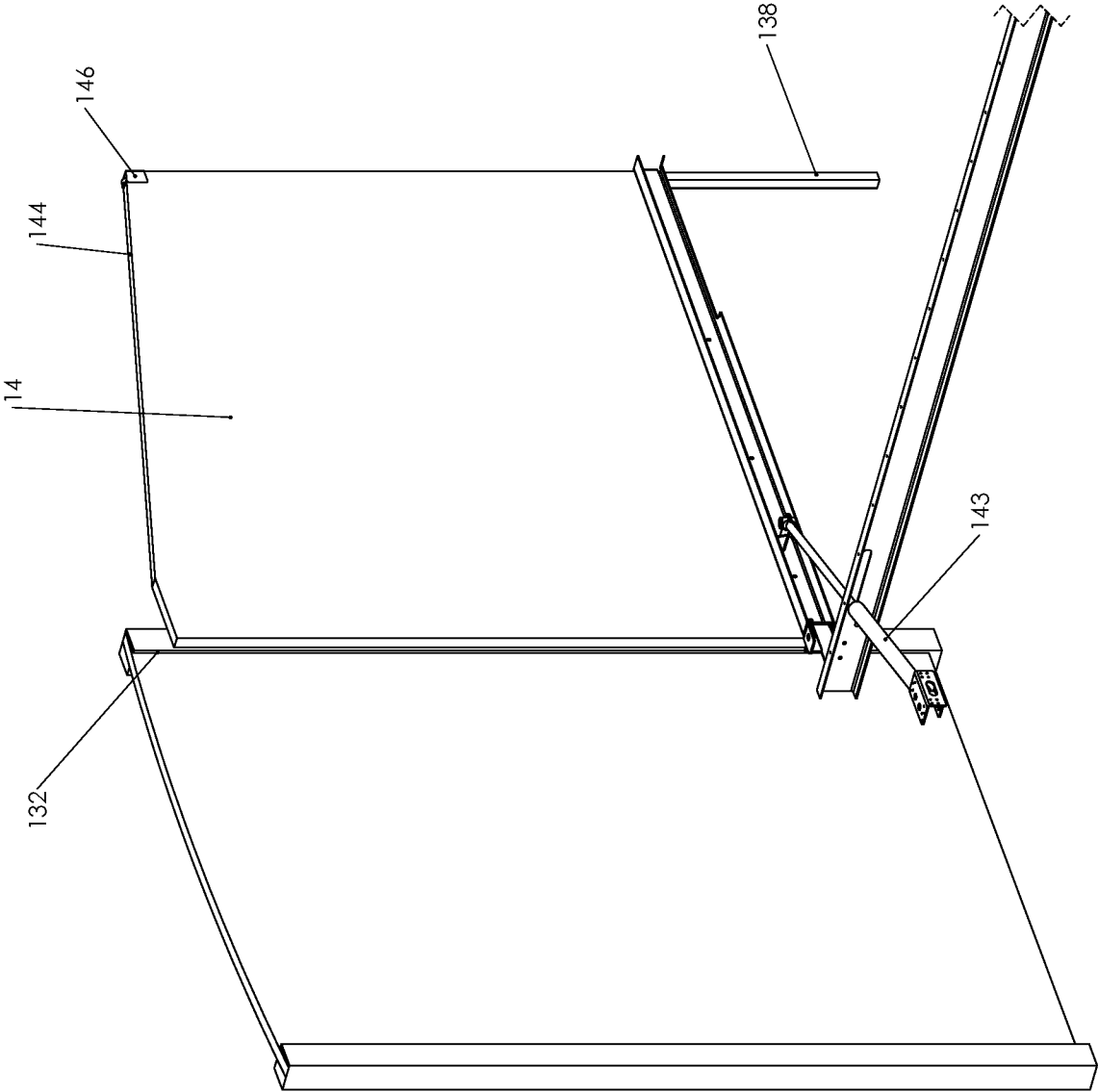


Figure 12

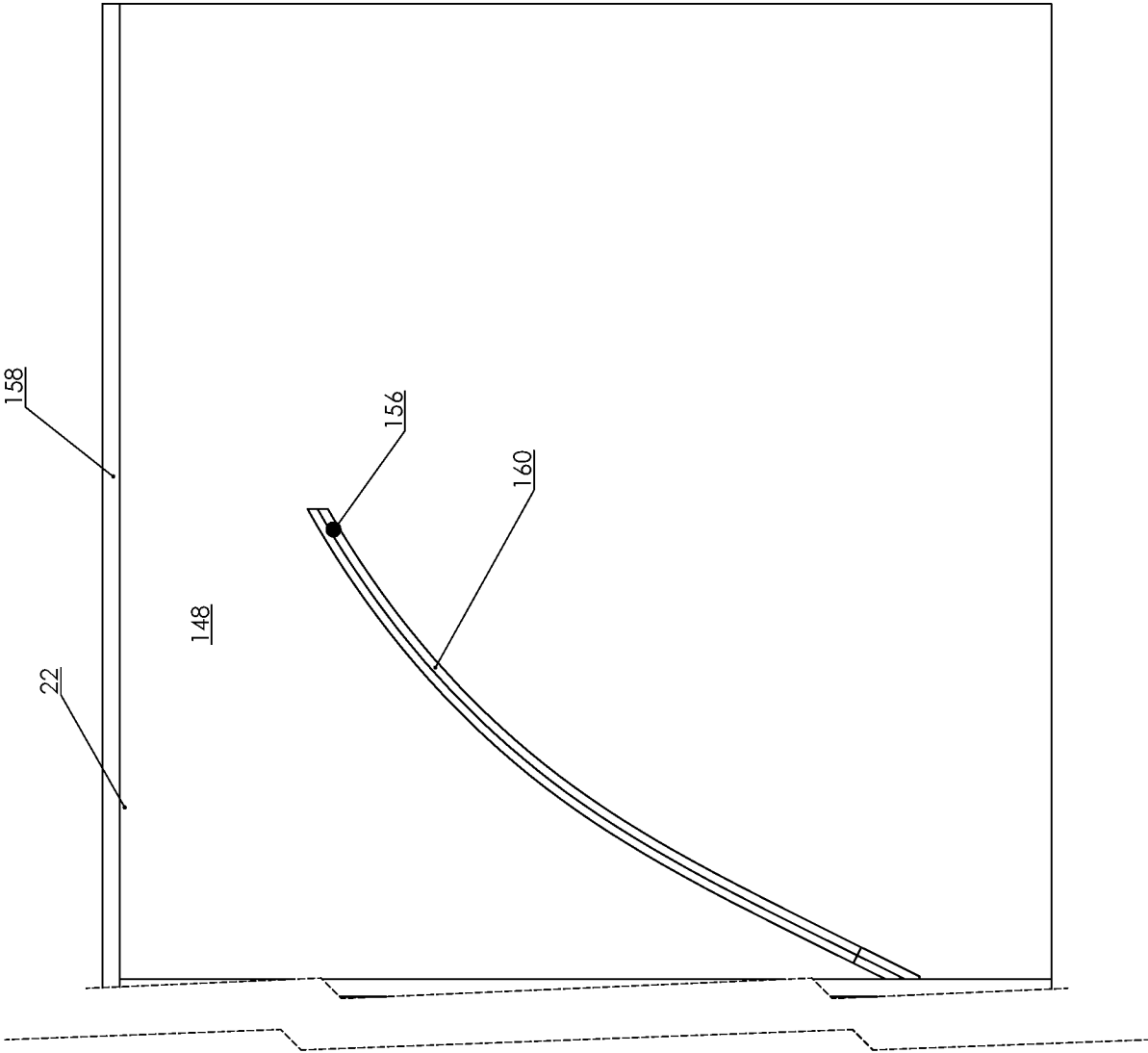


Figure 13

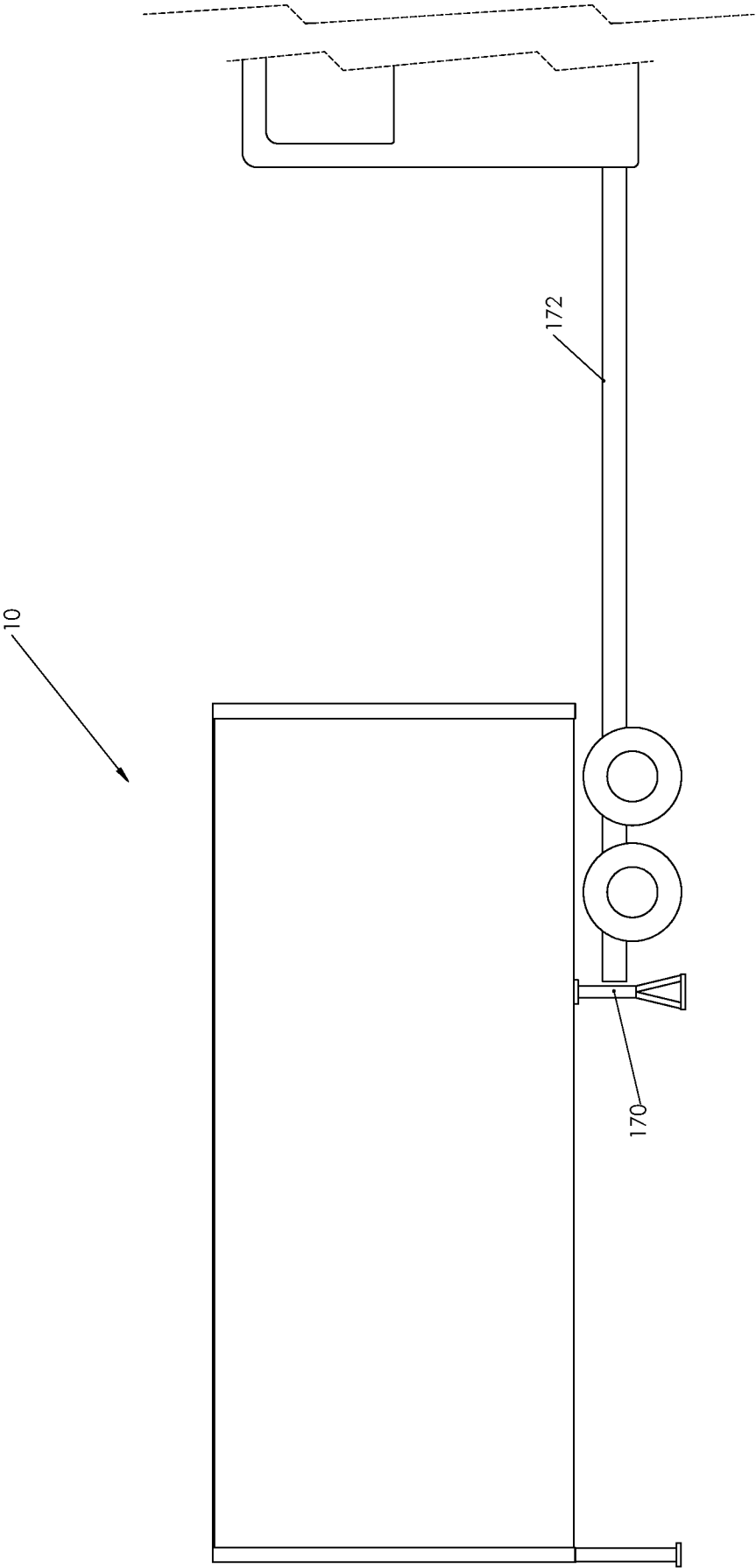


