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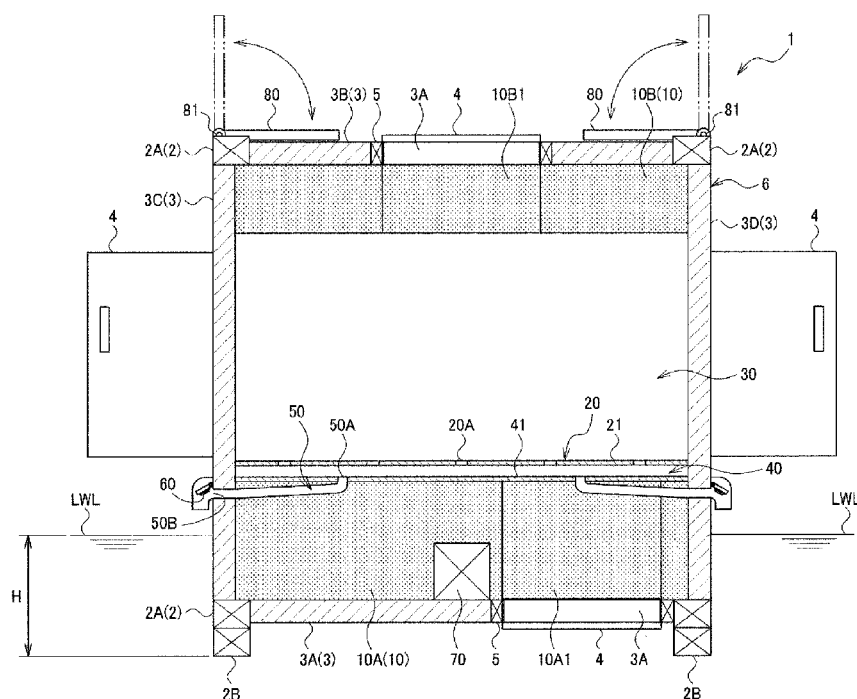
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(54) Title: EVACUATION STRUCTURE

(54) 発明の名称: 避難用構造物



(57) Abstract: This evacuation structure (1) has: a box-type structure body (6) that is not completely watertight, and is provided with at least one hatch door (4); a float (10) provided to the box-type structure body (6); and at least one drainage pipe (50) that has one end (50A) opening in the interior of the box-type structure body (6) and another end (50B) opening in an outer wall (3C-3D) above the load waterline (LWL). The one or more drainage pipes (50) have a check valve (60) comprising a valve that stops the inflow of water into the interior of the box-type structure body (6), and opens when water

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pressure of the exhaust water from the interior of the box-type structure body (6) is applied.

(57) 要約: 避難用構造物 (1) は、少なくとも一つのハッチ扉 (4) を備えた不完全水密性の箱型構造体 (6) と、箱型構造体 (6) に設けられたフロート (10) と、一端 (50A) が箱型構造体 (6) の内部に開口し、他端 (50B) が満載喫水線 (LWL) の上方にて外壁 (3C~3D) に開口する少なくとも一つの排水管 (50) と、を有し、少なくとも一つの排水管 (50) は箱型構造体 (6) の内部への水の流入を防止し、かつ、箱型構造体 (6) の内部からの排水の水圧が作用した時に開く弁を備える逆止弁 (60) を有する。

EVACUATION STRUCTURE

TECHNICAL FIELD

The present invention relates to an evacuation structure capable of surfacing at the time of water damage including a tsunami or flooding and securing an evacuation space, and the like.

BACKGROUND ART

A shelter that surfaces at the time of water damage has been proposed. Patent Document 1 discloses a floatable shelter formed of styrene foam. It has been described that a floor of the shelter has a discharge port penetrating through the floor into a bottom of the shelter, and that seawater that has entered the room can be discharged to the outside via the discharge port.

Patent Document 2 discloses providing a weight in a protrusion protruding below a spherical shelter in a freely drifting state. The protrusion and the weight are formed of a material having a larger specific gravity than the sphere, thereby preventing the spherical shelter from rolling over.

RELATED-ART DOCUMENT

PATENT DOCUMENT

Patent Document 1: JP-B-6170262

Patent Document 2: JP-A-2014-69778

TECHNICAL PROBLEM

In the shelter of Patent Document 1, when the shelter is floating on the sea, an outlet of the discharge port open into the bottom of the shelter is located in seawater. Accordingly, although from the discharge port located in the seawater, the seawater may flow into the inside of the shelter, the seawater that has flowed into the inside of the shelter is not discharged. Furthermore, in the shelter made of styrene foam in Patent Document 1, a weight for causing the shelter to sink in seawater is the total weight of evacuees, PET bottles, and the like in the shelter

room, and the weight is not a weight as a structural body and thus unstable; accordingly, the shelter is likely to roll over due to a shift of the center of gravity. Furthermore, unless the thickness of the floor through which the discharge port is formed is increased, the draft that is a distance from the lower most surface of the shelter to the water surface, that is, the depth in which the shelter sinks in seawater cannot be secured; accordingly, the shelter is likely to roll over.

The shelter of Patent Document 2 may be good in stability but is difficult to manufacture due to its complex structure including the sphere and the protrusion. Furthermore, if the sphere forming the shelter room is flooded via an opened hatch lid by any chance, it is extremely difficult to drain the water out of the sphere.

Certain aspects of the invention have an object to provide an evacuation structure easy to manufacture and capable of easily draining water even when an evacuation room in an incompletely watertight box-shaped structural body is flooded.

SUMMARY OF INVENTION

(1) An aspect of the invention relates to an evacuation chamber having an incompletely watertight box-shaped structural body including at least one hatch door, a float provided to the box-shaped structural body, at least one drain pipe having one end open into an inside of the box-shaped structural body, and the other end open into an outer wall of the box-shaped structural body at a position above a load water line of the box-shaped structural body, a check valve attached to the at least one drain pipe to prevent an inflow of water to the inside of the box-shaped structural body, and including a valve that opens when water pressure of drainage from the inside of the box-shaped structural body acts; and a floor board disposed inside the box-shaped structural body and having a floor surface at a position above the load water line, wherein the one end of the at least one drain pipe is open at a height equal to or lower than the floor surface of the floor board.

According to the aspect (1) of the invention, buoyancy acts when a part of the float submerges at the time of water damage, and a water line is set to a position below the load water line (LWL) when the evacuation structure is loaded with the maximum load, so that the

evacuation structure is floatable. In particular, the other end of the drain pipe is open at the position above the load water line, so that water pressure that comes from the outside of the box-shaped structural body and that inhibits drainage does not act on the drain pipe. The drain pipe has the check valve including the valve that opens when water pressure of drainage from the inside of the box-shaped structural body acts. Accordingly, a smooth drain action is secured by the drain pipe when the inner end submerges inside the box-shaped structural body and the outer end is located above the water surface outside the box-shaped structural body. Accordingly, an evacuation room in the box-shaped structural body can be prevented from being drenched. Moreover, the check valve is attached to the drain pipe, preventing an inflow of water to the inside of the box-shaped structural body via the drain pipe.

