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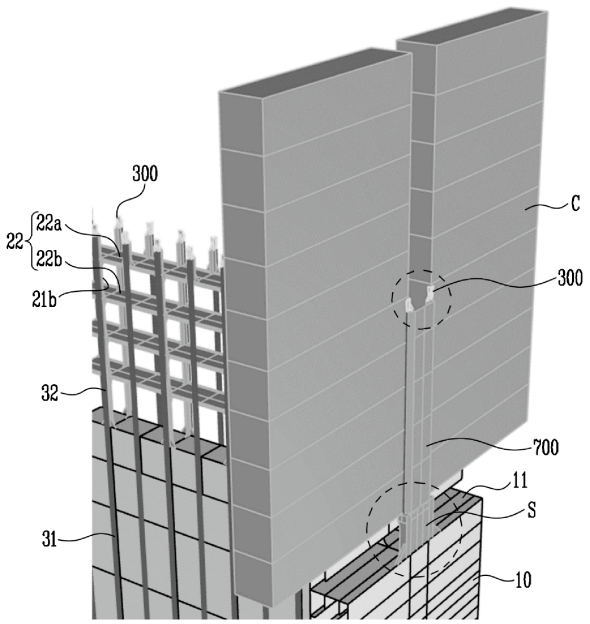
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(54) **CONTAINER CARRIER**

(57) A container carrier according to an embodiment of the present disclosure includes a hull including side plating, bottom plating, and an upper deck, a plurality of cargo holds divided in a length direction of the hull by a plurality of transverse bulkheads in the hull, a plurality of lower cell guides arranged before and after each of the plurality of transverse bulkheads with respect to the length direction, and arranged next to each other in a width direction of the hull crossing the length direction, a plurality of top bridges extending upward from the plurality of transverse bulkheads, extending to left and right edges of the upper deck in the width direction, and arranged in a plurality of rows in the length direction, a plurality of upper cell guides arranged before and after each of the plurality of top bridges with respect to the length direction, and arranged next to each other in the width direction, and a plurality of gap covers covering between one upper cell guide and another cell guide among the plurality of upper cell guides adjacent to each other in the length direction.

FIG. 50



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Description

TECHNICAL FIELD

[0001] The present disclosure relates to a container carrier.

BACKGROUND ART

[0002] Container carriers are gradually increasing their container loading capacity. Securing the stability of loaded containers during operation while increasing the loading capacity is gaining attention as an important factor.

[0003] A container carrier loads containers through a structure called a cell guide on cargo holds provided in a front-rear direction in a hull, mounts a hatch cover on a hatch coaming installed at the entrance of the cargo holds on the upper deck of the hull, and then loads the containers in a plurality of tiers on the hatch cover. The containers loaded on the hatch cover are lashed using various fittings on a lashing bridge located at an upper part of the space between the cargo holds to prevent overturning.

[0004] The hatch cover not only performs the function of blocking the inflow of foreign substances (sea water, rainfall, etc.) into the cargo holds while supporting the load of the containers loaded on the upper part of the upper deck, but also contributes to reinforcing the longitudinal strength of the container carrier.

[0005] However, the hatch cover is not only inconvenient to produce, transport, and load due to its high weight, but also requires additional structures to be installed at the entrance of the cargo holds. Thus, it takes up a lot of space between neighboring cargo holds, and as a result, the containers cannot be loaded as much as the occupied space.

[0006] Recently, as more containers are loaded, research has been conducted on small container carriers with an open-top concept without hatch covers to solve the problem of producing/transporting/loading the hatch covers.

[0007] When the open-top concept is applied to small container carriers, the number (tiers) of containers loaded continuously from the bottom of the cargo hold to the top of the upper deck is limited to a certain number (e.g., 12 tiers) or less due to damage to lower loaded containers caused by the load of the loaded containers and trim & stability of the ship. In addition, the side plating of the ship needs to be excessively raised and the hull strength needs to be reinforced, compared to container carriers of the same loading scale, in order to prevent green water from flowing into the deck of the ship in the rough sea during ship operation.

[0008] In large container carriers, in order to prevent containers loaded on the upper part of the hatch cover from overturning, when loading and unloading containers, it is necessary to lash/dismantle containers on the top of the hatch cover with various fittings on the lashing bridge. In addition, most of the processes are carried out manually by workers, requiring excessive working hours and safety management, which incurs costs in operating the container carrier. In addition, when excessive hull movement occurs due to bad weather during the operation of container carriers, incomplete elements of the hatch cover and the lashing system, such as the movement of the hatch cover due to load, damage to the deck or the fastening device of the hatch cover, breakage of the fittings of the lashing bridge, or occurrence of relative displacement between the hatch cover and the hull, cause the lashing system to continuously collapse and ultimately cause the loaded containers to be damaged or lost to the sea.

DISCLOSURE

TECHNICAL PROBLEM

[0009] The present disclosure was made to solve the problems of the related art as described above, and embodiments provide a container carrier that can maximize loading capacity by increasing the number (tiers) of containers loaded continuously from a bottom of a cargo hold to a top of an upper deck in a large container carrier without a hatch cover, simplify loading and unloading procedures by omitting a fitting operation between the containers and a lashing bridge to prevent the loaded containers from overturning, and prevent damage or loss of the loaded containers.

[0010] However, the subject matter of the present invention is not necessarily limited to the above-mentioned subject matter, and other technical subject matter not mentioned will be clearly understood by those skilled in the art from the following description.

TECHNICAL SOLUTION

[0011] In accordance with an aspect of the present disclosure, there is provided a container carrier including a hull including side plating, bottom plating, and an upper deck, a plurality of cargo holds divided in a length direction of the hull by a plurality of transverse bulkheads in the hull, a plurality of lower cell guides arranged before and after each of the plurality of transverse bulkheads with respect to the length direction, and arranged next to each other in a width

direction of the hull crossing the length direction, a plurality of top bridges extending upward from the plurality of transverse bulkheads, extending to left and right edges of the upper deck in the width direction, and arranged in a plurality of rows in the length direction, a plurality of upper cell guides arranged before and after each of the plurality of top bridges with respect to the length direction, and arranged next to each other in the width direction, and a plurality of gap covers covering between one upper cell guide and another cell guide among the plurality of upper cell guides adjacent to each other in the length direction.

[0012] According to an embodiment, each of the plurality of gap covers may include a gap cover body having a surface parallel to the length direction, and an extension member extending from one side of the gap cover body to the one upper cell guide and extending from another side of the gap cover body to the another upper cell guide with respect to the length direction.

[0013] According to an embodiment, the container carrier may further include a plurality of reinforcement members arranged on portions of the plurality of upper cell guides extending above the plurality of top bridges, the plurality of reinforcement members each including a surface parallel to the width direction.

[0014] According to an embodiment, a width of the gap cover body may be greater than a width of one of the plurality of reinforcement members with respect to the length direction.

[0015] According to an embodiment, the container carrier may further include support members disposed at both ends of the plurality of top bridges with respect to the width direction, the support members connecting one top bridge to another top bridge among the plurality of top bridges adjacent to each other in the length direction.

[0016] According to an embodiment, the container carrier may further include an entry guide extending upwardly from the plurality of upper cell guides and guiding a container when the container is unloaded.

[0017] According to an embodiment, the entry guide may include a plurality of first entry guide members extending obliquely upward in the plurality of upper cell guides, having same lower and upper widths, and guiding a front surface or a rear surface of the container, and a plurality of second entry guide members extending upwardly from the plurality of upper cell guides, having surfaces perpendicular to the plurality of first entry guide members and upper ends with inclined surfaces, and guiding one side surface of the container.

[0018] In accordance with an aspect of the present disclosure, there is provided a container carrier including a hull including side plating, bottom plating, and an upper deck, a plurality of cargo holds divided in a length direction of the hull by a plurality of transverse bulkheads in the hull, a plurality of lower cell guides arranged before and after each of the plurality of transverse bulkheads with respect to the length direction, and arranged next to each other in a width direction of the hull crossing the length direction, a plurality of top bridges extending upwardly from the plurality of transverse bulkheads, extending to left and right edges of the upper deck in the width direction, and arranged in a plurality of rows in the length direction, and a plurality of upper cell guides arranged before and after each of the plurality of top bridges with respect to the length direction and arranged next to each other in the width direction, wherein one of the plurality of upper cell guides and one of the plurality of lower cell guides overlapping each other in a height direction of the hull crossing the length direction and the width direction are connected to form a guide path of continuous containers, and wherein at least one of the plurality of top bridges and the plurality of upper cell guides comprises a twistlock zone visibly marked for a naked eye to a predetermined height in a direction from a top end of the at least one towards the upper deck.

[0019] In accordance with an aspect of the present disclosure, there is provided a container carrier including a hull including side plating, bottom plating, and an upper deck, a plurality of cargo holds divided in a length direction of the hull by a plurality of transverse bulkheads in the hull, a plurality of lower cell guides arranged before and after each of the plurality of transverse bulkheads with respect to the length direction and arranged next to each other in a width direction of the hull crossing the length direction, a plurality of upper cell guides arranged above the plurality of transverse bulkheads, and a protection bar protecting against impacts applied to the plurality of upper cell guides and reinforcing structural strength, wherein the protection bar comprises: a spacer portion arranged between one upper cell guide and another upper cell guide among the plurality of upper cell guides facing one another, and supporting and fixing the one upper cell guide and the another upper cell guide apart from each other, and a detachment preventing portion protruding from the spacer portion to an outside of the one upper cell guide and the another upper cell guide by a predetermined length with respect to the length direction to prevent detachment of a container.

[0020] According to an embodiment, the protection bar may be arranged at upper portions of the plurality of upper cell guides corresponding to a lower portion of an entry guide relatively vulnerable to external impacts and having weak structural strength over an entire length of the plurality of upper cell guides.

[0021] In accordance with an aspect of the present disclosure, there is provided a container carrier including a hull including side plating, bottom plating, and an upper deck, a plurality of cargo holds divided in a length direction of the hull by a plurality of transverse bulkheads in the hull, a plurality of lower cell guides arranged before and after each of the plurality of transverse bulkheads with respect to the length direction, and arranged next to each other in a width direction of the hull crossing the length direction, a plurality of upper cell guides arranged on top of the upper deck and connected to the plurality of lower cell guides to provide a guide path of continuous containers, and a plurality of cell

guide devices extending the plurality of upper cell guides upwards in length, wherein each of the plurality of cell guide devices comprises: an operation unit, and an extension cell guide rotated by the operation unit and detachably connected to an upper end of each of the plurality of upper cell guides.

[0022] According to an embodiment, the container carrier may further include an entry guide extending upwardly from the plurality of upper cell guides to guide a container when the container is loaded, and wherein the extension cell guide is detachably connected to an upper end of the entry guide.

[0023] According to an embodiment, the container carrier may further include an extension entry guide extending upwardly from the extension cell guide to guide a container when the container is unloaded.

[0024] In accordance with an aspect of the present disclosure, there is provided a container carrier including a hull including side plating, bottom plating, and an upper deck, a plurality of holds divided in a length direction of the hull by a plurality of transverse bulkheads in the hull, a plurality of lower cell guides arranged before and after each of the plurality of transverse bulkheads with respect to the length direction, and arranged next to each other in a width direction of the hull crossing the length direction, a plurality of top bridges extending upward from the plurality of transverse bulkheads, extending to left and right edges of the upper deck in the width direction, and arranged in a plurality of rows in the length direction, and a plurality of upper cell guides arranged before and after each of the plurality of top bridges with respect to the length direction, and arranged next to each other in the width direction, wherein one of the plurality of upper cell guides and one of the plurality of lower cell guides overlapping each other in a height direction of the hull crossing the length direction and the width direction are connected to form a guide path of continuous containers, wherein a plurality of containers loaded along the guide path comprises: a plurality of first containers loaded in the hull, and a plurality of second containers loaded on top of the upper deck, and wherein the container carrier further comprises a plurality of twist locks connecting at least a portion of the plurality of second containers.

[0025] According to an embodiment, the plurality of twist locks may connect one of the plurality of first containers and one of the plurality of second containers adjacent to each other.

[0026] According to an embodiment, the plurality of twist locks may connect at least a portion of the plurality of first containers.

ADVANTAGEOUS EFFECTS

[0027] In a container carrier according to embodiments of the present disclosure, loading capacity may be increased by increasing the number (tiers) of containers continuously loaded from the bottom of a cargo hold to the top of an upper deck in a large container carrier without a hatch cover, time and cost consumed due to an excessive fitting operation may be reduced by omitting the fitting operation between containers to be loaded and lashing bridges, and damage and/or loss of the loaded containers may be prevented.

BRIEF DESCRIPTION OF THE DRAWINGS

[0028]

FIG. 1 is a side cross-sectional view showing an embodiment of a container carrier.

FIG. 2 is a front cross-sectional view showing an embodiment of a container carrier.

FIGS. 3 to 7 are perspective and plan views showing an embodiment of a container carrier and an open-type container loading assist device.

FIGS. 8 to 12 are perspective and plan views showing an embodiment of a container carrier and a closed-type container loading assist device provided thereon.

FIG. 13 is a three-dimensional front perspective view illustrating an embodiment of a container carrier.

FIG. 14 is a perspective view of an embodiment of an open-type container loading assist device.

FIG. 15 is a perspective view showing an embodiment of a closed-type container loading assist device.

FIG. 16 is a side view showing a state in which the container loading assist device shown in FIG. 14 or 15 is stowed on a transport vehicle.

FIG. 17 is a perspective view showing a state in which the container loading assist device shown in FIG. 14 or 15 is stowed on a container carrier.

FIGS. 18 to 22 are conceptual views showing various position adjusting members for adjusting an installation position of the container loading assist device shown in FIG. 14 or FIG. 15.

FIGS. 23 and 24 are diagrams for comparing and explaining the loading stability of containers between a cell guide system according to an embodiment and an existing lashing system.

FIGS. 25 to 27 are tables for comparing and explaining the loading stability of containers between a cell guide system according to an embodiment and an existing lashing system.

FIG. 28 is a perspective view showing a container loading and unloading method using a container loading assist device in a container carrier according to an embodiment.
FIG. 29 is a flowchart illustrating a container loading and unloading method using a container loading assist device in a container carrier according to an embodiment.
FIG. 30 is another flowchart illustrating a container loading and unloading method using a container loading assist device in a container carrier according to an embodiment.
FIG. 31 is a perspective view illustrating an embodiment of a container carrier and a support member, an entry guide, and a reinforcement member provided therein.
FIG. 32 is a perspective view showing the support member of FIG. 31.
FIGS. 33 to 35 are perspective and side views showing the entry guide and the reinforcement member of FIG. 31.
FIG. 36 is a top cross-sectional view and a side view showing an embodiment of a protection bar installed on a container carrier.
FIG. 37 is a plan cross-sectional view and a side view showing another embodiment of the protection bar shown in FIG. 36.
FIG. 38 is a plan cross-sectional view and a side view showing another embodiment of the protection bar shown in FIG. 36.
FIG. 39 is a side view illustrating an embodiment of an upper cell guide.
FIG. 40 is a flowchart for describing a container loading and unloading method using the upper cell guide shown in FIG. 39.
FIG. 41 is a first partial flowchart for describing a method of unloading containers in the container loading and unloading method of FIG. 40.
FIG. 42 is a second partial flowchart for describing a method of loading containers in the container loading and unloading method of FIG. 40.
FIG. 43 is diagrams for describing the second partial flowchart of FIG. 42.
FIG. 44 is a third partial flowchart for describing the method of unloading containers in the container loading and unloading method of FIG. 40.
FIG. 45 is diagrams for describing the third partial flowchart of FIG. 44.
FIG. 46 is a diagram showing a state in which container loading assist devices are stowed in a plurality of layers and fastened with twist locks.
FIG. 47 is a perspective view illustrating an embodiment of a top bridge and an upper cell guide.
FIG. 48 is a side view illustrating an embodiment of a cell guide device.
FIG. 49 is a side view showing another embodiment of a cell guide device shown in FIG. 48.
FIG. 50 is a perspective view showing an embodiment of a gap cover.
FIG. 51 is a perspective view showing an upper part of a gap cover by enlarging a part of FIG. 50.
FIG. 52 is a perspective view showing a lower part of the gap cover by enlarging a part of FIG. 50.
FIG. 53 is a side view showing the gap cover shown in FIG. 50 as viewed from the front.
FIG. 54 is a front cross-sectional view the gap cover shown in FIG. 50 as viewed from the side.
FIG. 55 is a plan view showing the gap cover shown in FIG. 50 as viewed from the top.
FIG. 56 is a perspective view showing embodiments of the gap cover shown in FIG. 50.
FIG. 57 is a graph showing the relationship between a wind load factor (Cx) and a wind direction angle according to the computational fluid analysis (CFD).

DETAILED DESCRIPTION

[0029] The object, specific advantages and novel features of the present disclosure will be further apparent from the following detailed description and preferred embodiments associated with the accompanying drawings. In adding reference numbers to the components of each drawing herein, it should be noted that only the same components are to have the same number as much as possible, even if they are displayed on different drawings. In addition, in describing the present disclosure, when it is determined that the detailed description of the related known technology may unnecessarily obscure the subject matter of the present disclosure, the detailed description thereof will be omitted.

[0030] Throughout the specification, in a case in which a portion is "connected" to another portion, the case includes not only a case in which the portion is directly connected but also a case in which the portion is indirectly connected with one or more other elements interposed therebetween. Terms used herein are for describing specific embodiments and are not intended to limit the present disclosure. Throughout the specification, in a case in which a certain portion "includes," the case means that the portion may further include another component without excluding another component unless otherwise stated. "At least one of X, Y, and Z," "at least one of X, Y, or Z," and "at least one selected from the group consisting of X, Y, and Z" may be construed as X only, Y only, Z only, any combination of two or more of X, Y,

and Z, such as, for instance, XYZ, XYY, YZ, and ZZ, or any variation thereof. The term "and/or" includes any and all combinations of one or more of the associated listed items.

[0031] Here, terms such as "first" and "second" may be used to describe various components, but these components are not limited to these terms. These terms are used to distinguish one component from another component. Therefore, a "first" component may refer to a second component within a range without departing from the scope disclosed herein.

[0032] Various embodiments are described with reference to drawings schematically illustrating example or ideal embodiments. Accordingly, it will be expected that shapes may vary, for example, according to tolerances and/or manufacturing techniques. Therefore, the embodiments disclosed herein are not to be construed as being limited to shown specific shapes, and are to be interpreted as including, for example, changes in shapes that may occur as a result of manufacturing. As described above, the shapes shown in the drawings may not show actual shapes of areas of a ship, and the present embodiments are not limited thereto.

[0033] FIG. 1 is a side cross-sectional view showing an embodiment of a container carrier 1. FIG. 2 is a front cross-sectional view showing an embodiment of the container carrier 1. FIGS. 3 to 7 are perspective and plan views showing an embodiment of the container carrier 1 and an open-type container loading assist device provided therein. FIGS. 8 to 12 are perspective and plan views showing an embodiment of the container carrier 1 and a closed-type container loading assist device provided thereon. FIG. 13 is a three-dimensional front perspective view illustrating an embodiment of the container carrier 1. FIG. 14 is a perspective view of an embodiment of an open-type container loading assist device. FIG. 15 is a perspective view showing an embodiment of a closed-type container loading assist device.

[0034] As shown in FIGS. 1 to 15, the container carrier 1 as a new concept container carrier without a hatch cover may load containers C in plurality of tiers inside and outside a hull 10 and transport the containers C from a departure point to a destination, and may include a container loading assist device 100 or 100a which loads and supports the containers C.

[0035] In embodiments, the container carrier 1 may be, but the present disclosure is not necessarily limited to, a large container ship which loads a large quantity of containers C, including the containers C from the bottom of a cargo hold 17 to the amount loaded on top of an upper deck 11. For example, the containers C may include at least one of a 20 ft container (hereinafter referred to as a "small container") and a 40 ft container (hereafter referred to as a "large container") mainly loaded on the container carrier 1. However, it should be noted that, according to the ISO specifications, the containers C having various specifications and dimensions other than the above 20 ft or 40 ft containers may be used as the containers C for ships, and therefore, the small container C or the large container C as mentioned below is not limited to the 20 ft or40 ft containers.

[0036] The container loading assist device 100 or 100a may be an open-type container loading assist device 100 as shown in FIGS. 3 to 7 and 14, and may be a closed-type container loading assist device 100a as shown in FIG. 8 to 12 and FIG. 15. Since the open-type container loading assisting device 100 and the closed-type container loading assist device 100a are similar to some degree in terms of configuration and function. Thus, different aspects of the configuration and function of the closed-type container loading assist device 100a will be described with reference to FIGS. 8 to 12 and 15.

[0037] The hull 10 may form the exterior of the container carrier 1. The hull 10 may be surrounded by the upper deck 11, side plating 12, and bottom plating 13.

[0038] The hull 10 may have a double-hull structure in which the side plating 12 includes outer side plating 12a and inner side plating 12b, and a double-bottom structure in which the bottom plating 13 includes bottom outer plating 13a and bottom inner plating 13b.

[0039] A plurality of containers C may be loaded in the hull 10. To this end, a plurality of cargo holds 17, which are partitioned in the front-rear direction by a transverse bulkhead 16, may be arranged in the interior of the hull 10. In the cargo hold 17, a plurality of lower cell guides 31 are installed at regular intervals on the side of the traverse bulkhead 16 to guide the loading of the containers C entering the cargo holds 17.

[0040] In embodiments, the cargo hold 17 has a structure in which the entrance is open. The existing hatch cover is not installed at the entrance, but rather, the container loading assist device 100 to be described below may be mounted at the entrance of the cargo hold 17 or may be mounted at an arbitrary position in the cargo hold 17. For example, the entrance of the cargo hold 17 may have a simple structure so that the container loading assist device 100 may be mounted. When the container loading assist device 100 is mounted in the cargo hold 17, a groove (not shown) may be formed in the upper deck forming the entrance of the cargo hold 17 so that the container loading assist devices 100 may pass through the entrance of the cargo hold 17.

[0041] In addition, when the container loading assist device 100 is applied to a container carrier with an existing lashing bridge or a container carrier with a hatch coaming at the entrance of the cargo hold 17, the container loading assist device 100 may be mounted on the hatch coaming arranged on top of the upper deck 11.

[0042] An engine room R may be arranged in the interior of the hull 10 and adjacent to a stern 15. A propulsion engine (not shown) may be accommodated in the engine room R, and the propulsion engine may be mechanically or

electrically connected to a propeller and consumes liquefied gas as fuel to provide a driving force for to rotate the propeller.

[0043] The upper deck 11 of the hull 10 may be provided with a cabin A. The cabin A is a living space of crew, and may include a plurality of levels in a height direction of the hull 10, and a bridge for controlling navigation may be arranged on the top floor.

[0044] An engine casing I may be arranged behind the cabin A. The engine casing I may include a chimney for dischargging the exhaust generated by the propulsion engine to the outside, and an emergency generator or a fire extinguishing facility may be disposed.

[0045] On the upper deck 11 of the hull 10, the containers C may be loaded on parts except for the cabin A and the engine casing I. For the loading of the containers C, the upper deck 11 is provided with a plurality of top bridges 20 arranged in a plurality of rows in a longitudinal direction of the hull 10.

[0046] The top bridges 20 extends upwardly from the plurality of transverse bulkheads 16 and may be installed to extend to the left and right edges of the upper deck 11 in a width direction of the hull 10. The top bridges 20 may be arranged at regular intervals from a bow 14 to the stern 15.

[0047] A plurality of upper cell guides 32 may be installed before and after each of the plurality of top bridges 20 with respect to the longitudinal direction of the hull 10, and may be arranged next to each other in the width direction of the hull 10. In other words, the top bridge 20 may not be a lashing bridge to which an existing lashing system is applied, but may be a cell guide system to which the plurality of upper cell guides 32 are applied.

[0048] The plurality of upper cell guides 32 extend from the top of the top bridge 20 to the upper deck 11, and may be connected to the plurality of lower cell guides 31 installed in the cargo hold 17 to form a guide path of the continuous containers C. When the container loading assist device 100 or 100a is pulled into the upper cell guides 32 and lowered by using a crane CR, the container loading assist device 100 or 100a may be guided by the upper cell guides 32 and pulled into the guide path and lowered.

[0049] The upper cell guide 32 may guide the lifting and lowering of the containers C transported by the crane CR. The upper cell guide 32 installed on the top bridge 20 and the lower cell guide 31 installed on the traverse bulkhead 16 may be connected to each other to enable continuous loading and unloading work without additional work such as mounting a hatch cover or lashing work when the containers C are loaded and unloaded. In addition, the upper cell guide 32 may support the transverse load of the containers C generated by the movement of the hull 10.

[0050] The top bridge 20 may support and fix the containers C by installing the upper cell guides 32 in the front-rear direction based on the longitudinal direction of the hull 10, so that an existing lashing system (a fastening device such as a lashing rod or a lashing bar) may be omitted. In addition, the top bridge 20 may prevent the containers C loaded at one to four tier levels from overturning, and may also secure access and work space for maintenance and monitoring of control units and the like provided in a reefer container C. In this manner, the top bridge 20 may directly support the containers C on the upper deck 11 during the operation of the container carrier 1, thereby preventing damage or loss of the loaded containers C.

[0051] In particular, the continuous collapse of the lashing system resulting in the damage or loss of the loaded containers C to the sea may be prevented by removing imperfect elements of the hatch cover and the lashing system, such as the movement of the hatch cover due to load, damage to the deck or the fastening device of the hatch cover, breakage of the fittings of the lashing bridge, or relative displacement between the hatch cover and the hull when excessive hull movement occurs due to bad weather during operation of the conventional large container carrier.

[0052] In the case of the existing lashing bridge, since the lashing system is applied, a sufficient width is required for the lashing operation according to the worker environment regulations, while the top bridge 20 according to the embodiments may not only minimize the width but also simplify the complex structure in which the existing lashing bridge is installed by omitting the lashing system and applying the cell guide system. In addition, since the width of the top bridge 20 may be minimized, the width of the upper deck 11 between the cargo holds 17 may be reduced compared to a conventional container carrier in which an existing lashing bridge is installed, so that not only the design flexibility (such as the hull length; optimization made possible by the absence of the lashing system) of the container carrier 1 compared to the same specifications may be ensured, but also the loading capacity of the containers C may be increased.

[0053] In embodiments, the top bridge 20 may include a plurality of vertical members 21 and a plurality of horizontal members 22.

[0054] Among the vertical members 21, two outer vertical members 21a disposed on the upper deck 11 on the left and right sides with respect to the width direction of the hull 10 may be disposed at intervals corresponding to the widths of the containers C.

[0055] Among the vertical members 21, a plurality of intermediate vertical members 21b disposed between the outer vertical members 21a may be disposed at an interval corresponding to twice the width of the container C.

[0056] The upper cell guides 32 may be disposed between the outer vertical members 21a, the intermediate vertical members 21b, and the intermediate vertical member 21b.

[0057] Since the top bridge 20 is coupled with the upper cell guide 32, which supports the transverse load of the container C generated by the movement of the hull 10, the top bridge 20 may be preferably formed to withstand the transverse load.

[0058] The plurality of upper cell guides 32 may have the same height as the top bridge 20, but are not necessarily limited thereto. For example, the upper cell guides 32 may have various heights depending on the needs of a ship owner. In other words, the upper cell guides 32 may have a height which is greater or smaller than that of the top bridge 20. In this manner, as the upper cell guides 32 are installed in the top bridge 20, the loss of the containers C due to overturning may be fundamentally blocked. In addition, the number of tiers over the upper deck 11 may be customized according to the ship owner's request. In addition, the upper structure and the lower structure of the hull 10 may be integrated into unit blocks to thereby maximize weight reduction and productivity.

[0059] In addition, the top bridge 20 may apply the existing lashing system at the top in addition to the cell guide system as described above. For example, at least one of a lashing eye, a lashing ring, a lashing plate, a plug, and a cone, which are fixing devices of the lashing system, may be disposed at the top end of the top bridge 20 to further improve the safety of the loaded containers C.

[0060] Although it is described that the container carrier 1 includes the top bridges 20 to which the cell guide system is applied, a lashing bridge to which a lashing system is applied may be installed in some rows or in some sections on the left and right sides of one row in a manner similar or identical to the existing one. For example, the container carrier 1 may include a hybrid bridge in which the top bridge 20 to which the cell guide system is applied and the lashing bridge to which the existing lashing system is applied are mixed.

[0061] Referring to FIG. 14, the container carrier 1 may include the container loading assist device 100.

[0062] The container loading assist device 100 is applicable to the container carrier 1 without a hatch cover and may be mounted on at least one cargo hold 17 to load and support the plurality of containers C on the upper side.

[0063] The container loading assist device 100 may include an upper frame 111, a lower frame 112, a support 113, a protruding member 120, a reinforcing frame 130, a first fitting member 141, and a second fitting member 142. The container loading assist device 100 may form a main body 110 having a rectangular box shape as a whole by combining the upper frame 111, the lower frame 112, and the support 113.

[0064] The upper frame 111 may be configured in a rectangular shape having a width corresponding to the width of the small container C or the large container C and a length corresponding to the length of the large container C.

[0065] The upper frame 111 may include a pair of first major axis frames 111a which are arranged at a width corresponding to the width of the small container C or the large container C and have a length corresponding to the length of the large container C, and a pair of first minor axis fames 11b which connect the ends of the pair of first major axis frames 111a and have a width corresponding to a width of the small container C or the large container C.

[0066] The lower frame 112 may be configured in a rectangular shape having a width corresponding to the width of the small containers C or the large containers C and having a length corresponding to the length of the large container C.

[0067] The lower frame 112 may include a pair of second major axis frames 112a having a width corresponding to the width of the small containers C or the large containers C and having a length corresponding to the length of the large container C, and a pair of second minor axis fames 121b connecting end portions of the pair of second major axis frames 112a and having a width corresponding the width of the small container C or the large container C.

[0068] Each of the pair of second major axis frames 112a may be configured such that both ends may be connected to a lower end of the support 113 to be described below, have a downward slope towards the inside, be bent, and be horizontal to the pair of first major axis frames 111a in the middle section.

[0069] The support 113 may be provided on the upper frame 111 and the lower frame 112 in a height direction and may connect each of the square corners of the upper frame 111 to each of the square edges of the lower frame 112.

[0070] The protruding member 120 may protrude outward from the upper frame 111 and the lower frame 112, or the support 113 so as to be mounted at an arbitrary position of the cargo hold 17. The protruding member 120 may project longitudinally outwardly from the bottom of each support 113 so as to be mounted at the entrance of the cargo hold 17 or at an arbitrary location within the cargo hold 17.

[0071] When the protruding member 120 is mounted on the upper deck 11 at the entrance of the cargo hold 17, the load of the small container C or the large container C transmitted through the support 113 may be transmitted to the upper deck 11.

[0072] When the protruding member 120 is mounted at an arbitrary position in the cargo hold 17 by using the position adjusting member 40 to be described below, the upper deck 11 at the entrance of the cargo hold 17 may have a groove through which the protruding member 120 passes at a portion where the protruding member 120 is mounted. Accordingly, after the protruding member 120 passes through the groove formed in the upper deck 11, the protruding member 120 is mounted on the position adjusting member 40 to be described below, which is installed at an arbitrary position of the traverse bulkhead 16 in the cargo hold 17, and may transmit the load of the small container C or the large container C transmitted through the support 113 to the traverse bulkhead 16.

[0073] In embodiments, when the container loading assist device 100 is applied to a conventional container carrier in which the lashing bridge is installed or a conventional container carrier with a hatch coaming provided at the entrance of the cargo hold 17, the protruding member 120 may be mounted on the hatch coaming at the upper part of the upper deck 11 at the entrance of the cargo hold 17.

[0074] The reinforcing frame 130 connects an intermediate part in the longitudinal direction of the upper frame 111 and an intermediate part in the longitudinal direction the lower frame 112, and may support the load of the containers C loaded on the upper surface of the container loading assist device 100.

[0075] The reinforcement frame 130 may include a first horizontal stiffener 131 connecting an intermediate portion of each of the pair of first major axis frames 111a, a second horizontal stiffener 132 connecting an intermediate portion thereof of each of the pairs of second major axis frame 112a, a first vertical stiffener 133 connecting one end of the first horizontal stiffener 131 and one end of the second horizontal stiffener 132, and a second vertical stiffener (not shown) connecting another end of the first vertical stiffener 131 and another end of the second horizontal stiffener 132.

[0076] The container loading assist device 100 may further include a first plate 151, a second plate 152, and a reinforcing frame 160.

[0077] The first plate 151 may be installed on one frame formed by one of the pair of first major axis frames 111a, one of the pair of second major axis frames 112a, and the support 113 connecting both ends thereof.

[0078] The second plate 152 may be installed in the other frame formed by the other of the pair of first major axis frames 111a, the other of the pair of second major axis frames 112a, and the support 113 connecting both ends thereof.

[0079] The reinforcing frame 160 may be installed on at least one of an outer side surface and an inner side surface of each of the first plate 151 and the second plate 152.

[0080] When the reinforcing frame 160 is installed on the outer surface of each of the first plate 151 and the second plate 152, the reinforcing frame 160 may include an intermediate reinforcing frame 161 connected to each of the pair of first major axis frames 111a and each of the second major axis frames 112a so as to face the first vertical stiffener 133 and the second vertical stiffener with the first plate 151 and the second plate 152 interposed therebetween, respectively, and a first reinforcing frame 162 and a second reinforcing frame 163 disposed between the support 113 on both sides with respect to the intermediate reinforcing frame 161, and connected to the pair of first major axis frames 111a at bent portions of the pair of second major axis frames 112a, respectively.

[0081] The pair of second major axis frames 112a are shown as being bent, but are not necessarily limited thereto, and may have a flat shape, for example. In other words, the container loading assist device 100 may be manufactured in the form of a rectangular box shape as a whole.

[0082] In embodiments, the container loading assist device 100 may include all or part of the reinforcing frame 130, the first plate 151 and the second plate 152, and the reinforcing frame 160, thereby ensuring rigidity which may support the load of the containers C loaded on its own, unlike conventional similar technologies.

[0083] The first fitting member 141 is arranged at the upper part of each of the square corners of the upper frame 111, and may be used for fixing when loading the containers C, or for hoisting when transporting the containers C to the crane CR. The first fitting member 141 may be formed at the same height at each of the square corners of the upper frame 111.

[0084] The second fitting member 142 is provided in a pair at the upper part of the middle portion of the upper frame 111, and may be used for fixing when loading the container C, or used for hoisting together with the first fitting member 141 when transporting the containers to the crane CR.

[0085] The second fitting member 142 is provided at the upper part of the middle portion of each of the pair of first major axis frames 111a, and may be 5 mm to 15 mm higher than the height of the first fitting member 141 so that two containers C facing each other may not come into contact with each other even when the containers C arranged in the longitudinal direction are inclined inward due to a buckling phenomenon caused by a load when the containers C are loaded.

[0086] In the embodiments, the container loading assist device 100 includes the first fitting member 141 and the second fitting member 142, so that both the small containers C and the large containers C may be securely fixed on the upper surface unlike the conventional similar technologies.

[0087] FIG. 16 is a side view showing the state in which the container loading assist device 100 or 100a shown in FIG. 14 or 15 is stowed on a transport vehicle TR. FIG. 17 is a perspective view showing the state in which the container loading assist device 100 or 100a shown in FIG. 14 or 15 is stowed on the container carrier 1.

[0088] Referring to FIGS. 16 and 17, a stowage member 180 may have a structure capable of switching from a first state in which the container loading assist device 100 or 100a is stowed on the transport vehicle TR or on land (corresponding to reference numeral 2 in FIG. 13) to a second state in which the container loading assist device 100 or 100a is stowed on the container carrier 1.

[0089] The stowage member 180 may include stowage legs 181 provided on the outer side in the width direction from the side surface of each of the supports 113, and a third fitting member 182 provided at the lower part of each of

the stowage legs 181 and fastened to the first fitting member 141 provided on the main body 110 which is stowed on the upper part when the main body 110 is stowed in a plurality of tiers.

[0090] When the main body 110 is stowed in a plurality of tiers using the first fitting member 141 and the third fitting member 182, the stowage leg 181 may be configured such that the pair of second fitting members 142 provided in the main body 110 and stowed in the lower part may not contact the lower frame 112 of the main body 110 stowed in the upper part.

[0091] In embodiments, the stowage leg 181 may have a length such that when the container loading assist device 100 is stowed vertically, the lower part of the container loading assist device 100 stowed on the upper part and the upper part of the container loading assistance device 100 stowed in the lower part may not contact. The container loading assist devices 100 may be damaged due to contact friction when shaking occurs due to external environmental factors in a state that the container loading assist devices 100 disposed on the upper and lower parts are in contact with each other.

[0092] The stowage member 180 is a component which connects and/or supports the container loading assist devices 100. The stowage member 180 may have a function to safely store the container loading assist device 100 when the container loading assist device 100 is manufactured or stowed on the land 2, a function to support and connect each of the container loading assist devices 100 stowed vertically when a plurality of container loading assist devices 100 are transported by the transport vehicle TR on the land 2, and a function to support or connects each of the plurality of container loading assist devices 100 even when the plurality of container loading assist devices 100 are stowed and stored in some cells 18 of the container carrier 1.

[0093] The container loading assist device 100 may be guided by the upper cell guide 32 when the container loading assist device 100 is lifted and lowered between neighboring top bridges 20 by the crane CR.