Figure 14

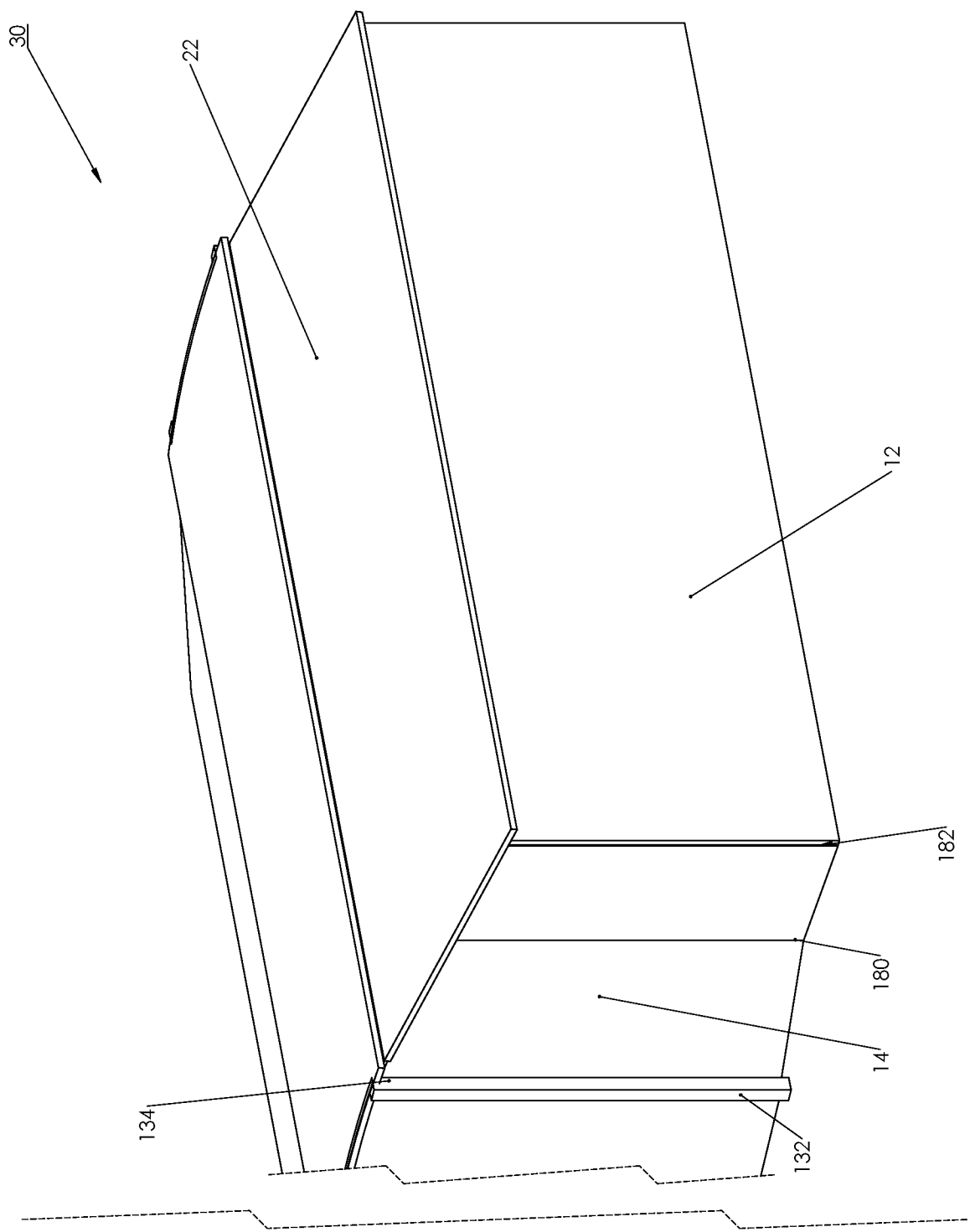


Figure 15

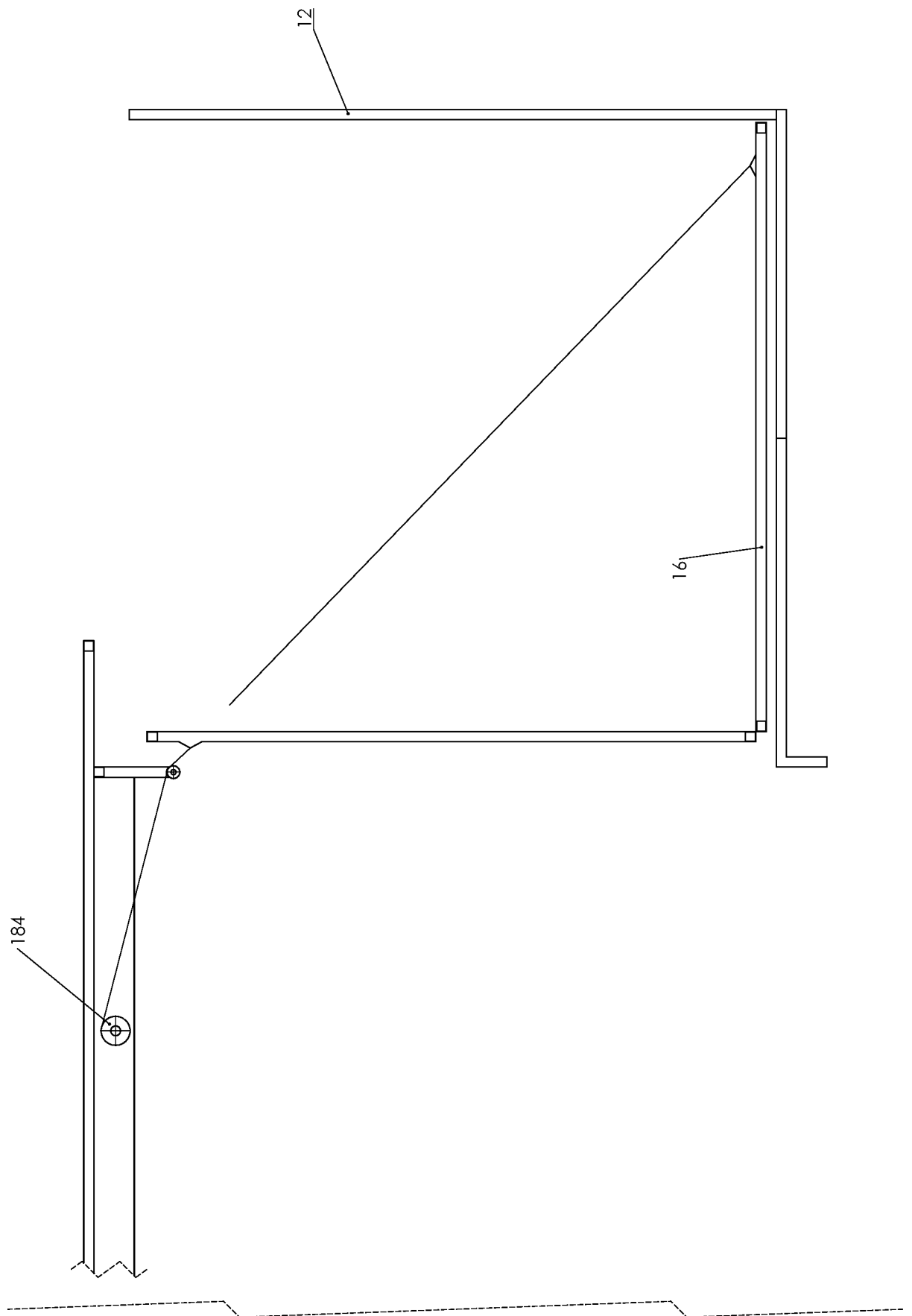


Figure 16