(2) In an aspect of the invention, the float has a volume that does not completely submerge the box-shaped structural body even when the box-shaped structural body is filled with flood. A max load water line (MLWL) serving as the water line at this time is calculated so as to be set to a position lower than a top surface of the box-shaped structural body, as described later. Thus, the box-shaped structural body does not sink, and if an evacuee stays in the box-shaped structural body, or escapes to the outside of the evacuation structure via at least one hatch door and waits, the evacuee can be rescued.

According to the aspect (1) or (2) of the invention, even when water flows into the box-shaped structural body, the water can be drained via the drain pipe open at the height equal to or lower than the floor surface. Accordingly, the top of the floor surface can be prevented from being drenched.

(3) In the aspect (2) of the invention,
a drain storage room disposed inside the box-shaped structural body at a position below the floor board, may be further provided,
the floor board may include a through hole penetrating in an up-down direction, and
the one end of the at least one drain pipe may be open into the drain storage room.

According to the aspect (3) of the invention, even when water flows into the box-shaped structural body, the water is quickly drained to the drain storage room below the floor board from a through port penetrating into the floor board. Accordingly, even when the amount of flood is relatively large, the evacuation room above the floor board can be prevented from being

drenched. The water collected in the drain storage room is drained to the outside of the box-shaped structural body via the drain pipe.

- (4) Another aspect of the invention relates to an evacuation chamber comprising:
an incompletely watertight box-shaped structural body including at least one hatch door;
a float provided to the box-shaped structural body;
at least one drain pipe having one end open into an inside of the box-shaped structural body, the at least one drain pipe having the other end open into an outer wall of the box-shaped structural body at a position above a load water line of the box-shaped structural body, and
a check valve attached to the at least one drain pipe to prevent an inflow of water to the inside of the box-shaped structural body, the check valve including a valve that opens when water pressure at a time of drainage from the inside of the box-shaped structural body acts,
wherein the other end of the at least one drain pipe has N (N is an integer of two or more) drain outlets open into the outer wall at N positions at different heights, the heights in a vertical direction sequentially increasing, and
wherein a max load water line at max load is at a position lower than at least one of the positions of the N drain outlets, the max load being when a space inside the box-shaped structural body at full load is filled with flood.

Even when water flows into the incompletely watertight box-shaped structural body, and the water line attempts to move to above the load water line LWL due to the weight that has increased by the inflow water, the inflow water from the one end of the drain pipe can be continued to be drained from, of a total of the N drain outlets, the drain outlet of any of the drain pipes open above the water line. Thus, the water that has flowed into the evacuation structure is continued to be drained via a plurality of the drain outlets at different heights, so that the water line can be prevented from exceeding the load water line LWL.

- (5) In the aspect (4) of the invention,
the at least one drain pipe can have N drain pipes including the N drain outlets and N drain inlets separately communicating with the N drain outlets. That is, one drain inlet may communicate with the N drain outlets, or the N drain inlets may separately communicate with the N drain outlets.

- (6) In the aspect (4) or (5) of the invention,

a max load water line at max load in which a space inside the box-shaped structural body at full load is filled with flood can be at a position lower than at least one of the positions of the N drain outlets. Thus, before the space inside the box-shaped structural body at full load is filled with flood, in other words, before the max load water line MLWL is reached, water of the flood can be continued to be drained from at least one of the N drain outlets that have different heights and that are at higher positions than the water line, preferably, the N drain outlets. Accordingly, in a normal use form, the space inside the box-shaped structural body is not filled with flood, and a situation in which the max load water line MLWL is reached also cannot happen.

(7) In the aspects (1) to (6) of the invention, a weight that imparts a restoring force to the box-shaped structural body can be disposed below the load water line. This weight functions as a balancer for preventing rollover of the evacuation structure.

(8) In the aspect (7) of the invention, a contour of a transverse cross-section of the box-shaped structural body is preferably formed in a polygon having horizontal widths of a bottom and an apex narrower than a horizontal width at a position between the bottom and the apex. Thus, the evacuation structure, even when attempting to roll over, is easily restored by the weight.

(9) In the aspects (1) to (8) of the invention, the box-shaped structural body can have a framework structural body and a ceiling wall attached to an upper surface of the framework structural body, and the ceiling wall can have a handrail disposed so as to surround a top surface area that allows an escape from the at least one hatch door provided to the box-shaped structural body. Thus, the evacuee who has escaped to the outside of the ceiling wall via the hatch door can safely wait for rescue while holding the handrail attached to the ceiling wall. Furthermore, even if the ceiling wall is separated from the framework structural body, the ceiling wall can continue to be loaded with the evacuee while surfacing like a raft.

(10) A further aspect of the invention relates to an evacuation chamber comprising:
an incompletely watertight box-shaped structural body including at least one hatch door;
a float provided to the box-shaped structural body;

at least one drain pipe having one end open into an inside of the box-shaped structural body, the at least one drain pipe having the other end open into an outer wall of the box-shaped structural body at a position above a load water line of the box-shaped structural body, and

a check valve attached to the at least one drain pipe to prevent an inflow of water to the inside of the box-shaped structural body, the check valve including a valve that opens when water pressure at a time of drainage from the inside of the box-shaped structural body acts,

wherein the box-shaped structural body houses a plurality of stabilizer boards capable of horizontally protruding from two outer walls facing each other in a transverse cross-sectional view orthogonal to a longitudinal axis of the box-shaped structural body.

(11) In the aspect (10) of the invention, each of the plurality of stabilizer boards may be folded and housed in the box-shaped structural body. Thus, even when the width of the evacuation structure is not increased, a space for housing the stabilizer boards is secured.

(12) In the aspect (10) of the invention, each of the plurality of stabilizer boards may be pivotally supported outside the box-shaped structural body and housed in a vertically arranged state. Thus, the inside of the evacuation structure is not occupied by a housing space of the plurality of stabilizer boards. Note that if the plurality of stabilizer boards is housed so as to be spaced apart from either one of the two outer walls, even when the drain pipe is attached to the outer wall, the other end of the drain pipe is not blocked.

(13) In the aspect (12) of the invention, it is possible to further have a locking part that locks at least one of the plurality of stabilizer boards in a vertically arranged state, and a release operation part that is operated inside the box-shaped structural body to release a state of the at least one of the plurality of stabilizer boards being locked by the locking part. Thus, the evacuee who has evacuated into the box-shaped structural body at the time of evacuation, after confirming floating of the box-shaped structural body, operates the release operation part inside the box-shaped structural body and can protrude the plurality of stabilizer boards onto the water surface outside the box-shaped structural body.