[0094] In addition, the container loading assist device 100 may be stowed and stored between the outer vertical members 21a facing each other in the front-rear direction with respect to the longitudinal direction of the hull 10 on the upper deck 11 on the left or right side of the hull 10 as shown in FIG. 17 during the container unloading operation or before the container loading operation, but the present disclosure is not necessarily limited thereto. For example, the container loading assist device 100 may be placed between the intermediate vertical members 21b facing each other in the front-rear direction, and may also be placed between the two or more vertical members 21 even when the two or more container loading assist devices 100 are connected in parallel. In this manner, by storing and stowing the container loading assist device 100 on the container carrier 1, a separate location for stowage may not be set on land, and the loading and unloading efficiency of the container C may be improved.

[0095] The open-type container loading assist device 100 in which the left and right sides of the main body 110 are sealed by the first and second plates 151 and 152, and the upper, lower, front, and rear sides of the main body 110 are opened has been described. Hereinafter, the closed-type container loading assist device 100a is described.

[0096] As shown in FIGS. 8 to 13 and 15, the closed-type container loading assist device 100a may be similar to the open-type container loading assist device 100 in terms of the overall shape, function, and configuration, but may further include a watertight member 153.

[0097] In the following description relating to the closed-type container loading assist device 100a, the same reference numerals are used for components except for the watertight member 153 which are the same as or similar to those of the open-type container loading assist 100 (parts not shown in FIGS. 8 to 13 and 15 are referred to those shown in FIGS. 3 to 7 and 14). In order to avoid duplication of descriptions, detailed descriptions of each of the same components are omitted. Only the watertight member 153, which is not included in the open-type container loading assist device 100, and different parts due to the existence of the watertight member 153 will be described.

[0098] The watertight member 153 may prevent water (sea water or rainfall) from flowing into the cargo hold 17 when the closed-type container loading assist device 100a is mounted on the upper deck 11 at the entrance of the cargo hold 17 and the containers C are loaded thereon. In embodiments, the watertight member 153 may include a first watertight plate 153a, a second watertight plate 153b, and a third watertight plate 153c.

[0099] The first watertight plate 153a may be installed in a top frame formed by one pair of first major axis frames 111a and one pair of first minor axis frames 111b forming the upper frame 111, and may block water from flowing into the cargo hold 17 through the upper part of the closed-type container loading assist device 100a.

[0100] The second watertight plate 153b may be installed in a front-rear frame formed by the first minor axis frame 111b of the upper frame 111, the support 113, and the protruding member 120, and may block water from flowing into the cargo hold 17 through the front-rear portion of the closed-type container loading assist device 100a. The lower part of the second watertight plate 153b protrudes outwards corresponding to the shape of the protruding member 120 and is thereby disposed on the upper deck 11 of the entrance of the cargo hold 17.

[0101] The third watertight plate 153c may be installed at a predetermined height along the edge of each of the pair of first major axis frames 111a forming the upper frame 111, and may guide water accumulated on the first watertight plate 150a to the second watertight plate 153b forming the side of the closed-type container loading assist device 100a to block the inflow of water into the cargo hold 17.

[0102] In embodiments, the closed-type container loading assist device 100a may be formed such that the width of the top may be larger than the width of the small container C or the large container C, unlike the open-type container loading assist device 100. For example, the third watertight plate 153c may be formed with a width greater than the width of the small container C or the large container C, or with a height less than the first fitting member 141 and the second fitting member 142, so that the small container C or the large container C may not be damaged when the small container C or the large container C is fixed to the first and second fitting members 141 and 142.

[0103] When the closed-type container loading assist device 100a including the watertight member 153 is mounted on the upper deck 11 around the entrance of the cargo hold 17, and water flows down to the side wall of the container C while the containers C are loaded thereon, the water accumulates on the first watertight plate 153a, and the accumulated water overflows to the side surface of the closed-type container loading assist device 100a by the third watertight plate 153c, and does not flow into the cargo hold 17 and may be drained to the upper deck 11 through the second watertight plate 153b.

[0104] The container loading assist device 100 or 100a may be operated in the same manner as the ISO container C, may be operated with the crane CR to maximize loading convenience, may be loaded and transported on land by the transport vehicle TR to promote production and logistics convenience, and may reduce the reference weight of the existing 6Row hatch cover by about 25% (e.g., about 600 tons based on 15K).

[0105] FIGS. 18 to 22 are conceptual views showing various position adjusting members for adjusting the installation position of the container loading assist device 100 or 100a shown in FIG. 14 or FIG. 15.

[0106] Referring to FIGS. 18 to 22, the container carrier 1 may further include a position adjusting member 40 for adjusting the position of the container loading assist device 100 and the number of loading tiers.

[0107] The position adjusting member 40 is disposed in a horizontal direction between neighboring lower cell guides 31 in each of the plurality of cells 18 in the cargo hold 17. At least one position adjusting member 40 may be provided on the traverse bulkhead 16 which partitions the cargo hold 17.

[0108] The position adjusting member 40 may pass through the groove formed in the upper deck 11 and mount the container loading assist device 100 lowered into the cargo hold 17.

[0109] The position adjusting member 40 may include at least one of a fixed stopper 41, a sliding stopper 42, and hinged stoppers 43a, 43b, and 43c.

[0110] Referring to FIG. 18, the position adjusting member 40 may be the fixed stopper 41.

[0111] In each of the plurality of cells 18, a pair of fixed stoppers 41 are arranged in the horizontal direction between neighboring lower cell guides 31, and may be installed on the traverse bulkhead 16 so as to correspond to the protruding member 120 of the container loading assist device 100 and mount the protruding member 120.

[0112] Referring to FIG. 19, the position adjusting member 40 may be the sliding stopper 42.

[0113] A pair of sliding stoppers 42 may be installed in each of the plurality of cells 18 so as to be movable along rails 42a installed horizontally in the transverse bulkhead 16 between neighboring lower cell guides 31.

[0114] The sliding stopper 42 may be moved left and right when the container loading assist device 100 is lifted and lowered so that the protruding member 120 may be mounted thereon (shown by a solid line in the drawing), or may be moved in the middle so that the protruding member 120 may not interferer (shown by a dotted line in the drawing).

[0115] Referring to FIGS. 20 to 22, the position adjusting member 40 may be the hinged stoppers 43a, 43b, and 43c which rotate in various ways.

[0116] A pair of hinged stoppers 43a, 43b, and 43c are arranged horizontally between adjacent lower cell guides 31 in each of the plurality of cells 18, and the pair may be rotatably installed on the traverse bulkhead 16 near the position at which the protruding member 120 passes.

[0117] The hinged stoppers 43a, 43b, and 43c may be rotated in one direction (shown by a solid line in the drawing) when the container loading assist device 100 is lifted and lowered so that the protruding member 120 is mounted thereon, or may be rotated in another direction so that the protruding member 120 may not interfere (shown by a dotted line in the drawing).

[0118] FIG. 22A is a side view of the hinged stopper 43c showing the state of rotation. FIG. 22B is a plan view of the hinged stopper 43c and shows a state that the hinged stopper 43c is rotated so that the protruding member 120 may pass. FIG. 22C is a plan view of the hinged stopper 43c and shows a state in which the protruding member 120 is rotated so that the protruding member 120 may pass.

[0119] As described above, the position adjusting member 40 may include various types of stoppers such as the fixed stopper 41, the sliding stopper 42, and the hinged stoppers 43a, 43b, and 43c, and these various stoppers may be used in parallel.

[0120] For example, when the fixed stopper 41 is installed at an arbitrary position of the traverse bulkhead 16, the sliding stopper 42 or the hinge stoppers 43a, 43b, and 43c may be installed at least one or more position on the horizontal partition wall 14 above or below the fixed stopper 41, so that at least two container loading assist devices 100 may be installed on each of the plurality of cells 18 in the cargo hold 17.

[0121] In another example, when the fixed stopper 41 is not installed at an arbitrary position of the transverse

bulkhead 16, the sliding stopper 42 or the hinged stoppers 43a, 43b, and 43c may be installed at least one or more position on the transverse bulkhead 16, so that at least one container loading assist device 100 may be installed on each of the plurality of cells 18 in the cargo hold 17.

[0122] In embodiments, the container carrier 1 may include the lower cell guides 31 which are installed at regular intervals on the side of the transverse bulkhead 16 in the cargo hold 17, and the upper cell guides 32 which are installed in top bridges 20, 20-1, 20a, and 20b vertically corresponding thereto and connected to the lower cell guides 32. Loading the containers C continuously from the bottom of the cargo hold 17 to the top of the upper deck 11 may be similar to the open-top conventional small container carrier. However, the container carrier 1 according to the embodiments may load the containers C in a large quantity of 13 tiers or more, including the amount loaded from the bottom of the cargo hold 17 to the top of the upper deck 11 top by the container loading assist device 100 or 100a disposed at the center of the lower cell guide 31 and the upper cell guide 32, the top bridges 20, 20-1, 20a, and 20b installed on the upper deck 11, and the upper cell guide 32.

[0123] In the container carrier 1 according to the embodiments, the existing lashing system applied to the existing lashing bridge is omitted, and the cell guide system in which the upper cell guide 32 is provided in the top bridge 20 is applied. Hereinafter, , the loading stability between the containers C in the cell guide system according to the embodiments and the existing lasher system will be compared and described with reference to FIGS. 23 and 24.

[0124] FIGS. 23 and 24 are diagrams for comparing and explaining the loading stability of containers between a cell guide system according to an embodiment and an existing lashing system.

[0125] FIG. 23A shows a load acting on a socket foundation part during internal lashing in the existing lashing system applied to the existing lashing bridge, and shows that the compressive load due to self-weight and the transverse load due to the movement of the hull act as additional compressive loads on the socket foundation part as moment components.

[0126] FIG. 23B shows a load acting on the socket foundation part during external lashing in the existing lashing system applied to the existing lashing bridge, and shows that the compressive load due to self-weight and the transverse load due to the movement of the hull act as additional compressive loads on the socket foundation part as moment components, but the load is relatively reduced compared to the internal lashing.

[0127] FIG. 23C shows that in the existing lashing system applied to the existing lashing bridge, as shown in FIGS. 23A and 23B, the excessive hull motion load acts as an incomplete element on the hatch cover and the lashing system, resulting in hatch cover movement and relative displacement of the deck stool, the hatch cover, and the hull, thereby causing damage to the socket foundation part, which is the main cause of container collapse and loss.

[0128] FIG. 24 shows the load acting on the first and second fitting members 141 and 142 as the socket foundation of the container loading assist device 100 or 100a when applying the cell guide system and the container loading assist device 100 or 100a according to the embodiments in which the upper cell guide 32 is arranged in the top bridge 20. The compressive load due to self-weight and the transverse load due to the movement of the hull are absorbed by the upper cell guides 32, so that no additional compressive force is generated. A margin equal to the general structural strength of the hull 10 against the load due to the motion of the hull 10 may be ensured. The influence of the relative displacement of the hull 10 is insignificant. Damage to the loading container C due to load shifting and a domino collapse phenomenon of the containers C due to the collapse of the lashing system may be fundamentally blocked.

[0129] In the container carrier 1 according to the embodiment, the existing lashing system applied to the existing lashing bridge is omitted, and a cell guide system in which the upper cell guide 32 is provided in the top bridge 20 is applied. Hereinafter, referring to FIGS. 25 to 27, the loading stability of the containers C between the cell guide system according to the embodiments and the existing lashing system is compared, whereby the present invention is differentiated from the existing ones.

[0130] FIGS. 25 to 27 are tables for comparing and explaining the loading stability of containers between a cell guide system according to an embodiment and an existing lashing system.

[0131] FIG. 25 is a table obtained by calculating racking force, corner post force, and twistlock force when containers are loaded in 12 tiers on the upper hatch cover of the upper deck of the hull and the containers are lashed in three tiers using the lashing system in the existing lashing system applied to the existing lashing bridge.

[0132] The racking force is the force which the loaded containers C receive in an oblique direction under the influence of hull rolling, the corner post force is the force exerted vertically on four corner posts of the loaded container, and the twistlock force is the force applied to a twistlock connecting the container by the movement of the hull.

[0133] FIG. 26 is a table obtained by calculating racking force, corner post force, and twistlock force in a cell guide system according to embodiments in which the upper cell guide 32 is disposed in the top bridge 20, when the containers C are loaded in 12 tiers on top of the container loading assist device 100 and the cell guide system is applied up to four tiers based on the container loading assist device 100.

[0134] FIG. 27 is a table of results of analysis of the racking force, the corner post force, and the twistlock force in the existing lashing system and the cell guide system according to embodiments, based on the tables in FIGS. 25 and 26.

[0135] As shown in FIG. 27, as a result of analyzing the corner post force at the maximum motion acceleration when the loaded container C moves left and right during the rolling motion of the container carrier, compared to the allowable value of 848 kN, it is found that the corner post force of 927.5 kN at the bottom of the loaded container on the top of the hatch cover exceeded the allowable value in the existing lashing system (container three-tier lashing bridge), which may lead to a container collapse accident. On the other hand, in the cell guide system according to embodiments (a structure which supports up to the four-tier containers C loaded on the top of the container loading assist device 100 or 100a with a cell guide), the cell guide absorbs the motion acceleration up to the four tiers of the loaded containers, and the maximum value of 805.7 kN is less than the allowable value. Therefore, there is no risk of a container collapse.

[0136] In addition, although not shown in the drawing, under the same condition that the containers C are loaded in 12 tiers and small containers (20 ft container) are loaded from one to 10 tiers, in the existing lashing system, there is no lashing when the 20 ft containers are loaded on the top of the hatch cover (when only one side is lashed, a worse condition occurs compared to non-lashing), but in the cell guide system according to the embodiments (a structure which supports the containers C in up to five tiers by a cell guide), the cell guide supports the containers C. Therefore, the load transfer is possible in a purely transverse direction (the same load transfer as in the cargo hold), unlike the existing lashing system. As a result, the twistlock allowable load (Min. breaking 500kN (per person) and 420kN (shear)), a design safety factor in the embodiments was increased by about 8 times greater than an existing design safety factor. In other words, when the cell guide system according to the embodiments is applied, it is expected to secure superior stability compared to the existing lashing system under the condition of 20ft containers loaded in rough sea navigation.

[0137] FIG. 28 is a perspective view showing a container loading and unloading method using a container loading assist device in a container carrier according to an embodiment. FIG. 29 is a flowchart illustrating a container loading and unloading method using a container loading assist device in a container carrier according to an embodiment. FIG. 30 is another flowchart illustrating a container loading and unloading method using a container loading assist device in a container carrier according to an embodiment.

[0138] Referring to FIGS. 28 and 29, an embodiment of a container loading and unloading method using the container loading assist device 100 or 100a in the container carrier 1 will be described.

[0139] In embodiments, the container loading assist device 100 or 100a used in the container unloading method may include the upper frame 111 and the lower frame 112 having a width and a length 1 to n times (n is a natural number) the width and the length of the container C and having a flat cross-section smaller than the entrance of the cargo hold 17, the support 113 disposed in a height direction with respect to the upper frame 111 and the lower frame 111, the protruding member 120 protruding outward from the upper frame 111, the lower frame 112, or the support 113 so as to be mounted at an arbitrary position of the cargo hold 17, and a coupling member 170 connecting two or more upper and lower frames 111 and 112 disposed adjacent to each other so that the container loading assist device 100 or 100a may be applied to at least one cargo hold 17 of the container carrier 1 which loads the containers C and load the containers C on the upper part.

[0140] The method of unloading the containers C from the container carrier 1 including the container loading assist device 100 or 100a will be described in detail.

[0141] First, the operation of loading the containers C on the land 2 onto the container carrier 1 using the crane CR will be described.

[0142] An operation of loading the containers C in the cargo hold 17 by using the crane CR may be performed to complete the loading of the containers C inside of the cargo hold 17 at step S11.

[0143] The container loading assist devices 100 or 100a may be connected in parallel using the coupling member 170 at step S12.

[0144] In embodiments, it is desirable to connect an odd number of container loading assist devices 100 or 100a connected in parallel for center of gravity when transporting the container loading assist devices 100 or 100a by the crane CR. For example, when the container loading assist devices 100 or 100a are transported using a spreader SR attached to the crane CR, the spreader SR is connected to intermediate container loading assist devices 100 or 100a among the container loading assist devices 100 or 100a connected in parallel. Therefore, the center of gravity may be easily adjusted during transport only when an odd number of container loading assist devices 100 or 100a are connected in parallel.

[0145] By using the crane CR, the container loading assist devices 100 or 100a connected in parallel may be transported at step S13.

[0146] The container loading assist device 100 or 100a may be mounted at an arbitrary position of the cargo hold 17 by using the crane CR at step S14.

[0147] At step S14, the container loading assist devices 100 or 100a while stored on the land 2 may be transported to the cargo hold 17 of the container carrier 1 using the crane CR.

[0148] The containers C may be loaded on top of the container loading assist device 100 or 100a by using the crane CR to complete the loading of the containers C on top of the container loading assist device 100 or 100a at step S15.

[0149] Hereinafter, the work of loading and unloading the containers C of the container carrier 1 onto the land 2 using the crane CR will be described.

[0150] The work of unloading he containers C loaded on the container loading assist device 100 or 100a using the crane CR is performed at step S16.

[0151] An operation of removing the container loading assist devices 100 or 100a from the entrance of the cargo hold 17 by using the crane CR may be performed to open the entrance of the cargo hold 17 at step S17.

[0152] At step S17, the container loading assist devices 100 or 100a connected in parallel may be transported to an arbitrary location on the upper deck 11, stowed and stored on the upper deck 11, and may be transported to the land 2, and stowed and stored on the land 2.

[0153] The work of unloading the containers C loaded in the cargo hold 17 may be performed by using the crane CR at step S18.

[0154] In the embodiments, the container carrier 1 includes the hull 10 including the upper deck 11, the side plating 12, and the bottom plating 13 forming the exterior, the cargo hold 17 partitioned by the traverse bulkhead 16 in the hull 11, the lower cell guides 31 provided at regular intervals on the side surface of the vertical partition wall 16, the top bridges 20 extending to the left and right edges of the upper deck 10 between the cargo holds 17 and arranged in a plurality of rows in the longitudinal direction of the hull 10, and the upper cell guides 32 connected to the lower cell guides 31, respectively, and provided on both sides of the top bridge 20. While the container loading assist devices 100 and 100a are connected in parallel using the coupling member 170 at step S12, the upper cell guides 32 may be inserted into the gap between the container loading assist devices 100 or 100a connected in parallel to guide the lifting and lowering when the container loading assist devices 100 and 100a are mounted on the upper deck 11 at the entrance of the cargo hold 17 using the crane CR at step S14 or removed from the entrance of the cargo hold 17 at step S17.

[0155] Referring to FIGS. 28 and 30, another method of loading and unloading containers using the container loading assist device 100 or 100a in the container carrier 1 according to an embodiment will be described.

[0156] In embodiments, the container loading assist device 100 or 100a used in the container unloading and unloading method may include the upper frame 111 and the lower frame 112 having a width and length 1 to n times (n is a natural number) the width and length of the containers C and having a flat cross section smaller than the entrance of the cargo hold 17, the support 113 disposed in the height direction of the upper frame 111 and the lower frame 112, and the protruding member 120 protruding outward from the upper frame 111, the lower frame 112, or the support 113 so as to be mounted on the entrance to the cargo hold 17 so that the container loading assist device 100 or 100a may be applied to at least one cargo hold 17 of the container carrier 1 which loads the containers C and load the containers C on the upper part.

[0157] Hereinafter, a method of loading and unloading containers from the container carrier 1 including the container loading assist devices 100 or 100a will be described in detail.

[0158] First, the operation of loading the containers C on the land 2 onto the container carrier 1 using the crane CR will be described.

[0159] An operation of loading the containers C in the cargo hold 17 by using the crane CR may be performed to complete the loading of the containers C inside of the cargo hold 17 at step S21.

[0160] The crane CR may be used to mount the container loading assist devices 100 or 100a at an arbitrary position on the cargo hold 17 at step S22.

[0161] At step S22, the container loading assist devices 100 or 100a are transported to the cargo hold 17 of the container carrier 1 by using the crane CR while being stored on the land 2, or may be transported to the cargo hold 17 of the container carrier 1 by means of the crane CR while being kept at an arbitrary location on the upper deck 11 of the container carrier 1.

[0162] The containers C may be loaded onto the container loading assist devices 100 or 100a by using the crane CR to complete the loading of the containers C on the container loading assist device 100 or 100a at step S23.

[0163] Hereinafter, the work of unloading the containers C of the container carrier 1 onto the land 2 using the crane CR will be described.

[0164] The work of unloading the containers C loaded on the upper part of the container loading assist device 100 or 100a is performed using the crane CR at step S24.

[0165] An operation of removing the container loading assist devices 100 or 100a from the entrance of the cargo hold 17 by using the crane CR is performed, and the container loading assist devices 100 or 100a being removed may be lowered to the land 2 or transported to an arbitrary location on the upper deck 11 to open the entrance of the cargo hold 17 at step S25.

[0166] At step S25, the container loading assist devices 100 or 100a may be transported to an arbitrary location on the upper deck 11, and stowed and stored on the upper deck 11, and transported to the land 2 and stowed and stored on the land 2.

[0167] The work of unloading the containers C loaded in the cargo hold 17 may be performed by using the crane CR

at step S26.

[0168] In the embodiments, the container carrier 1 includes the hull 10 including the upper deck 11, the side plating 12, and the bottom plating 13 forming the exterior, the cargo hold 17 partitioned by the traverse bulkhead 16 in the hull 11, the lower cell guides 31 provided at regular intervals on the side surface of the vertical partition wall 16, the top bridges 20 extending to the left and right edges of the upper deck 10 between the cargo holds 17 and arranged in a plurality of rows in the longitudinal direction of the hull 10, and the upper cell guides 32 connected to the lower cell guides 31, respectively, and provided on both sides of the top bridge 20. At step S25 in which the entrance of the cargo hold 17 is opened, the container loading assist devices 100 and 100a may be stowed and stored between the top bridges 20 facing each other in the front-rear direction on the upper deck 11, or stowed and stored on the land 2.

[0169] According to the above structure, the top bridges 20, 20-1, 20a, and 20b in which the upper cell guide 32 is installed are provided, so that the containers C may be supported and fixed by the upper cell guides 32, and the existing lashing system (a fastening device such as a lashing rod and a lashing bar) may be omitted, which not only reduces the material cost but also reduces the time and cost required for the lashing operation. In addition, the loaded containers C may be proved from being damaged or lost by directly supporting the containers C on top of the upper deck 11 during the operation of the container carrier 1. Further, the upper cell guides 32 provided on the top bridges 20, 20-1, 20a, and 20b and the lower cell guides 31 provided on the traverse bulkhead 16 are connected to each other, so that continuous loading or unloading work is possible without additional work such as mounting a hatch cover or lashing work when the container C is loaded and unloaded.

[0170] Further, according to the embodiments, by configuring the container loading assist device 100 or 100a to be mountable at the entrance of the cargo hold 17 of the container carrier 1, it is possible not only to contribute to the longitudinal strength of the hull 10 while being mounted at the entrance to the cargo hold 17, but also to transmit the loading load of the containers C loaded on the upper deck 11 to the hull 11, so that a large amount of the containers C may be loaded in 13 tiers or more, including the amount loaded on the upper part of the upper deck 11 from the bottom of the cargo hold 17.

[0171] In addition, in the present embodiment, by configuring the container loading assist devices 100 or 100a so as to be stowed on their own when one or more container loading assist devices may be transported by the crane CR, handling may be easier for mounting at the entrance of the cargo hold 17 of the container carrier 1, the container loading assist devices 100 or 100a may be conveniently stored in the container carrier 1 or on the land 2, and the container loading assist devices 100 or 100a may be easily transported by the transport vehicle TR on the land 2.

[0172] In addition, according to embodiments, since the container loading assist device 100 or 100a includes all or part of the reinforcing frame 130, the first plate 151, and the second plate 152, and the reinforcing frame 160, so that the container loading assist device 100 or 100a may ensure rigidity for supporting the load of the containers C loaded on the top.

[0173] In addition, according to the embodiments, the first and second fitting members 141 and 142 corresponding to the corner casting of the container C are disposed on the upper surface of the container loading assist device 100 or 100a, so that not only the container C loaded on the upper surface thereof may be securely fixed, but also the small containers C of 20 ft and the large containers C of 40 ft may be stowed together.

[0174] In addition, according to the embodiments, instead of omitting the lashing bridge, the top bridges 20, 20-1, 20a, and 20b are configured as a cell guide system in which the upper cell guide 32 and the lower cell guide 31 installed on the traverse bulkhead 16 are respectively connected. Thus, the width may be reduced compared to the existing lashing bridge, and the complex structure in which the existing lashing bridge is installed may be formed into a simple structure. In addition, the width of the upper deck 11 between the cargo holds 17 may be reduced compared to the existing container carrier in which the existing lashing bridge is installed, so that the design flexibility (such as the hull length; optimization made possible by the absence of the lashing system) of the container carrier 1 compared to the same specifications may be ensured, or the loading capacity of the containers C may be increased.

[0175] In addition, according to the embodiments, by providing the position adjusting member 40 for adjusting the position of the container loading assist device 100 or 100a, one or more container loading assist devices 100 may be installed at an arbitrary position in the cargo hold 17, thereby increasing the flexibility of loading the container C.

[0176] FIG. 31 is a perspective view illustrating an embodiment of a container carrier and a support member, an entry guide, and a reinforcement member provided therein. FIG. 32 is a perspective view showing the support member of FIG. 31. FIGS. 33 to 35 are perspective and side views showing the entry guide and the reinforcement of FIG. 31.

[0177] As shown in FIGS. 31 to 35, the container carrier 1 according to an embodiment may further include support members 200, an entry guide 300, and a reinforcement member 400.

[0178] The support member are disposed at both ends of the plurality of top bridges 20 with respect to the width direction of the hull 10, and may connect one of the plurality of top bridges 20 adjacent to each other in the longitudinal direction to another bottom bridge 20 to thereby reinforce the structure and reduce vibrations of the hull 10.

[0179] The top bridge 20 may include the plurality of vertical members 21 and the plurality of horizontal members 22. The plurality of vertical members 21 may include the outer vertical members 21a arranged in pairs of two on the upper

deck 11 on the left and right sides with respect to the width direction of the hull 10, and the plurality of intermediate vertical members 21b arranged at regular intervals between the outer vertical members 21a.

[0180] One pair of support members 200 may connect the outer side of the outer vertical member 21a between an upper horizontal member 22a and an intermediate horizontal member 22b adjacent thereto among the plurality of horizontal members 22.

[0181] Referring to FIG. 32, each of the support members 200 may include a first support member 210, a second support member 220, a third support member 230, and a fourth support member 240. Hereinafter, each of the support members 200 is described as including the first to fourth support members 210 to 240, but the present disclosure is not necessarily limited thereto. For example, the first to fourth support members 210 to 240 may be integrally formed, or the first and third support members 210 and 230 and the second and fourth support members 220 and 240 may be respectively integrally formed.

[0182] Each of the first to fourth support members 210 to 240 may have a 'U' shape in which one side surface is opened and the other side surface is closed. Although each of the first to fourth support members 210 to 240 is illustrated as having a 'U' shape in the drawing, each support member have various shapes.

[0183] The first support member 210 may be connected to another side surface opposite to the opened side surface of the outer vertical member 21a of one of the pair of top bridges 20 spaced apart from each other in the front-rear direction.

[0184] The second support member 220 may be connected to another side surface opposite to the opened side surface of the outer vertical member 21a of the other top bridge of the pair of top bridges 20 spaced apart from each other in the front-rear direction.

[0185] The third and fourth support members 230 and 240 may be disposed between the first support member 210 and the second support member 220.

[0186] The third and fourth support members 230 and 240 may be coupled between the first support member 210 and the second support member 220 by connecting another side surface opposite to the opened side surface of the third support member 230 and the another side surface opposite to the opened side surface of the fourth support member 240.

[0187] The opened side surface of the third support member 230 may be connected to the opened side surface of the first support member 210. In this manner, one support member 200 having a hollow may be configured by coupling the first support member 210 and the third support member 230.

[0188] The opened side surface of the fourth support member 240 may be connected to the opened side surface of the second support member 220. In this manner, another support member 200 having a hollow may be configured by coupling the second support member 220 and the fourth support member 240.

[0189] The entry guide 300 may be disposed on top of each of the plurality of upper cell guides 32 to guide the containers C when the container C are loaded.

[0190] Referring to FIGS. 33 to 35, the entry guide 300 may include a first entry guide member 310 which guides a front surface or a rear surface of the container C, and a second entry guide member 320 which guides one side surface of the container C.

[0191] The first entry guide member 310 may be connected to the upper end of the upper cell guide 32, and may extend to be inclined upward at an angle so as to guide the front surface or the rear surface of the container C.

[0192] The first entry guide member 310 may have a rectangular shape having the same lower and upper width.

[0193] The second entry guide member 320 may be connected to an upper end of the upper cell guide 32 and extend upward. The second entry guide member 320 may have a trapezoidal shape in which one side is connected to the first entry guide member 310 and the width thereof extends in the left-right direction toward the upper end.

[0194] The second entry guide member 320 may include a first guide member 320a having a first height and a second guide member 320b having a second height greater than the first height.

[0195] The first and second guide members 320a and 320b may include inclined surfaces 321a and 321b whose upper ends are inclined at an angle so as to guide one surface of each container C.

[0196] The inclined surface 321a of the first guide member 320a and the inclined surface 321b of the second guide member 320b may have the same width and length. As described above, since the first and second guide members 320a and 320b have different heights and the inclined surfaces 321a and 321b have the same length, the widths thereof may expand at different ratios in the left-right direction toward the upper end.

[0197] As described above, the length of the inclined surface 321a of the first guide member 320a may be the same as the length of the inclination surface 321b of the second guide member 320b. However, the present invention is not necessarily limited thereto. For example, the widths of the first and second guide members 320a and 320b may expand at the same ratio in the left-right direction toward the upper end. Thus, the length of the inclined surface 321a of the first guide member 320a having the first height may be smaller than the length of the inclination surface 321b of the second guide member 320b having the second height.

[0198] The entry guide 300 having the first guide member 320a of the first height and the entry guide 300 having the

second guide member 320b of the second height may be alternately disposed on top of each of the plurality of upper cell guides 32, but the present disclosure is not necessarily limited thereto.

[0199] The reinforcement member 400 may support the upper cell guide 32.

[0200] The top bridge 20 may include a combination of the plurality of vertical members 21 and the plurality of horizontal members 22. The plurality of horizontal members 22 may include the upper horizontal member 22a forming an uppermost portion of the top bridge 20, and a plurality of intermediate horizontal members 22b arranged at regular intervals between the upper horizontal members 22a and the upper deck 11.

[0201] The upper cell guide 32 may be disposed on the upper end of the upper horizontal member 22a.

[0202] According to this structure, the reinforcement member 400 may support a portion of the upper cell guide 32 which extends above the upper horizontal member 22a of the top bridge 20 and/or the entry guide 300 which is disposed on top of the upper cell guide 32.

[0203] This reinforcement member 400 may protrude from the back of the upper cell guide 32 in the central direction of the top bridge 20 and may include first to fourth reinforcement members 410 to 440.

[0204] The first reinforcement member 410 may have a bottom surface connected to the upper horizontal member 22a on the rear surface of the upper cell guide 32 which extends above the horizontal member 22a on top of the top bridge 20, and may extend to the upper end of the upper cell guide 32.

[0205] One side of the second reinforcement member 420 may be vertically connected to the first reinforcement member 410, and a lower surface thereof may be fixed on the upper horizontal member 22a. The second reinforcement member 420 may protrude in the central direction of the top bridge 20.

[0206] A lower surface of the third reinforcement member 430 may be connected to an upper surface of the second reinforcement member 420, and an upper surface thereof may be connected to one flat side surface of the first entry guide member 310.

[0207] A lower surface of the fourth reinforcement member 440 may be connected to an upper surface of the first reinforcement member 410, and an upper surface thereof may be connected to one flat side surface of the first entry guide member 310.

[0208] In embodiments, the first and second reinforcement members 410 and 420 may support the upper cell guide 32, and the third and fourth reinforcement members 430 and 440 may support the entry guide 300.

[0209] Referring to FIG. 31, the upper cell guides 32 are installed before and after each of the plurality of top bridges 20 with respect to the longitudinal direction of the hull 10, and may be arranged next to each other in the width direction of the hull 10.

[0210] The upper cell guide 32 may guide the lifting and lowering of the containers C transported to the crane CR, and may also support and secure the containers C loaded on the upper deck 11.

[0211] As the height of the top bridge 20 increases, the upper cell guide 32 may be more vulnerable to the impact from the outside and the structural strength thereof may be more weakened, in particular, toward the top. As a result, when the upper part of the upper cell guide 32 is damaged, the containers C may be detached. Accordingly, the container carrier 1 according to embodiments may further include protection bar 500a, 500b, or 500c to protect the hull 10 from impacts on the upper cell guide 32 and reinforce structural strength. The protection bar 500a, 500b, or 500c may have various shapes, which will be described below with reference to FIGS. 36 to 38.

[0212] FIG. 36 is a plan cross-sectional view and a side view showing an embodiment of a protection bar installed on a container carrier. FIG. 37 is a plan cross-sectional view and a side view showing another embodiment of the protection bar shown in FIG. 36. FIG. 38 is a plan cross-sectional view and a side view showing another embodiment of the protection bar shown in FIG. 36.

[0213] As shown in FIGS. 36A to 38A and 36B to 38B, a portion of the protection bar 500a, 500b, or 500c may be fixed between one pair of upper cell guides 32 facing each other on one side, and the other portion may protrude outward of the pair of upper cell guides 32 by a predetermined length.

[0214] The protection bar 500a, 500b, or 500c may have a predetermined length and width at the lower portion of the entry guide 300, which is relatively vulnerable to external impact and has weak structural strength over the entire length of the upper cell guide 32, i.e., at the upper portion of the upper cell guide 32.

[0215] The protection bars 500a, 500b, and 500c may include spacer portions 510a, 510b, and 510c which are disposed between a pair of upper cell guides 32 adjacent to each other to support and fix the pair of upper cell guides 32 apart, and detachment preventing portions 520a, 520b, and 520c which extend a predetermined length outward of the pair of upper cell guides 32 from the spacer portions 510a, 510b, and 510c, respectively, to prevent the containers C from being detached.

[0216] The spacer portions 510a, 510b, and 510c may secure the pair of upper cell guides 32 adjacent to each other.

[0217] The detachment preventing portions 520a, 520b, and 520c protrude to the outside of the upper cell guides 32 and serve to hold the container C when the container C deviates from the upper cell guide 32 due to the deformation of the hull, thereby preventing the container C from being detached from the upper cells guide 32.

[0218] The spacer portions 510a, 510b, and 510c and the detachment preventing portions 520a, 520b, and 520c may have various configurations.

[0219] Referring to FIG. 36, the protection bar 500a may include the spacer portion 510a and the detachment preventing portion 520a which are integrally formed with each other.

[0220] When the protection bar 500a is of an integral type, the spacer portion 510a may be positioned between a pair of upper cell guides 32 adjacent to each other, and the detachment preventing portion 520a may protrude outward from the pair of upper cell guides 32 adjacent to one another.

[0221] The spacer portion 510a may have a thickness corresponding to a spacing between the pair of upper cell guides 32 adjacent to each other, may have a length of 45 mm to 65 mm inward from an end of the pair of upper cell guides 32, and may have a length from an upper end to a lower end of 1.4 m to 1.6 m. For example, the spacer portion 510a may have a shape of a rectangular hexahedron. However, the above numerical values are merely examples and the present invention is not necessarily limited thereto, and numerical values to be mentioned below are also not limited.

[0222] The detachment preventing portion 520a has the same thickness as the spacer portion 510a, has a length of 30 mm to 50 mm outward from the end of the pair of upper cell guides 32, and may have a length of 0.9 m to 1.1 m from the top to the bottom. An upper end of the detachment preventing portion 520a may coincide with an upper end of the spacer portion 510a. For example, the detachment preventing portion 520a may have a shape of a rectangular hexahedron with a length smaller than that of the rectangular hexahedron of the spacer portion 510a with the upper end thereof coincident with the upper end of the spacer portion 510a.

[0223] In addition, the detachment preventing portion 520a may have a wedge-shaped end, and the length between the upper end and the lower end may decrease toward the outside.

[0224] Referring to FIG. 37, the protection bar 500b may include the spacer portion 510b and the detachment preventing portion 520b which are separated from each other.

[0225] When the protection bar 500b is of a separable type, the spacer portion 510a is disposed between a pair of upper cell guides 32 adjacent to each other, and is located within a certain distance from an end of the pair of upper cell guides 32, and the detachment preventing portion 520b protrudes outward from the pair of upper cell guides 32, and a portion thereof may be disposed between the pair of upper cell guides 32.

[0226] The spacer portion 510a may have a thickness corresponding to a distance between the pair of upper cell guides 32 adjacent to each other, have a length of 25 mm to 45 mm from one end to the other end, and have a length of 1.4 m to 1.6 m from the top to the bottom. For example, when the spacer portion 510a is positioned between the pair of upper cell guides 32, the spacer portion 510a is positioned within a certain distance from an end of the pair of upper cell guides 32, and may have a shape of a rectangular hexahedron.