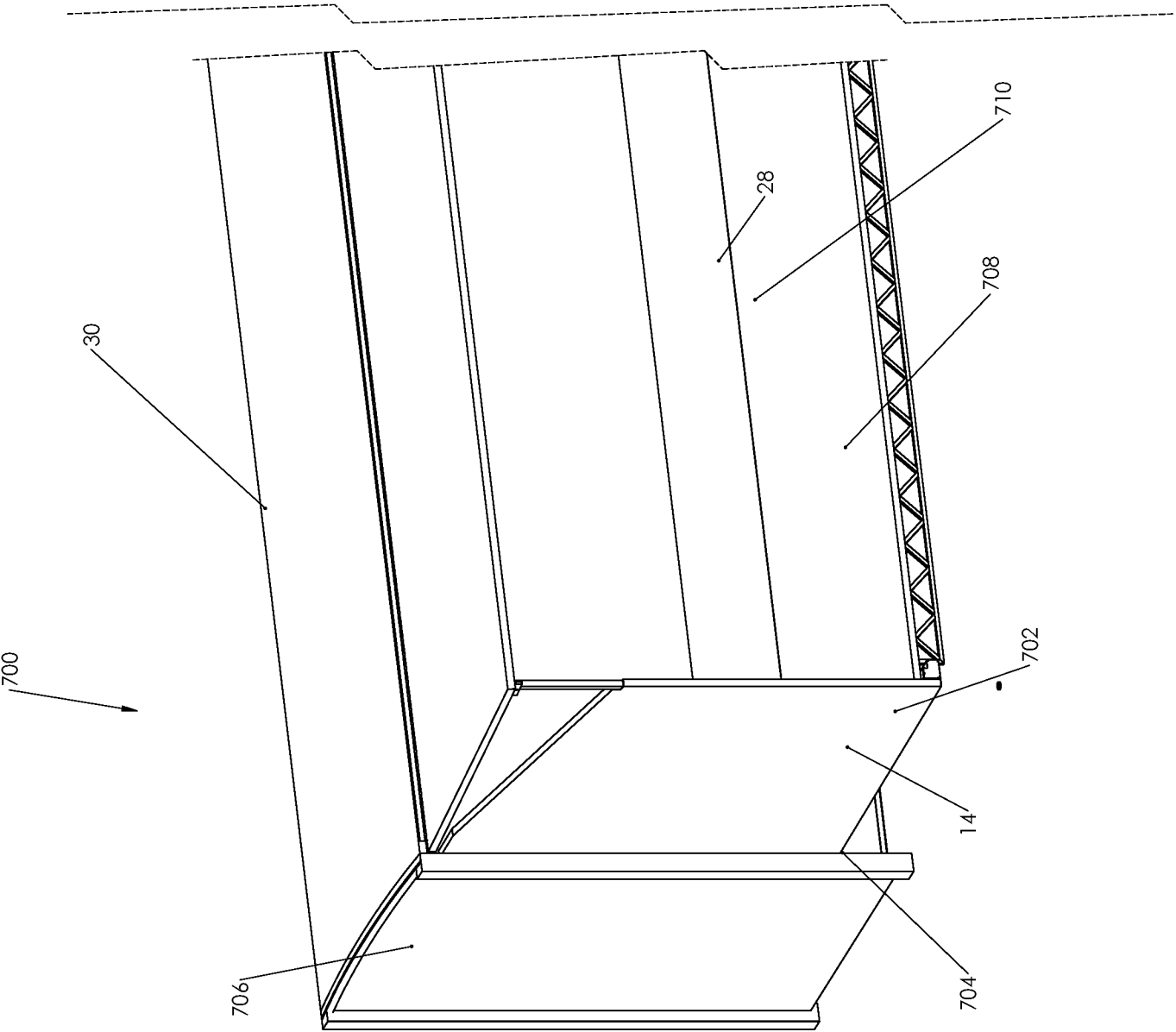


Figure 17

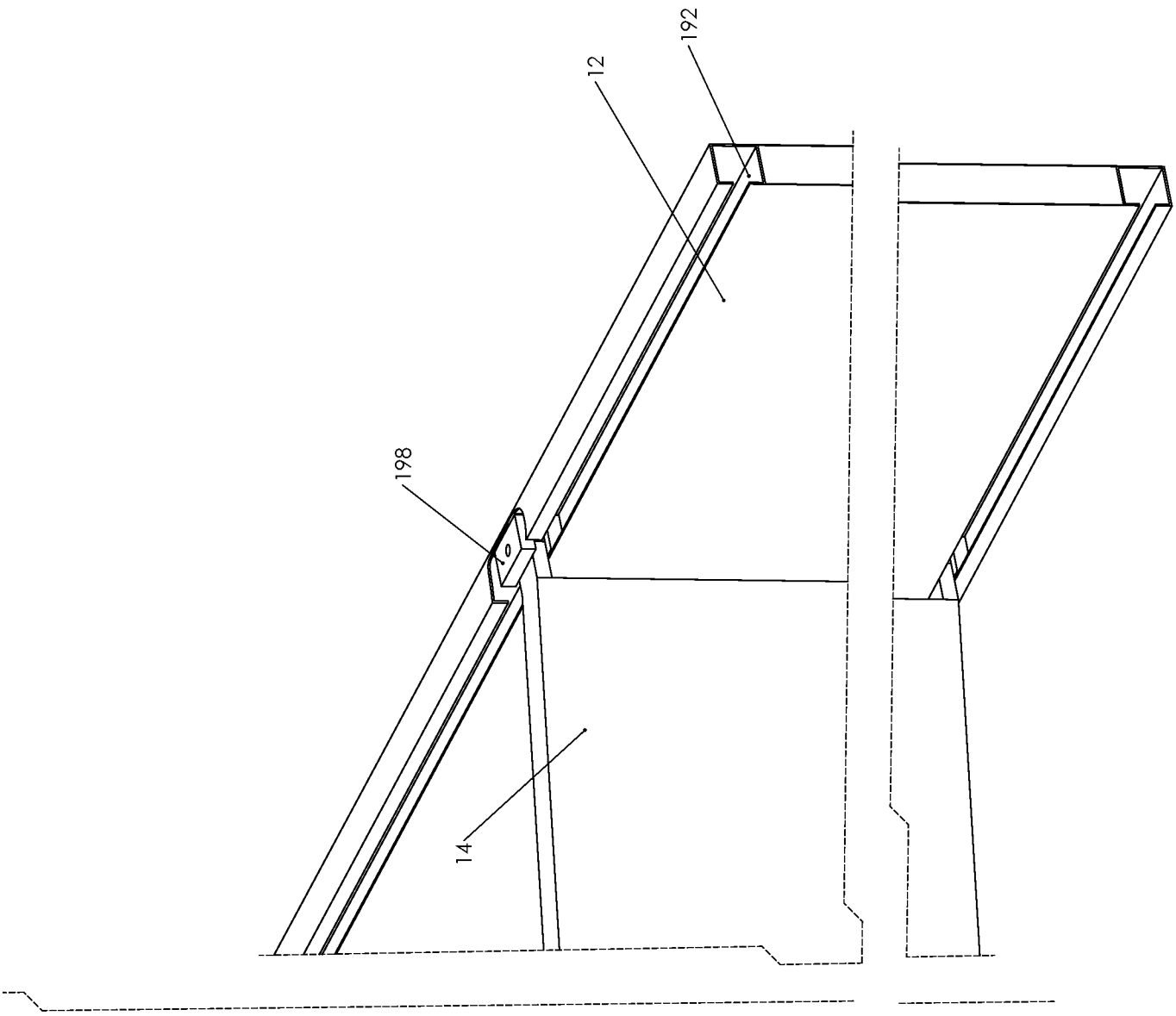


Figure 18

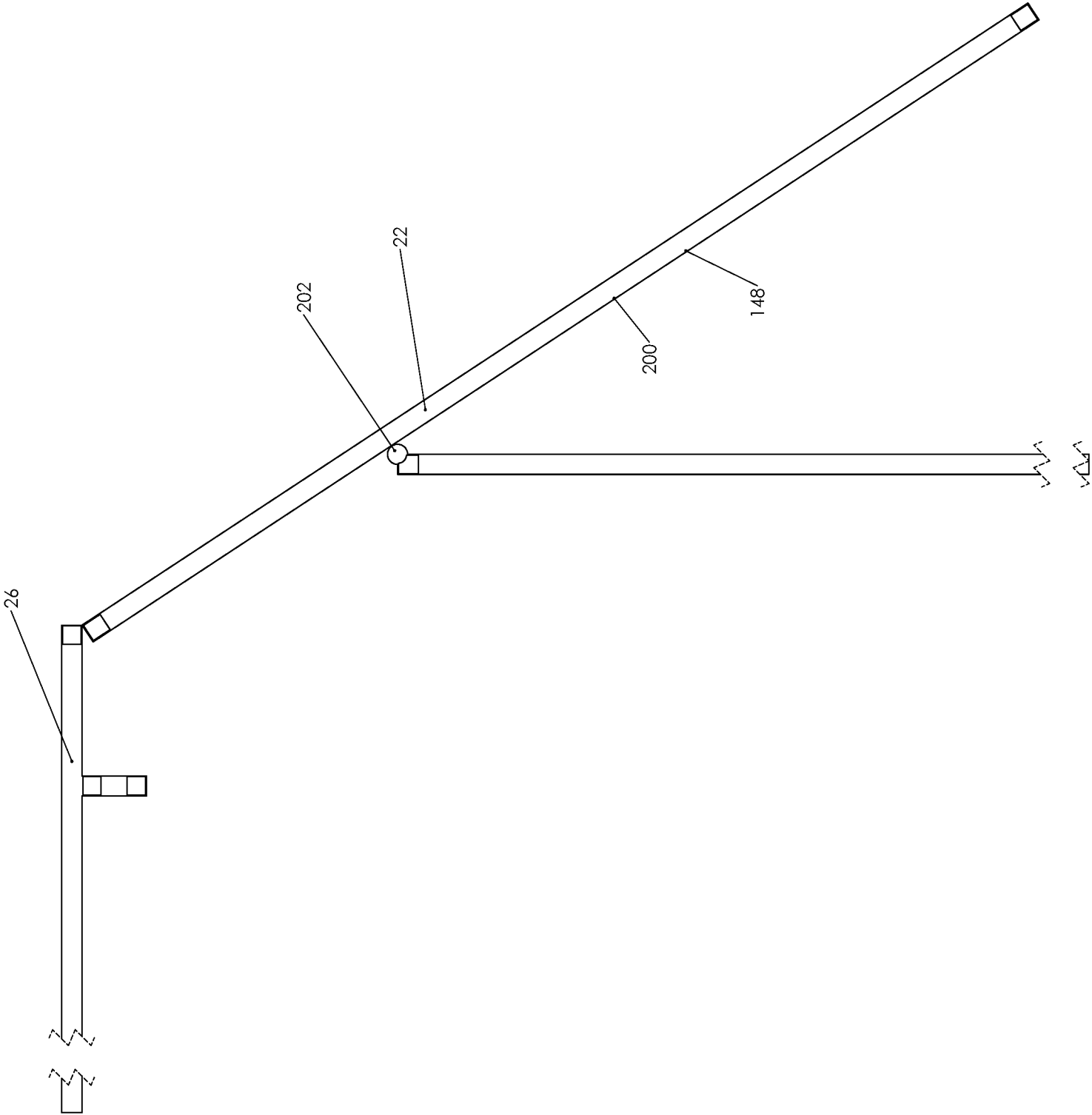


Figure 19