(14) In the aspects (1) to (13) of the invention, the box-shaped structural body can include an attachment part for attachment of a propulsion device that imparts propulsion to the box-shaped structural body. Examples of the propulsion device include an electric screw and a

manual oar. Attaching the propulsion device can achieve a self-propelled evacuation structure capable of moving on the water surface by itself.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a cross-sectional view of an evacuation structure according to a first embodiment of the invention.

FIG. 2 is a view illustrating the evacuation structure in a floating state.

FIG. 3 is a view illustrating a check valve attached to a drain pipe.

FIG. 4 is a view illustrating the evacuation structure floatable even if an evacuation room is flooded.

FIG. 5 is a cross-sectional view of an evacuation structure according to a second embodiment of the invention.

FIG. 6 is a view illustrating an evacuation structure according to a third embodiment of the invention.

FIG. 7 is a transverse cross-sectional view of the evacuation structure illustrated in FIG. 6.

FIG. 8 is a view illustrating an evacuation structure according to a fourth embodiment of the invention.

FIG. 9 is a view illustrating a state of using a handrail of the evacuation structure illustrated in FIG. 8.

5 FIG. 10 is a transverse cross-sectional view of the evacuation structure illustrated in FIG. 8.

FIG. 11 is a view illustrating an evacuation structure according to a fifth embodiment of the invention.

10 FIG. 12 is a transverse cross-sectional view of the evacuation structure illustrated in FIG. 11.

FIGS. 13A to 13D are views illustrating a process of pulling out a stabilizer board of the evacuation structure illustrated in FIG. 11 to a use position.

FIG. 14 is a view illustrating an evacuation structure according to a sixth embodiment of the invention.

15 FIG. 15 is a view illustrating a state of a handrail of a ceiling wall of FIG. 14 being folded.

FIG. 16 is a vertical cross-sectional view of a box-shaped structural body illustrated in FIG. 14.

FIG. 17 is a transverse cross-sectional view of the box-shaped structural body illustrated in FIG. 14.

20 FIG. 18 is a perspective view illustrating the inside of the box-shaped structural body illustrated in FIG. 14, with partially cut.

FIG. 19 is a cross-sectional view of a drain pipe.

FIG. 20 is a view illustrating arrangement of the drain pipe.

25 FIG. 21 is a view illustrating a self-propelled evacuation structure having a box-shaped structural body to which a screw is attached.

FIG. 22 is a view illustrating a self-propelled evacuation structure using an oar protruding from a hatch door.

FIG. 23 is a view illustrating floating of the ceiling wall or a self-propelled state by means of the oar.

FIG. 24 is a view illustrating a use state of a stabilizer board.

FIG. 25 is a side view illustrating a state of the stabilizer board being housed in a vertically arranged state.

FIG. 26 is a view illustrating a release operation part of the stabilizer board.

5 FIG. 27 is a side view illustrating a use state of the stabilizer board.

DESCRIPTION OF EMBODIMENTS

Hereinafter, preferred embodiments of the invention will be described in detail. Note that the present embodiments described below do not unreasonably limit the contents of the invention described in the claims, and all of the configurations described in the present embodiments are not
10 necessarily essential as solving means of the invention.

1. First Embodiment

FIG. 1 illustrates an evacuation structure 1 according to a first embodiment of the invention. In FIG. 1, the evacuation structure 1 includes a box-shaped structural body 6. The box-shaped
15 structural body 6 includes, for example, a framework structural body 2 and an outer wall 3. The framework structural body 2 is formed by, for example, a beam 2A such as a steel pipe, and a column (not illustrated). For example, the outer wall 3 such as a steel plate is supported on, for example, six surfaces of the framework structural body 2. As illustrated in FIGs. 1 and 2, a hatch door 4 is attached to at least one surface of the outer wall 3 having the six surfaces, for example,
20 four surfaces thereof. A hatch frame 5 is assembled to an aperture formed in the outer wall 3, and the hatch door 4 is openably and closably supported on the hatch frame 5 by a hinge or the like. The hatch door 4 is preferably sealed watertightly against the hatch frame 5. A lower part of the box-shaped structural body 6 can be provided with a base 2B formed of a steel material or the like for coupling to a substructure installed on the ground. The base 2B may be coupled to a
25 downstairs structural body, and the evacuation structure 1 may be installed upstairs. The base 2B is easily released from its coupling to the foundation or the downstairs by, preferably, an operation in the box-shaped structural body 6 so as to be capable of surfacing at the time of water damage.

A float 10 is arranged to, for example, the inside of the box-shaped structural body 6. The float 10 is formed of a material having a smaller density than water (the specific gravity is less than 1), and polystyrene having a density of 45 kg/m³ is used, for example. In FIG. 1, a float 10A is disposed on a bottom wall 3A of the outer wall 3 having the six surfaces. A large portion of this float 10A submerges, so that buoyancy for the evacuation structure 1 to float is secured as illustrated in FIG. 2.

FIG. 1 illustrates a load water line LWL. The position of the load water line LWL is obtained as follows. First, the total weight of the evacuation structure 1 at full load is obtained. This total weight is the sum of the total weight of the evacuation structure 1 itself and the total weight at full load into the evacuation structure 1. The total weight at full load into the evacuation structure 1 includes an estimated total body weight of the maximum number of occupants (for example, the number of occupants $\times$ 65 kg) and the total weight of the load (beverage PET bottles, first-aid tools, and the like). Then, where a depth at which the evacuation structure 1 submerges is H, the position of the load water line LWL is obtained as the depth H in which (the volume of water eliminated by the evacuation structure 1 that submerges at the depth H) $\times$ (specific gravity of water) = (the total weight of the evacuation structure 1 at full load) is established. Note that in the present description, "water" includes seawater, freshwater, brackish water in which seawater and freshwater are mixed, or the like.

In FIG. 1, at a position above the load water line LWL of the box-shaped structural body 6, a floor board 20 is disposed inside the box-shaped structural body 6. A space surrounded by the floor board 20, a ceiling wall 3B, and two side walls 3C and 3D is the maximum volume of an evacuation room 30. The floor board 20 has a floor surface 21 at a higher position than the load water line LWL. The floor board 20 includes one or more, for example, a plurality of drain ports 20A penetrating in the up-down direction. A drain storage room 40 is arranged between a lower surface of the floor board 20 and an upper surface of the float 10A located below the floor board 20. In the present embodiment, as a bottom plate of the drain storage room 40, a waterproof plate 41 is attached to the upper surface of the float 10A. Thus, water in the drain storage room 40 does not leak to the float 10A side. The drain storage room 40 is disposed inside the box-shaped structural body 6, above the load water line LWL of the box-shaped structural body 6. If the

evacuation room 30 is flooded by any chance, the water is supplied to the drain storage room 40 via the drain port 20A open into the floor surface 21 of the floor board 20. Accordingly, even when the amount of flood to the evacuation room 30 is relatively large, the evacuation room 30 above the floor board 20 can be prevented from being drenched. Note that the drain storage room 40 may be arranged to, not limited to the entire area below the floor board 20 as illustrated in FIG. 1, a part of the lower side of the floor board 20 (for example, a peripheral edge area).