[0227] The detachment preventing portion 520b has the same thickness as the spacer portion 510a and has a length of 50 mm to 70 mm from one end to the other end. A portion of the detachment preventing portion 520b disposed between the pair of upper cell guides 32 adjacent to each other is 1/3 of the total length, and a portion of the detachment preventing portion 520b protruding outward from the pair of upper cell guides 32 is 2/3 of the total length and has a length of 0.9 m to 1.1 m from the top to the bottom. The upper end of the detachment preventing portion 520b may coincide with the upper end of the spacer portion 510a. For example, the detachment preventing portion 520b projects outwardly from the pair of upper cell guides 32, a portion of the detachment preventing portion 520b is located between the pair of upper cell guides 32, and the detachment preventing portion 520b has a shape of a rectangular hexahedron with a length less than that of the rectangular hexahedron of the spacer portion 510a with an upper end thereof coincident with the upper end of the spacer portion 510a.

[0228] In addition, the detachment preventing portion 520b may have a wedge-shaped end. While the length of the detachment preventing portion 520b between the top and the bottom may be constant between the pair of upper cell guides 32, the length thereof outside the pair of upper cell guides 32 may decrease toward the outer side. A part of the detachment preventing portion 520b according to an embodiment is positioned between the pair of upper cell guides 32 in order to increase the fixing force because the detachment preventing portion is formed separately from the spacer portion 510a unlike the above-described integral type protection bar 500a.

[0229] Referring to FIG. 38, the spacer portion 510c and the detachment preventing portion 520c of the protection bar 500c according to an embodiment may overlap each other.

[0230] When the protection bar 500c is of an overlapping type, one pair of spacer portions 510c may be arranged between one pair of upper cell guides 32 adjacent to each other. The pair of the spacer portions 510c may be spaced apart from each other by a predetermined distance to be in close contact with surfaces of the pair of upper cell guides 32, respectively. The detachment preventing portion 520c may protrude outward from the pair of upper cell guides 32, and a portion of the detachment preventing portion 520c may be positioned and fixed between the pair of spacer portions 510C.

[0231] Each of the pair of spacer portions 510c may have a thickness corresponding to 1/3 to 1/4 of the spacing between the pair of upper cell guides 32, have a length of 45 mm to 65 mm inward from the end of the pair of upper

cell guides 32, and have a length of 1.4 m to 1.6 m from the top to the bottom. For example, when the pair of spacer portions 510c are between the pair of upper cell guides 32, the pair of spacers portions 510c may each be spaced apart from each other by a predetermined distance so as to be in close contact with the surfaces of the pair of upper cell guides 32, respectively, and may have a shape of a rectangular hexahedron.

[0232] Further, each of the pair of spacer portions 510c may extend a length outward from an end of the pair of upper cell guides 32, and the extended portion of each spacer portion 510c may be chamfer-shaped.

[0233] The detachment preventing portion 520c may have a thickness corresponding to the spacing between the pair of spacer portions 510c, and may have a length of 85 mm to 105 mm from one end to the other end. The detachment preventing portion 520c may have a length of 45 mm to 65 mm inwardly from the end of the pair of upper cell guides 32, a length of 30 mm to 50 mm outwardly from the end of the pair of upper cell guides 32, and a length of 0.9 m to 1.1 m from the top to the bottom. The one end and the upper end of the detachment preventing portion 520c may coincide with the one end and the upper end of the pair of spacer portions 510c. For example, the detachment preventing portion 520c projects outwardly from the pair of upper cell guides 32, a portion of the detachment preventing portion 520c is located between the pair of spacer portions 510c, and the detachment preventing portion 520c has a shape of a rectangular hexahedron with a smaller length and a greater with than the rectangular hexahedron of the pair of spacer portions 510c with the one end and the upper end thereof coincident with the one end and the upper end of the pair of spacer portions 510a, and with the other end thereof extending outwards than the other end of the pair of spacer portions 510c.

[0234] Further, the detachment preventing portion 520c may have a rounded end, and may be formed such that a length thereof between an upper end and a lower end may be constant between the pair of upper cell guides 32 and the length thereof outside the pair of upper cell guides 32 may decrease toward the outer side.

[0235] FIG. 39 is a side view illustrating an embodiment of the upper cell guides 32.

[0236] Referring to FIG. 39, the upper cell guides 32 installed on the container carrier 1 according to an embodiment may be installed on both sides of the top bridge 20. However, as described above, the top bridge 20 is not a lashing bridge to which an existing lashing system is applied, but a cell guide system to which the upper cell guide 32 is applied, and the top bridge 20 may be weaker in terms of strength than the existing lashing systems.

[0237] In terms of supporting and fixing the containers C in a plurality of tiers by the upper cell guides 32 installed on the top bridge 20, when the containers C are shaken by the movements of the hull 10 and eventually tilt to one side to excessively load the upper cell guide 32 and/or the top bridge 20 in the lateral direction, the upper cell guide 32 and/or the top bridge 20 may be damaged, and in severe cases, the containers C may overturn. Accordingly, embodiments may provide a method of minimizing the shaking of the top bridge 20.

[0238] In the case of the upper cell guide 32 in which the small containers C or the large containers C are loaded in a 5-tier level, the containers C in lower layers (e.g., one to third tier levels) are closer to the upper deck 11, so there is little shaking, but the containers C in higher layers (e. g., the four and five tier levels) may be relatively shaken. Thus, by installing twist locks TL on the containers C loaded in the higher layer, stability may be ensured.

[0239] In the drawing, it is shows that the twist lock TL is installed in the containers C loaded in the higher layers in the four and five tier levels in order to reduce the number of installations, the present invention is not necessarily limited thereto. For example, if necessary, the twist locks TL may also be installed in the containers C which are loaded in the one to three tiers.

[0240] Since the twist locks TL are installed in the corner fittings of the lower container C and the corner fitting of the upper container C, it is not easy to check whether the twist locks TL are installed or not and to check for installation errors. Therefore, if there is no installation standard of the twist locks TL, the installation of the twist locks TL may be omitted in the containers C of the same level where the twist locks TL are to be installed, or the twist locks TL may be installed in the containers C on the lower layer where the installation of the twist locks TL is not necessary, which not only causes confusion in the installation work of the twist lock TL, but also leads to a serious accident when the containers C are unloaded without removing the twist locks TL.

[0241] To address this, a twistlock zone TW which is easily visible to the naked eye may be formed at the top bridge 20 or the upper cell guide 32. The twistlock zone TW may be marked so as to fasten the upper and lower containers C, which are loaded in the higher layer, to each other with the twist locks TL, among the containers C loaded in a plurality of layers.

[0242] The twistlock zone TW may be configured based on the containers C loaded in a specific area (corresponding to the four and five tier levels) among the containers C in the plurality of layers loaded between the upper cell guides 32. The twist lock TL may be fastened to the upper container C on the basis of the twistlock zone TW to ensure stability against installation and installation errors.

[0243] Such the twistlock zone TW may be implemented by painting a supporting structure or an upper structure of the top bridge 20 or the upper cell guide 32 corresponding to a specific area (corresponding to the four and five tier levels) with a specific color or by installing a visible indicating structure, so that the twistlock zone TW may serve as an indicator of whether the twist locks TL are properly mounted.

[0244] When the twistlock zone TW is displayed in the area corresponding to the four and five tier levels, as shown in FIG. 39 in which the containers C are arranged in two rows, the lower limit height may be between the three tier level and the four tier level based on the small container C, and the upper limit height may be between the four tier level and the five tier level based on the large container C.

[0245] The twistlock zone TW serves as guidelines stating that all the containers C loaded on the upper part of the twistlock zone TW, including the container C whose part is present in a target area, are equipped with the twist locks TL. For example, the twistlock zone TW allows visual inspection guidelines to be created based on the installation guidelines.

[0246] In the visual inspection guidelines, items, such as whether the twist lock TL is installed and a locking state of the twist lock TL, may be checked in the corresponding area or more.

[0247] It has been described above that the twistlock zone TW is mainly displayed on the upper cell guide 32. However, the twistlock zone TW may be displayed in the same manner as described above on the top bridge 20 on which the upper cell guide 32 is installed.

[0248] In embodiments, the upper cell guide 32 may be of a different material than the lower cell guide 31.

[0249] The upper cell guide 32 according to the embodiments applied to the lashing-free container carrier 1 has to guide the containers C loaded on top of the upper deck 11, so the upper cell guide 32 may include a higher-tensile material than the lower cell guide 31 installed on the transverse bulkhead 16 of the cargo hold 17. For example, the upper cell guide 32 may include a second high tensile steel which is higher in grade than the first high tensile steel which forms the lower cell guide 31.

[0250] In addition, the upper cell guide 32 may include the second high-tensile steel, and the entry guide 300 may include a flexible material. In embodiments, the entry guide 300 portion may include a flexible material to mitigate impact, as there is a possibility of damage due to impact by the containers C during loading or unloading of the container C. For example, the flexible material may be a metal+rubber composite material, an iron core+rubber sandwich material, or a plastic material, which is excellent in abrasion resistance and has high durability.

[0251] Hereinafter, with reference to FIG. 40, a container loading and unloading method in the container carrier 1 including the container loading assist device 100 or 100a, the twistlock zone TW, and the upper cell guide 32 will be described in more detail.

[0252] FIG. 40 is a flowchart for describing a container loading and unloading method using the upper cell guide shown in FIG. 39.

[0253] First, the method of loading the containers C will be explained.

[0254] An operation of loading the containers C in the cargo hold 17 by using the crane CR may be performed to complete the loading of the containers C in the cargo hold 17 at step S31.

[0255] The crane CR may be used to lower the container loading assist device 100 or 100a so as to be guided by the upper cell guide 32 and introduced into a guide path at step S32.

[0256] The container loading assist device 100 or 100a may be mounted at an arbitrary position of the cargo hold 17 using the crane CR at step S33.

[0257] The container loading assist device 100 or 100a alone or the container loading assist devices 100 or 100a in parallel using the coupling member 170 may be transported using the crane CR. The container loading assist devices 100 or 100a connected in parallel may be connected in an odd number to adjust the center of gravity when transported by the crane CR, but this is not necessarily limited thereto.

[0258] The containers C may be loaded on top of the container loading assist device 100 or 100a by loading the containers C on the container loading assist device 100 or 100a through the upper cell guide 32 by using the crane CR at step S34.

[0259] Among the containers C loaded in a plurality of layers between the upper cell guides 32, the upper and lower containers loaded in an area corresponding to the twistlock zone TW indicated in the upper cell guide 32 may be fastened by the twist lock TL at step S35.

[0260] As described above, the twistlock zone TW may be displayed from the entry guide 300 to a certain height of the upper cell guide 32 by using paint of a specific color or using an indicating structure which may be visually confirmed. In addition, when the containers C in a plurality of layers are loaded at five tiers, twistlock zone TW may be displayed at a portion corresponding to four and five tier levels so that the twist locks TL may not be fastened to the containers C loaded at the one to third tier levels corresponding to lower layers and the twist locks LT may be fastened only to the containers C loaded at the four and five tier levels corresponding to higher layer.

[0261] Next, whether the twist lock TL is installed and an installation error occurs may be checked, and the loading operation of the containers C may be completed at step S36.

[0262] It is important to check whether the twist lock TL is installed and the installation error at step S36. Since the twist locks TL are installed in the containers C which are loaded between the upper cell guides 32, the twist locks TL are not easily visible due to interference with the upper cell guide 32. As a result, the installation of the twist locks TL may be omitted or the twist locks TL may not be installed at correct positions.

[0263] After completing the loading operation of the containers C at step S36, the containers C are transported to the destination by the container carrier 1, and the operation of unloading the containers C from the container carrier 1 to the land is performed at the destination. Hereinafter, a method of unloading the container C is described.

[0264] The twist locks TL may be unlocked so as to unload the containers C loaded on top of the container loading assist device 100 or 100a by using the crane CR at step S37.

[0265] After whether the twist lock TL is unlocked is checked, the unloading operation of the containers C may be performed at step S38.

[0266] It is important to check whether the twist locks TL are unlocked at step S38. Since the twist locks TL are installed in the containers C loaded between the upper cell guides 32, the twist locks TL are hidden by the upper cell guides 32, which makes it difficult to check whether the twist locks TL are unlocked. If the containers C are unload without unlocking the twist locks TL, it may lead to a big accident.

[0267] At step S37 of unlocking the twist locks TL, the twist locks TL may be retrieved by unlocking all twist locks TL from the upper and lower containers C on the hull 10, but the present disclosure is not necessarily limited thereto. For example, the twist locks TL may be retrieved after the containers C and the container loading assist device 100 or 100a are transported to the land. Hereinafter, another method of retrieving the twist locks TL will be described in more detail with reference to FIG. 41.

[0268] FIG. 41 is a first partial flowchart for describing a method of unloading containers in the container loading and unloading method of FIG. 40.

[0269] Referring to FIG. 41, only the twist lock TL fastened to the upper surface of the lower container C among the upper and lower containers C may be unlocked at step S41.

[0270] At step S38 of performing the work of unloading the containers C, when the upper container C is transported to the land 2 in a state where the twist lock TL is fastened to the lower surface, the twist lock TL fastened to the bottom surface of the container C on the land 2 is unlocked, and the twist lock TL may be retrieved from the land at step S42.

[0271] Hereinafter, with reference to FIGS. 42 and 43, step S33 of mounting the container loading assist device 100 or 100a at the arbitrary position of the cargo hold 17 using the crane CR will be described in more detail.

[0272] FIG. 42 is a second partial flowchart for describing a method of loading containers in the container loading and unloading method of FIG. 40. FIG. 43 is diagrams for describing the second partial flowchart of FIG. 42.

[0273] First, the container C may be positioned on the upper surface of the container loading assist device 100 or 100a provided on the land 2 by using the crane CR at step S331.

[0274] The container C and the container loading assist devices 100 and 100a may be engaged with each other by the twist lock TL at step S332.

[0275] The container C and the container loading assist devices 100 and 100a engaged with each other may be transported to the cargo hold 17 by using the crane CR at step S333.

[0276] As a result, the container loading assist device 100 or 100a may be transported together with the container C without being transported alone, thereby reducing the transport operation of the crane CR.

[0277] Hereinafter, the operation of unloading the containers C at step S38 will be described in more detail with reference to FIGS. 44 and 45.

[0278] FIG. 44 is a third partial flowchart for describing the method of unloading the containers C in the container loading and unloading method of FIG. 40. FIG. 45 is diagrams for describing the third partial flowchart of FIG. 44. FIG. 46 is a diagram showing a state in which the container loading assist devices 100 or 100a are stowed in a plurality of layers and fastened with twist locks.

[0279] First, a fastening operation may be performed when the container loading assist devices 100 or 100a and the containers C on top thereof are not fastened by the twist locks TL at step S381.

[0280] Step S381 may be omitted when the foregoing steps S331 to S333 are performed.

[0281] By using the crane CR, the containers C may be transported together with the container loading assist devices 100 or 100a fastened by the twist locks TL to the land 2 at step S382.

[0282] The twist locks TL fastening the container C with the container loading assist devices 100 or 100a may be unlocked on the land 2 at step S383.

[0283] The container loading assist devices 100 or 100a may be stored in a stowage location on the land 2. During the loading or unloading work of the containers C, the container loading assist devices 100 or 100a are transported between the land loading location and the container carrier 1. To increase the efficiency of the transport operation, as shown in FIG. 46, after the container loading assist devices 100 or 100a are loaded in three or more tiers, the container loading assist devices 100 or 100a are vertically fastened with the twist locks TL, and several container loading assist devices 100 or 100a may be moved at once with a mobile crane.

[0284] FIG. 47 is a perspective view illustrating an embodiment of the top bridges 20 and the upper cell guides 32.

[0285] FIG. 47A shows the top bridges 20 and the upper cell guides 32 according to an embodiment, and FIG. 47B shows an existing lashing bridge 20c.

[0286] Referring to FIG. 47A, the plurality of top bridges 20 according to an embodiment may be installed extending

to the left and right edges of the upper deck 11 between the cargo holds 17 in the width direction of the hull 10, and may be arranged in a plurality of rows at regular intervals from the bow 14 to the stern 15 in the longitudinal direction of the hull 10. The upper cell guides 32 may be installed at regular intervals on both sides of the top bridge 20.

[0287] In embodiments, the top bridge 20 may be a cell guide system in which the upper cell guide 32 is installed, rather than the existing lashing bridge 20c in which a lashing system lashing the containers C is applied.

[0288] Referring to FIG. 47B, the existing lashing bridge 20c may be one of the known lashing bridges having components such as various fittings to prevent overturning of the containers C loaded on the hatch cover. Thus, the specific configuration thereof will not be described here, but portions of the existing lashing bridge 20c compared against the top bridge 20 of this embodiment will be mainly described.

[0289] Referring again to FIG. 47A, the top bridge 20 according to an embodiment includes a combination of the plurality of vertical members 21 and the plurality of horizontal members 22, and may be installed on the upper deck 11 which divides between the cargo holds 17 between the left and right sides of the upper deck 11 on the outer side plating 12a and the inner side plating 12b of the container carrier 1.

[0290] The plurality of vertical members 21 may be arranged in pairs at regular intervals in the longitudinal direction of the upper deck 11 which divides between adjacent cargo holds 17. The plurality of horizontal members 22 may be arranged in pairs at regular interval in the upper direction of the upper deck 11 and installed on the pair of vertical members 21.

[0291] In addition, passage spaces 25a through which an operator pass for maintenance and monitoring of the control unit or the like provided in the reefer container C may be provided in a plurality of layers at regular intervals in the vertical direction between the pair of vertical members 21.

[0292] The passage spaces 25a may be connected with other passage spaces 25a in a plurality of layers provided between a pair of adjacent vertical members 21 by a passageway 26a, thereby allowing the operator to perform maintenance work while moving.

[0293] In embodiments, the passageway 26a may be a stringer and floor member disposed between the upper deck 11 which devices between the cargo holds 17 on which the top bridges 20 are installed and the horizontal members 22 which are arranged in pairs and provided in a plurality of layers. For example, the passageway 26a may be provided in a plurality of layers based on the upper deck 11, and the height of each layer may be determined in connection with the height of the reefer container C.

[0294] The width of each of the passage spaces 25a provided in the top bridge 20 and the passageway 26a connecting the passage spaces 25a may be determined by the width between the pair of vertical members 21 corresponding to the width of the top bridge 20.

[0295] Referring to FIG. 47B, the existing lashing bridge 20c as compared to the top bridge 20 may be installed on the upper deck 11 which divides between adjacent cargo holds 17, and a passage space 25b and a passageway 26b may be formed on the upper deck 10 for a lashing operation and maintenance.

[0296] The width of the passage space 25b and the passageway 26b of the existing lashing bridge 20c is installed according to the minimum width (e.g. 600 mm) defined in the International Maritime Organization (IMO) code. In the case of the existing lashing bridge 20c, the space for installing the hatch cover must be secured, interference must be avoided when the containers C are loaded into the cargo hold 17 in which the lower cell guides 31 are installed, and furthermore, the code regulations of the IMO described above must be complied with. Thus, there is a limitation in reducing the width of the upper deck 11 which divides between the cargo holds 17 on which the lashing bridges 20c are installed.

[0297] In other words, the existing lashing bridge 20c is installed in compliance with the code regulations of the IMO, but has to be installed to have a width less than the width of the upper deck 11 which divides between the cargo holds 17. As a result, a portion of the upper deck 10 which is outside a width range of the existing lashing bridge 20c remains an ineffective area, and there is a limitation in reducing the overall size of the container carrier 1.

[0298] On the other hand, the top bridge 20 according to the embodiments fixes and supports the upper cell guide 32 integrally connected to the lower cell guide 31, and may be installed at the edge of the upper deck 11 which partitions between the cargo holds 17 without interfering with the container since the containers C are guided and loaded on the upper cell guide 31.

[0299] According to this structure, the top bridge 20 according to the embodiments may have the same width as the width of the upper deck 11 which divides between the adjacent cargo holds 17, so that the part of the upper deck 10 may be utilized as much as possible, and the overall size of the container carrier 1 may be reduced by removing the ineffective area of the upper deck 11 when installed in compliance with the code regulations of the IMO in comparison with the existing lashing bridge 20c.

[0300] In addition, when the top bridge 20 according to embodiments is installed on the upper deck 11 where the existing lashing bridge 20c is installed, even the effective area of the upper deck 11 may be utilized, and the passage space 25a and the passageway 26a having a larger width than that specified in the code regulations of the IMO may be ensured.

[0301] FIG. 48 is a side view illustrating an embodiment of a cell guide device 600. FIG. 49 is a side view showing another embodiment of the cell guide device 600 as shown in FIG. 48.

[0302] Specifically, FIG. 48A is a side view illustrating a use state of the cell guide device 600. FIG. 48B is a side view showing an operating state of the cell guide device 600. FIG. 48C is a side view showing an unused state of the cell guide device 600.

[0303] Referring to FIG. 48, the container carrier 1 according to an embodiment may further include the cell guide device 600. The cell guide device 600 is a component which may extend the length of the upper cell guide 32, and may include an extension cell guide 610 and an operation unit 620.

[0304] The extension cell guide 610 may have the same structure as the upper cell guide 32 and have a predetermined length.

[0305] The extension cell guide 610 may be connected and fixed in a straight line with the upper cell guide 32 by the operation unit 620 when the container C is loaded, to support and fix the container C, or to guide the lifting and lowering of the container C.

[0306] When the container C is not loaded, the extension cell guide 610 may be separated from the upper cell guide 32 and stored at the top of the top bridge 20 by the operation unit 620, as shown in FIGS. 48B and 48C.

[0307] The entry guide 300 which guides the container C may be installed at the top of the upper cell guide 32. The extension cell guide 610 may be connected and fixed to or separated from the top of the entry guide 300.

[0308] The operation unit 620 may operate the extension cell guide 610, and may include a fixing member 621, a hinge member 622, a rotating member 623, and a handle 624.

[0309] A lower end of the fixing member 621 is fixed to the upper end of the top bridge 20 and may extend a predetermined length in the vertical direction.

[0310] The hinge member 622 may be installed on the upper end of the fixing member 621 and enables rotation of the rotating member 623.

[0311] One end of the rotating member 623 may be rotatably connected to the hinge member 622, and the other end thereof may be connected to the extension cell guide 610.

[0312] The rotating member 623 may be provided with the handle 624, and the extension cell guide 610 may be rotated by using the handle 624.

[0313] Referring to FIG. 49, the container carrier 1 according to an embodiment may further include an extension entry guide 630. The extension entry guide 630 is installed at an upper end of the extension cell guide 610. When the extension cell guide 620 guides the lifting and lowering of the container C, interference of the upper end with the container C may be avoided.

[0314] Since the configuration of the extension entry guide 630 may be the same as that of the entry guide 300 as described above, a detailed description thereof will be omitted. However, the extension entry guide 630 may have a configuration which is the same as or similar to that of the existing entry guide.

[0315] FIG. 50 is a perspective view showing an embodiment of a gap cover 700. FIG. 51 is a perspective view showing an upper part of the gap cover 700 by enlarging part of FIG. 50. FIG. 52 is a perspective view showing a lower part of the gap cover 700 by enlarging part of FIG. 50. FIG. 53 is a side view showing the gap cover 700 shown in FIG. 50 as viewed from the front. FIG. 54 is a front cross-sectional view showing the gap cover 700 shown in FIG. 50 as viewed from the side. FIG. 55 is a plan view showing the gap cover 700 shown in FIG. 50 as viewed from the top.

[0316] The hull 10, the upper deck 11, the top bridge 20, the lower cell guide 31, the upper cell guide 32, the entry guide 300, and the reinforcement member 400 as shown in FIGS. 50 to 55 may be configured substantially the same as the hull 10, the upper deck 11, the top bridge 20, the lower cell guide 31, the upper cell guide 32, the entry guide 300, and the reinforcement member 400 as described with reference to FIGS. 1 to 13 and FIGS. 31 to 35. Thus, overlapping descriptions thereof will be omitted. However, components which are structurally coupled to the gap cover 700, which is described below with reference to FIGS. 50 to 55, will be additionally described together with the gap cover 700 if necessary.

[0317] Referring to FIGS. 50 to 55, the gap cover 700 may cover between one upper cell guide 32 and another upper cell guide 32 among the plurality of upper cell guides 32 adjacent to each other in the longitudinal direction of the hull 10. The upper cell guide 32 may have an L-shaped cross-section to cover side and rear surfaces of the container C.

[0318] Referring to FIG. 51, the gap cover 700 may include a gap cover body 710 in the form of a plate which has both ends connected to one side surface of the first reinforcement member 410 and covers between a pair of adjacent first reinforcement members 410. In embodiments, the gap cover body 710 may be integrally formed with the first reinforcement member 410, but the present disclosure is not necessarily limited thereto. For example, though not shown in the drawing, the gap cover body 710 may include a coupling member (not shown) such as a ring, and the gap cover main body 710 and the first reinforcement members 410 may be connected to each other in such a manner that the coupling member passes through a hole (not shown) formed in one surface of the first reinforcement member 410. The gap cover body 710 may cover between a pair of adjacent first reinforcement members 410, and a material

thereof is not limited.

[0319] The gap cover 700 may further include extension members 720 extending from both ends of the gap cover body 710 in contact with one side surface of the first reinforcement member 410. In other words, the extension members 720 may extend to one of the upper cell guides 32 on one side of the gap cover body 710 with respect to the longitudinal direction of the hull 10, and may extend to another upper cell guide 32 disposed on the opposite side with respect to the gap cover body 710 on the other side of the gap cover body 710.

[0320] The extension member 720 may be bent in a direction toward the upper cell guide 32. In other words, the extension member 720 may have an inclined surface facing the upper cell guide 32, but the present disclosure is not necessarily limited thereto. For example, the extension member 720 may extend in a direction parallel to the gap cover body 710. With this structure, the extension member 720 may support the upper cell guide 32 in the lateral direction. Since the extension member 720 includes surfaces formed in the front and rear of the container carrier 1 to thereby reduce the wind resistance of the hull 10.

[0321] Referring to FIGS. 52 to 54, the gap cover 700 may be supported by a stool S disposed on the upper deck 11. Accordingly, an empty space may be formed between the upper deck 11 and the containers C at the left and right edges based on the width direction of the hull 10. Workers may move along these empty spaces.

[0322] In embodiments, the gap cover body 710 may be of a closed type with no holes, but the present disclosure is not necessarily limited thereto. For example, a hole may be formed in one region of the gap cover body 710. When the container C is a reefer container, a hole may be formed in one area of the gap cover body 710 for ventilation.

[0323] The gap cover body 710 may be disposed at the left and right edges of the top bridge 20 on the upper deck 11, and blocks a gap formed between the upper cell guides 32 adjacent to each other to prevent air from being transmitted to the top bridge 20 or the gap to generate wind resistance.

[0324] FIG. 56 is a perspective view showing embodiments of the gap cover 700 shown in FIG. 50.

[0325] FIG. 56A is a diagram illustrating a date arrangement of the gap cover 700. FIG. 56B is a diagram illustrating an oblique arrangement of the gap cover 700.

[0326] Referring to FIG. 56, in the container carrier 1, the containers C may be loaded wider to the left and right of the hull 10 in the middle part of the hull 10 than at the bow 14 or the stern 15 of the hull 10. For example, the containers C closer to the bow 14 are narrower on the left and right than the containers C placed behind. Conversely, the containers C closer to the stern 15 may be loaded narrower on the left and right than the containers C placed ahead. In other words, the containers C closer to the bow 14 or the stern 15 may be loaded narrower in the width direction of the hull 10 than the containers C closer to the central part of the ship.

[0327] As described above, in a case where the widths of the left and right sides of the containers C loaded in the longitudinal direction of the container carrier 1 are different, the gap cover 700 may be disposed at an angle to the longitudinal direction of the container carrier 1 in order to cover a gap between the containers C adjacent to each other in the longitudinal direction.

[0328] Referring to FIG. 56A, the gap cover 700 may be disposed between the containers C adjacent to each other in the longitudinal direction of the hull 10. The gap cover 700 may be disposed in a direction next to the side surface of the container C.

[0329] Referring to FIG. 56B, a portion of the gap cover 700 is arranged in a direction next to the side surface of the container C, but another portion of the gap cover 700 may be arranged in a direction intersecting the longitudinal direction of the container carrier 1 according to the arrangement of the container C. The gap cover 700 may be disposed between the containers C adjacent to each other to cover a gap between the containers C. For example, the gap cover 700 may be arranged next to each other in a direction in which a point of an edge defined when a wall surface of one of the containers C is connected and a point of an edge defined when a wall surface of another container C adjacent to the one container C is connected. The edges formed by connecting the wall surfaces may in a direction toward the outside of the hull 10 in the container C disposed on the outermost side of the hull 10.

[0330] According to this structure, the gap cover 700 may cover between an edge defined when a wall surface of one container C meets and an edge defined when a wall surface of another container C adjacent to the one container C meets.

[0331] Though not shown in the drawing, the top bridge 20 and/or the upper cell guide 32 may be arranged between the containers C adjacent to each other in the longitudinal direction of the hull 10, and the gap cover 700 may cover at least one of the top bridge 20 or the upper cell guide 32.

[0332] As described above, since the horizontal width length of the hull 10 may vary in the longitudinal direction of the hull 10, the horizontal width lengths of the plurality of top bridges 20 may also vary according to the horizontal width length of the hull 10.

[0333] Referring to FIG. 56, the gap cover 700b may have a step on a lower surface thereof, a portion of the lower surface extending upward from the upper deck 11, and a portion of the lower surface extending upward from a bulwark formed in the bow. The gap cover 700b with this structure may be arranged at a position where the number of containers C stacked on the upper deck 11 varies in the longitudinal direction of the hull 10.

[0334] FIG. 57 is a graph showing the relationship between a wind load factor (Cx) and the wind direction angle according to the computational fluid analysis (CFD).

[0335] Referring to FIG. 57, the wind resistance coefficient according to the longitudinal direction of the container carrier 1 and the angle of the wind toward the container carrier 1 is confirmed. When the gap cover 700 is provided between the top bridges 20 adjacent to each other based on the longitudinal direction of the hull 10 regardless of the wind direction (Case 2), the wind resistance coefficient was reduced compared to when the lashing bridges are provided at the left and right edges of the hull 10 (Case 1). The lashing bridge may be the lashing bridge 20c shown in FIG. 47B. The gap cover 700 may have a face which extends towards the containers C as compared to the lashing bridge.

[0336] In particular, as shown in Table 1 below, when the longitudinal direction of the container carrier 1 and the wind angle toward the container carrier 1 reached 30 degrees, the improvement in wind resistance was the largest, and the wind resistance was reduced by about 3% or more.

[Table 1]

	Case 1	Case 2
Wind Resistance Reduction Rate	-	3%

[0337] In the above, although the present disclosure has been described centering on the embodiments of the present disclosure, this is merely exemplary and does not limit the present disclosure, and those skilled in the art to which the present disclosure belongs will know that various combinations or modifications and applications not exemplified in the embodiments are possible without departing from the essential technical content of the present embodiment. Therefore, technical contents related to modifications and applications that may be easily derived from embodiments of the present disclosure should be construed as being included in the present disclosure.

Claims

1. A container carrier, comprising:

a hull including side plating, bottom plating, and an upper deck;
a plurality of cargo holds divided in a length direction of the hull by a plurality of transverse bulkheads in the hull;
a plurality of lower cell guides arranged before and after each of the plurality of transverse bulkheads with respect to the length direction, and arranged next to each other in a width direction of the hull crossing the length direction;
a plurality of top bridges extending upward from the plurality of transverse bulkheads, extending to left and right edges of the upper deck in the width direction, and arranged in a plurality of rows in the length direction;
a plurality of upper cell guides arranged before and after each of the plurality of top bridges with respect to the length direction, and arranged next to each other in the width direction; and
a plurality of gap covers covering between one upper cell guide and another cell guide among the plurality of upper cell guides adjacent to each other in the length direction.

2. The container carrier of claim 1, wherein each of the plurality of gap covers comprises:

a gap cover body having a surface parallel to the length direction; and
an extension member extending from one side of the gap cover body to the one upper cell guide and extending from another side of the gap cover body to the another upper cell guide with respect to the length direction.

3. The container carrier of claim 1, further comprising a plurality of reinforcement members arranged on portions of the plurality of upper cell guides extending above the plurality of top bridges, the plurality of reinforcement members each including a surface parallel to the width direction.

4. The container carrier of claim 3, wherein a width of the gap cover body is greater than a width of one of the plurality of reinforcement members with respect to the length direction.

5. The container carrier of claim 1, further comprising support members disposed at both ends of the plurality of top bridges with respect to the width direction, the support members connecting one top bridge to another top bridge among the plurality of top bridges adjacent to each other in the length direction.

6. The container carrier of claim 1, further comprising an entry guide extending upwardly from the plurality of upper cell guides and guiding a container when the container is unloaded.

7. The container carrier of claim 6, wherein the entry guide comprises:

a plurality of first entry guide members extending obliquely upward in the plurality of upper cell guides, having same lower and upper widths, and guiding a front surface or a rear surface of the container; and
a plurality of second entry guide members extending upwardly from the plurality of upper cell guides, having surfaces perpendicular to the plurality of first entry guide members and upper ends with inclined surfaces, and guiding one side surface of the container.

8. A container carrier, comprising:

a hull including side plating, bottom plating, and an upper deck;
a plurality of cargo holds divided in a length direction of the hull by a plurality of transverse bulkheads in the hull;
a plurality of lower cell guides arranged before and after each of the plurality of transverse bulkheads with respect to the length direction, and arranged next to each other in a width direction of the hull crossing the length direction;
a plurality of top bridges extending upwardly from the plurality of transverse bulkheads, extending to left and right edges of the upper deck in the width direction, and arranged in a plurality of rows in the length direction; and
a plurality of upper cell guides arranged before and after each of the plurality of top bridges with respect to the length direction and arranged next to each other in the width direction,
wherein one of the plurality of upper cell guides and one of the plurality of lower cell guides overlapping each other in a height direction of the hull crossing the length direction and the width direction are connected to form a guide path of continuous containers, and
wherein at least one of the plurality of top bridges and the plurality of upper cell guides comprises a twistlock zone visibly marked for a naked eye to a predetermined height in a direction from a top end of the at least one towards the upper deck.

9. A container carrier, comprising:

a hull including side plating, bottom plating, and an upper deck;
a plurality of cargo holds divided in a length direction of the hull by a plurality of transverse bulkheads in the hull;
a plurality of lower cell guides arranged before and after each of the plurality of transverse bulkheads with respect to the length direction and arranged next to each other in a width direction of the hull crossing the length direction;
a plurality of upper cell guides arranged above the plurality of transverse bulkheads; and
a protection bar protecting against impacts applied to the plurality of upper cell guides and reinforcing structural strength,
wherein the protection bar comprises:

a spacer portion arranged between one upper cell guide and another upper cell guide among the plurality of upper cell guides facing one another, and supporting and fixing the one upper cell guide and the another upper cell guide apart from each other; and
a detachment preventing portion protruding from the spacer portion to an outside of the one upper cell guide and the another upper cell guide by a predetermined length with respect to the length direction to prevent detachment of a container.

10. The container carrier of claim 9, wherein the protection bar is arranged at upper portions of the plurality of upper cell guides corresponding to a lower portion of an entry guide relatively vulnerable to external impacts and having weak structural strength over an entire length of the plurality of upper cell guides.

11. A container carrier, comprising:

a hull including side plating, bottom plating, and an upper deck;
a plurality of cargo holds divided in a length direction of the hull by a plurality of transverse bulkheads in the hull;
a plurality of lower cell guides arranged before and after each of the plurality of transverse bulkheads with respect to the length direction, and arranged next to each other in a width direction of the hull crossing the length direction;
a plurality of upper cell guides arranged on top of the upper deck and connected to the plurality of lower cell guides to provide a guide path of continuous containers; and
a plurality of cell guide devices extending the plurality of upper cell guides upwards in length,
wherein each of the plurality of cell guide devices comprises:

an operation unit; and
an extension cell guide rotated by the operation unit and detachably connected to an upper end of each of the plurality of upper cell guides.

12. The container carrier of claim 11, further comprising an entry guide extending upwardly from the plurality of upper cell guides to guide a container when the container is loaded, and
wherein the extension cell guide is detachably connected to an upper end of the entry guide.

13. The container carrier of claim 11, further comprising an extension entry guide extending upwardly from the extension cell guide to guide a container when the container is unloaded.

14. A container carrier, comprising:

a hull including side plating, bottom plating, and an upper deck;
a plurality of holds divided in a length direction of the hull by a plurality of transverse bulkheads in the hull;
a plurality of lower cell guides arranged before and after each of the plurality of transverse bulkheads with respect to the length direction, and arranged next to each other in a width direction of the hull crossing the length direction;
a plurality of top bridges extending upward from the plurality of transverse bulkheads, extending to left and right edges of the upper deck in the width direction, and arranged in a plurality of rows in the length direction; and
a plurality of upper cell guides arranged before and after each of the plurality of top bridges with respect to the length direction, and arranged next to each other in the width direction,
wherein one of the plurality of upper cell guides and one of the plurality of lower cell guides overlapping each other in a height direction of the hull crossing the length direction and the width direction are connected to form a guide path of continuous containers,
wherein a plurality of containers loaded along the guide path comprises:

a plurality of first containers loaded in the hull; and
a plurality of second containers loaded on top of the upper deck, and
wherein the container carrier further comprises a plurality of twist locks connecting at least a portion of the plurality of second containers.