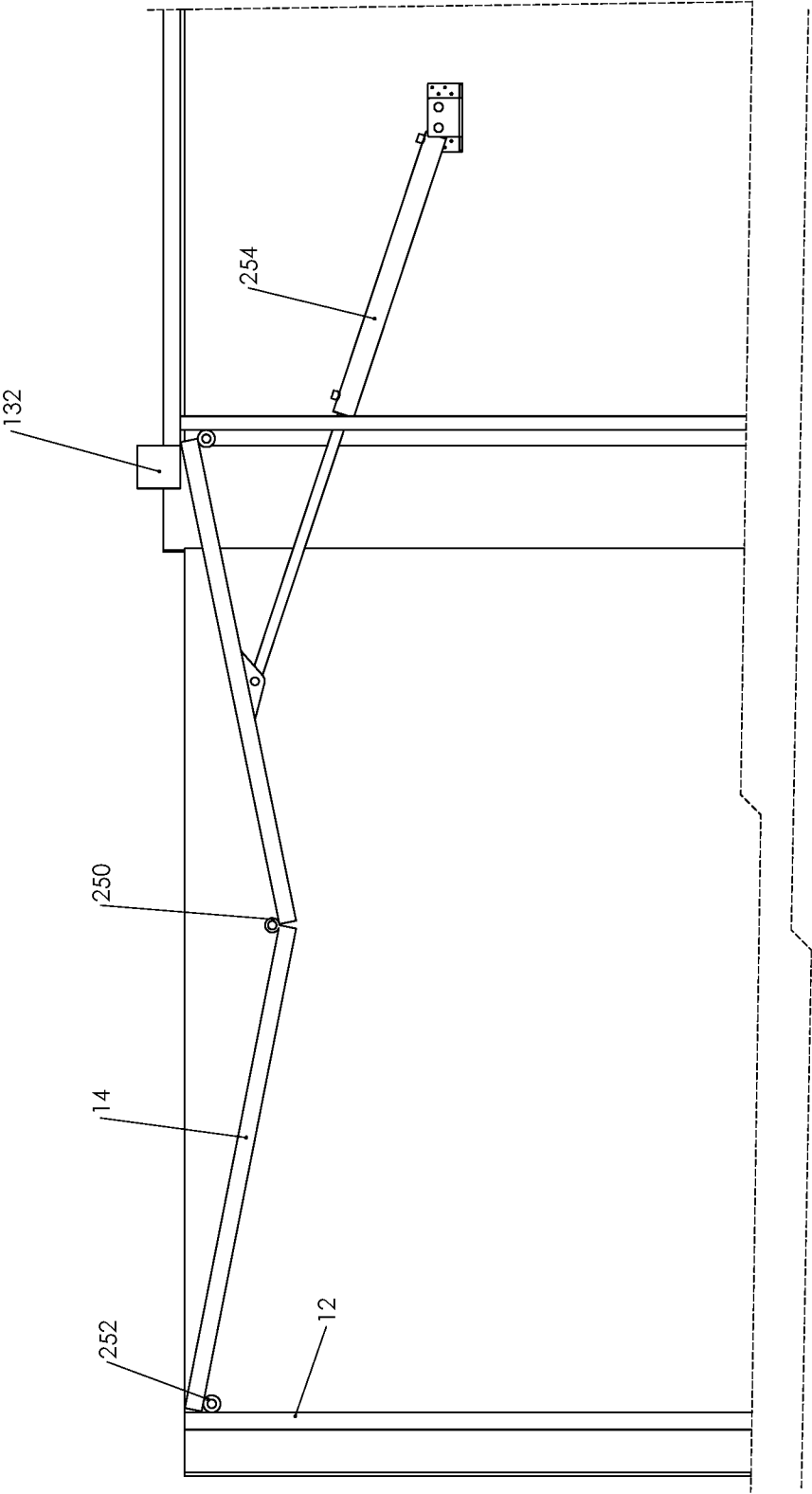


Figure 20

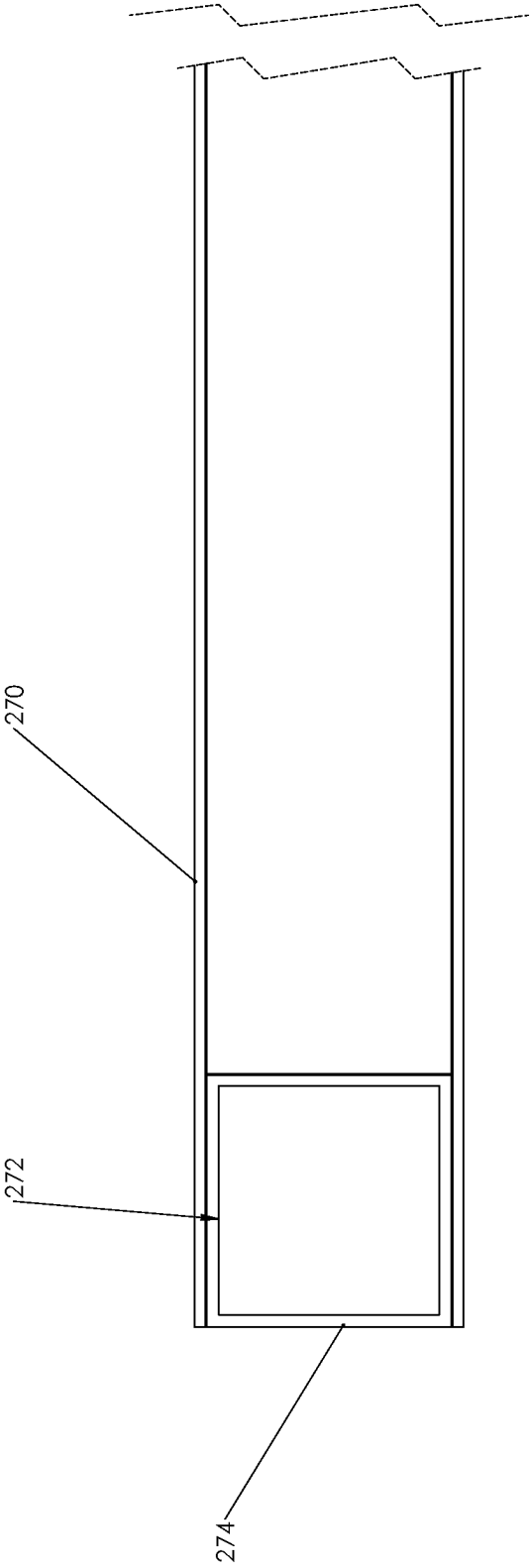


Figure 21

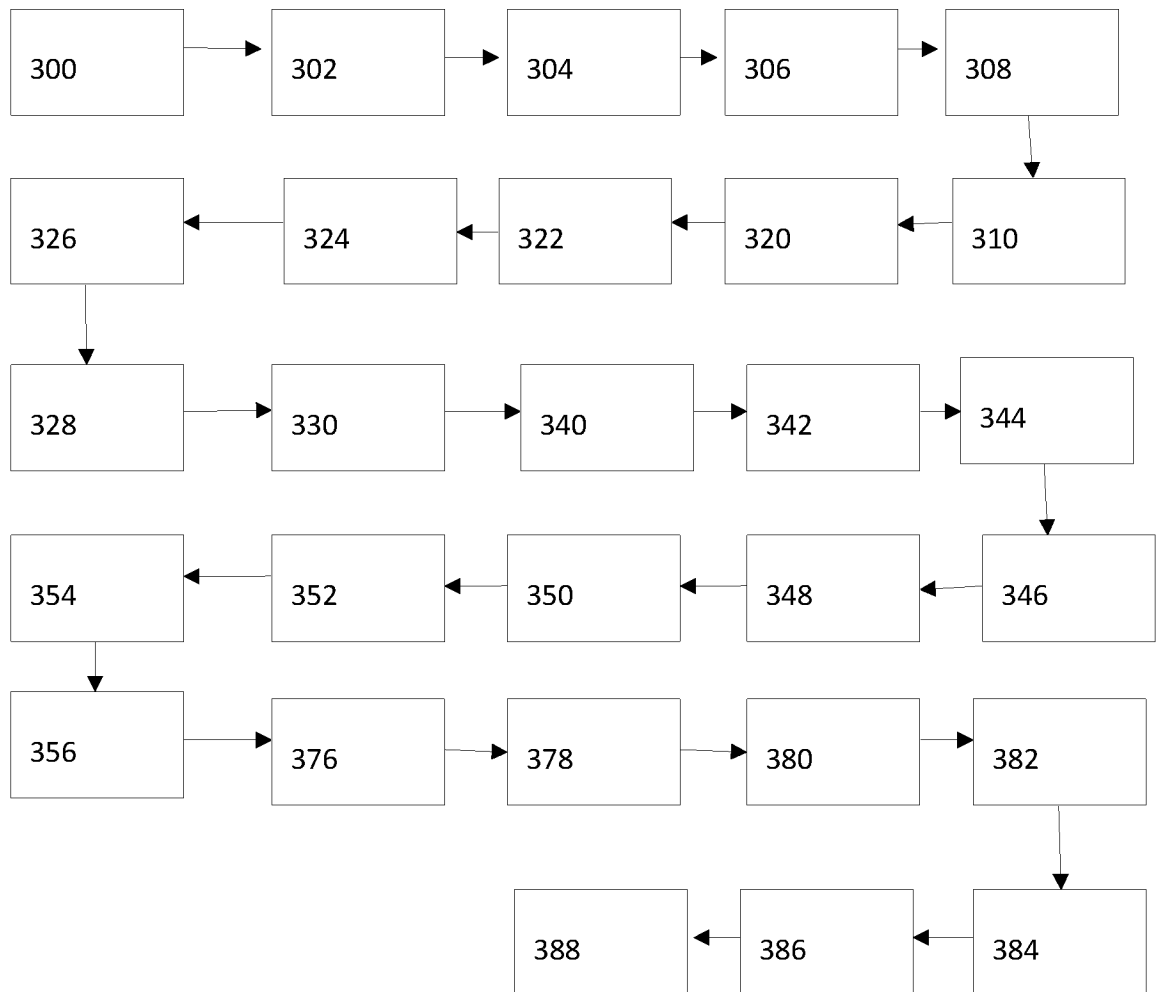