To supply the water collected in the drain storage room 40 to the outside of the box-shaped structural body 6, a drain pipe 50 is provided. The drain pipe 50 has an inlet 50A at one end open into the inside of the box-shaped structural body 6, for example, the drain storage room 40, and an outlet 50B at the other end open into the outside of the side wall 3C or 3D, above the load water line LWL. Thus, the water collected in the drain storage room 40 is drained to the outside of the box-shaped structural body via the drain pipe 50. In particular, the outlet 50B of the drain pipe 50 is open above the load water line LWL, so that water pressure that is an external pressure inhibiting drainage does not act on the drain pipe. Accordingly, a smooth drain action in the drain pipe 50 is secured. The drain pipe 50 is preferably set to a position such that the outlet 50B is lower than the inlet 50A, and in particular, the water gradient is preferably set so as to be directed from the inlet 50A to the outlet 50B. Thus, accumulation of water in the evacuation room 30 above the floor board 20 is prevented. Note that without the drain storage room 40, the one end of the drain pipe 50 may be disposed so as to be open at a position equal to or lower than the height of the floor surface 21 of the floor board 20.

In the present embodiment, the drain pipe 50 can include a check valve 60 that prevents an inflow of water from the outside of the box-shaped structural body 6. Thus, an inflow of water to the inside of the box-shaped structural body 6 via the drain pipe 50 is prevented. In particular, the check valve 60, as illustrated in FIG. 3, can include a valve 61 that opens when water pressure of drainage from the drain storage room 40 acts. The valve 61 is pivotally hung and supported by, for example, a hinge 62. Thus, when water pressure of drainage from the drain storage room 40 does not act, the valve 61 is hung by its own weight and closes the outlet 50B of the drain pipe 50. Accordingly, a backflow from the outlet 50B of the drain pipe 50 to the inlet 50A is normally prevented by the valve 61. When a predetermined water pressure acts on the valve 61 due to

drainage from the drain storage room 40, the valve 61 pivots in the arrow direction of FIG. 3 and is opened. In FIG. 3, a cover 63 that surrounds and protects the valve 61 and the hinge 62 is provided. The check valve 60 may use another structure or may not be provided with the cover 63. Note that as illustrated in FIG. 2, when the box-shaped structural body 6 is a substantially rectangular parallelepiped, one or more drain pipes 50 and one or more check valves 60 can be attached to, in addition to each of the two side walls 3C and 3D parallel to a longitudinal axis of the substantially rectangular parallelepiped, each of two end walls 3E and 3F orthogonal to the longitudinal axis of the substantially rectangular parallelepiped.

In the present embodiment, a weight 70 that imparts a restoring force to the box-shaped structural body 6 that tilts due to wind or waves can be disposed in the bottom wall 3A located below the load water line LWL. This weight 70 functions as a balancer for preventing rollover of the evacuation structure 1. For this reason, the weight 70 is located at the center of a transverse cross-section of the evacuation structure 1 illustrated in FIG. 2. Furthermore, as illustrated in FIG. 2, in a case where the box-shaped structural body 6 is a substantially rectangular parallelepiped, the weight 70 is preferably disposed along the longitudinal axis of the substantially rectangular parallelepiped.

In the present embodiment, the float 10 preferably has a volume that does not completely submerge the box-shaped structural body 6 even when the box-shaped structural body 6 is flooded. When the evacuation room 30 illustrated in FIG. 1 is flooded, the total weight of the evacuation structure 1 increases, and the water line rises to a position exceeding the load water line LWL. Even in such a case, in order not to completely submerge the evacuation structure 1, a float 10B can be added to the evacuation room 30 of the box-shaped structural body 6. Even when the evacuation structure 1 is flooded, the evacuation structure 1 does not completely submerge, so that complete watertightness is not required in the evacuation room 30. Although in the present embodiment, the float 10B is added to the inner side of the ceiling wall 3B, the float 10B is preferably added to the floor board 20 and the inner sides of the two side walls 3C and 3D as well. The buoyancy increases in proportion to the volume of water eliminated by this added float 10B, so that the evacuation structure 1 can be prevented from completely submerging. Thus, in the present embodiment, $V \times \rho \times G$ (G is gravitational acceleration) that is the weight obtained by

5 multiplying the volume V of water eliminated by submerging of all of the floats 10A, 10A1, 10B, and 10B1 by water density ρ is made larger than the total weight of the evacuation structure 1. In particular, even when the box-shaped structural body 6 is flooded, the float 10 has the volume that does not completely submerge the box-shaped structural body 6, such that the outlet 50B of the drain pipe 50 is located above the water surface outside of the box-shaped structural body. Note that the total weight of the evacuation structure 1 may or may not include the body weight of the maximum number of people on board and the weight of the equipment on board. In practice, members other than the floats also eliminate water, and thus a larger buoyancy than $V \times \rho \times G$ is obtained, so that any weight other than that of the evacuation structure 1 itself may be ignored in some cases.

10 Here, the box-shaped structural body 6 may be incompletely watertight such that the box-shaped structural body 6 is not completely watertightly sealed, and it is sufficient that the box-shaped structural body 6 is not immediately invaded by a large amount of water over at least a few hours during which evacuation is performed. The incompletely watertight box-shaped structural body 6 can naturally include an air hole due to the structural principle, or an air hole may be disposed on the upper side of the box-shaped structural body 6. Thus, even when the hatch door 4 is tightly closed, an evacuee is not choked.

15 FIG. 4 illustrates a floating state of the evacuation structure 1 in a state of the box-shaped structural body 6 being flooded. In this case, at least a top surface of the ceiling wall 3B is secured at a position above the water line. Accordingly, in the state as in FIG. 4, the evacuee may escape to the top surface of the ceiling wall 3B via the hatch door 4 of the ceiling wall 3B. At this time, if the float 10B1 at a position facing the hatch door 4 of the ceiling wall 3B is removable, or if the float 10B1 is not arranged at the position, the escape is not obstructed.

25 As described above, when the added float 10B is arranged in the evacuation room 30, the evacuation structure 1, even in any posture, does not completely submerge, and if the evacuee escapes to the outside of the evacuation structure 1 via at least one hatch door 4 and waits, his or her life can be rescued. Furthermore, when the added float 10B is disposed in the six surfaces surrounding the evacuation room 30, the float 10B formed of a foam or the like can be used as a cushioning material for protecting the evacuee at the time of shaking or rollover.