15. The container carrier of claim 14, wherein the plurality of twist locks connect one of the plurality of first containers and one of the plurality of second containers adjacent to each other.

16. The container carrier of claim 15, wherein the plurality of twist locks connect at least a portion of the plurality of first containers.

FIG. 1

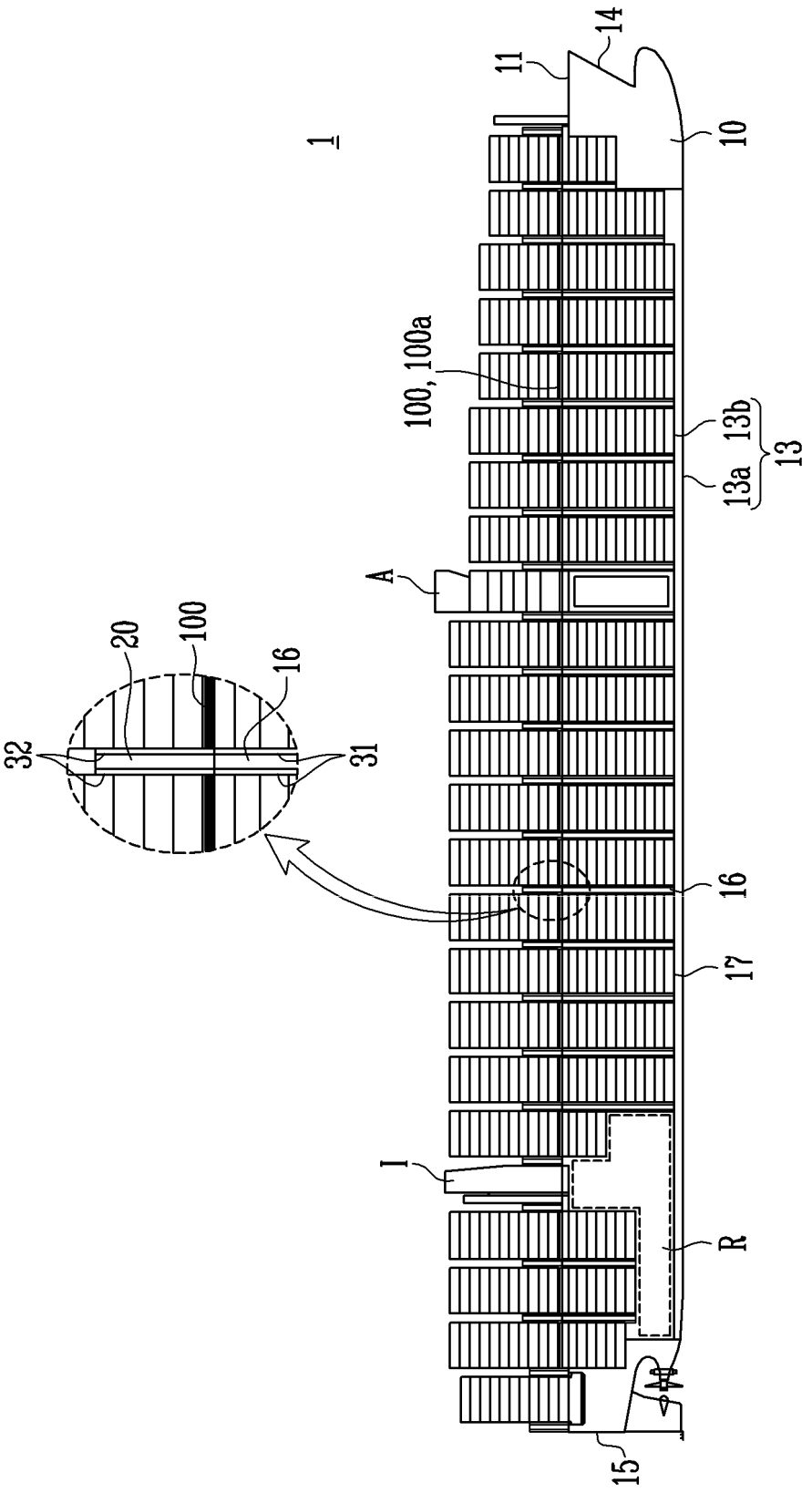


FIG. 2

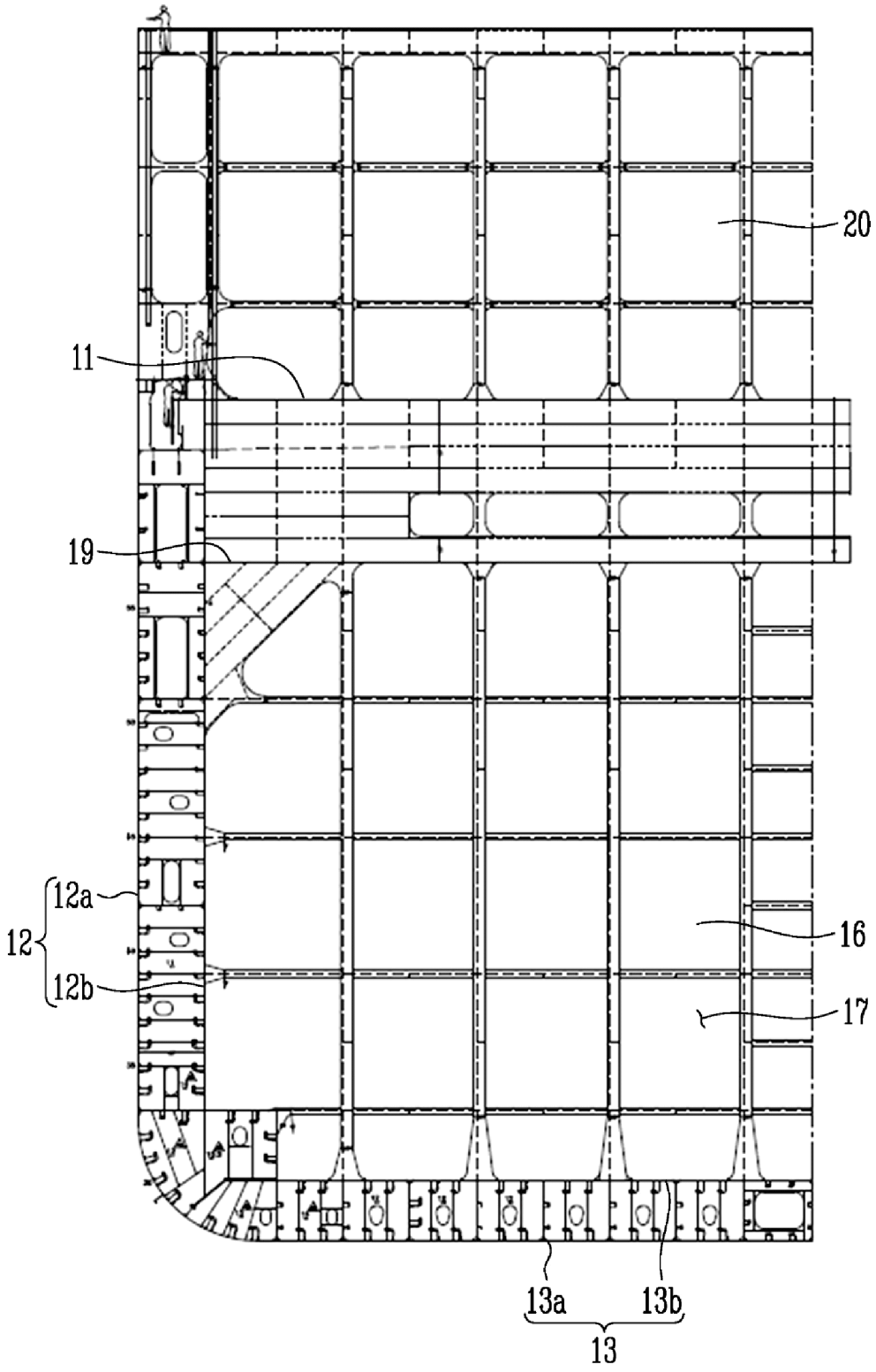


FIG. 3

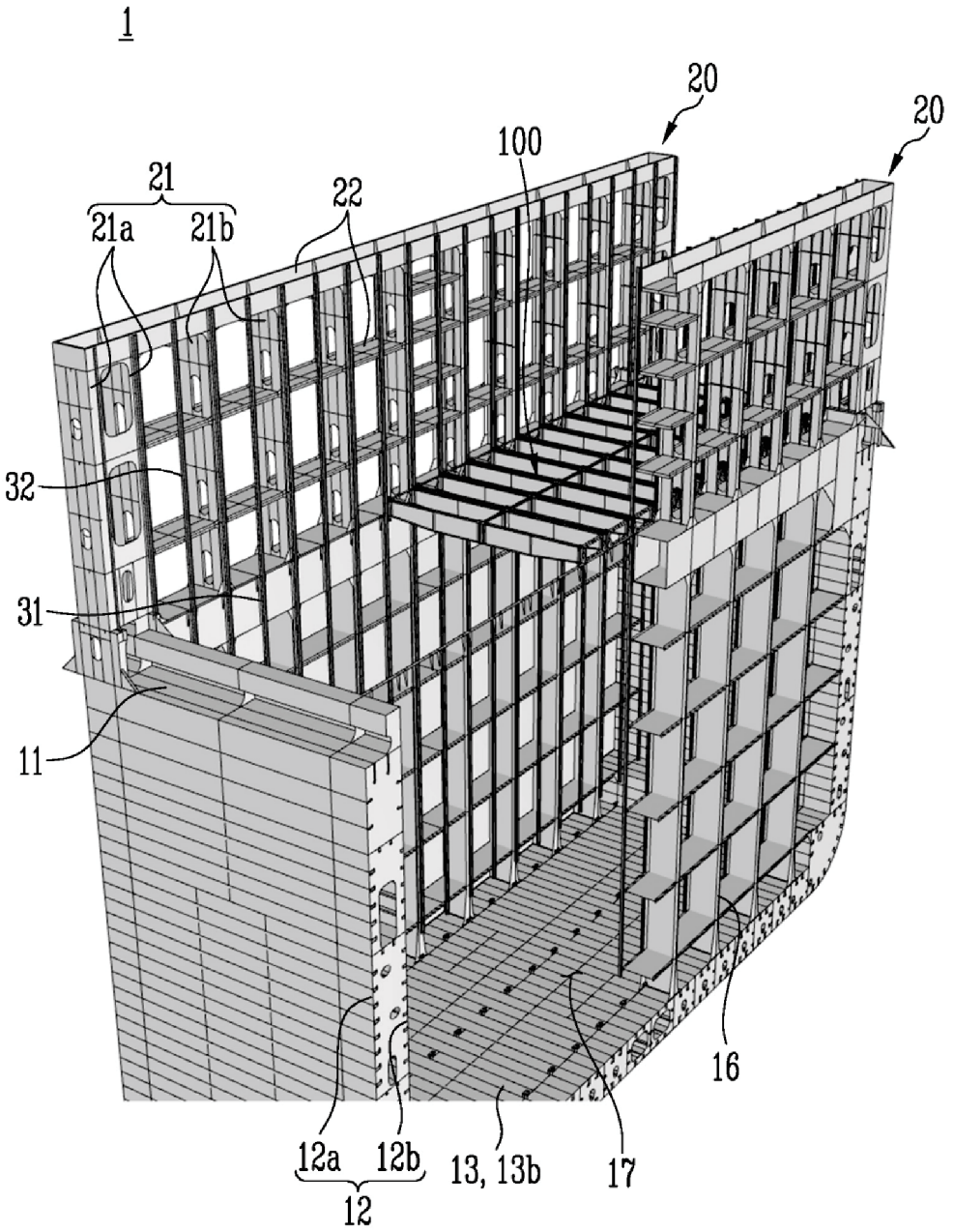


FIG. 4

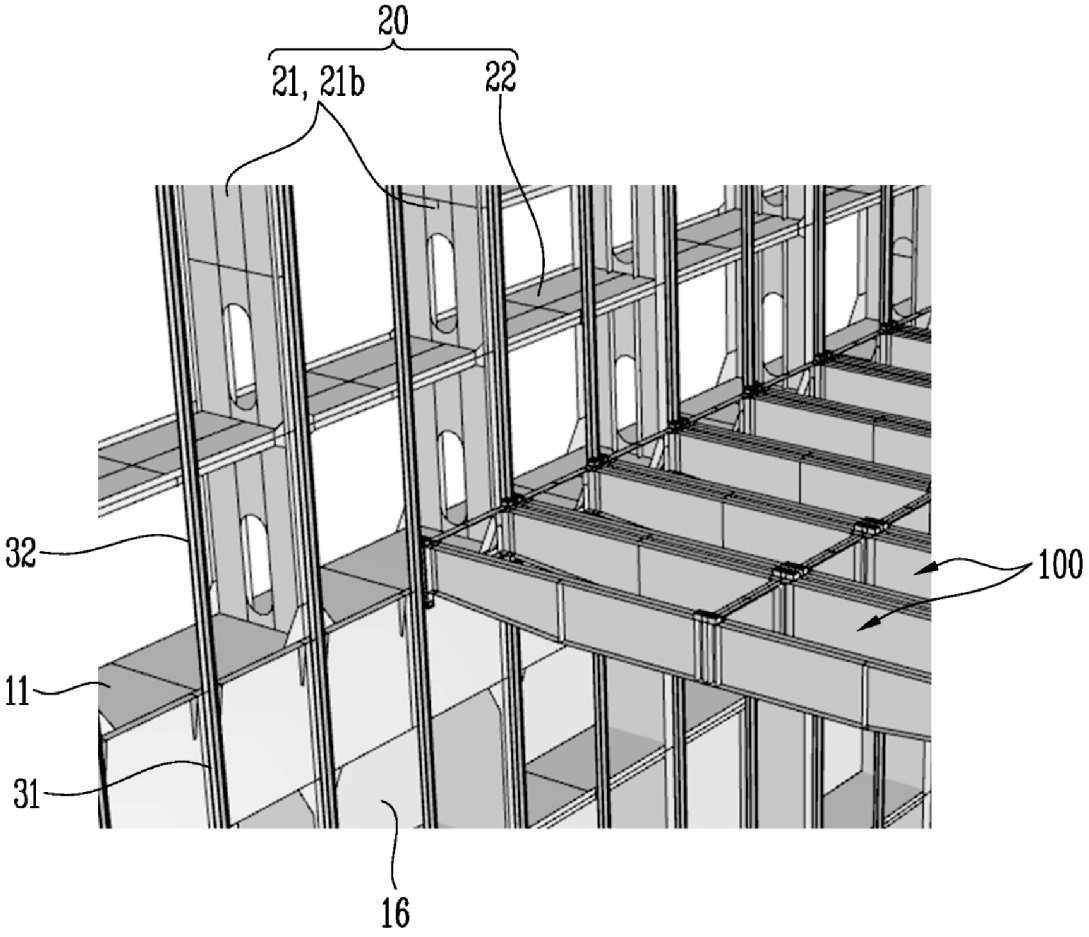


FIG. 5

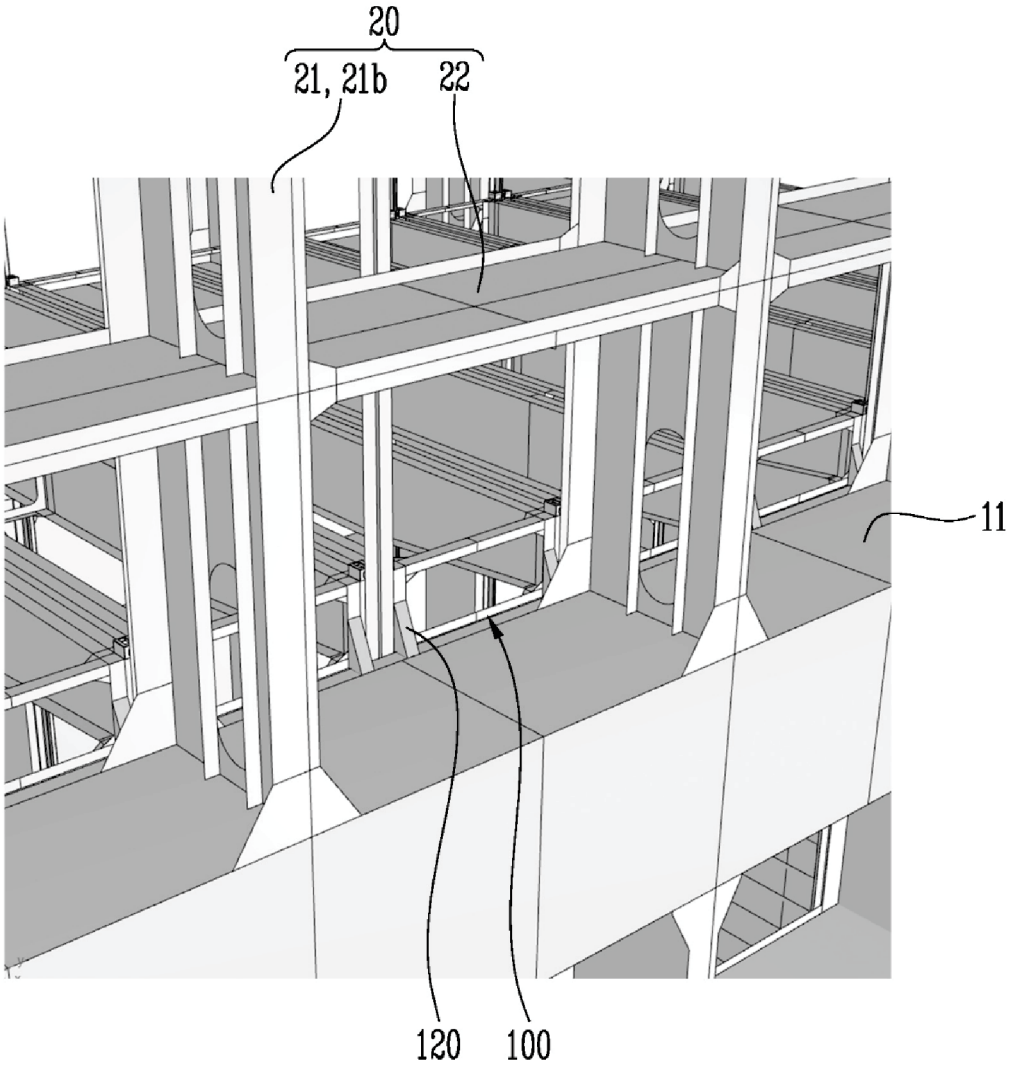


FIG. 6

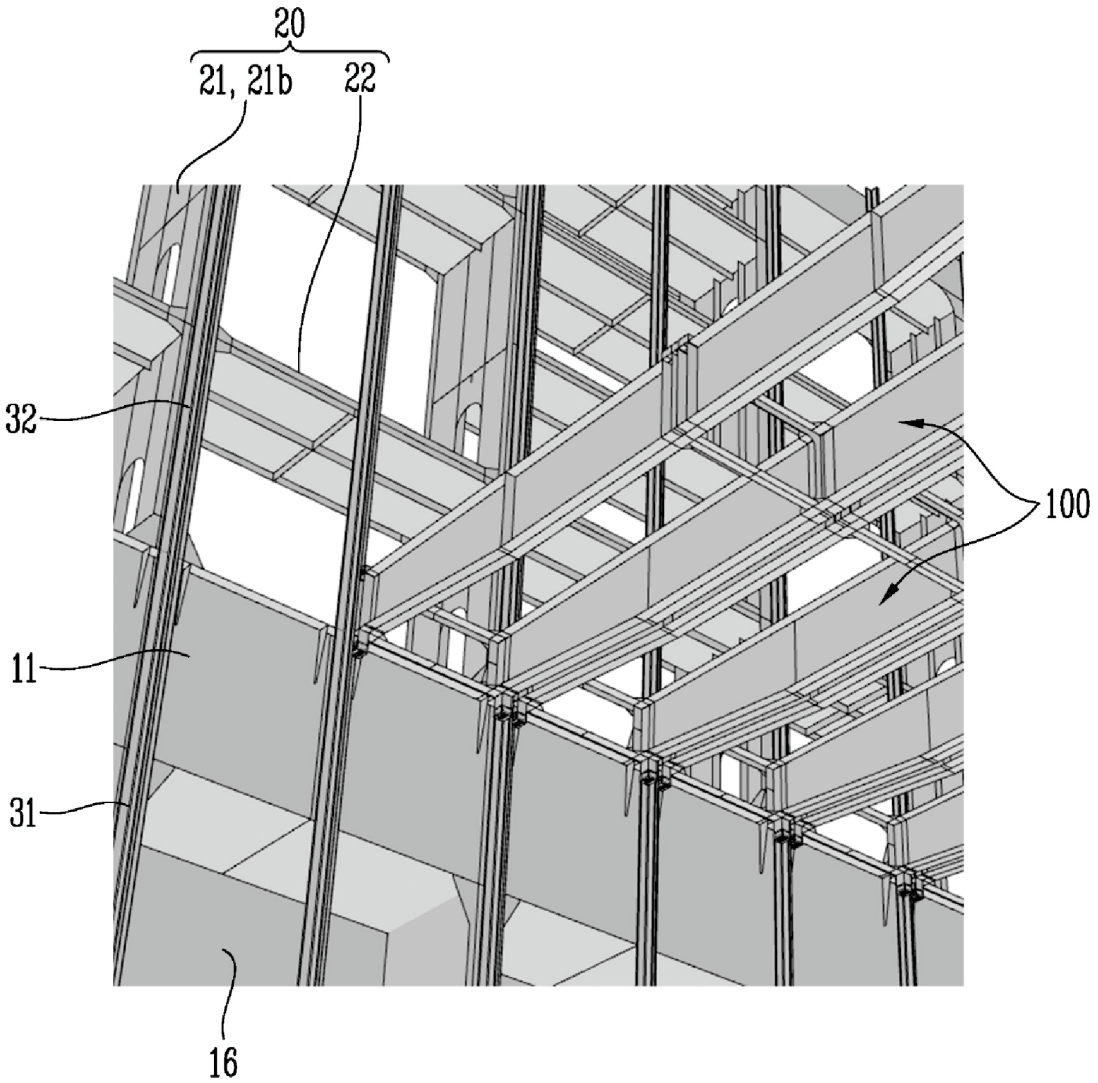


FIG. 7

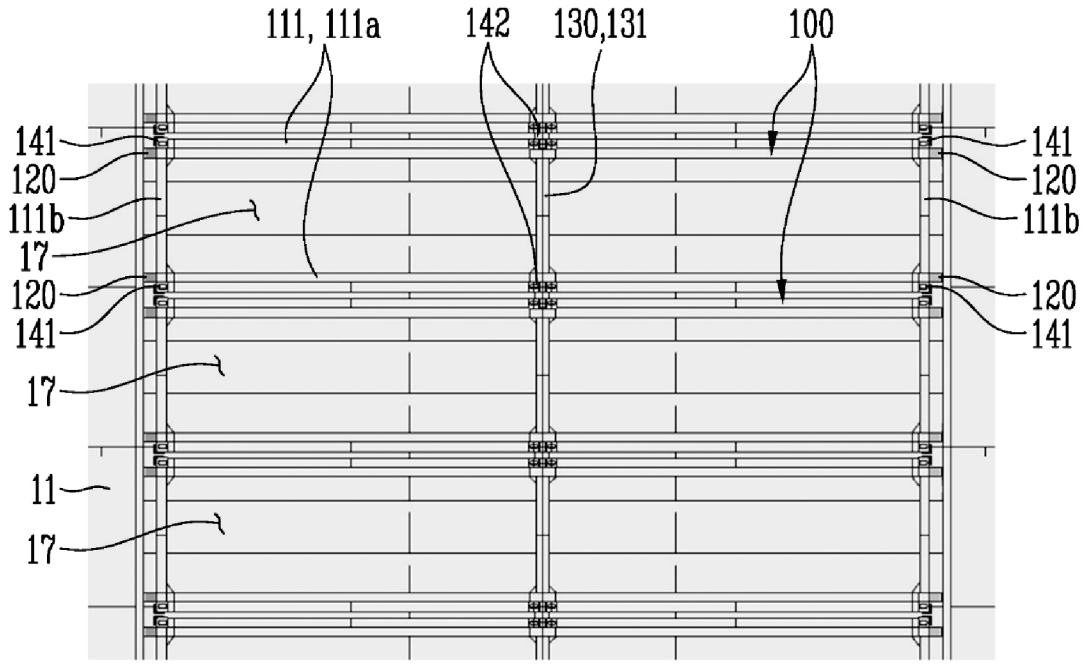

111, 111a
142
130,131
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141
120
111b
17
120
141
17
11
17
141
120
111b
120
141

FIG. 8

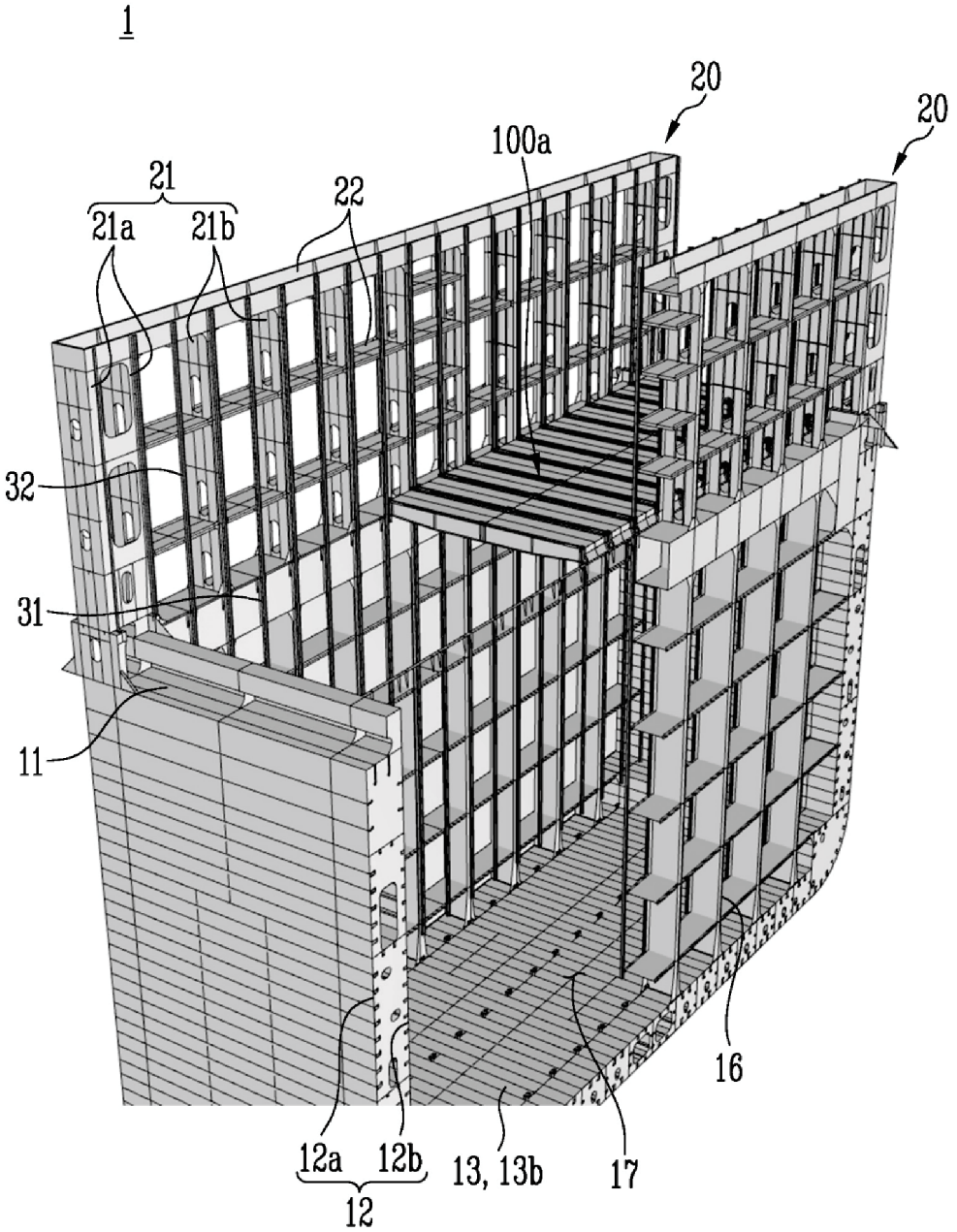


FIG. 9

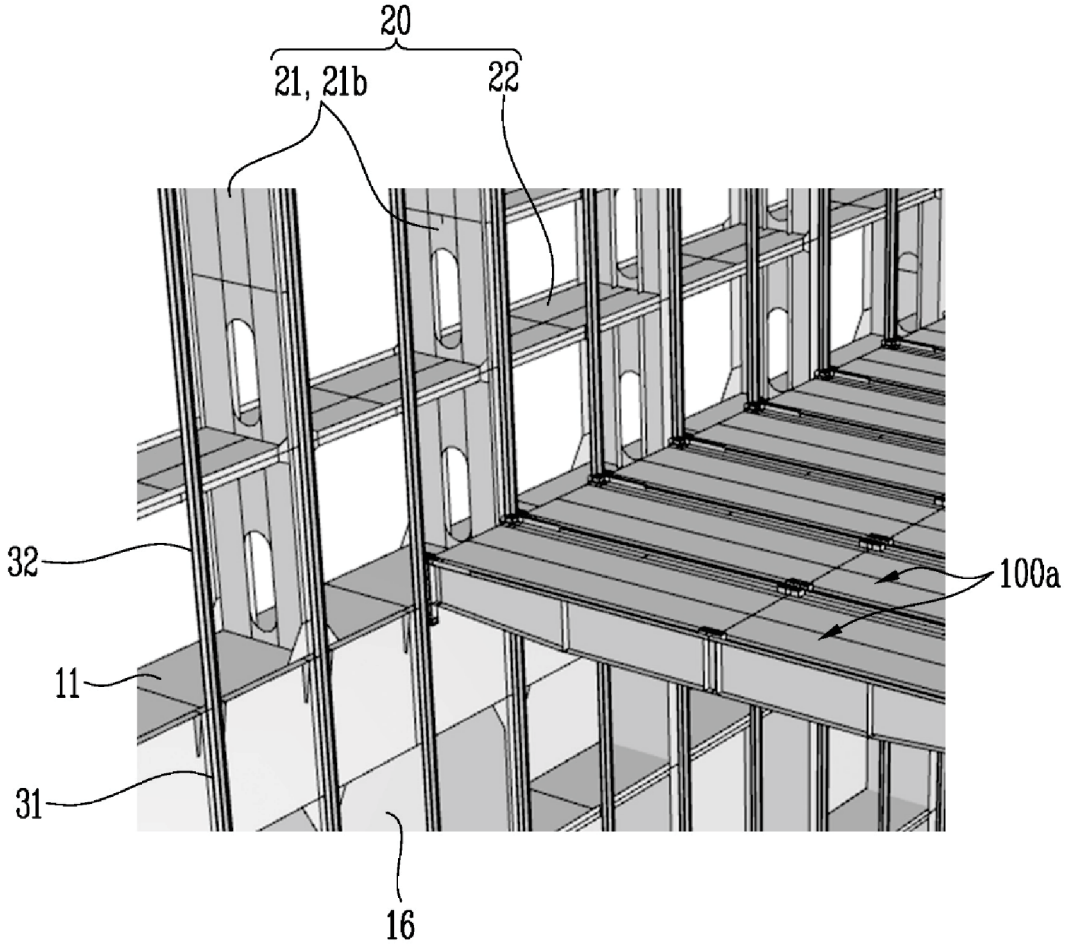


FIG. 10

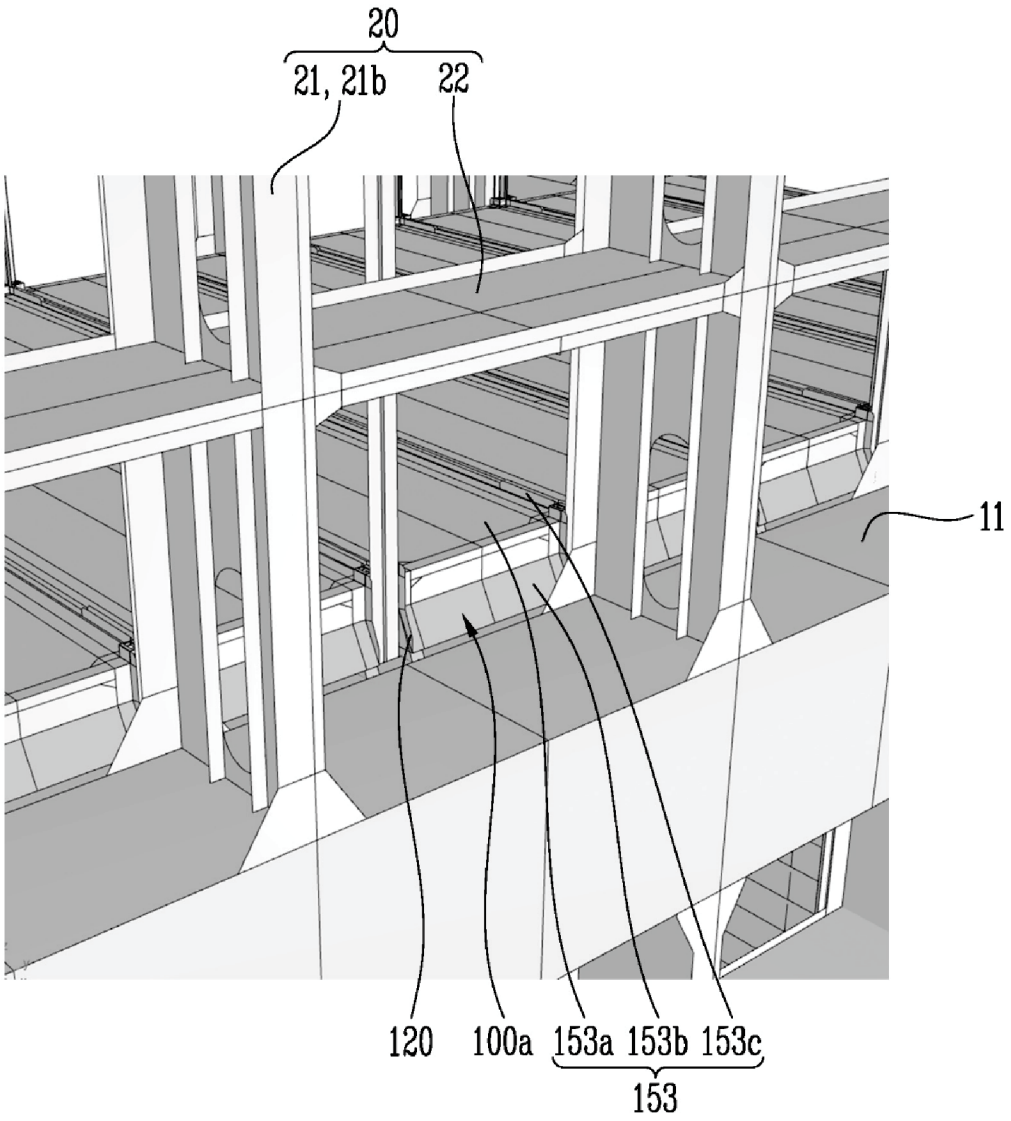


FIG. 11

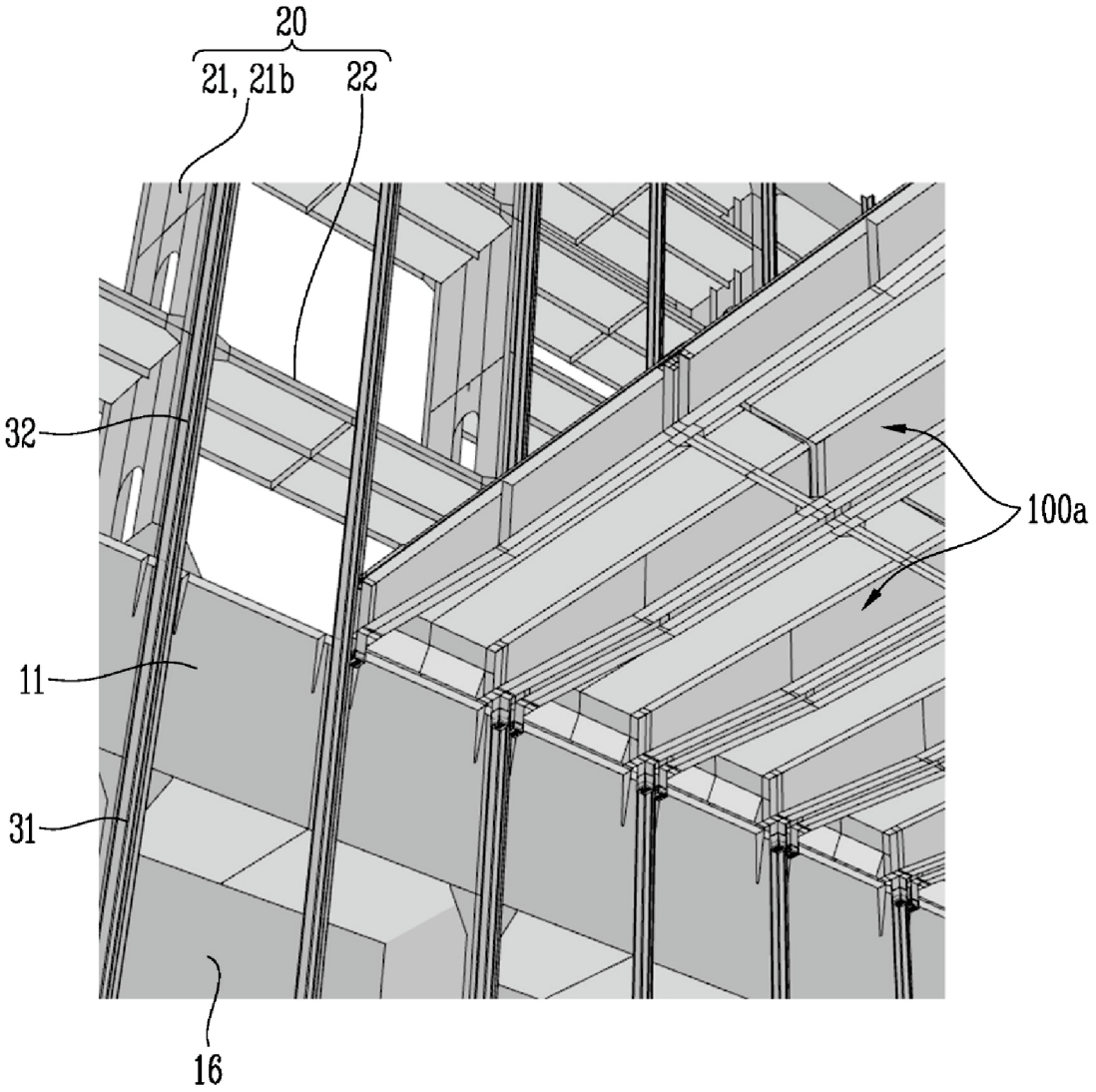


FIG. 12

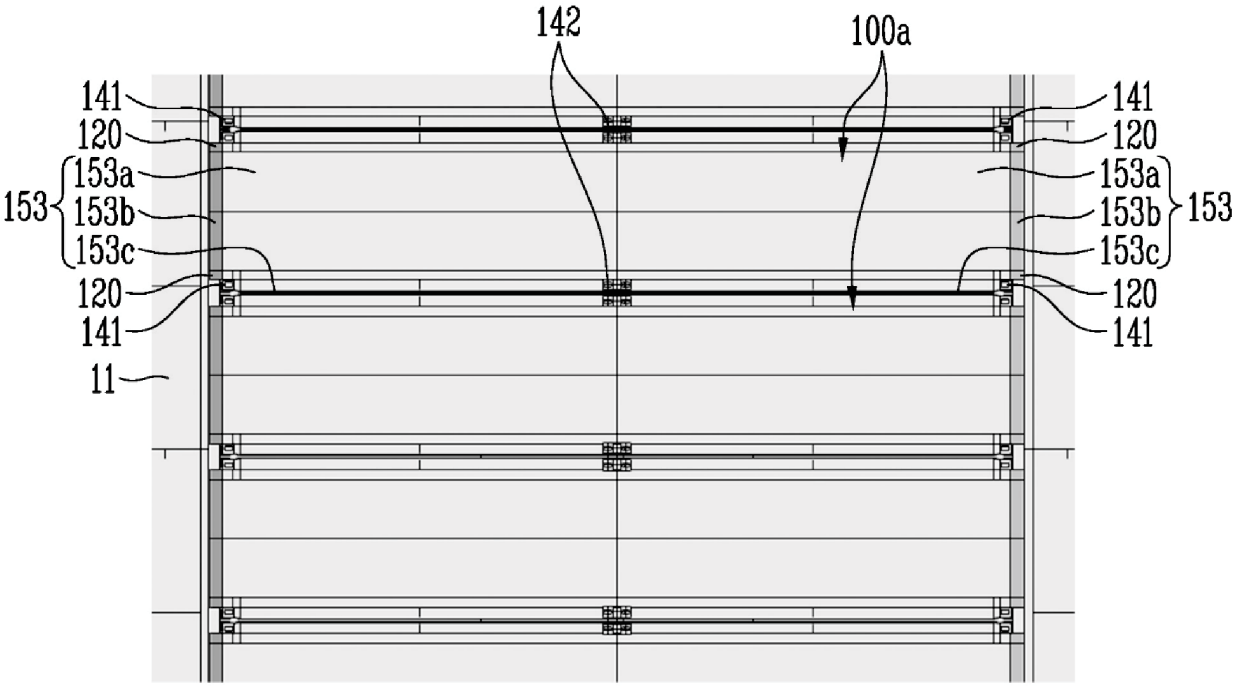

142
100a
141
120
153a
153
153b
153c
120
141
11
141
120
153a
153b
153c
153
120
141