Figure 22

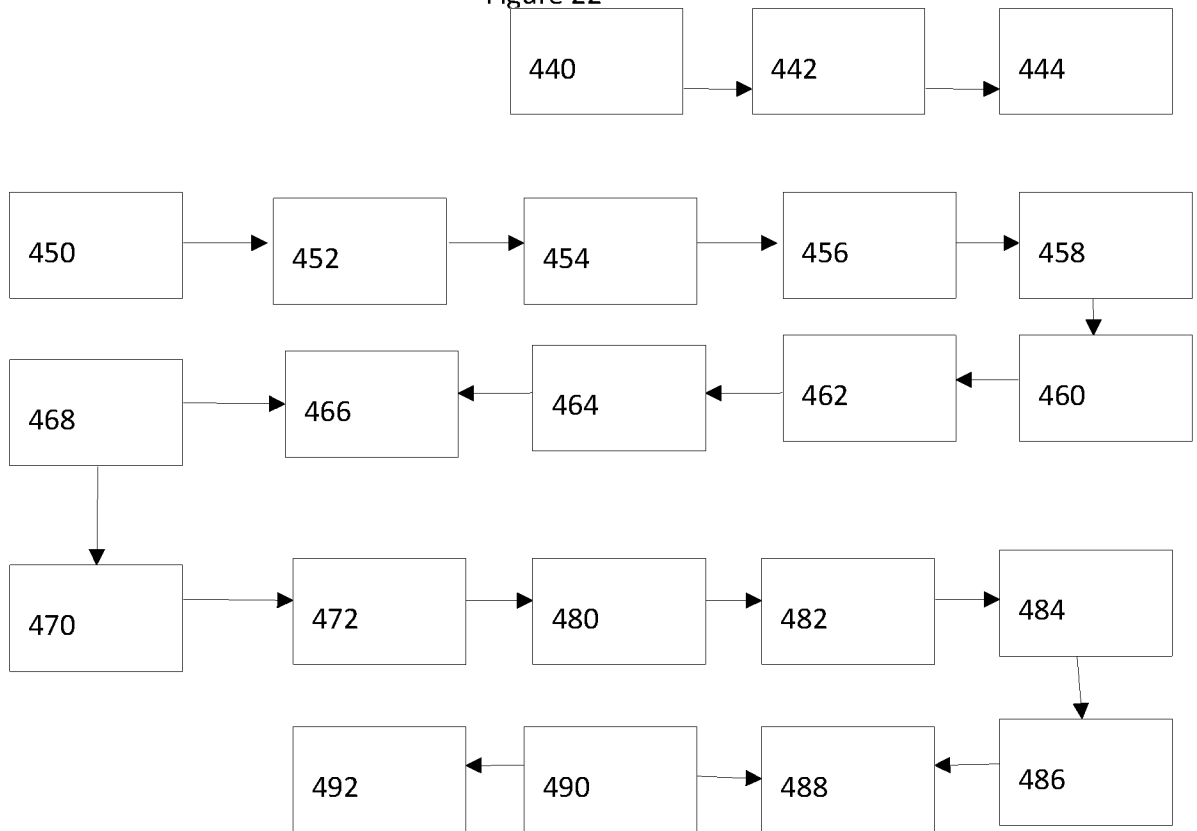


Figure 23

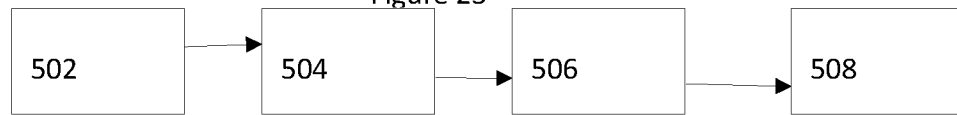


Figure 24