As described above, the hatch door 4 can be attached to, of the outer wall 3 having the six surfaces, the bottom wall 3A, the ceiling wall 3B, and the two side walls 3C and 3D that are four surfaces parallel to the longitudinal axis of the substantially rectangular parallelepiped. The box-shaped structural body 6, if rolling over by any chance, is stabilized in a posture in which any of the four surfaces parallel to the longitudinal axis of the box-shaped structural body 6 faces upward. Accordingly, attaching the hatch door 4 to the bottom wall 3A, the ceiling wall 3B, and the two side walls 3C and 3D that are the four surfaces parallel to the longitudinal axis of the box-shaped structural body 6 facilitates an escape from the box-shaped structural body 6 at the time of rollover. Note that in FIG. 1, if the float 10A1 at a position facing the hatch door 4 of the bottom wall 3A, a part of the floor board 20, and a part of the waterproof plate 41 are removable, or if the float 10A1 is not arranged at the position, the escape is not obstructed.

In the present embodiment, as illustrated in FIG. 2, the hatch door 4 that is attached to one side wall 3C of the two side walls 3C and 3D can be disposed at a position close to one end wall 3E of the two end walls 3E and 3F located at both ends in the direction of the longitudinal axis of the substantially rectangular parallelepiped. Similarly, the hatch door 4 that is attached to the other side wall 3D of the two side walls 3C and 3D can be disposed at a position close to the other end wall 3F of the two end walls 3E and 3F. Thus, even when the evacuation structure 1 is turned to be vertical such that any of the two end walls 3E and 3F becomes the top surface, the hatch door 4 attached to either one of the two side walls 3C and 3D is easily disposed above the water surface, allowing an escape from the evacuation structure 1.

In the present embodiment, in a case where at least one hatch door 4 is attached to the ceiling wall 3B as illustrated in FIG. 1 or 4, the ceiling wall 3B can have a handrail 80 that can be raised by, for example, a hinge 81. Thus, the evacuee who has escaped to the outside of the ceiling wall 3B via the hatch door 4 raises the handrail 80 attached to the ceiling wall 3B, so that the evacuee can safely wait for rescue while holding the handrail 80. Note that in FIG. 4, the handrails 80 adjacent to each other are coupled by four couplers 82 so that the handrails 80 are maintained in a raised state.

Although the present embodiment has been described in detail as above, it should be easily understood by a person skilled in the art that many modifications can be made without substantially

departing from the new matters and effects of the invention. Accordingly, all such modifications are intended to be included within the scope of the invention. For example, throughout the description or the drawings, terms used at least once together with broader or synonymous different terms can be replaced with the different terms in any place in the description or the drawings. Furthermore, all combinations of the present embodiment and the modifications are also included within the scope of the invention.

2. Second Embodiment

FIG. 5 illustrates an evacuation structure 1A according to a second embodiment of the invention. In the first embodiment, when the evacuation room 30 is flooded and the water line rises above the load water line LWL, the valve 61 of the check valve 60 is closed by the external water pressure. Then, drainage via the drain pipe 50 becomes impossible. The evacuation structure 1A illustrated in FIG. 5 has an additional drain pipe 90 that dewateres the evacuation room 30 when the evacuation room 30 is flooded and the water line rises.

In FIG. 5, the additional drain pipe 90 is attached to at least one of the outer walls 3C to 3F intersecting with the floor board 20, for example, the outer wall 3C. In this drain pipe 90, one end 90A open into a lower part of the evacuation room 30 serves as a drain inlet. In the drain pipe 90, each of a plurality of branch ends (also referred to as drain outlets) 90B1 to 90Bm (m is an integer of two or more) open into the outer side of the outer wall 3C serves as a drain outlet.

Each of the plurality of branch ends 90B1 to 90Bm has the same structure as the outlet 50B of the drain pipe 50. That is, each of the plurality of branch ends 90B1 to 90Bm has the check valve 60 (the valve 61 and the hinge 62) and the cover 63. Accordingly, when water pressure of the evacuation room 30 acts on the plurality of branch ends 90B1 to 90Bm via the inlet 90A of the drain pipe 90, the valve 61 illustrated in FIG. 3 is opened so as to allow the drainage.

The reason why the plurality of branch ends 90B1 to 90Bm is provided is because even when the evacuation room 30 is flooded and the water line attempts to rise above the load water line LWL, at least one of the plurality of branch ends 90B1 to 90Bm is disposed above the water line, so that water of the flood can be drained by the water pressure in the evacuation room 30. Thus, the water line can be prevented from rising above the load water line LWL.

3. Third Embodiment

FIGs. 6 and 7 illustrate an evacuation structure 100 according to a third embodiment of the invention. A contour of a transverse cross-section of the evacuation structure 100 is a polygon having more corners than the square as in the first and second embodiments, for example, substantially a hexagon. In particular, in the evacuation structure 100 in a floating state, as illustrated in FIG. 6, a horizontal width W1 of a bottom (bottom wall) 103A and a horizontal width W2 of an apex (ceiling wall) 103B are narrower than a horizontal width W3 at a position between the bottom 103A and the apex 103B ($W1 < W3$, $W2 < W3$). In particular, where $W1 < W3$, the evacuation structure 100, even when attempting to roll over, is easily restored to an upright state as compared with the evacuation structures 1 and 1A of the first and second embodiments.

As illustrated in FIG. 7, the evacuation structure 100 has a box-shaped structural body 106 formed by, for example, a framework structural body 102, wall materials (the bottom wall 103A, the ceiling wall 103B, side walls 103C and 103D, and the like), and a float 110, and a contour of a transverse cross-section of the box-shaped structural body 106 is substantially a hexagon. An exposed surface of the float 110 exposed to the outside may be covered with an iron plate or the like. A hatch door 104 is disposed at the same position as the hatch door 4 of the first embodiment. That is, the hatch door 104 can be attached to the bottom wall 103A, the ceiling wall 103B, and the two side walls 103C and 103D that are four surfaces parallel to a longitudinal axis of the box-shaped structural body 106. The evacuation structure 100, if rolling over by any chance, is stabilized in a posture in which any of the four surfaces parallel to the longitudinal axis of the box-shaped structural body 106 faces upward. Accordingly, attaching the hatch door 104 to the bottom wall 103A, the ceiling wall 103B, and the two side walls 103C and 103D that are the four surfaces parallel to the longitudinal axis of the box-shaped structural body 106 facilitates an escape from the evacuation structure 100 at the time of rollover.