FIG. 13

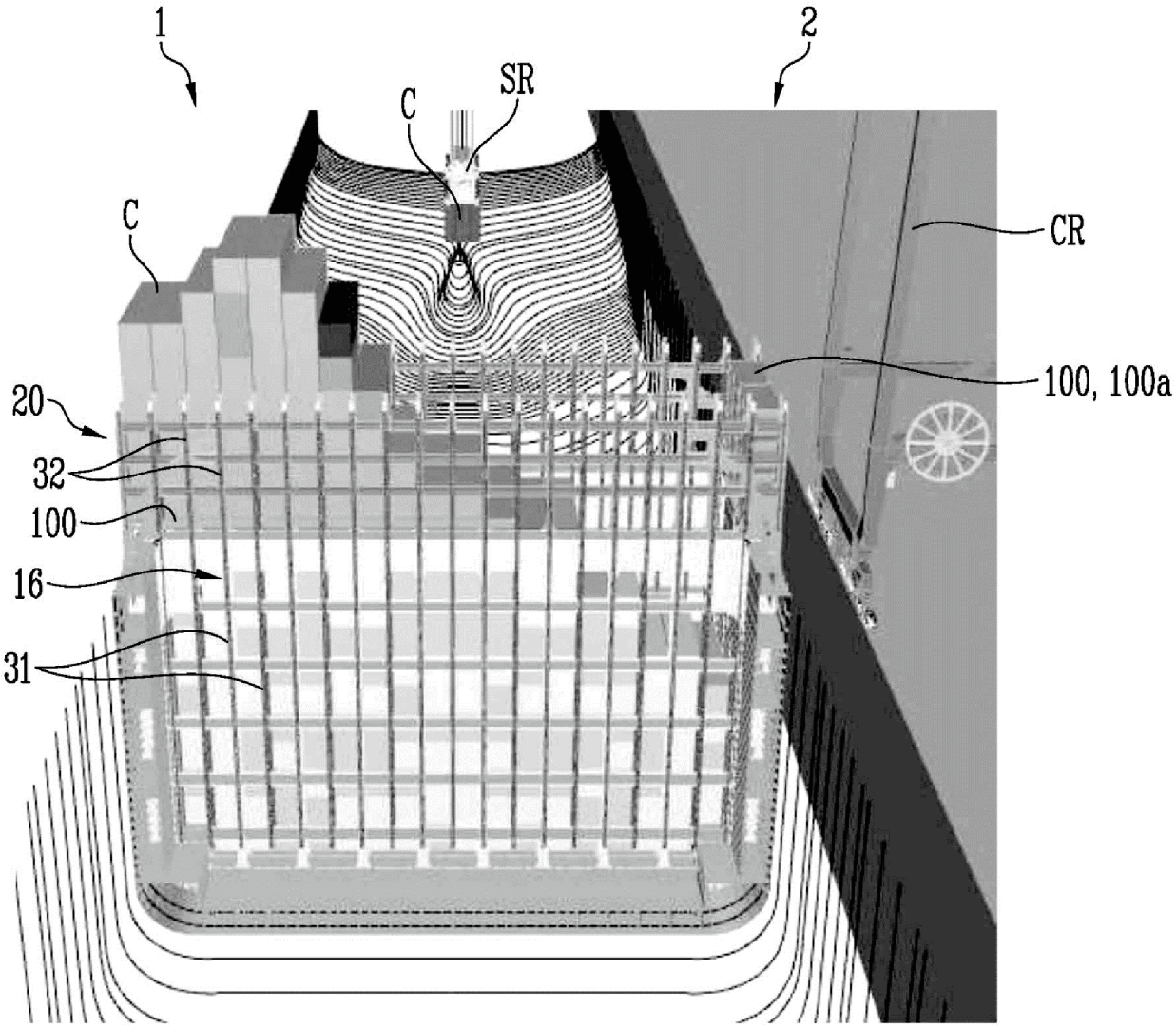


FIG. 14

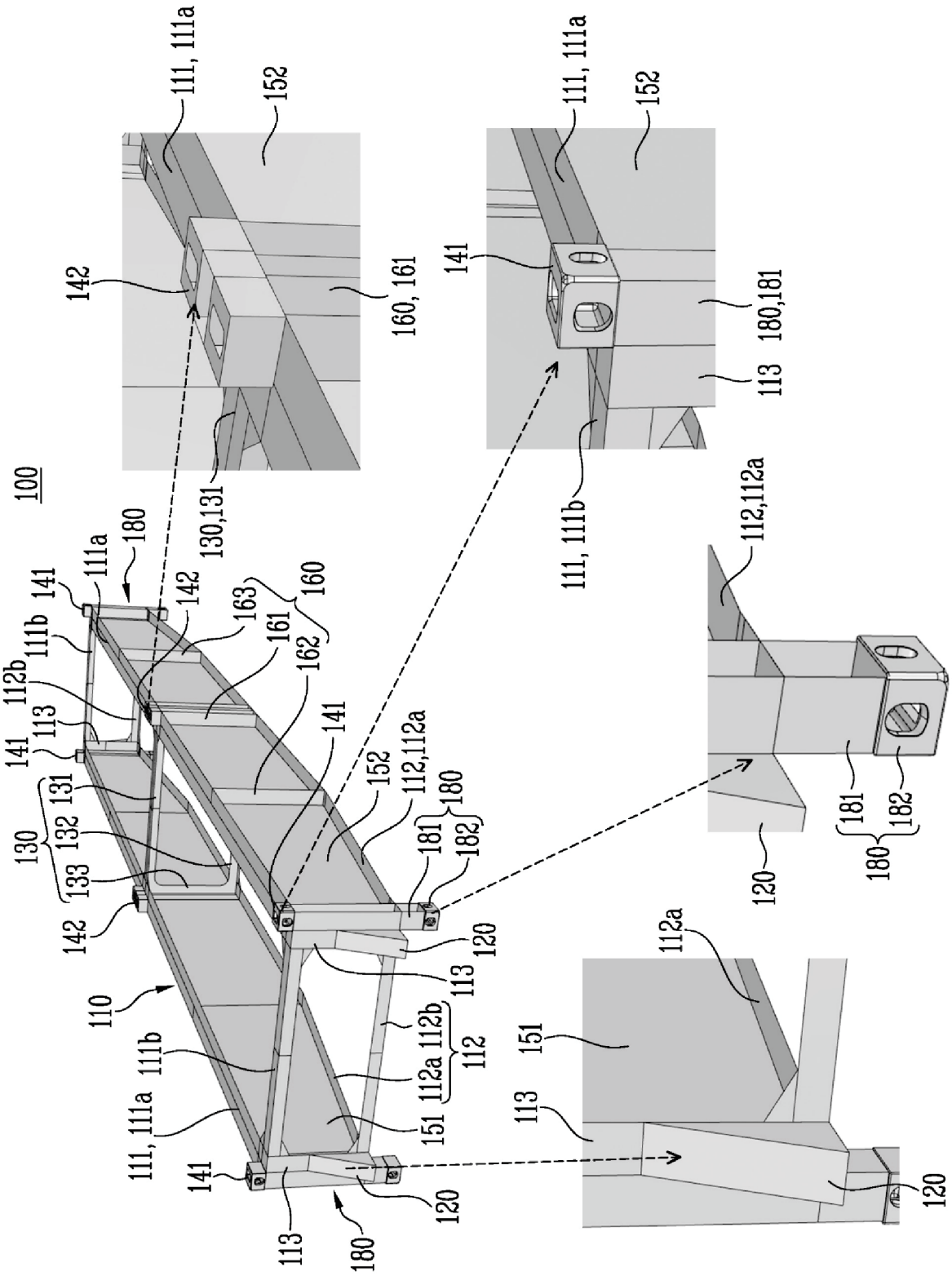

100
110
111, 111a
111b
112
112a
112b
112,112a
113
120
130
130,131
131
132
133
141
142
151
152
160
160, 161
161
162
163
180
180,181
181
182

FIG. 15

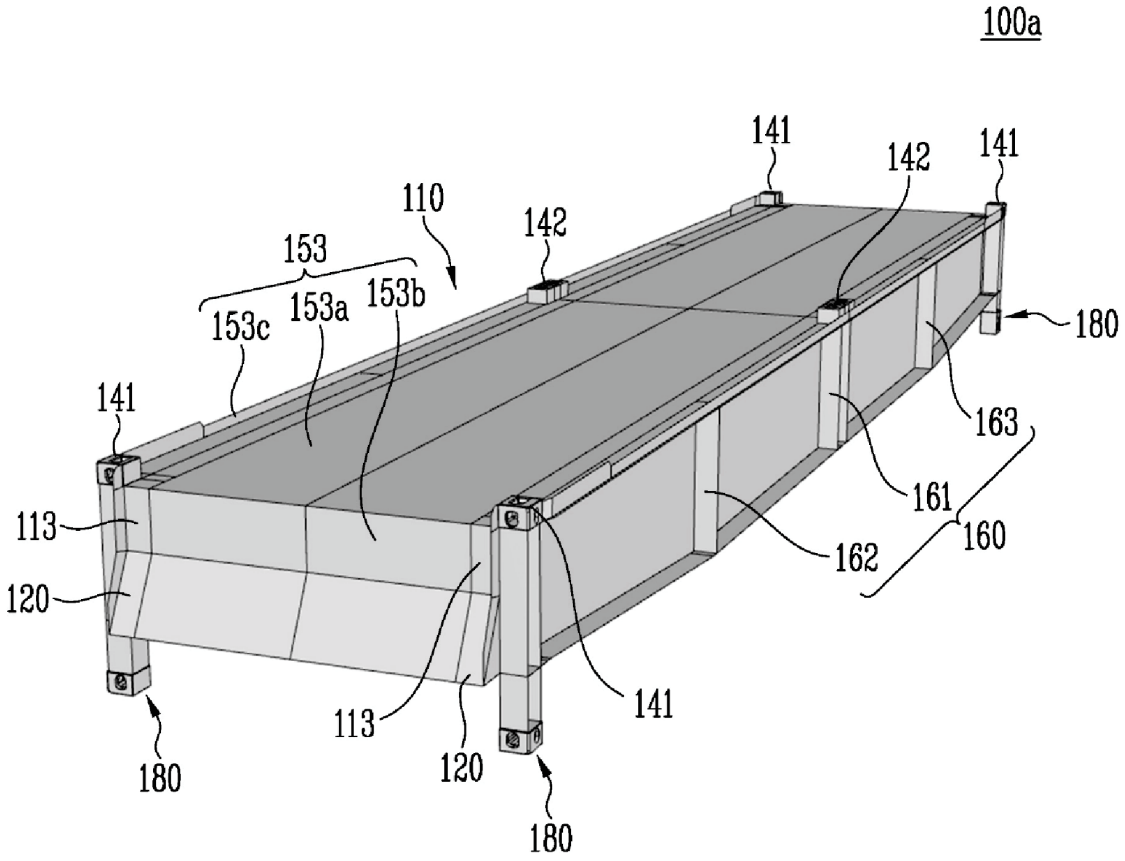

100a
141
142
141
110
142
153
153c
153a
153b
180
141
163
161
113
162
160
120
141
113
120
180
180

FIG. 16

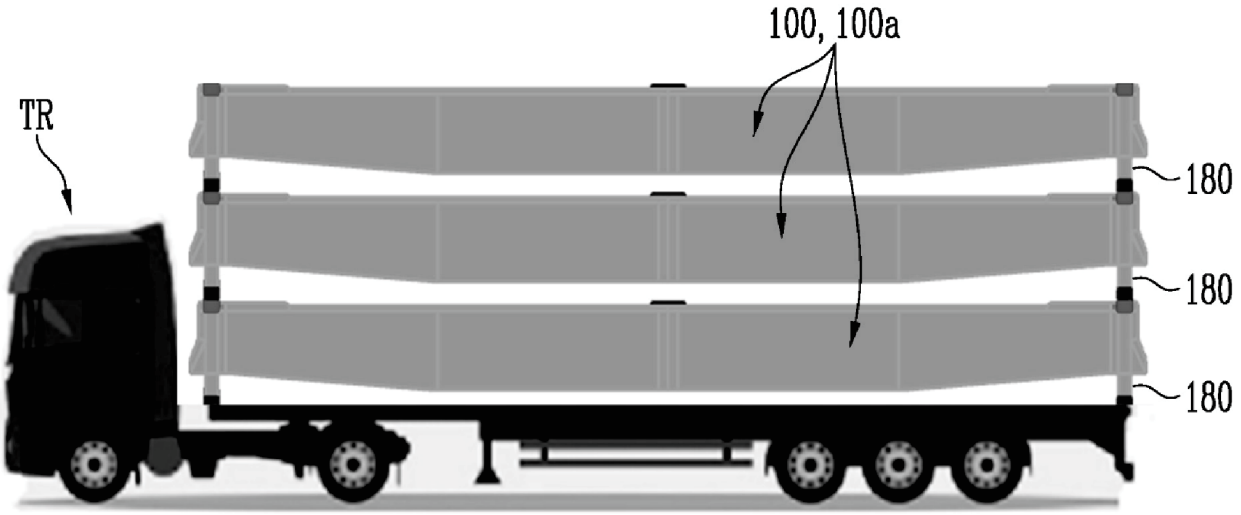

100, 100a
TR
180
180
180

FIG. 17

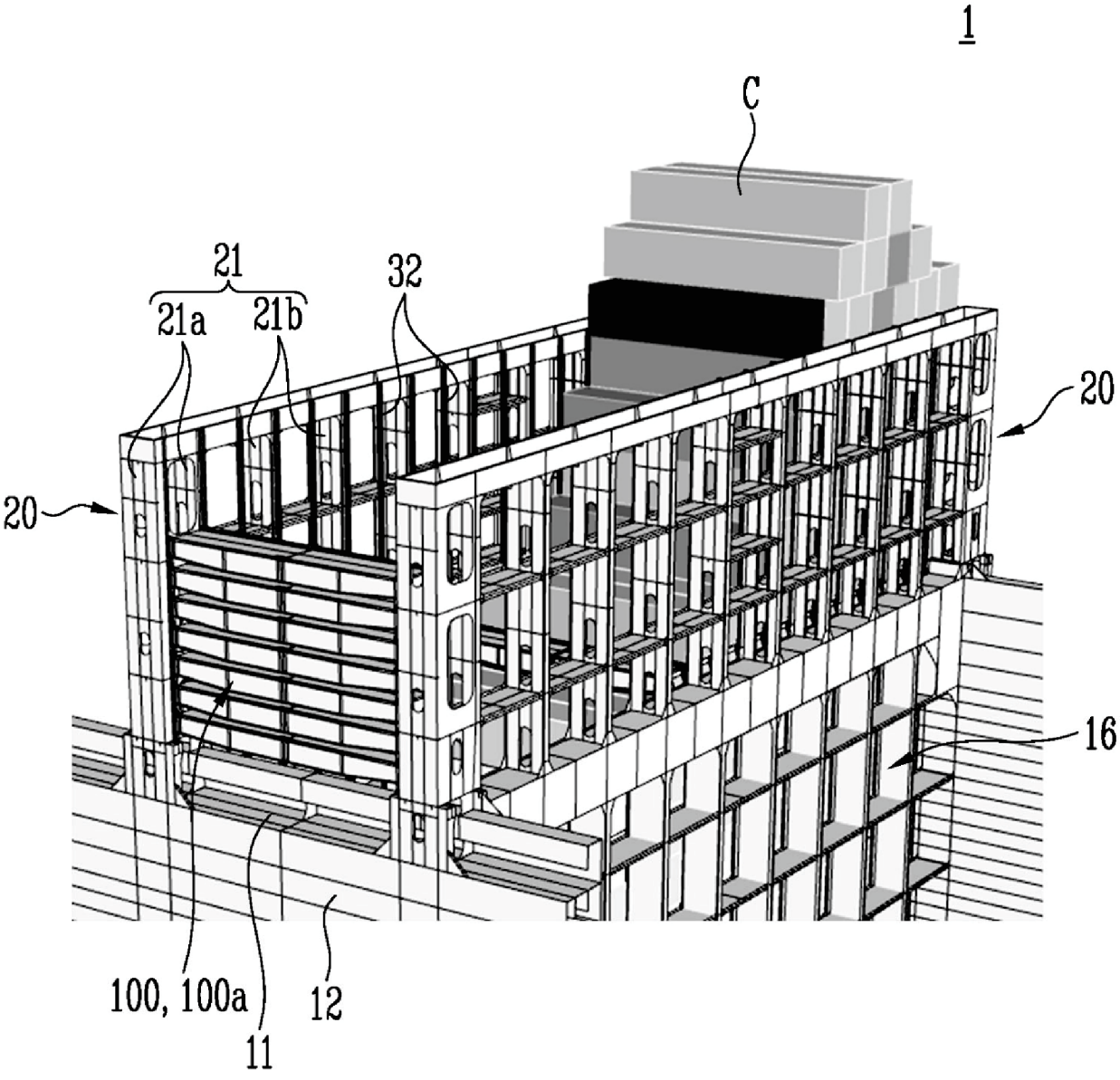


FIG. 18

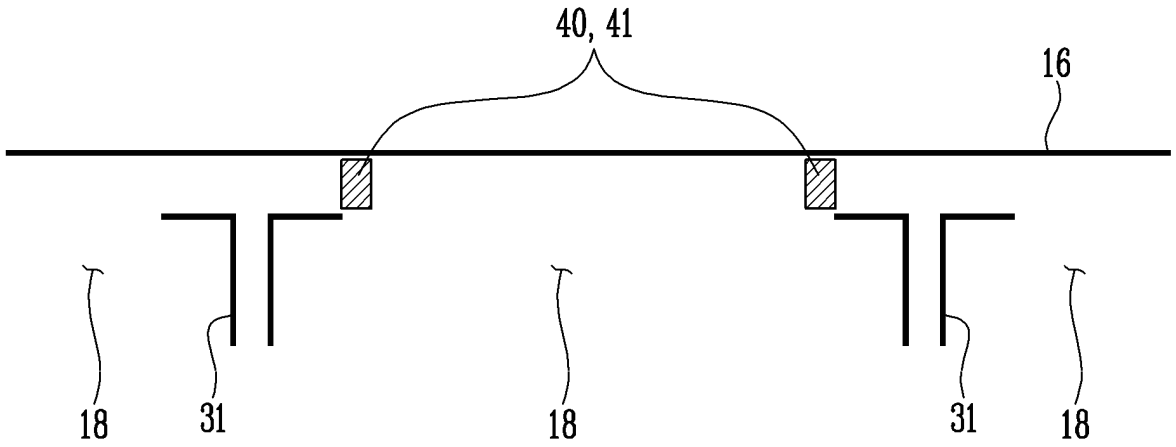


FIG. 19

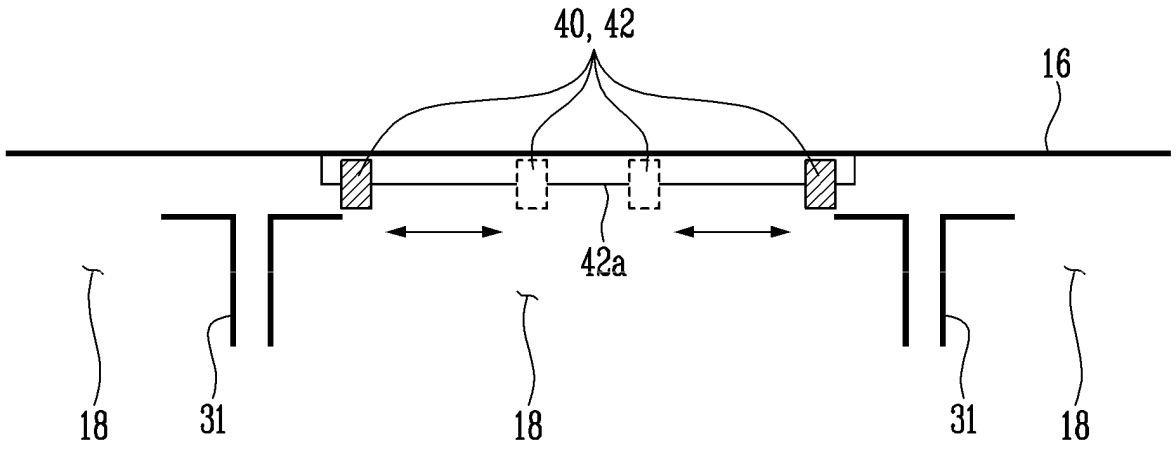


FIG. 20

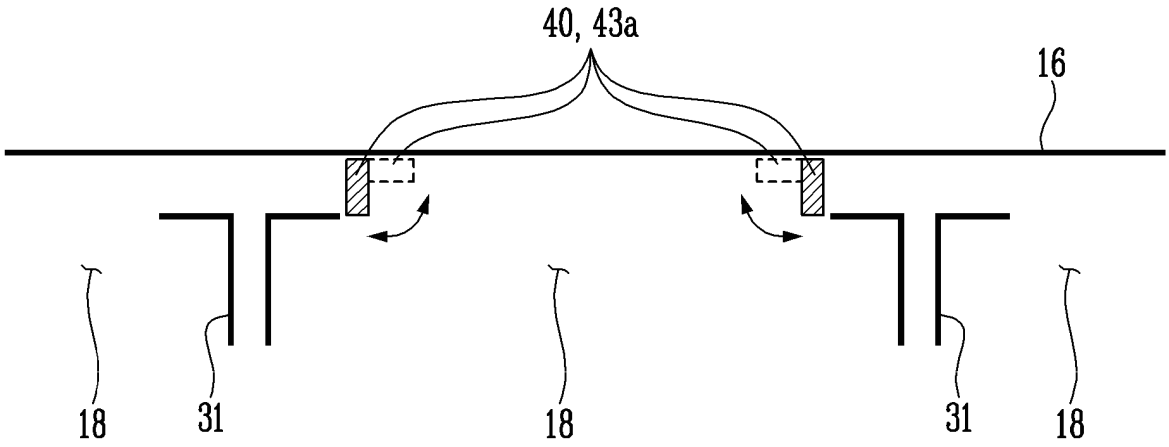


FIG. 21

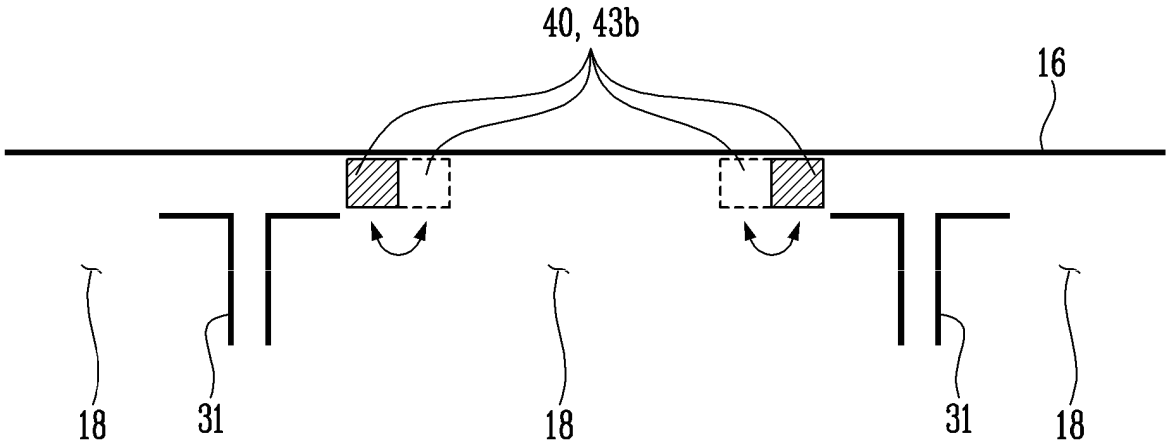


FIG. 22

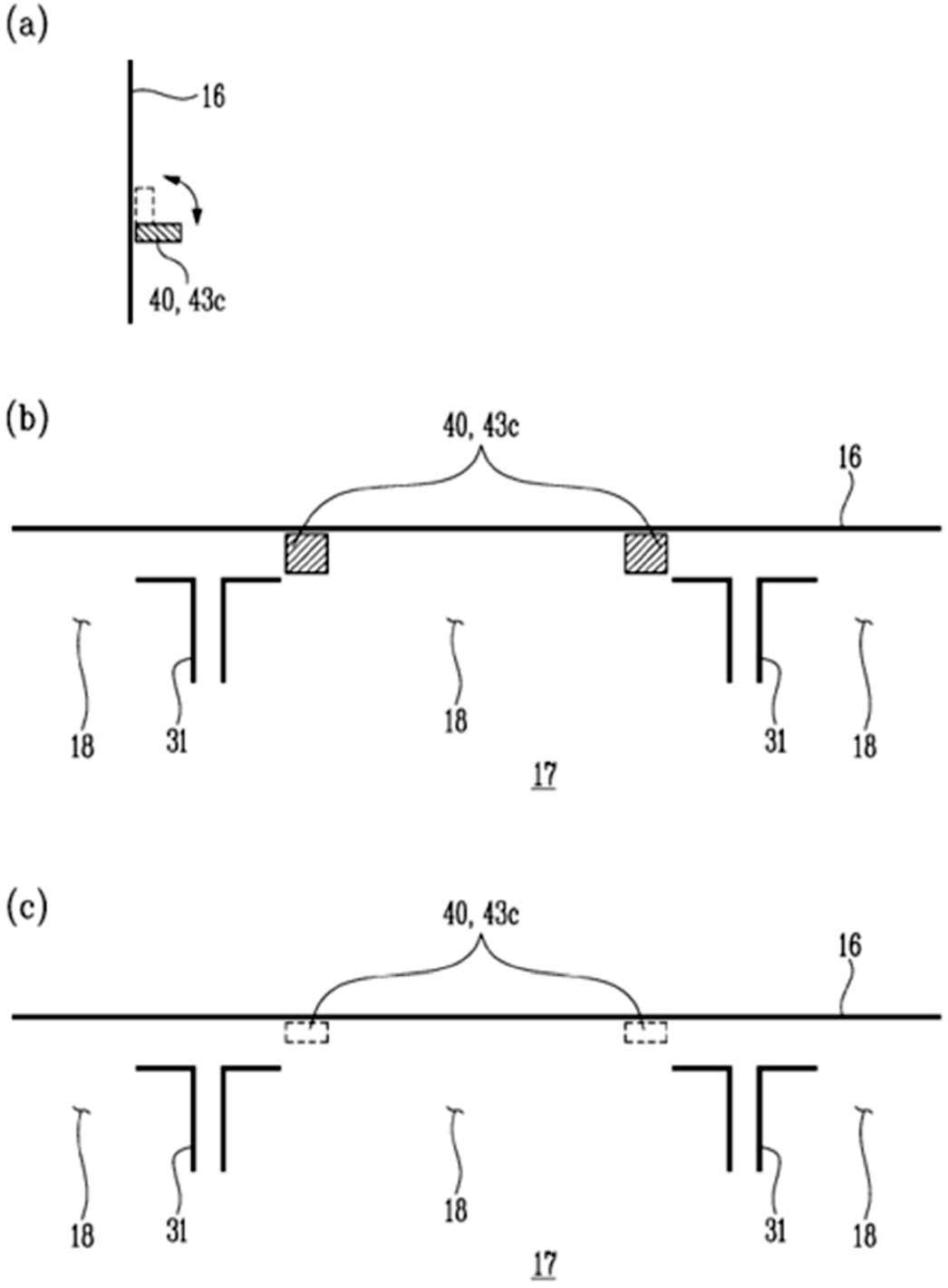


FIG. 23

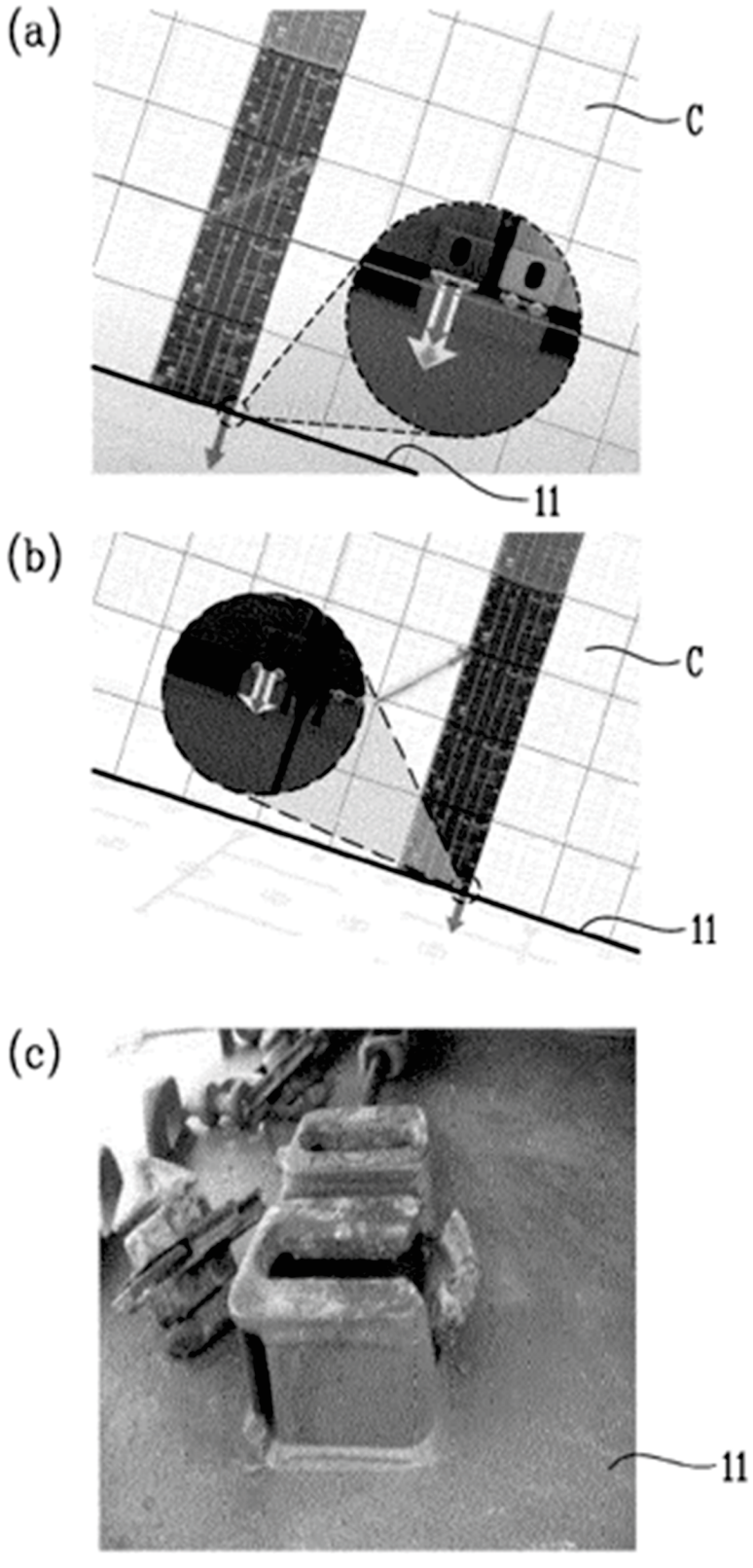


FIG. 24

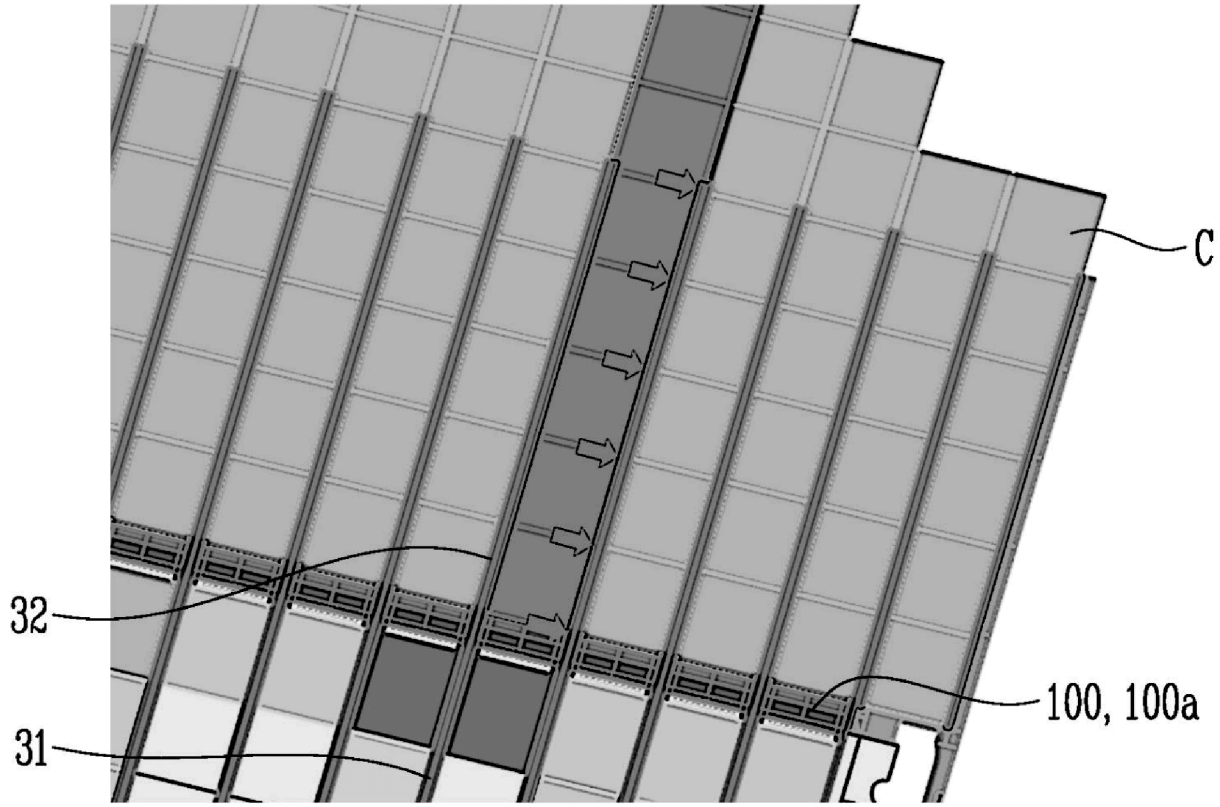


FIG. 25

Tier	TwistLock Force		Corner Post Force		Racking	Lashing Rod Tension			
	(PS)	(SB)	(PS)	(SB)	Force	A	B	C	D
12	-12.5	-7.2	0	0	2.3	0	0	0	0
11	-39.8	-13.7	-12.5	-7.2	9	0	0	0	0
10	-85.8	-15.6	-39.8	-13.7	19.2	0	0	0	0
9	-151	-6.7	-85.8	-15.6	32.1	0	0	0	0
8	-232.3	18.3	-151	-6.7	46	0	0	0	0
7	-329.4	59.1	-232.3	18.3	59.8	0	0	0	0
6	-442.2	115.6	-329.4	59.1	73.4	0	0	0	0
5	-570.5	91.6	-442.2	115.6	86.8	0	146.7	0	0
4	-597.8	-31.5	-570.5	23.8	-69.1	69.1	77	0	0
3	-725	-174.6	-597.8	-31.5	-6.9	0	0	0	0
2	-927.5	-242.5	-725	-174.6	58.3	0	0	0	0
1	-1206.2	-234	**-927.5**	-242.5	124.5	0	0	0	0