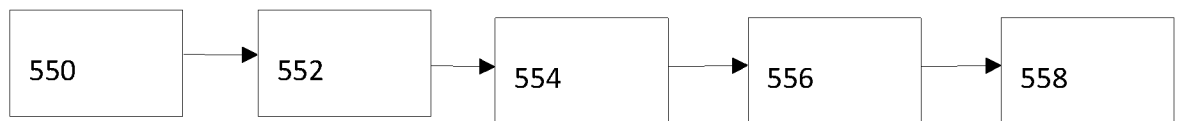


Figure 25

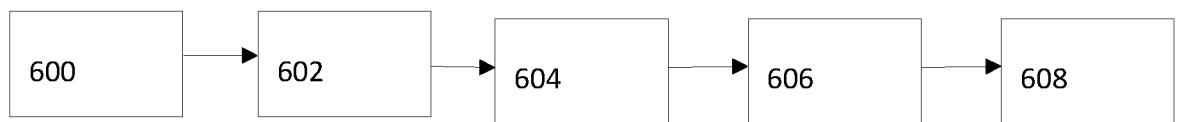


Figure 26

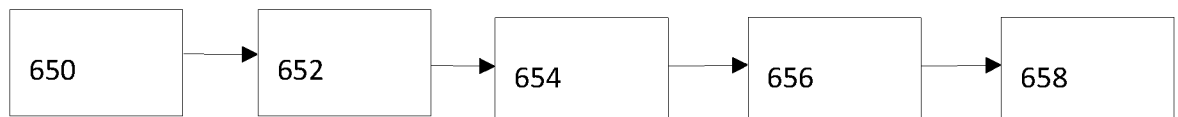


Figure 27A