A floor board 120 is disposed inside the box-shaped structural body 106, and a weight 170 is disposed at a position below the floor board 120 and away from the hatch door 104. A handrail 180 is attached to the apex 103B of the box-shaped structural body 106 and foldable similarly to the handrail 80 of the first embodiment.

The box-shaped structural body 106 can have the drain pipe 90 illustrated in FIG. 5 or, instead of the drain pipe 90, can have a plurality of drain pipes 150 as illustrated in FIG. 7. Each

of the plurality of drain pipes 150 has one end 150A open into an evacuation room 130, and the other end 150B open into the side wall 103C or 103D of the box-shaped structural body 106. Note that openings of the other ends 150B of the plurality of drain pipes 150 are omitted in FIG. 6. Furthermore, each of the plurality of drain pipes 150 has a check valve 160 provided with a valve 161. The plurality of drain pipes 150 is disposed at positions at different heights. Thus, the plurality of drain pipes 150 acts similarly to the drain pipe 90 of FIG. 5 having the branch ends 90B1 to 90Bm at different heights. The drain storage room 40 and the drain pipe 50 that are illustrated in FIG. 5 can also be provided in the structure of FIG. 7. Thus, accumulation of water in the evacuation room 130 above a floor surface of the floor board 120 is prevented.

4. Fourth Embodiment

FIGS. 8 to 10 illustrate an evacuation structure 200 according to a fourth embodiment of the invention. A contour of a transverse cross-section of the evacuation structure 200 is a polygon having more corners than the square as in the first and second embodiments, for example, substantially an octagon. In particular, in the evacuation structure 200 in a floating state, a horizontal width of a bottom (bottom wall) 203A and a horizontal width of an apex (ceiling wall) 203B are narrower than a horizontal width at a position between the bottom 203A and the apex 203B. Thus, the evacuation structure 200, even when attempting to roll over, is easily restored to an upright state as compared with the evacuation structures 1 and 1A of the first and second embodiments.

As illustrated in FIG. 10, the evacuation structure 200 has a box-shaped structural body 206 formed by, for example, a framework structural body 202, wall materials (the bottom wall 203A, the ceiling wall 203B, side walls 203C and 203D, and the like), and a float 210, and a contour of a transverse cross-section of the box-shaped structural body 206 is substantially an octagon. A hatch door 204 is disposed at the same position as the hatch door 4 of the first embodiment. That is, the hatch door 204 can be attached to the bottom wall 203A, the ceiling wall 203B, and the two side walls 203C and 203D that are four surfaces parallel to a longitudinal axis of the box-shaped structural body 206. The evacuation structure 200, if rolling over by any chance, is stabilized in a posture in which any of the four surfaces parallel to the longitudinal axis of the box-shaped structural body 206 faces upward. Accordingly, attaching the hatch door 204 to the bottom wall

203A, the ceiling wall 203B, and the two side walls 203C and 203D that are the four surfaces parallel to the longitudinal axis of the box-shaped structural body 206 facilitates an escape from the evacuation structure 200 at the time of rollover.

A floor board 220 is disposed inside the box-shaped structural body 206, and a weight 270 is disposed at a position below the floor board 220 and away from the hatch door 204. A handrail 280 is attached to the apex 203B of the box-shaped structural body 206. Although the handrail 280 may be foldable similarly to the handrail 80 of the first embodiment, the handrail 280 may be adjusted to a position when not in use illustrated in FIG. 8 and a position when in use illustrated in FIG. 9.

The box-shaped structural body 206 can have the drain pipe 90 illustrated in FIG. 5 or, instead of the drain pipe 90, can have a plurality of drain pipes 250 similar to the plurality of drain pipes 150 of FIG. 7, as illustrated in FIG. 10. Note that openings of the other ends of the plurality of drain pipes 250 are omitted in FIGs. 8 and 9. The plurality of drain pipes 250 acts similarly to the drain pipe 90 of FIG. 5 having the branch ends 90B1 to 90Bm at different heights. The drain storage room 40 and the drain pipe 50 that are illustrated in FIG. 5 can also be provided in the structure of FIG. 10. Thus, accumulation of water in an evacuation room 230 above the floor board 220 is prevented.

5. Fifth Embodiment

FIGs. 11 and 12 illustrate an evacuation structure 300 according to a fifth embodiment of the invention. The evacuation structure 300 has the same structure as that of the fourth embodiment of the invention except for a housing structure of a stabilizer board 310 described below. However, the stabilizer board 310 may be added to any of the evacuation structures of the first to fourth embodiments of the invention.

The evacuation structure 300 can house a plurality of the stabilizer boards 310 capable of horizontally protruding from, of the box-shaped structural body 206 of the evacuation structure 300, two side walls 203C and 203D facing each other in a transverse cross-sectional view. When the evacuation structure 300 floats, the plurality of stabilizer boards 310 is horizontally protruded from the two side walls 203C and 203D of the evacuation structure 300. Thus, resistance that is generated by the stabilizer board 310 contacting water prevents rollover of the evacuation structure

300, and the posture is stabilized. The stabilizer board 310 is preferably provided to a box-shaped structural body that has a polygonal vertical cross-section and that is likely to roll over as illustrated in, in particular, FIG. 6 and the subsequent figures. The stabilizer board 310 may be disposed at a plurality of stages at positions at different heights.

As illustrated in FIG. 13A, the plurality of stabilizer boards 310 can be housed in the box-shaped structural body 206 of the evacuation structure 300. Here, as illustrated in FIG. 13A, the stabilizer board 310 can include first and second stabilizer boards 311 and 312 that are coupled by a hinge and foldable. In order to protrude the stabilizer board 310, the stabilizer board 310 is, from a housed state illustrated in FIG. 13A, slid outward as illustrated in FIG. 13B. This sliding movement can be performed on, for example, the floor board 220 illustrated in FIG. 10. Next, as illustrated in FIG. 13C, the second stabilizer board 312 is rotated by 90 ° relative to the first stabilizer board 311 so as to stand up. Thereafter, as illustrated in FIG. 13D, while the stabilizer board 310 is being slid, the second stabilizer board 312 is further rotated by 90° relative to the first stabilizer board 311. Thus, while the first and second stabilizer boards 311 and 312 are in a flat plate state, the stabilizer board 310 can be protruded to a final position. With this, the stabilizer board 310 having a predetermined protrusion length can be housed in the evacuation structure 300 without an unnecessary increase in the size of the evacuation structure 300.

6. Sixth Embodiment

6.1. Appearance and Internal Structure

FIGs. 14 to 18 illustrate an evacuation structure 400 according to a sixth embodiment of the invention. The evacuation structure 400 has a box-shaped structural body 406. Of the box-shaped structural body 406, members having the same functions as those of the box-shaped structural body 206 of the evacuation structure 200 according to the fourth embodiment of the invention are denoted by the same reference signs as those of the box-shaped structural body 206 and description thereof will be omitted. Furthermore, of the members already described as the box-shaped structural body 206, the members that are not changed as the box-shaped structural body 406 are intended to be included in the box-shaped structural body 406 as well.