FIG. 26

Tier	TwistLock Force		Corner Post Force		Racking	Lashing Rod Tension			
	(PS)	(SB)	(PS)	(SB)	Force	A	B	C	D
12	12	-12.5	-7.2	0	0	2.3	0	0	0
11	11	-39.8	-13.7	-12.5	-7.2	9	0	0	0
10	10	-85.8	-15.6	-39.8	-13.7	19.2	0	0	0
9	9	-151	-6.7	-85.8	-15.6	32.1	0	0	0
8	8	-232.3	18.3	-151	-6.7	46	0	0	0
7	7	-329.4	59.1	-232.3	18.3	59.8	0	0	0
6	6	-442.2	115.6	-329.4	59.1	73.4	0	0	0
5	5	-570.5	187.6	-442.2	115.6	86.8	0	0	0
4	Cell Guide								
3									
2									
1			-805.7						

FIG. 27

Loads	Criteria	Lashing system 3-tier lashing bridge**	Cell guide system 4-tier
Racking force(kN)	150	124.5	86.8
Post force(kN) (Compression)	848	927.5	805.7 (442.2+363.5***)
Twistlock force(kN) (Tension)	250(500*)	115.6	187.6
Remarks	* Min. breaking load (tension) of twistlock	**External lashing, lashing at bottom/top of 4th tier & bottom of 5th tier	*** (18+48+48) x 9.81 x 1.3(g) ÷4 = 363.5 kN

FIG. 28

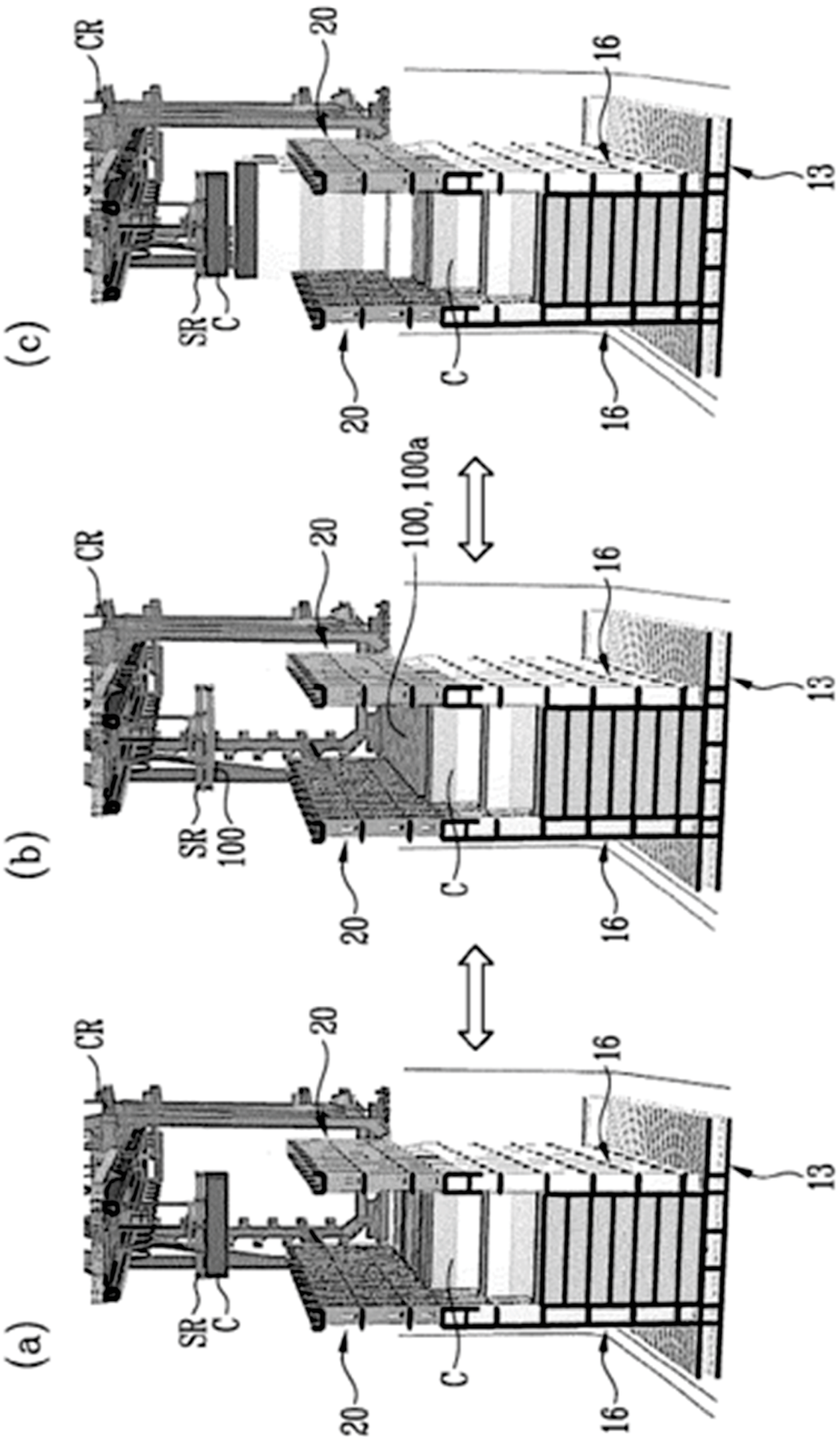


FIG. 29

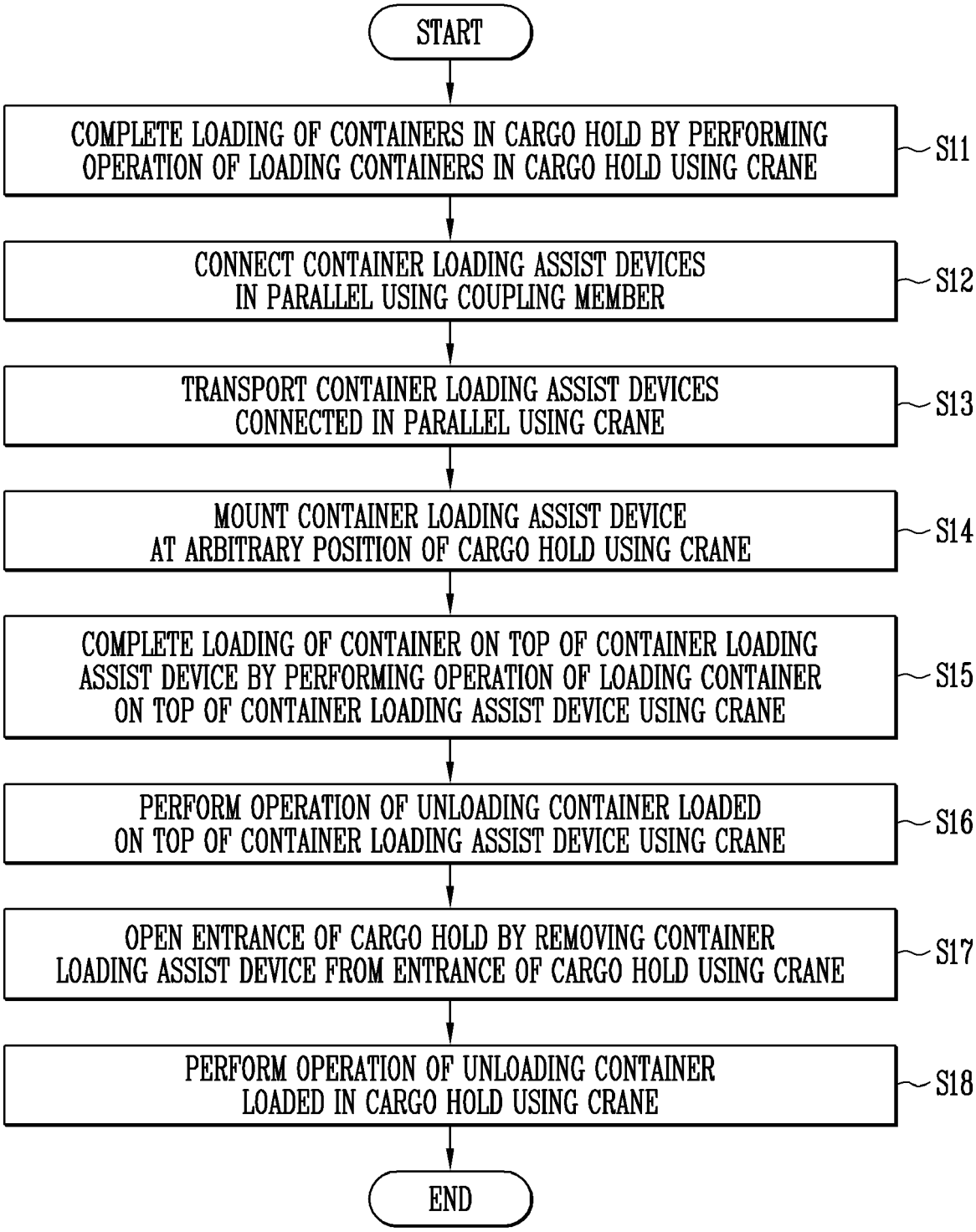

START
COMPLETE LOADING OF CONTAINERS IN CARGO HOLD BY PERFORMING OPERATION OF LOADING CONTAINERS IN CARGO HOLD USING CRANE
S11
CONNECT CONTAINER LOADING ASSIST DEVICES IN PARALLEL USING COUPLING MEMBER
S12
TRANSPORT CONTAINER LOADING ASSIST DEVICES CONNECTED IN PARALLEL USING CRANE
S13
MOUNT CONTAINER LOADING ASSIST DEVICE AT ARBITRARY POSITION OF CARGO HOLD USING CRANE
S14
COMPLETE LOADING OF CONTAINER ON TOP OF CONTAINER LOADING ASSIST DEVICE BY PERFORMING OPERATION OF LOADING CONTAINER ON TOP OF CONTAINER LOADING ASSIST DEVICE USING CRANE
S15
PERFORM OPERATION OF UNLOADING CONTAINER LOADED ON TOP OF CONTAINER LOADING ASSIST DEVICE USING CRANE
S16
OPEN ENTRANCE OF CARGO HOLD BY REMOVING CONTAINER LOADING ASSIST DEVICE FROM ENTRANCE OF CARGO HOLD USING CRANE
S17
PERFORM OPERATION OF UNLOADING CONTAINER LOADED IN CARGO HOLD USING CRANE
S18
END

FIG. 30

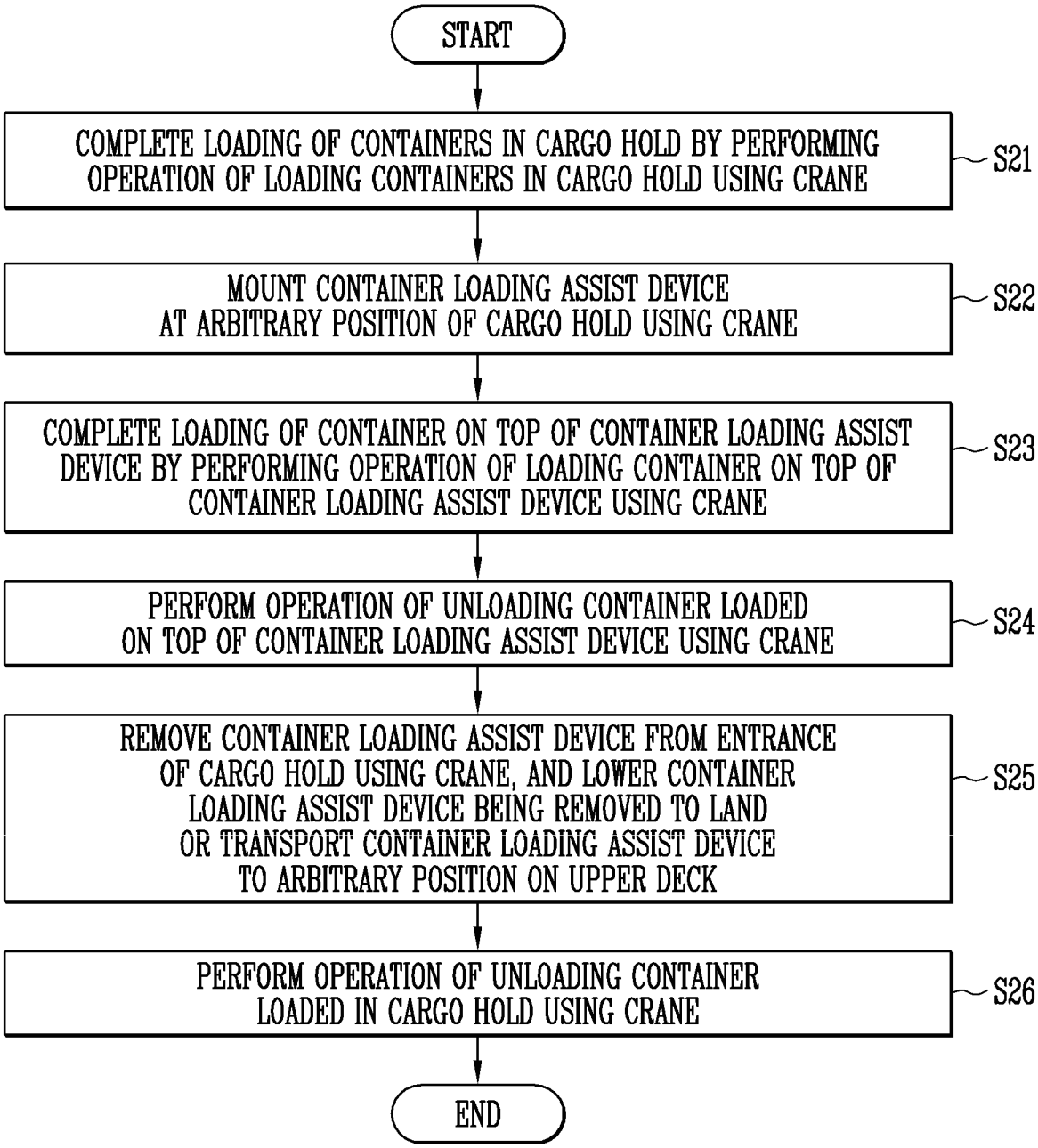

START
COMPLETE LOADING OF CONTAINERS IN CARGO HOLD BY PERFORMING OPERATION OF LOADING CONTAINERS IN CARGO HOLD USING CRANE
S21
MOUNT CONTAINER LOADING ASSIST DEVICE AT ARBITRARY POSITION OF CARGO HOLD USING CRANE
S22
COMPLETE LOADING OF CONTAINER ON TOP OF CONTAINER LOADING ASSIST DEVICE BY PERFORMING OPERATION OF LOADING CONTAINER ON TOP OF CONTAINER LOADING ASSIST DEVICE USING CRANE
S23
PERFORM OPERATION OF UNLOADING CONTAINER LOADED ON TOP OF CONTAINER LOADING ASSIST DEVICE USING CRANE
S24
REMOVE CONTAINER LOADING ASSIST DEVICE FROM ENTRANCE OF CARGO HOLD USING CRANE, AND LOWER CONTAINER LOADING ASSIST DEVICE BEING REMOVED TO LAND OR TRANSPORT CONTAINER LOADING ASSIST DEVICE TO ARBITRARY POSITION ON UPPER DECK
S25
PERFORM OPERATION OF UNLOADING CONTAINER LOADED IN CARGO HOLD USING CRANE
S26
END

FIG. 31

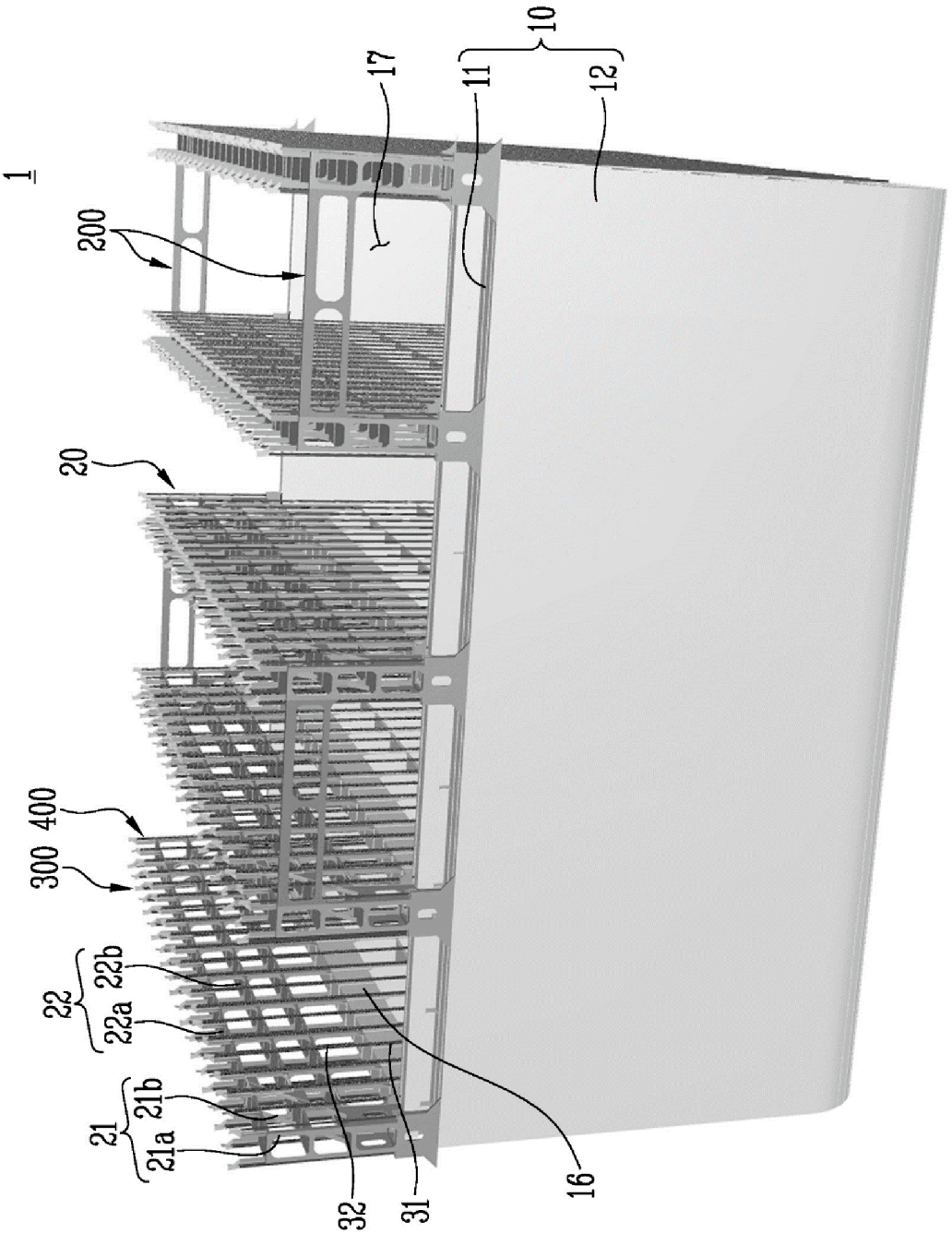


FIG. 32

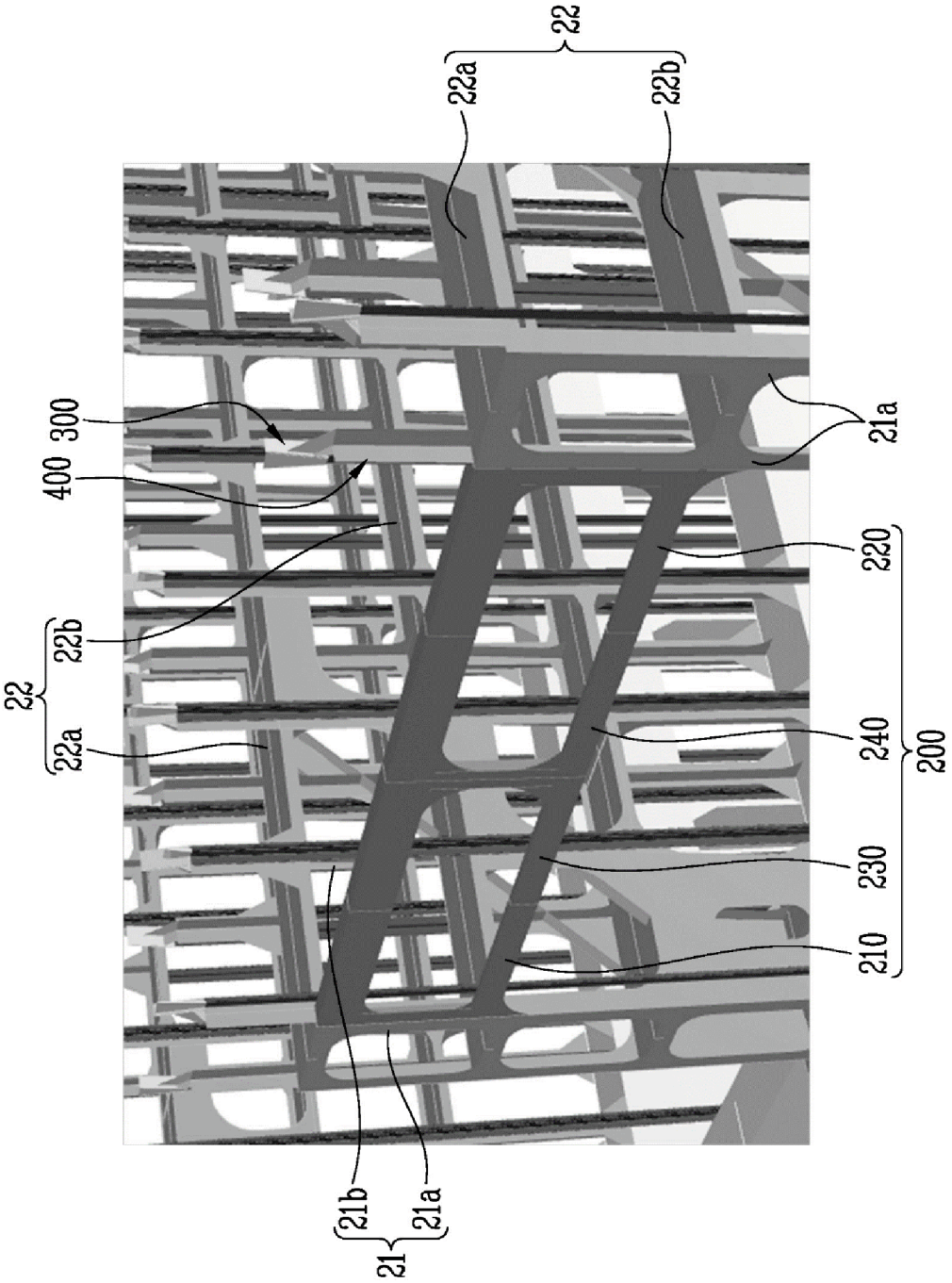


FIG. 33

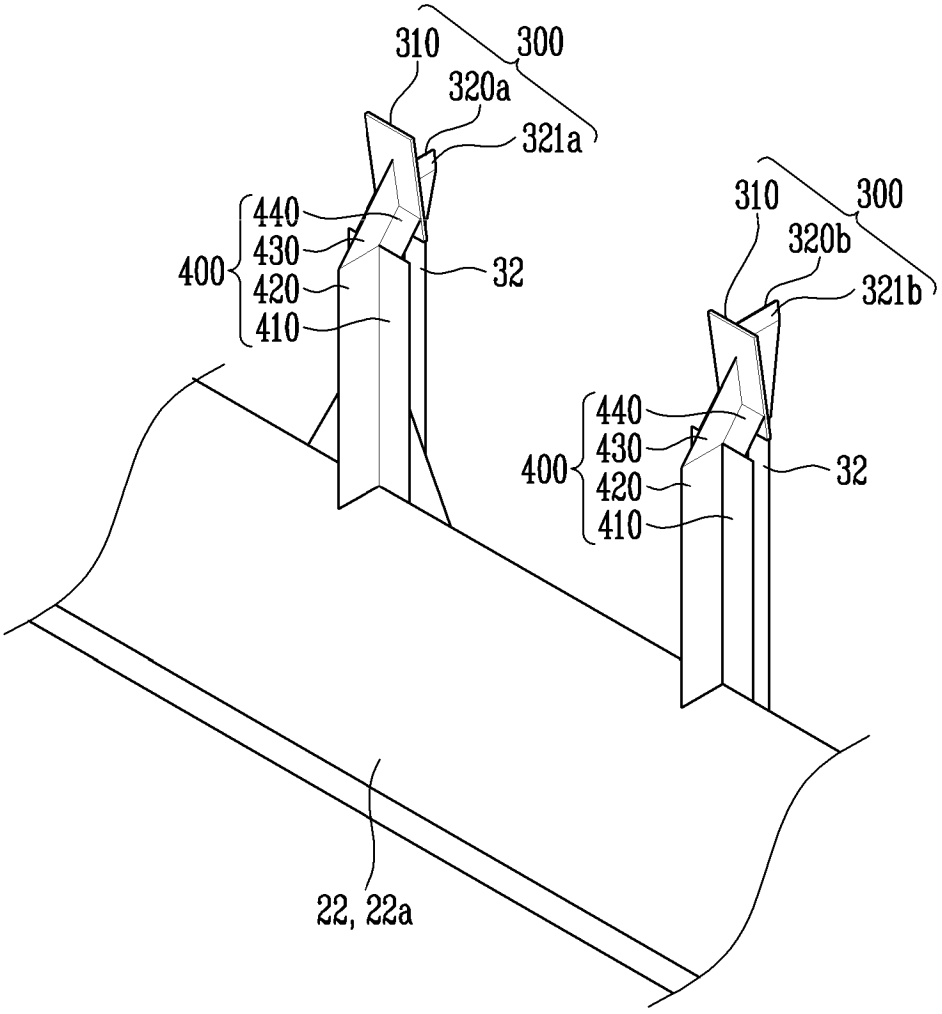

310
300
320a
321a
440
430
400
420
410
32
310
300
320b
321b
440
430
400
420
410
32
22, 22a

FIG. 34

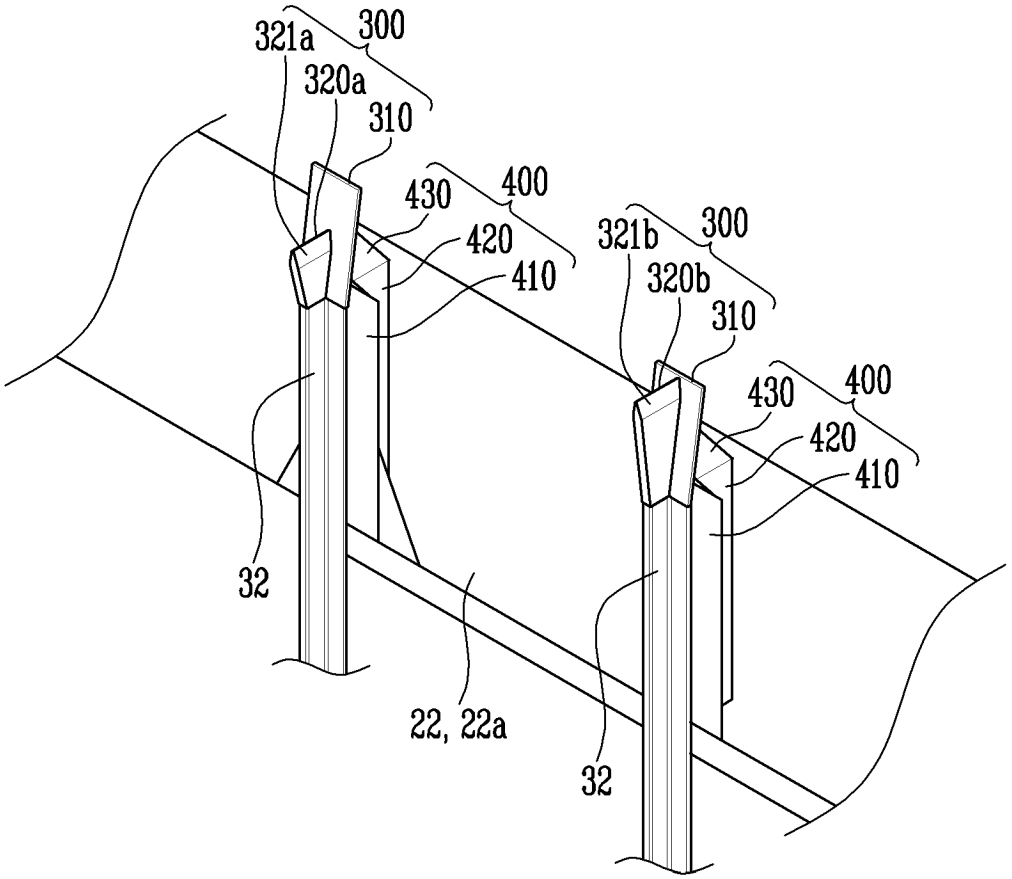

321a
300
320a
310
430
400
420
410
321b
300
320b
310
430
400
420
410
32
22, 22a
32