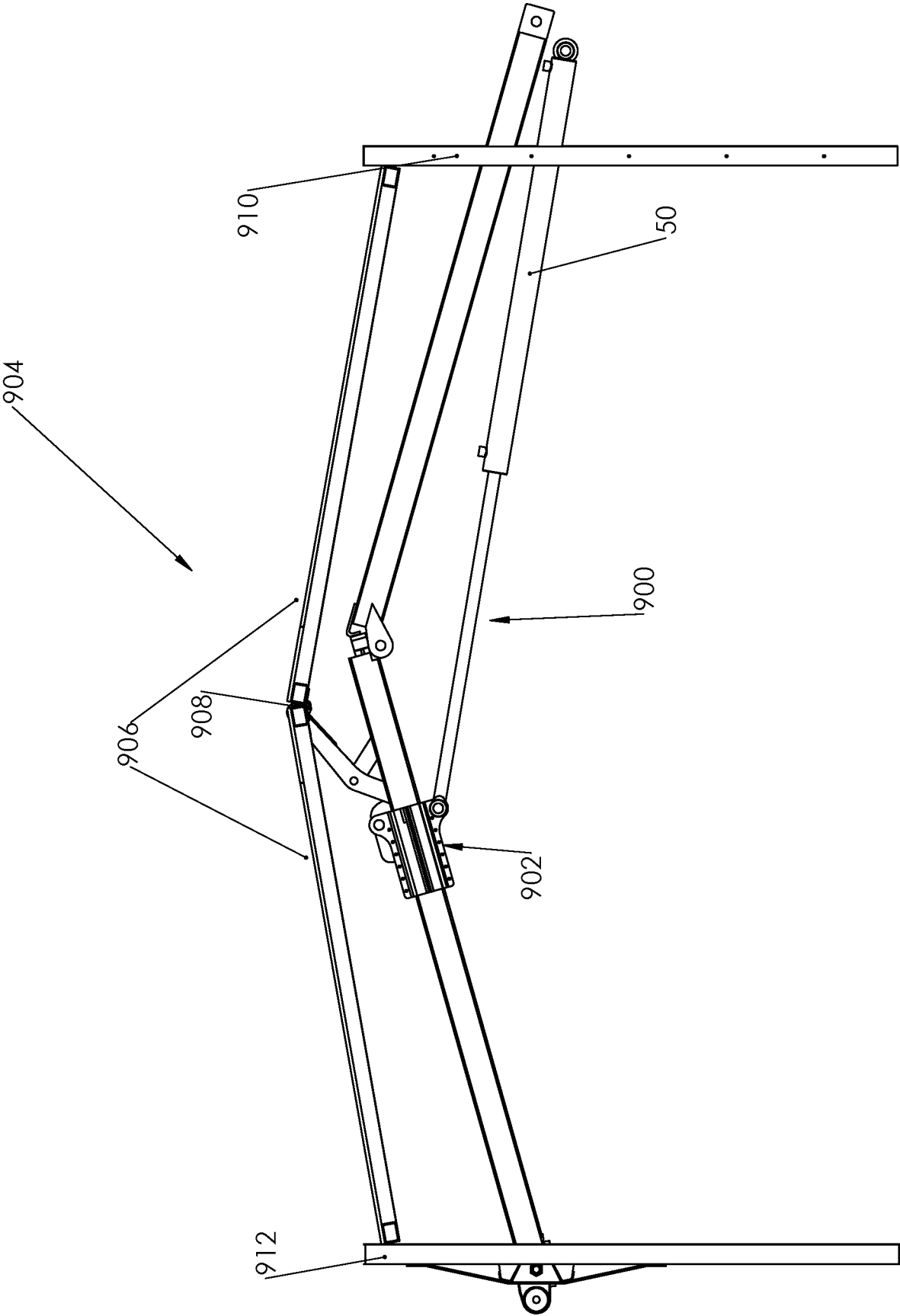


Figure 27B

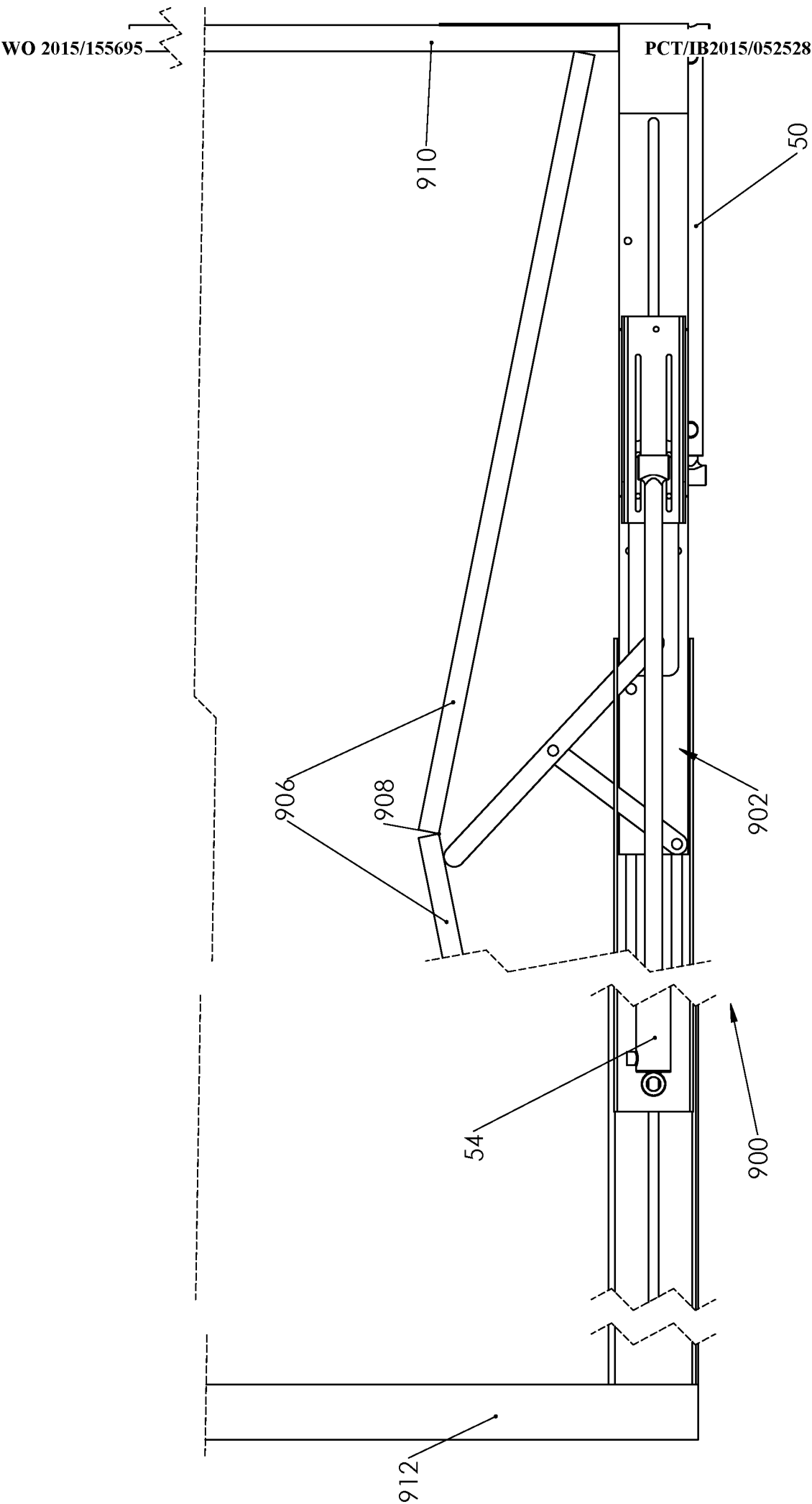
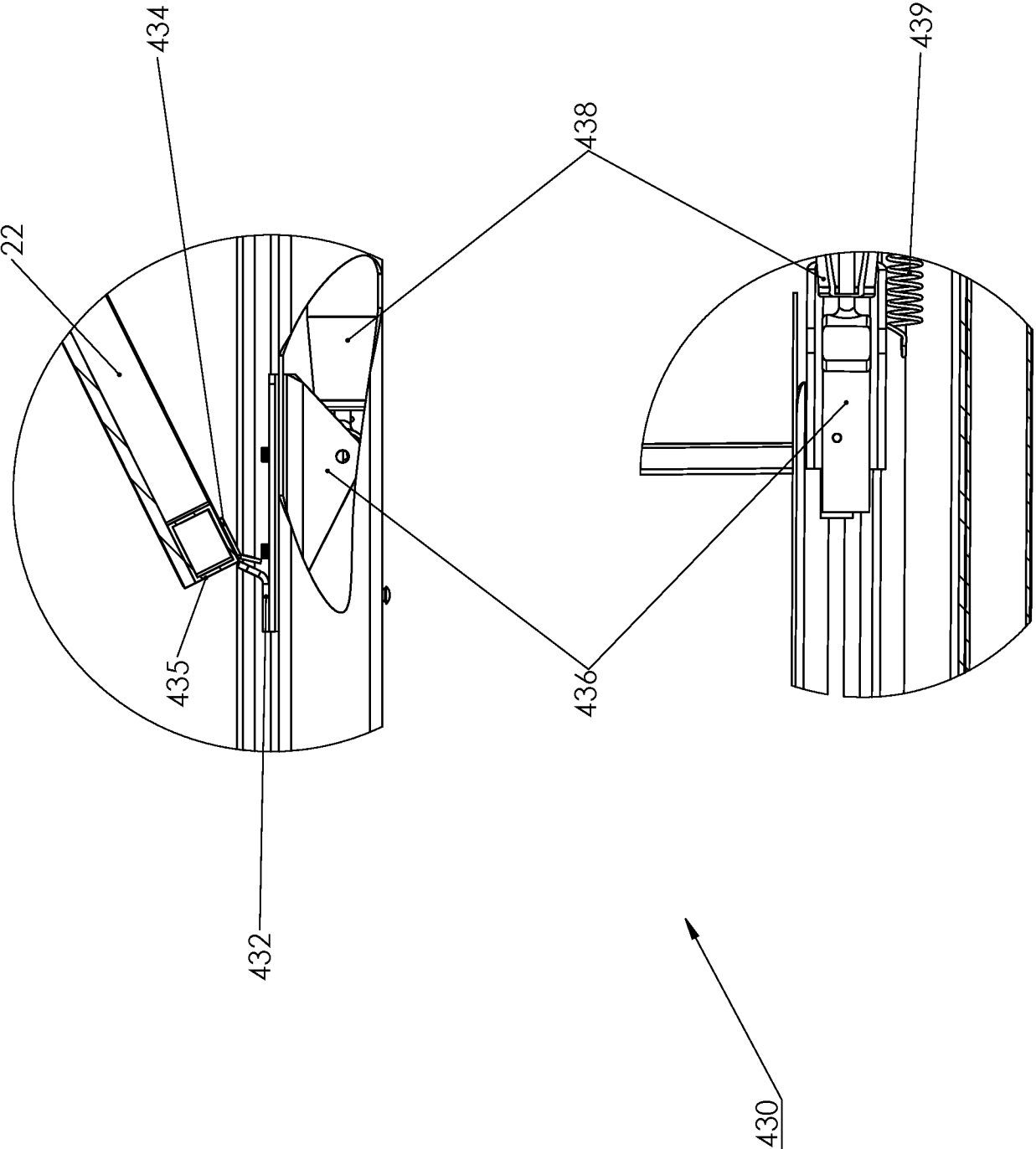