As illustrated in FIGs. 14 and 15, the box-shaped structural body 406 has two hatch doors 204 in each of two outer walls 203C and 203D facing each other in a transverse cross-sectional

view in the direction orthogonal to a longitudinal axis of the box-shaped structural body 406. That is, the box-shaped structural body 406 includes a total of six hatch doors 204 such that each of the bottom wall 203A and the ceiling wall 203B includes one hatch door 204 and each of the outer walls 203C and 203D includes two hatch doors 204. However, the number of the hatch doors 204 is not limited to this. The outer wall 203D having three areas on both sides of the two hatch doors 204 is covered with stabilizer boards 450, 451, and 452. As illustrated in FIG. 24, when the stabilizer boards 450, 451, and 452 are rotated around the lower fulcrums, the outer wall 203D having the three areas is exposed.

The box-shaped structural body 406 is provided with 280 that is folded when not in use as illustrated in FIG. 15, such that the handrail 280 can be vertically arranged to the ceiling wall 203B of the box-shaped structural body 406 as illustrated in FIGs. 14 and 18. As illustrated in FIGs. 14 and 18, a shade member 290 covering the ceiling wall 203B can be mounted on the handrail 280. As an evacuation passage through which evacuation is performed from the box-shaped structural body 406 to the ceiling wall 203B, in addition to the ceiling hatch door 204 not illustrated in FIGs. 14 and 15 but illustrated in FIG. 8, a ladder 410 may be attached to the outer walls 203D on both sides. The ladder 410 in, of the outer wall 203D to which the ladder 410 is attached, the area covered with the stabilizer board 452 can protrude via a through hole 452A formed in the stabilizer board 452.

As illustrated in FIGs. 16 and 17, for example, six people in each of two rows, that is, a total of twelve people can board the box-shaped structural body 406. However, the number of passengers can be changed. In the present embodiment, as means on which the passenger can sit, a fixed or moveable chair, for example, a fixed chair 420 is disposed in each of the three areas on both sides of the two hatch doors 204. In each of the two areas facing the two hatch doors 204, as illustrated in FIGs. 16 and 18, a moveable chair as means on which the passenger can sit, for example, a moveable chair plate 421 is disposed so as to be pivotable around a fulcrum 422. The moveable chair plate 421, when the two hatch doors 204 are in use, is leaned against above the fulcrum 422 and thus does not obstruct the entrance and exit. Note that as illustrated in FIG. 17, the bottom-surface hatch door 204 and the weight 270 are disposed such that the transverse cross-section is flush with the substantially hexagonal bottom surface.

6.2. Drain Operation

Next, drainage of water that has invaded the box-shaped structural body 406 will be described with reference to FIGs. 16, 19, and 20. In the present embodiment, for example, a drain pipe 91 illustrated in FIG. 19 is, in a vertical and horizontal array as illustrated in FIG. 20, disposed in the outer wall 203D that is exposed by pivot of the stabilizer boards 450 to 452, as illustrated in FIG. 24 (the drain pipe 91 is omitted in FIG. 24).

Here, in the present embodiment, similarly to FIGs. 1 and 5, the load water line LWL is set so as to be lower than a floor surface level FL of the box-shaped structural body 406, as illustrated in FIG. 16. Furthermore, as illustrated in FIG. 16, an upper most surface level of the ceiling wall 203B of the box-shaped structural body 406 is described as an upper most level (UML), and a lower most surface level thereof is described as a lower most level (LML). A max load water line (MLWL) illustrated in FIG. 16 is the max load water line of the box-shaped structural body 406 that is surfacing when the inside of the box-shaped structural body 406 at full load is filled with flood. The max load water line MLWL is located above the load water line LWL by a height h but is lower than the upper most surface level UML.

Zones Z1 to Z8 illustrated in FIG. 20 indicate zones obtained by dividing a height range from the floor surface level FL of the box-shaped structural body 406 to the upper most surface level UML of the ceiling wall 203B into, for example, eight, and the zone Z1 is located lowest and the zone Z8 is located highest. In each of the zones Z1 to Z8, at least one drain pipe 91 is disposed in the perpendicular direction, and a plurality of the drain pipes 91 is disposed in the horizontal direction at a predetermined pitch P . Note that this zone division is an example, and the height range in the internal space in which the zones are set and the number of zones are not limited to this. Here, FIG. 20 is an example of N (N is an integer of two or more) drain pipes 91 having outlets at N = for example, eight positions at different heights in which the heights in the vertical direction sequentially increase. In FIG. 20, the drain pipes 91 that are disposed in the zone Z1 are disposed above the floor surface level FL by, for example, 0.12 m, and the drain pipes 91 are disposed at, for example, the pitch $P = 0.15$ m in the vertical direction. Note that in a case of having the drain pipe 50 having the outlet (other end) below the floor surface 21 and above the load water line LWL as illustrated in FIG. 5, an example is applied in which N drain pipes have

outlets (other ends) at N = nine positions at different heights in which the heights in the vertical direction sequentially increase.

As illustrated in FIG. 19, the drain pipe 91 has one end 91A open into the inside of the box-shaped structural body 406, the other end 91B open into the outer wall 203D, and a valve 92 disposed therebetween. The inner diameter of the drain pipe 91 is, for example, 52 mm. Between the one end 91A and the other end 91B, the drain pipe 91 has an annular projection 93 narrowing the inner diameter, and a plurality of local projections 94 protruding at a plurality of locations spaced apart in the circumferential direction. The valve 92 having, for example, a spherical shape is disposed in a conduit between the annular projection 93 and the local projections 94. At the time of drainage from the inside of the box-shaped structural body 206 to the outside, the valve 92 is moved to the local projections 94 side by the water pressure. Accordingly, drainage is performed via an area with no local projections 94 in the circumferential direction. On the other hand, at the time of flood from the outside of the box-shaped structural body 206 to the inside, the valve 92 is moved to the annular projection 93 side by the water pressure. Accordingly, the passage of the drain pipe 91 is blocked by the sphere 92 and the annular projection 93, preventing the flood.

The size of the evacuation structure 400 is, for example, approximately 5.8 m × 2.1 m × 2.3 m in length × height × width. Furthermore, the total weight of the evacuation structure 400 is estimated to be 2400 kg by adding 350 kg of the framework structural body, 260 kg of the float, 180 kg of the wall materials, 350 kg of the weight 270, 840 kg of twelve passengers, and 420 kg of others.