FIG. 35

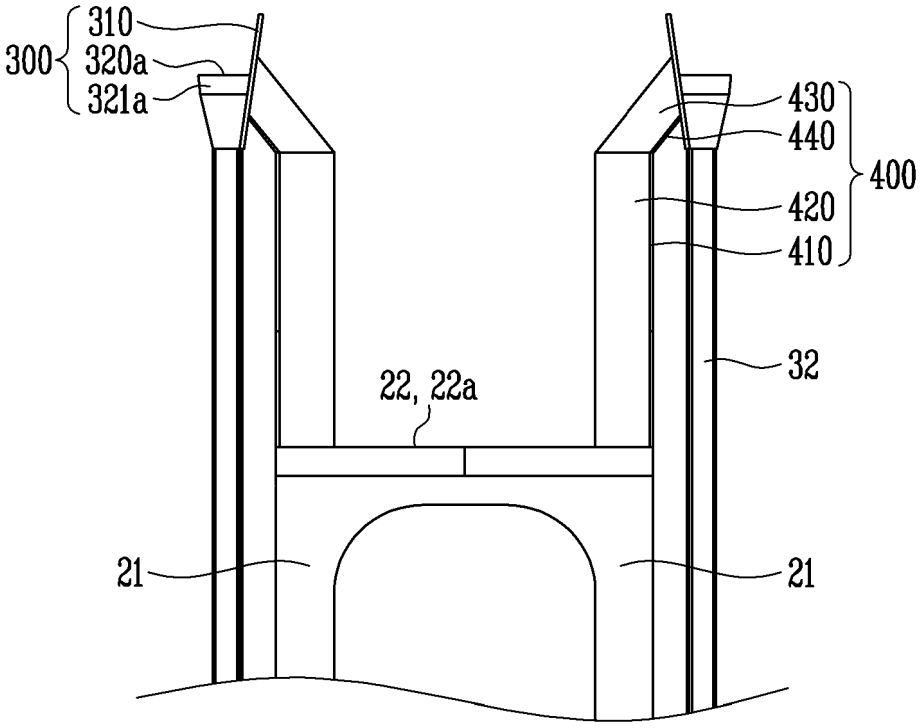


FIG. 36

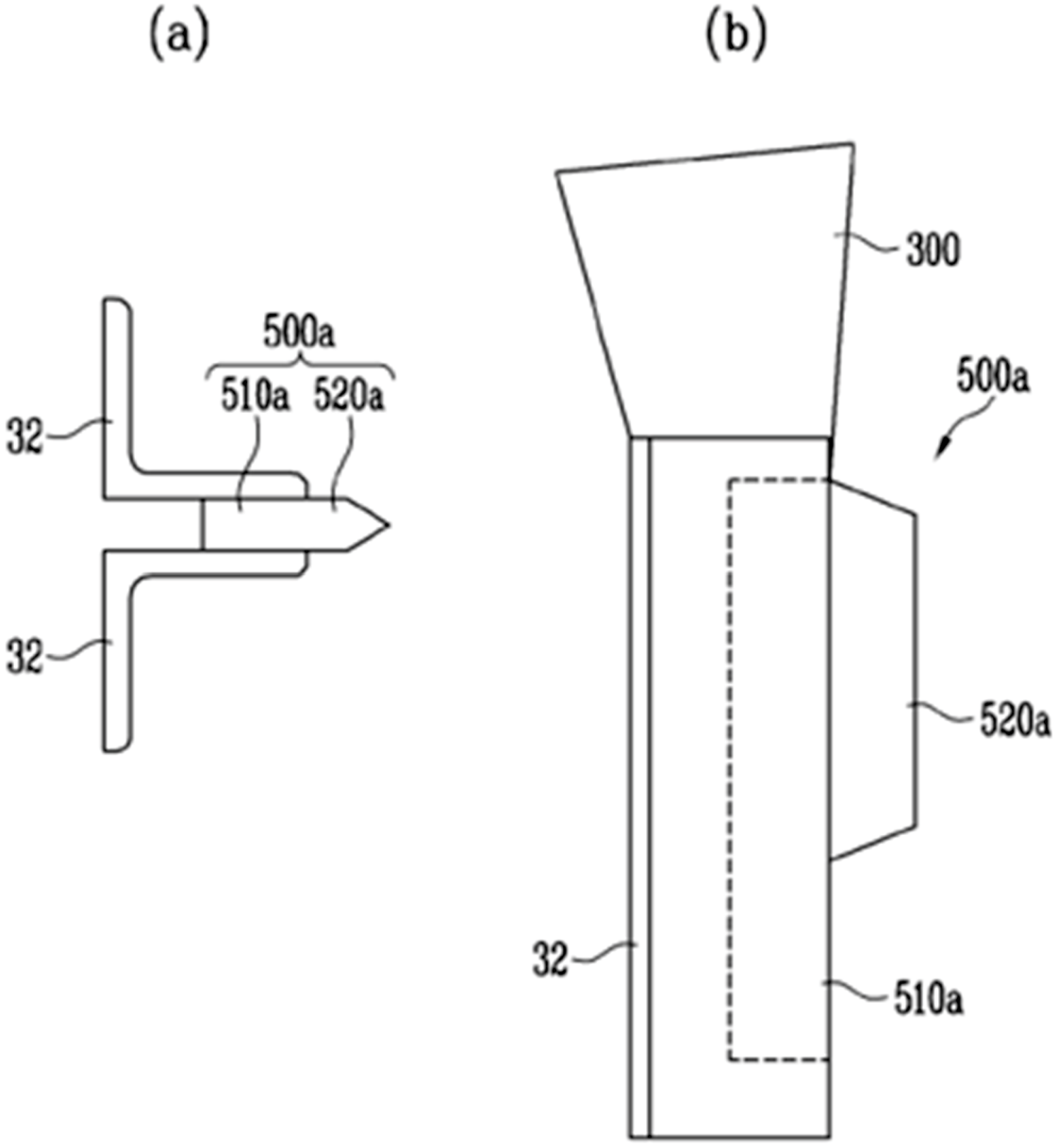


FIG. 37

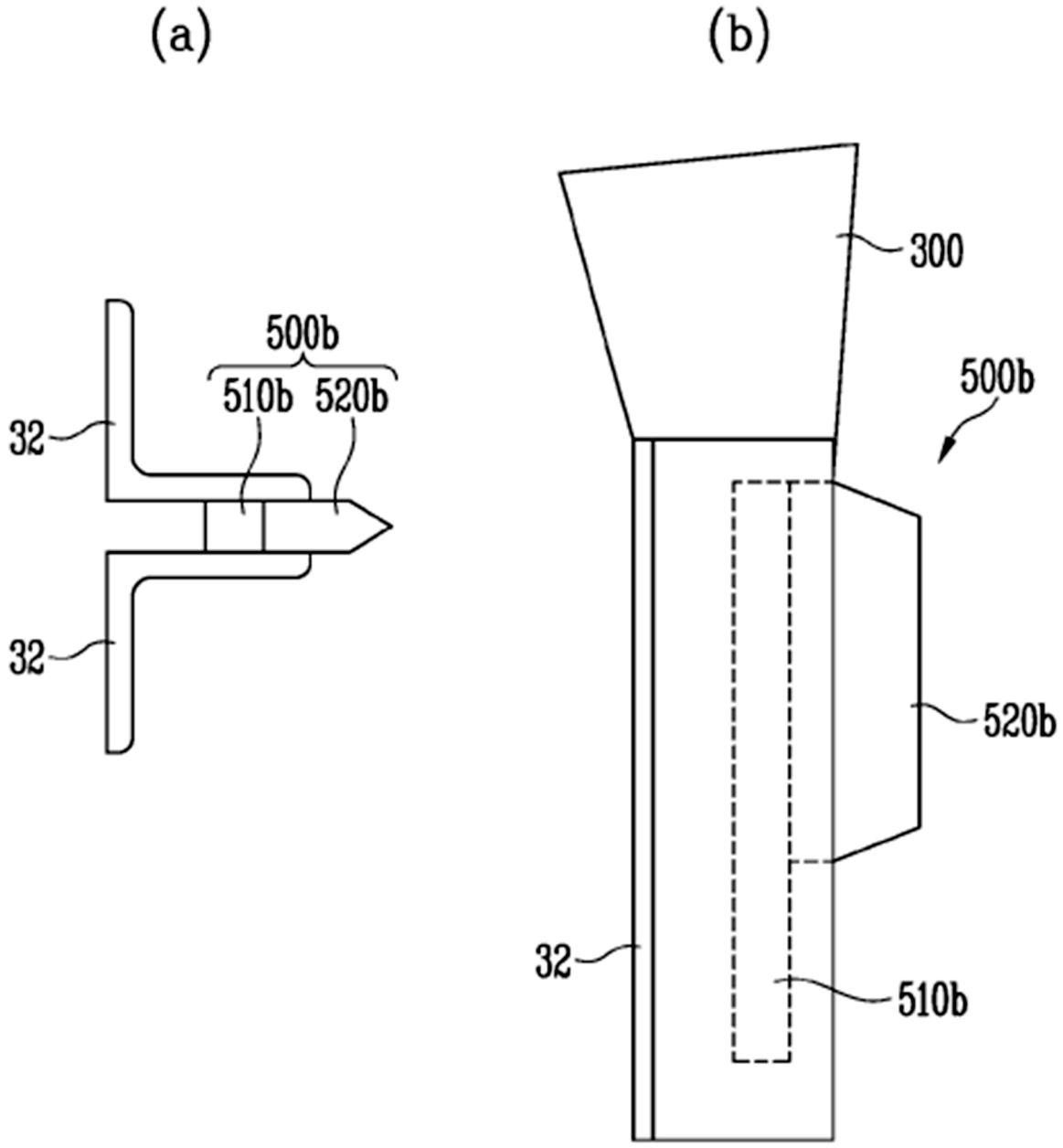


FIG. 38

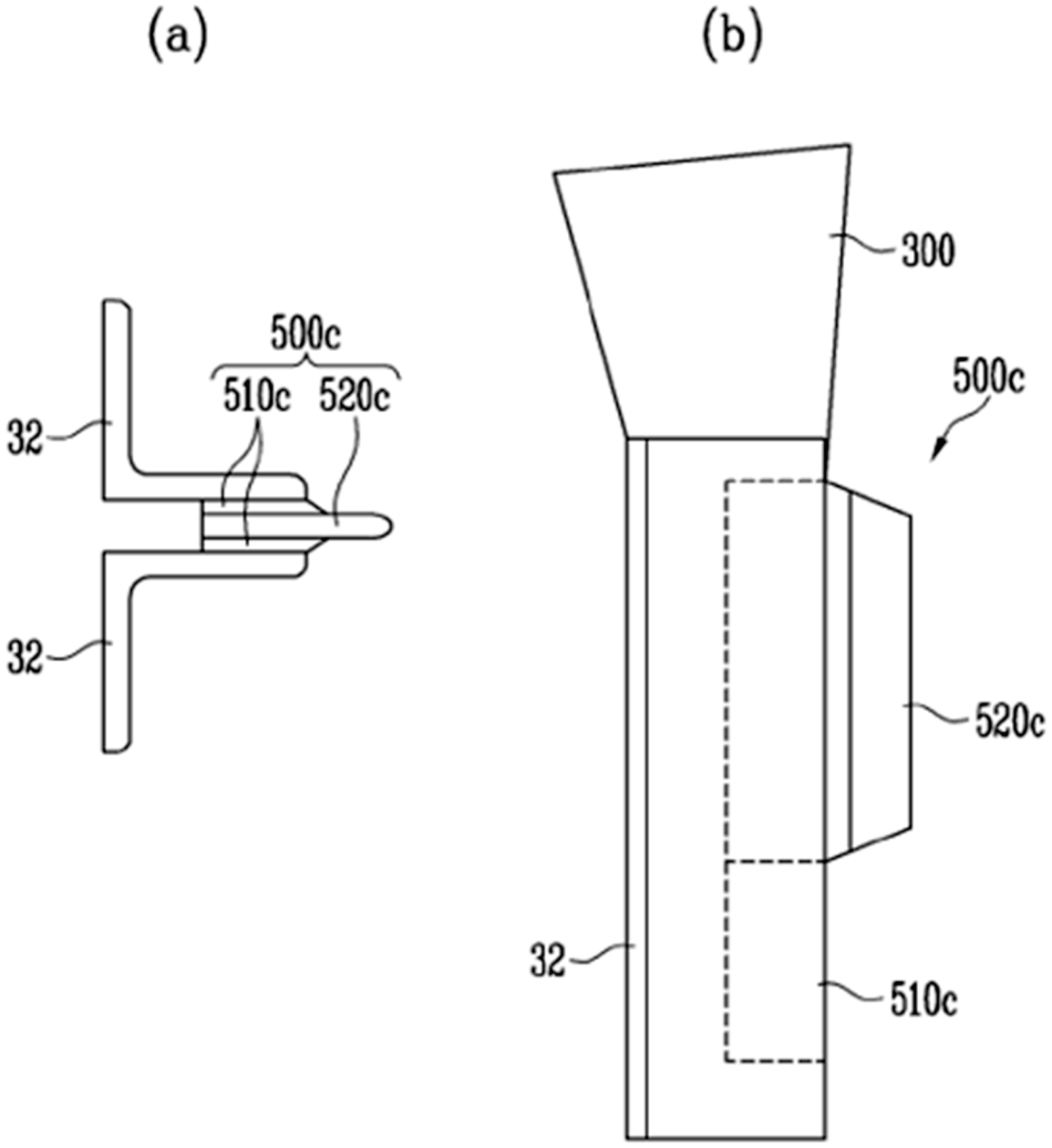


FIG. 39

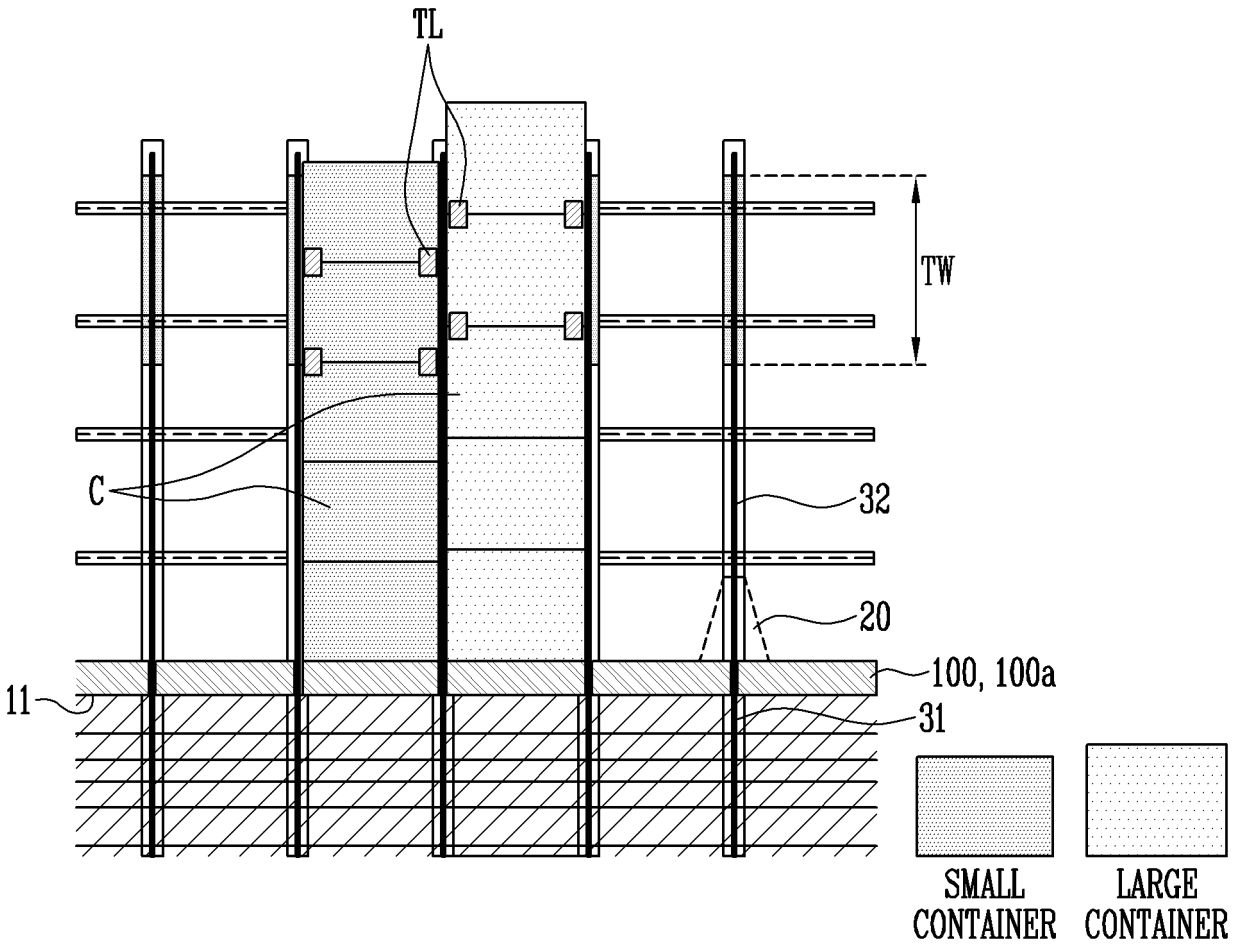


FIG. 40

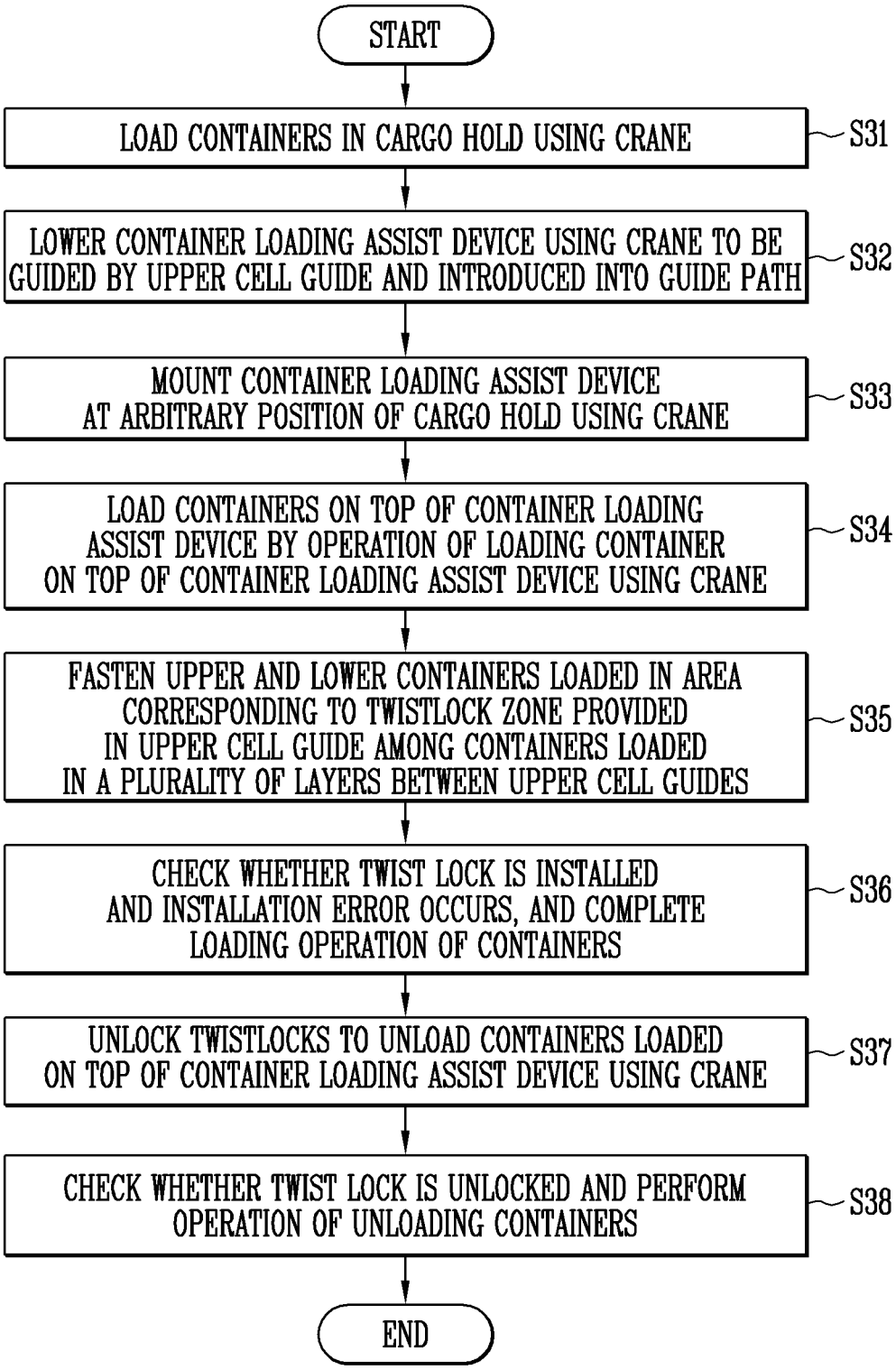

START
LOAD CONTAINERS IN CARGO HOLD USING CRANE
S31
LOWER CONTAINER LOADING ASSIST DEVICE USING CRANE TO BE GUIDED BY UPPER CELL GUIDE AND INTRODUCED INTO GUIDE PATH
S32
MOUNT CONTAINER LOADING ASSIST DEVICE AT ARBITRARY POSITION OF CARGO HOLD USING CRANE
S33
LOAD CONTAINERS ON TOP OF CONTAINER LOADING ASSIST DEVICE BY OPERATION OF LOADING CONTAINER ON TOP OF CONTAINER LOADING ASSIST DEVICE USING CRANE
S34
FASTEN UPPER AND LOWER CONTAINERS LOADED IN AREA CORRESPONDING TO TWISTLOCK ZONE PROVIDED IN UPPER CELL GUIDE AMONG CONTAINERS LOADED IN A PLURALITY OF LAYERS BETWEEN UPPER CELL GUIDES
S35
CHECK WHETHER TWIST LOCK IS INSTALLED AND INSTALLATION ERROR OCCURS, AND COMPLETE LOADING OPERATION OF CONTAINERS
S36
UNLOCK TWISTLOCKS TO UNLOAD CONTAINERS LOADED ON TOP OF CONTAINER LOADING ASSIST DEVICE USING CRANE
S37
CHECK WHETHER TWIST LOCK IS UNLOCKED AND PERFORM OPERATION OF UNLOADING CONTAINERS
S38
END

FIG. 41

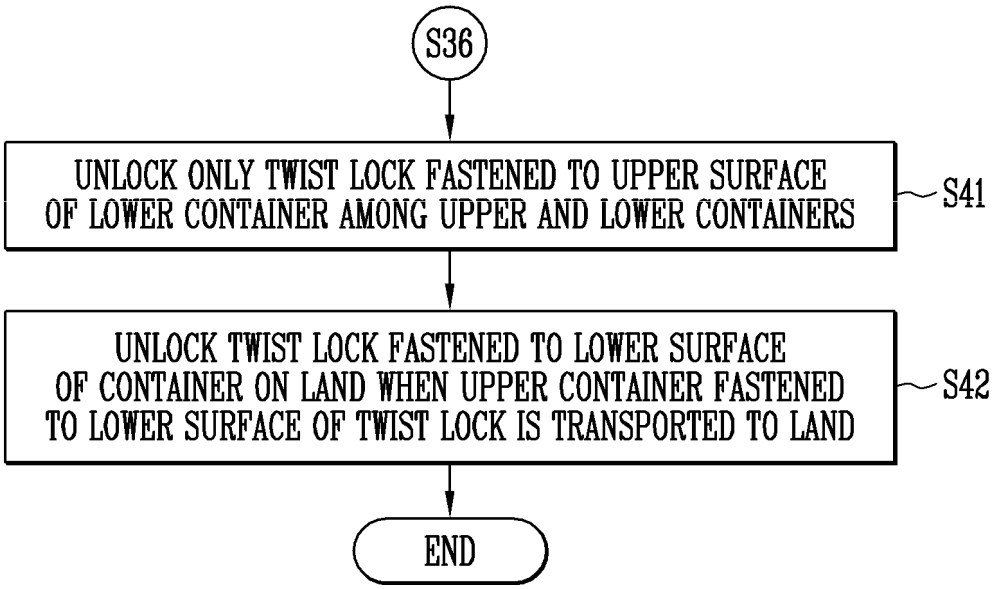

S36
UNLOCK ONLY TWIST LOCK FASTENED TO UPPER SURFACE OF LOWER CONTAINER AMONG UPPER AND LOWER CONTAINERS
S41
UNLOCK TWIST LOCK FASTENED TO LOWER SURFACE OF CONTAINER ON LAND WHEN UPPER CONTAINER FASTENED TO LOWER SURFACE OF TWIST LOCK IS TRANSPORTED TO LAND
S42
END

FIG. 42

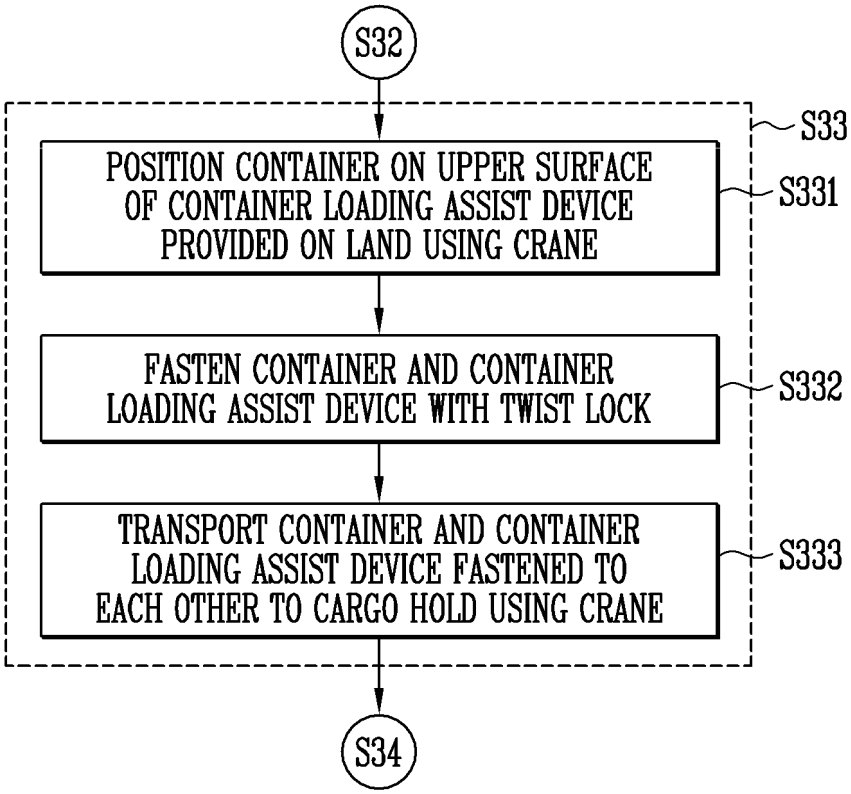

S32
S33
POSITION CONTAINER ON UPPER SURFACE OF CONTAINER LOADING ASSIST DEVICE PROVIDED ON LAND USING CRANE
S331
FASTEN CONTAINER AND CONTAINER LOADING ASSIST DEVICE WITH TWIST LOCK
S332
TRANSPORT CONTAINER AND CONTAINER LOADING ASSIST DEVICE FASTENED TO EACH OTHER TO CARGO HOLD USING CRANE
S333
S34

FIG. 43

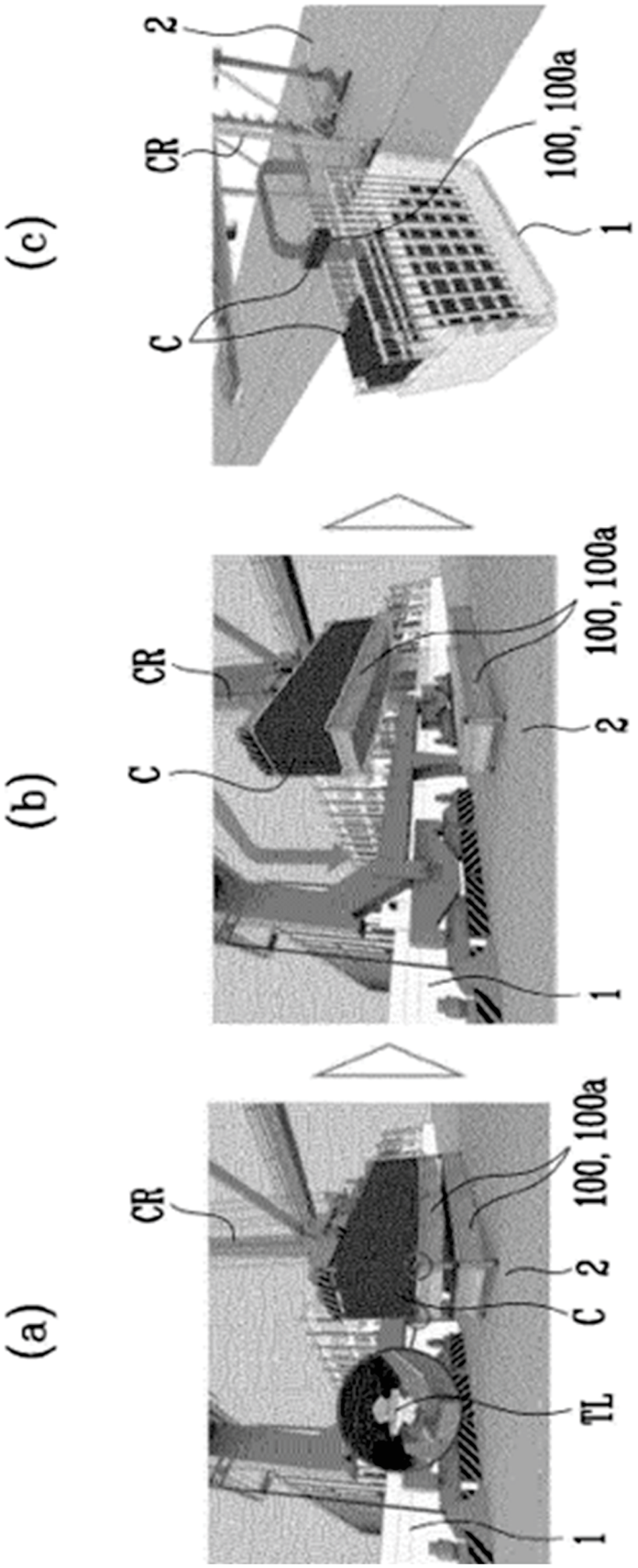


FIG. 44

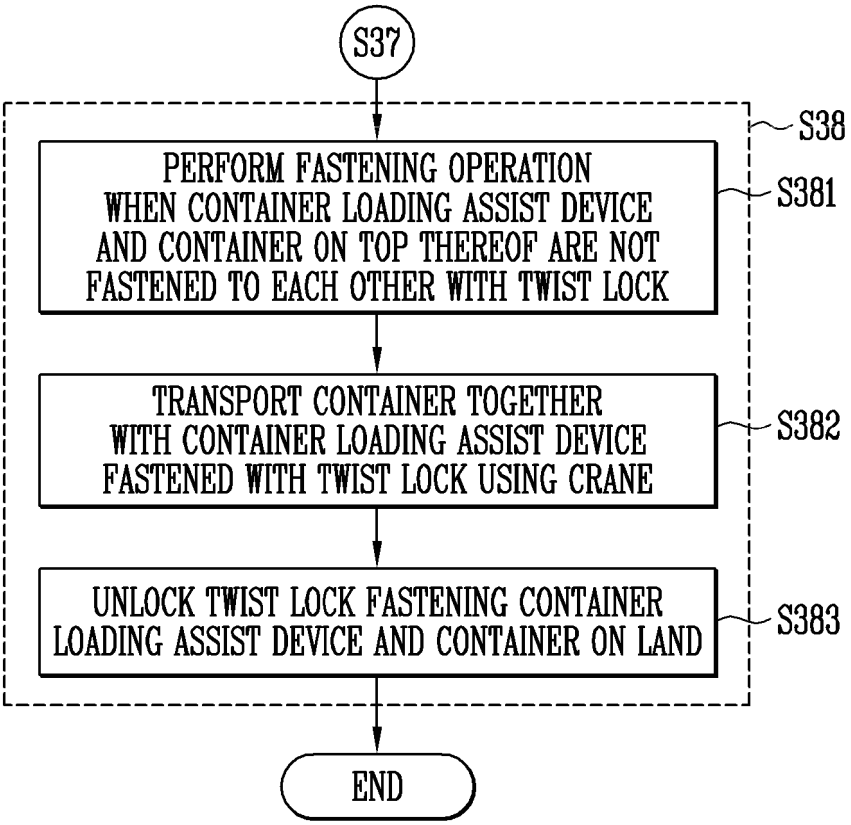

S37
S38
PERFORM FASTENING OPERATION WHEN CONTAINER LOADING ASSIST DEVICE AND CONTAINER ON TOP THEREOF ARE NOT FASTENED TO EACH OTHER WITH TWIST LOCK
S381
TRANSPORT CONTAINER TOGETHER WITH CONTAINER LOADING ASSIST DEVICE FASTENED WITH TWIST LOCK USING CRANE
S382
UNLOCK TWIST LOCK FASTENING CONTAINER LOADING ASSIST DEVICE AND CONTAINER ON LAND
S383
END

FIG. 45

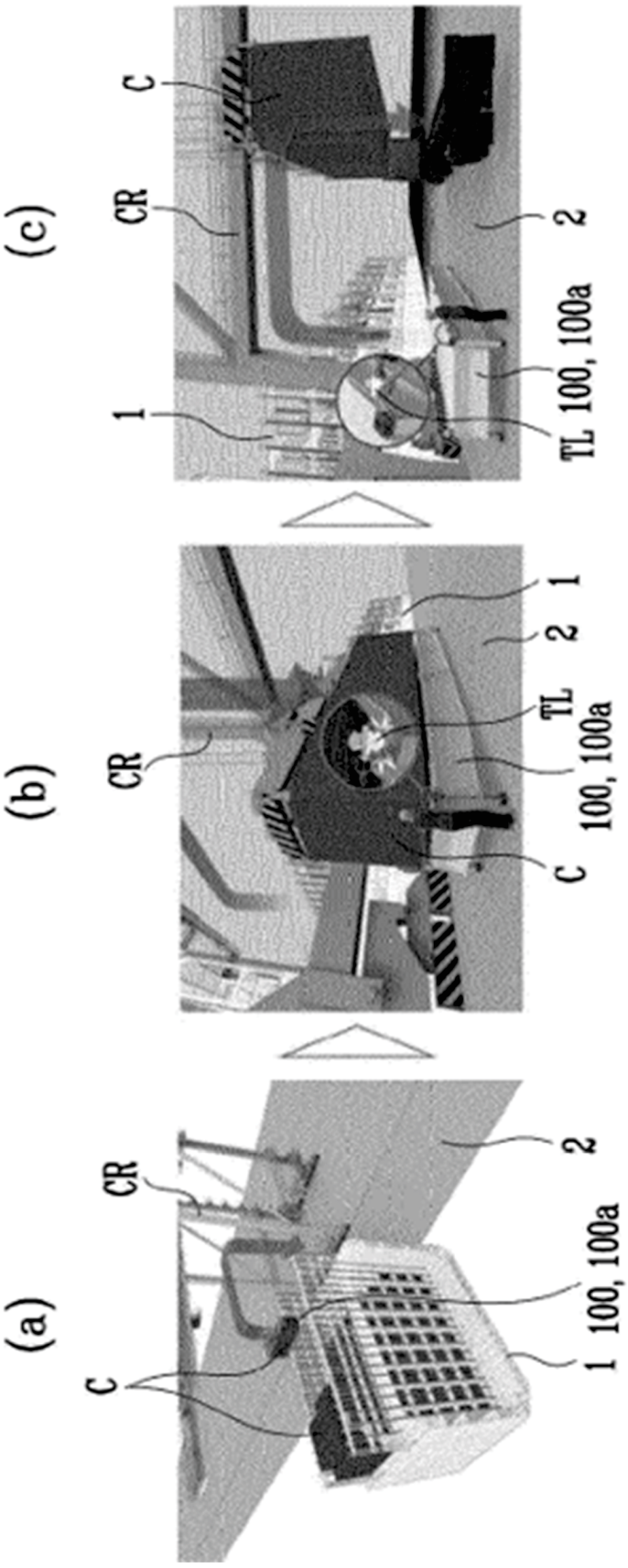


FIG. 46

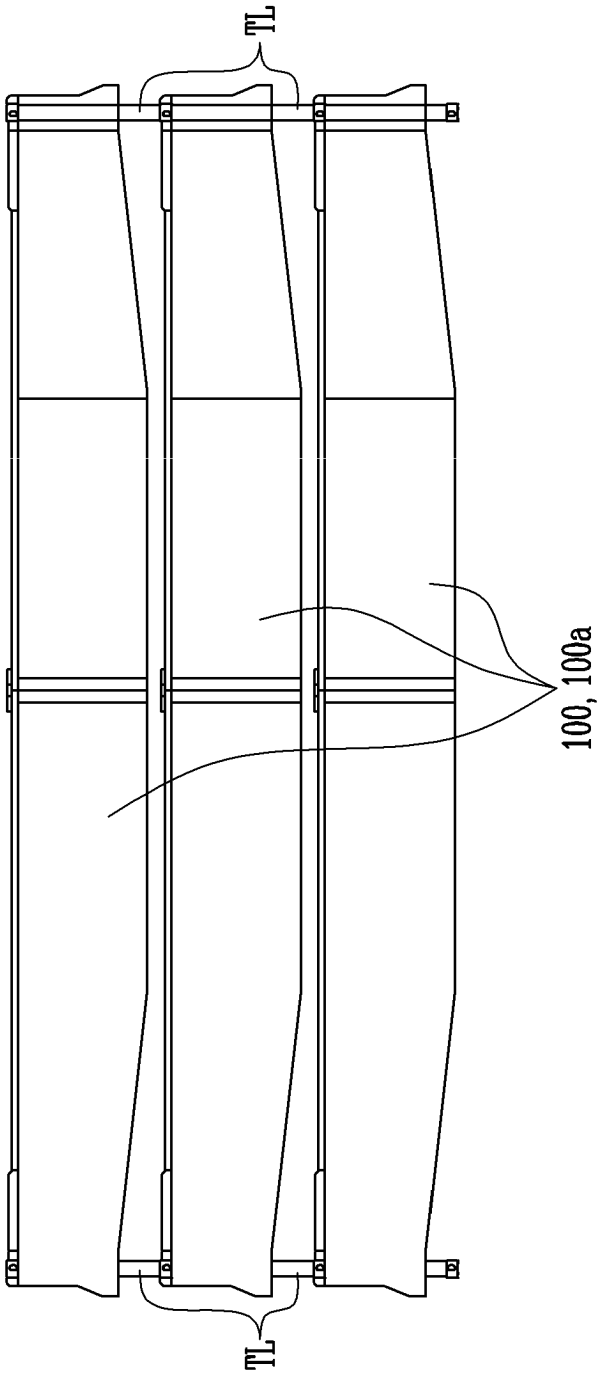


FIG. 47

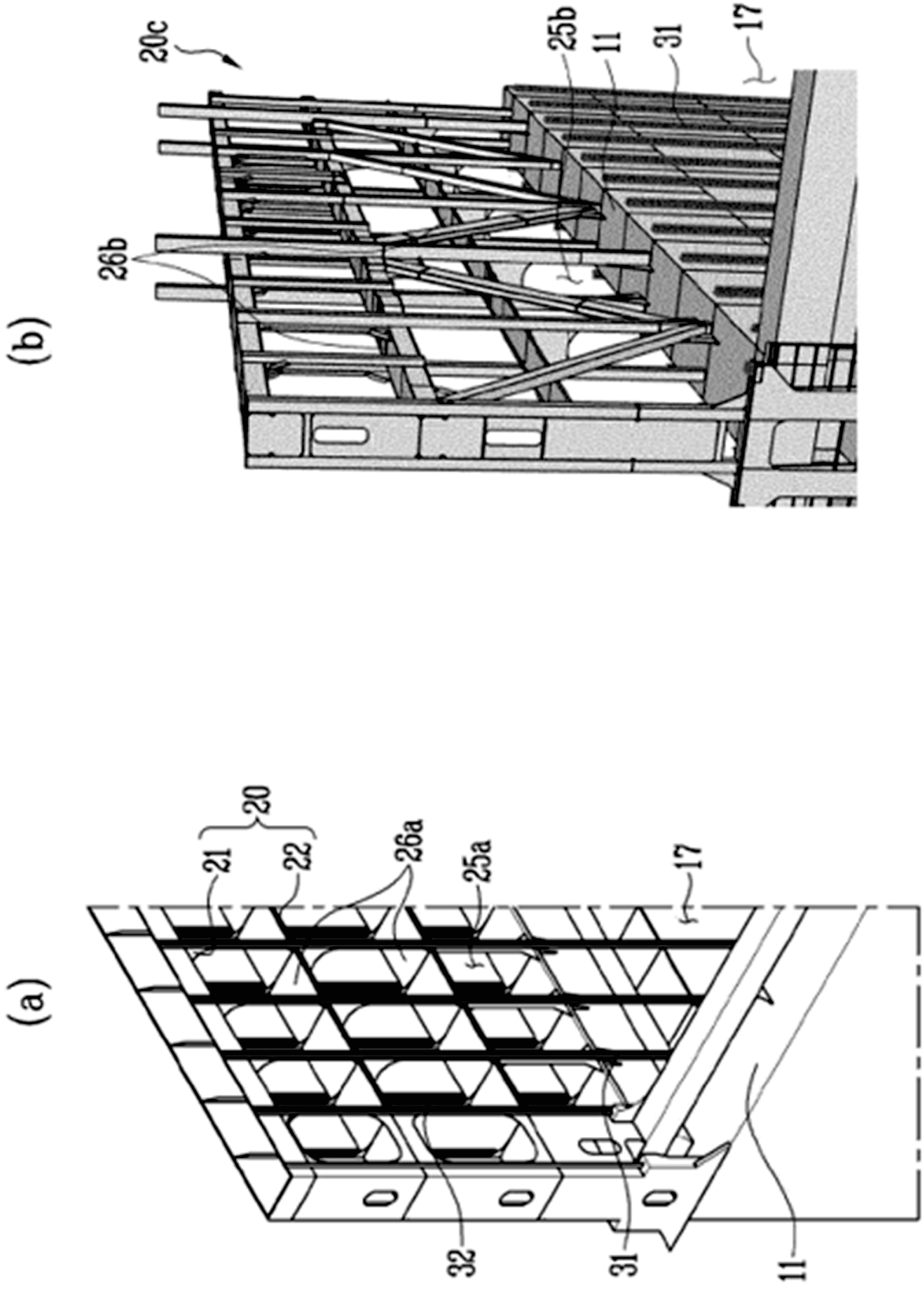


FIG. 48

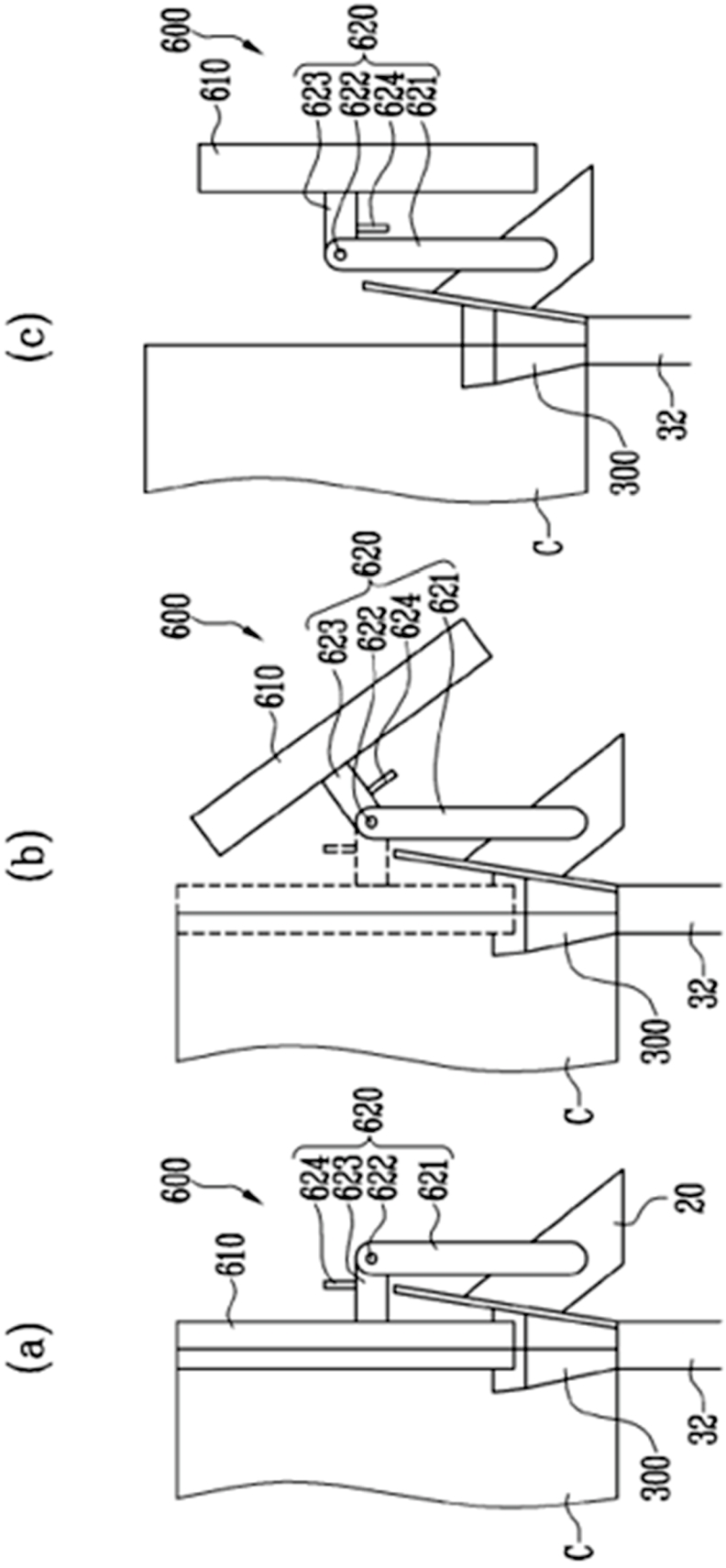

(a)
600
610
620
624
623
622
621
20
32
300
C
(b)
600
610
620
623
622
624
621
u
32
300
C
(c)
600
610
620
623
622
624
621
32
300
C