Figure 28



INTERNATIONAL SEARCH REPORT

International application No.

PCT/IB2015/052528

A. CLASSIFICATION OF SUBJECT MATTER
 IPC: **E04B 1/343** (2006.01), **E04B 1/344** (2006.01)

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: E04B 1/343 (2006.01), E04B 1/344 (2006.01)

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

Electronic database(s) consulted during the international search (name of database(s) and, where practicable, search terms used)

Questel Orbit (Keywords: Actuator, below, under, arm, swing, articul*, telescop*, fold*, hing*, pivot*, floor, lift*, rais*, core, cent*, space, compat*, driv*, cable, pulley, actuat*, lever*, initiat*, corner, post*, bracket*)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO2010015062A1, (DI FRANCO, B.) 11 February 2010 (11-02-2010) *whole document*	
P, A	WO2014074884A1, (TROUT, E. J. et al.) 15 May 2014 (15-05-2014) *whole document*	
A	US5894698A, (DEWALD, J. E., JR. et al.) 20 April 1999 (20-04-1999) *whole document*	
A	US2010269419A1, (GYORY, J. et al.) 28 October 2010 (28-10-2010) *whole document*	
P, A	US2014202089A1, (NAKAJIMA, M. et al.) 24 July 2014 (24-07-2014) *whole document*	

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* "A" "E" "L" "O" "P"	Special categories of cited documents: document defining the general state of the art which is not considered to be of particular relevance earlier application or patent but published on or after the international filing date document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) document referring to an oral disclosure, use, exhibition or other means document published prior to the international filing date but later than the priority date claimed	"T" "X" "Y" "&"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art document member of the same patent family
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Date of the actual completion of the international search
 27 July 2015 (27-07-2015)

Date of mailing of the international search report
 29 July 2015 (29-07-2015)

Name and mailing address of the ISA/CA
 Canadian Intellectual Property Office
 Place du Portage I, C114 - 1st Floor, Box PCT
 50 Victoria Street
 Gatineau, Quebec K1A 0C9
 Facsimile No.: 001-819-953-2476

Authorized officer

Shawn De Salvo (819) 934-4270

INTERNATIONAL SEARCH REPORT

International application No.

PCT/IB2015/052528**Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of the first sheet)**

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claim Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claim Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claim Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

Group A: Claims 1-23 and 29-43

An expandable facility featuring a core having a top, bottom, two ends and an expandable portion, characterized by an end wall actuator located under the bottom of the core of the facility

Group B: Claims 24- 28

An initiator comprising an arm and a contractible member

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☒ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claim Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/IB2015/052528

Patent Document Cited in Search Report	Publication Date	Patent Family Member(s)	Publication Date
WO2010015062A1	11 February 2010 (11-02-2010)	None	
WO2014074884A1	15 May 2014 (15-05-2014)	WO2014074884A1 US8555558B1 US8844212B1 US2014130421A1 US8959843B2 US2014360105A1	15 May 2014 (15-05-2014) 15 October 2013 (15-10-2013) 30 September 2014 (30-09-2014) 15 May 2014 (15-05-2014) 24 February 2015 (24-02-2015) 11 December 2014 (11-12-2014)
US5894698A	20 April 1999 (20-04-1999)	None	
US2010269419A1	28 October 2010 (28-10-2010)	US2010269419A1 US8347560B2 EP2491191A2 EP2491191A4 KR20120085811A MX2012004566A US2009266006A1 US7882659B2 US2012266546A1 US8826601B2 WO2009132166A2 WO2009132166A3 WO2011050124A2 WO2011050124A3	28 October 2010 (28-10-2010) 08 January 2013 (08-01-2013) 29 August 2012 (29-08-2012) 10 September 2014 (10-09-2014) 01 August 2012 (01-08-2012) 03 August 2012 (03-08-2012) 29 October 2009 (29-10-2009) 08 February 2011 (08-02-2011) 25 October 2012 (25-10-2012) 09 September 2014 (09-09-2014) 29 October 2009 (29-10-2009) 17 December 2009 (17-12-2009) 28 April 2011 (28-04-2011) 29 September 2011 (29-09-2011)
US2014202089A1	24 July 2014 (24-07-2014)	US2014202089A1 JP5564138B1 JP2014156765A US2014202088A1	24 July 2014 (24-07-2014) 30 July 2014 (30-07-2014) 28 August 2014 (28-08-2014) 24 July 2014 (24-07-2014)