FIG. 49

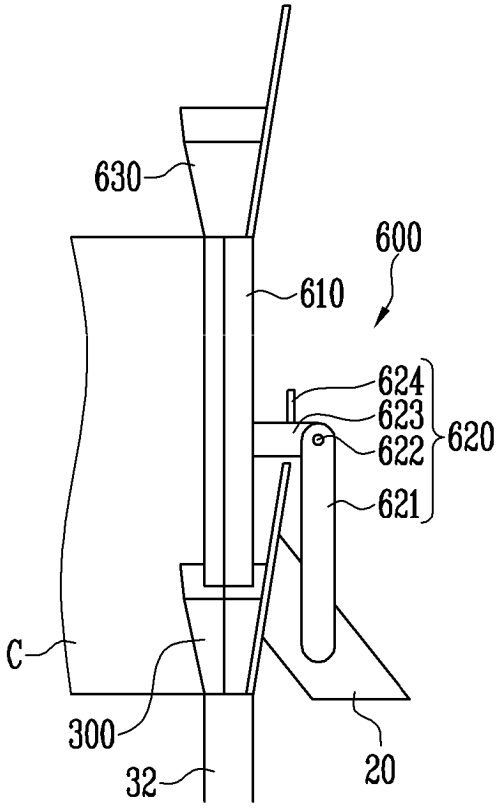


FIG. 50

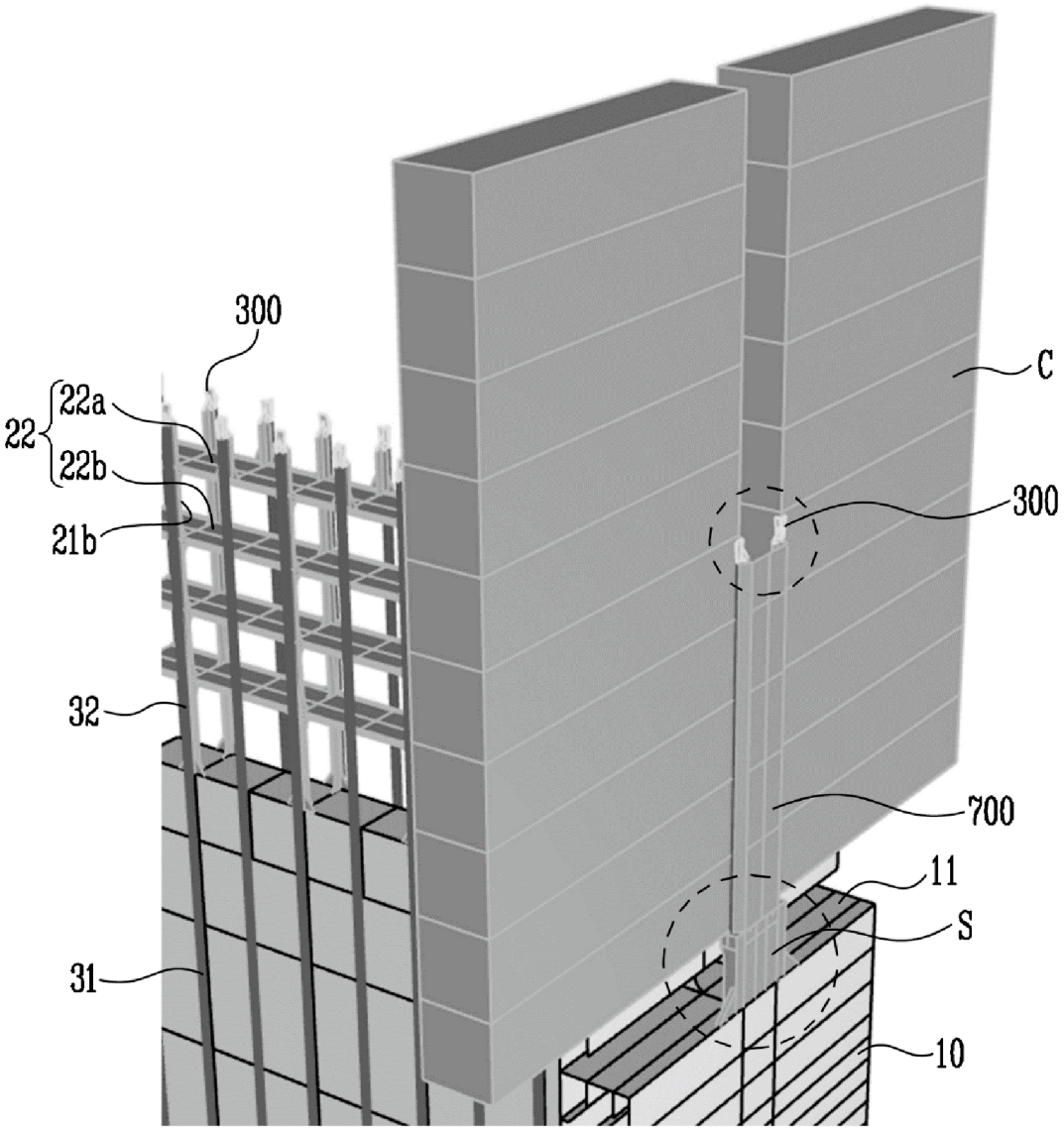


FIG. 51

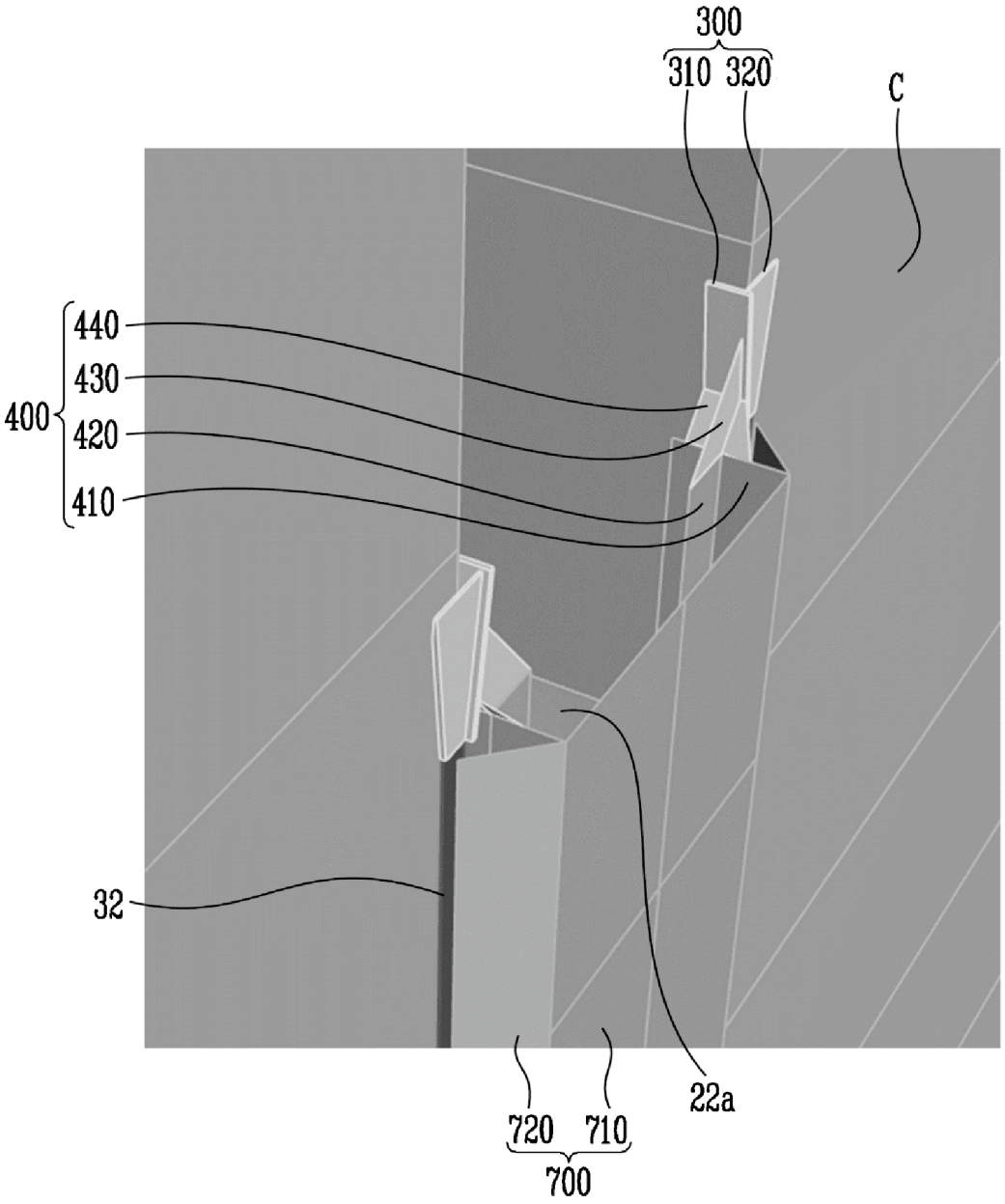


FIG. 52

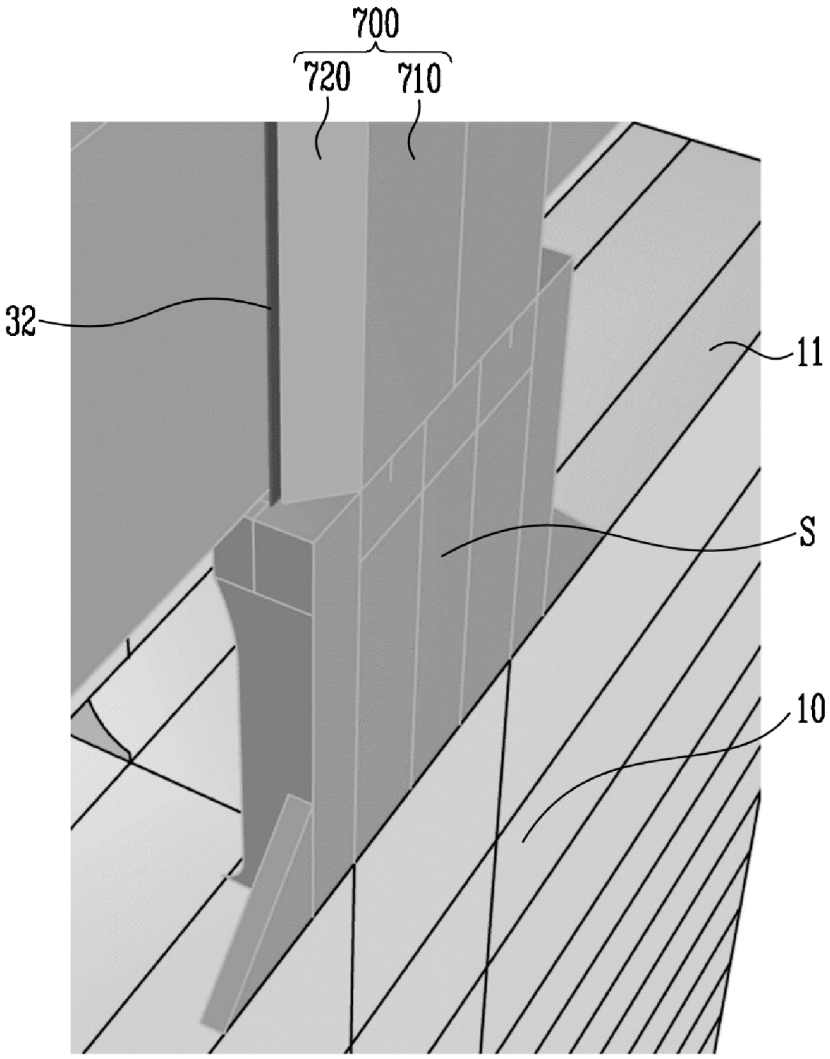


FIG. 53

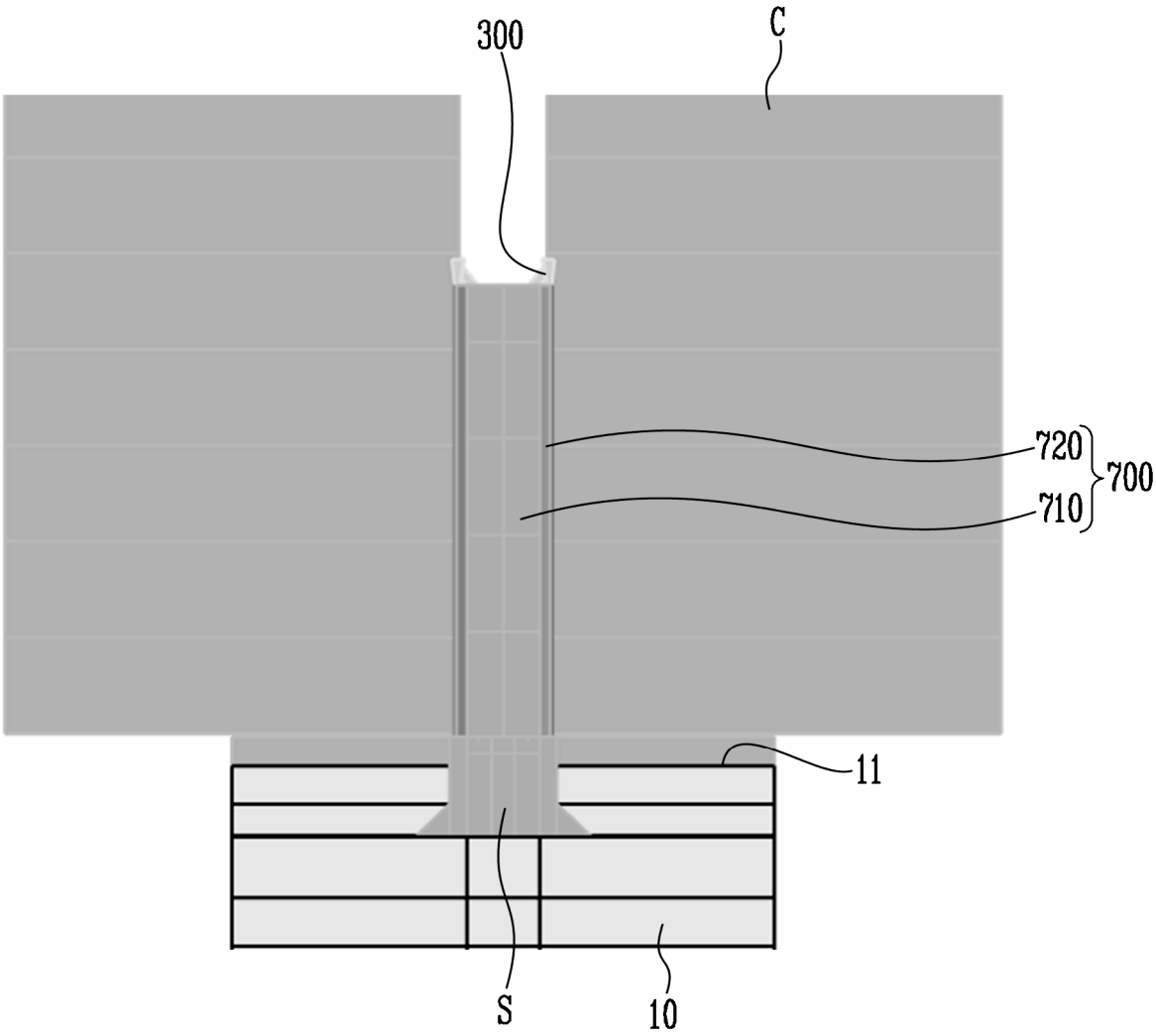


FIG. 54

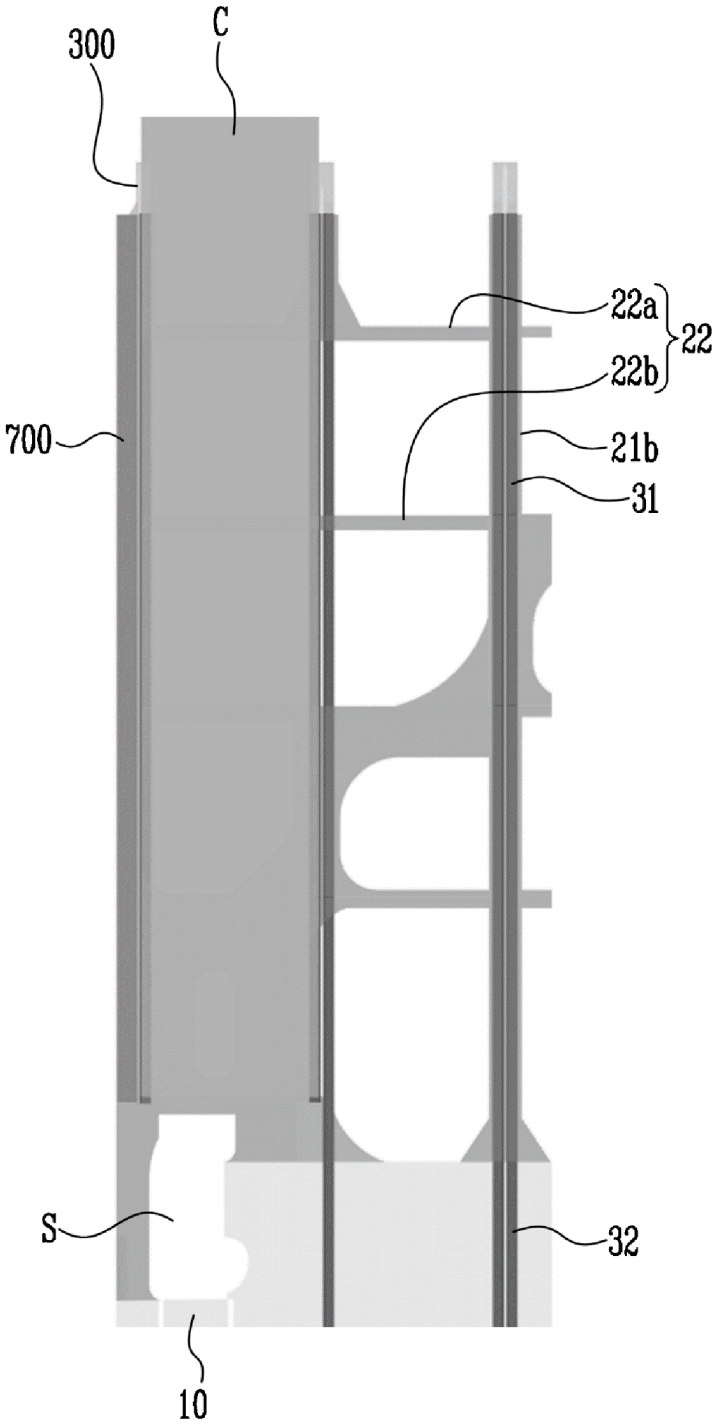


FIG. 55

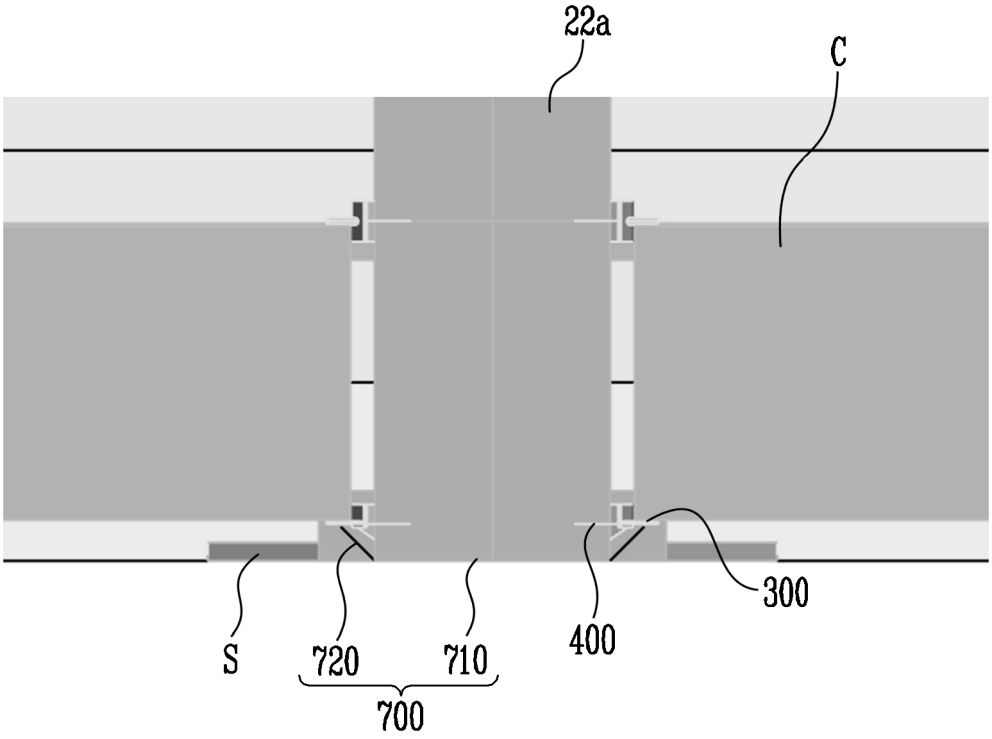


FIG. 56

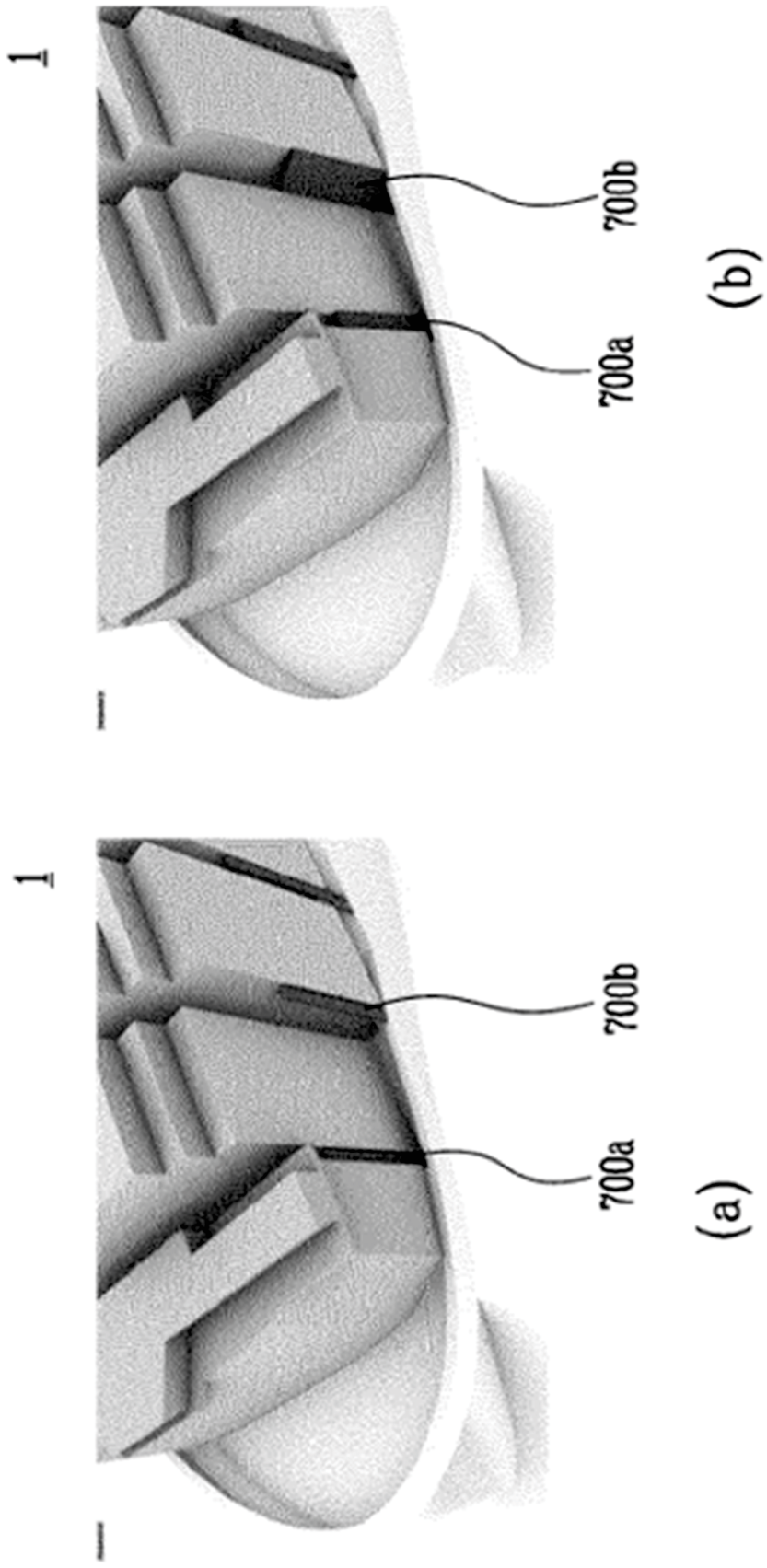
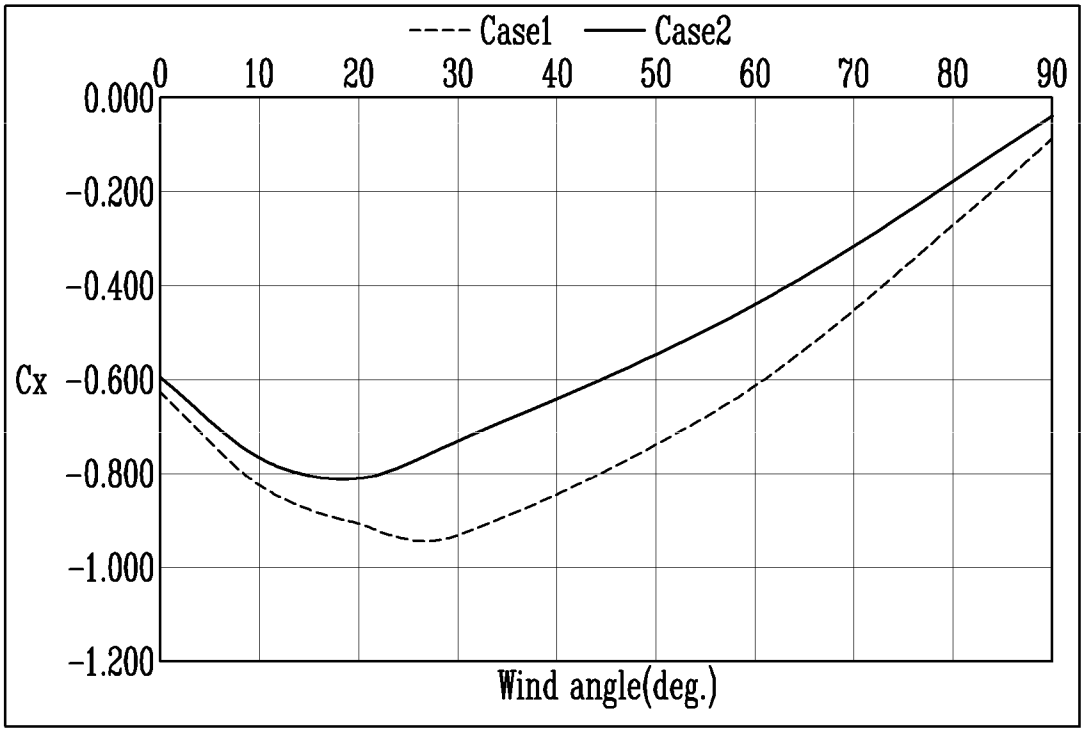


FIG. 57


Case1
Case2
0
10
20
30
40
50
60
70
80
90
0.000
-0.200
-0.400
Cx -0.600
-0.800
-1.000
-1.200
Wind angle(deg.)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2024/096945

A. CLASSIFICATION OF SUBJECT MATTER

B63B 25/28(2006.01)i; **B63B 25/24**(2006.01)i

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)

B63B 25/28(2006.01); B63B 15/00(2006.01); B63B 17/00(2006.01); B63B 25/00(2006.01); B63B 25/04(2006.01); B63B 25/22(2006.01); B63B 25/24(2006.01)

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

Korean utility models and applications for utility models: IPC as above
Japanese utility models and applications for utility models: IPC as above

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

eKOMPASS (KIPO internal) & keywords: 카고 홀드(cargo hold), 셀 가이드(cell guide), 커버(cover), 컨테이너(container), 트위스트 락(twist lock)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	KR 10-2530035 B1 (HD HYUNDAI HEAVY INDUSTRIES CO., LTD.) 09 May 2023 (2023-05-09) See paragraphs [0026]-[0039] and [0231]-[0266] and figures 1 and 38-42.	1-16
Y	KR 10-2019-0048523 A (SAMSUNG HEAVY IND. CO., LTD.) 09 May 2019 (2019-05-09) See paragraphs [0023]-[0028] and figures 1 and 3.	1-7
Y	KR 10-2017-0098034 A (SAMSUNG HEAVY IND. CO., LTD.) 29 August 2017 (2017-08-29) See paragraphs [0025]-[0028] and figure 3.	8
Y	KR 10-2012-0001909 A (HYUNDAI HEAVY INDUSTRIES CO., LTD.) 05 January 2012 (2012-01-05) See paragraphs [0021]-[0025] and figures 4-5.	9-10
Y	KR 20-2017-0004010 U (HYUNDAI HEAVY INDUSTRIES CO., LTD.) 28 November 2017 (2017-11-28) See paragraphs [0037]-[0040] and figures 3-4.	11-13

☑ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

* Special categories of cited documents:
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"T" 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
"X" 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
"Y" 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

Date of the actual completion of the international search	Date of mailing of the international search report
19 March 2025	**19 March 2025**

Name and mailing address of the ISA/KR	Authorized officer
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Facsimile No. **+82-42-481-8578**	Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2024/096945

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	KR 10-2010-0034255 A (SAMSUNG HEAVY IND. CO., LTD.) 01 April 2010 (2010-04-01) See paragraphs [0014]-[0016] and figures 5-6.	14-16
A	JP 2002-166879 A (MITSUBISHI HEAVY IND. LTD.) 11 June 2002 (2002-06-11) See claim 1 and figures 1-2.	1-16
A	US 4697967 A (SCHULZ et al.) 06 October 1987 (1987-10-06) See column 2, line 46 - column 4, line 30 and figures 3-4.	1-16

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/KR2024/096945

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
KR 10-2530035 B1	09 May 2023	CN 117222577 A	12 December 2023
		CN 117377613 A	09 January 2024
		EP 4316972 A1	07 February 2024
		EP 4316973 A1	07 February 2024
		JP 2024-508188 A	22 February 2024
		JP 2024-509320 A	29 February 2024
		JP 7592189 B2	29 November 2024
		JP 7592190 B2	29 November 2024
		KR 10-2023-0068964 A	18 May 2023
		KR 10-2023-0069027 A	18 May 2023
		KR 10-2023-0069028 A	18 May 2023
		KR 10-2023-0129344 A	08 September 2023
		KR 10-2024-0002141 A	04 January 2024
		KR 10-2024-0002142 A	04 January 2024
		KR 10-2024-0002143 A	04 January 2024
		KR 10-2024-0002144 A	04 January 2024
		KR 10-2024-0002145 A	04 January 2024
		KR 10-2024-0002146 A	04 January 2024
		KR 10-2024-0002147 A	04 January 2024
		KR 10-2024-0002148 A	04 January 2024
		KR 10-2024-0002149 A	04 January 2024
		KR 10-2024-0002150 A	04 January 2024
		KR 10-2024-0002151 A	04 January 2024
		KR 10-2024-0002152 A	04 January 2024
		KR 10-2024-0002153 A	04 January 2024
		KR 10-2024-0002154 A	04 January 2024
		KR 10-2525110 B1	25 April 2023
		KR 10-2525125 B1	25 April 2023
		KR 10-2525135 B1	25 April 2023
		KR 10-2525139 B1	25 April 2023
		KR 10-2525145 B1	25 April 2023
		KR 10-2525151 B1	25 April 2023
		KR 10-2525152 B1	25 April 2023
		KR 10-2525243 B1	25 April 2023
		KR 10-2529985 B1	09 May 2023
		KR 10-2529995 B1	09 May 2023
		KR 10-2530004 B1	10 May 2023
		KR 10-2530019 B1	09 May 2023
		KR 10-2530022 B1	09 May 2023
		KR 10-2532335 B1	15 May 2023
		KR 10-2700481 B1	30 August 2024
		KR 10-2712087 B1	02 October 2024
		KR 10-2719525 B1	21 October 2024
		KR 10-2719526 B1	21 October 2024
		KR 10-2719532 B1	21 October 2024
		KR 10-2719541 B1	21 October 2024
		KR 10-2719544 B1	21 October 2024
		KR 10-2722763 B1	29 October 2024
		KR 10-2722766 B1	29 October 2024
		TW 202335903 A	16 September 2023

Form PCT/ISA/210 (patent family annex) (July 2022)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/KR2024/096945

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
		TW 202340040 A	16 October 2023
		WO 2023-085667 A1	19 May 2023
		WO 2023-085668 A1	19 May 2023
KR 10-2019-0048523 A	09 May 2019	KR 10-2006683 B1	02 August 2019
KR 10-2017-0098034 A	29 August 2017	KR 10-1774926 B1	05 September 2017
KR 10-2012-0001909 A	05 January 2012	KR 10-1428129 B1	07 August 2014
KR 20-2017-0004010 U	28 November 2017	None	
KR 10-2010-0034255 A	01 April 2010	None	
JP 2002-166879 A	11 June 2002	None	
US 4697967 A	06 October 1987	None	

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