6.2.1. Load Water Line LWL

In the present embodiment, the total volume of the float below the floor surface FL is 5.3 m³ (average area 8.84 m² × height 0.6 m). At this time, where the density of the float is 24 kg/m³ and the density of water is 1000 kg/m³, buoyancy F_F acting on the box-shaped structural body 406 through only this float is

$$\begin{aligned} F_F &= (\text{the volume weight of water eliminated by the float}) - (\text{the weight of the float itself}) \\ &= 5.3 \text{ m}^3 \times 1000 \text{ kg/m}^3 \times 9.81 \text{ m/s}^2 \\ &\quad - 5.3 \text{ m}^3 \times 24 \text{ kg/m}^3 \times 9.81 \text{ m/s}^2 \end{aligned}$$

$$= (1000 - 24) \times 5.3 \times 9.81$$

$$= 50754 \text{ (N)}$$

On the other hand, the buoyancy in balance with the evacuation structure 400 having the total weight of 2400 is $2400 \times 9.81 = 23544 \text{ N}$, and accordingly it is sufficient that the volume of 2.4 m³ corresponding to about 46% ($100 \times 23544/50745$) of the total volume of 5.3 m³ of the float below the floor surface FL is sunk. Accordingly, as illustrated in FIG. 16, it is understood that the load water line LWL is located below the floor surface FL and at almost the middle of 0.6 m in height between the floor surface FL and the lower most surface MLL. In FIG. 16, the height from the lower most surface LML to the load water line LWL is 0.3 m.

6.2.2. Max Load Water Line MLWL

Next, the max load water line MLWL is obtained. The max load water line MLWL is a water line at max load in which the weight when the space inside the box-shaped structural body 406 is filled with water further acts on the total weight of the box-shaped structural body 406. Although such a situation is not normally expected, for the purpose of securing safety, it is ensured that the box-shaped structural body does not sink even at the max load exceeding the weight on board.

Here, the capacity of the space inside the box-shaped structural body 406 is, where the average area excluding the passengers and the chairs is 8 m² and the height is 1.5 m, 12 m³. When this space is flooded and air (specific gravity 1.225 kg/m³) in this space is replaced with water (specific gravity 1000 kg/m³), an additional gravity F_w obtained by the following formula acts on the box-shaped structural body 406.

$$F_w = (\text{the weight of water launched into the space}) - (\text{the weight of the space itself})$$

$$= (8 \text{ m}^3 \times 1000 \text{ kg/m}^3 \times 9.81 \text{ m/s}^2)$$

$$- (8 \text{ m}^3 \times 1.225 \text{ kg/m}^3 \times 9.81 \text{ m/s}^2)$$

$$= (1000 - 1.225) \times 8 \times 9.81$$

$$= 78384 \text{ (N)}$$

Here, assuming that the max load water line MLWL is at the position of FIG. 16, buoyancy F_A that increases due to sinking of the box-shaped structural body 406 in water by the height h

relative to the load water line LWL is generated. Here, where the average area A defined by the contour of the box-shaped structural body 406 = 10 m^2 , the buoyancy F_A is represented as follows.

$$\begin{aligned} F_A &= \text{volume } (h \times A) \times \text{specific gravity of water } (1000 \text{ kg/m}^3) \times 9.81 \text{ (m/s}^2\text{)} \\ &= 98100 \times h \end{aligned}$$

5 In order for the box-shaped structural body 406 to float, $F_W = F_A$ is established.

Therefore, $h = 78384/98100 = 0.8 \text{ m}$.

That is, the height from the lower most surface LML of the box-shaped structural body 406 to the max load water line MLWL is 0.3 m (the height from the lower most surface LML of the box-shaped structural body 406 to the load water line LWL) + 0.8 m (the height h from the load
10 water line LWL to the max load water line MLWL) = 1.1 m .

The overall height of the box-shaped structural body 406 is 2.1 m , and the position of the highest drain pipe 91 in FIG. 20 has 1.77 m ($0.6 + 0.12 + 0.15 \times 7$) in height from the lower most surface LML of the box-shaped structural body 406. From this, it is understood that even when the box-shaped structural body 406 is filled with flood, the volume of the float is a volume that
15 does not completely submerge the box-shaped structural body 406, such that at least one of the other ends of the N drain pipes 91 is located above the water surface outside the box-shaped structural body 406.

Note that if the height from the lower most surface LML of the box-shaped structural body 406 to the floor surface FL is larger, the volume of the float that can be disposed below the floor
20 surface FL increases. Accordingly, the max load water line MLWL can also be set below the floor surface FL. Thus, even at the max load in which the weight when the space inside the box-shaped structural body 406 is filled with flood acts, all of the drain outlets of the N drain pipes 91 illustrated in FIG. 20 can be disposed above the max load water line MLWL. Thus, the N drain pipes 91 can be simultaneously used at all times, so that the drain speed can be further increased.

25 6.2.3. Use of Drain Pipes Having Different Heights

The max load water line MLWL at the max load in which the space inside the box-shaped structural body 406 at full load illustrated in FIG. 16 is filled with flood is at a position lower than at least one of the positions of the drain outlets of the N drain pipes 91. Thus, before the space inside the box-shaped structural body 406 at full load is filled with flood, in other words, before

the max load water line MLWL is reached, water of the flood can be continued to be drained from at least one of the N drain outlets at higher positions than the water line, preferably, a plurality, N, of the drain outlets having different heights. Accordingly, in a normal use form, a situation in which the amount of flood exceeds the amount of drainage and in which the space inside the box-shaped structural body 406 is filled with flood cannot occur. In other words, a situation in which the max load water line MLWL is reached cannot happen.

FIGs. 21 to 23 illustrate an evacuation structure capable of not only floating but also moving by itself. First, as illustrated in FIGs. 14, 15, 18, and 21, the box-shaped structural body 406 can include an attachment part 430 for attachment of a propulsion device that imparts propulsion to the box-shaped structural body 406, for example, an electric screw 431. The electric screw 431 is energized by being connected to a connector that is exposed by opening a door 432. As illustrated in FIG. 21, the attachment part 430, as illustrated in FIG. 21, can be attached to both end parts of the box-shaped structural body 406 in the longitudinal direction. Thus, the box-shaped structural body 406 can be advanced in the directions of arrows A and B illustrated in FIG. 21.

Together with the attachment part 430 or instead of the attachment part 430, as illustrated in FIG. 22, for example, on the hatch doors 204 on both side surfaces of the box-shaped structural body 406, an oar (propulsion device) 440 can be protruded outward via a clutch (attachment part) 204A serving as a fulcrum of the oar 440. The evacuee inside the box-shaped structural body 406 rows with the oar 440 by hand with the clutch 204A as a fulcrum, so that the box-shaped structural body 406 can be advanced.

Alternatively, as illustrated in FIG. 23, in order for the evacuee who has evacuated to the ceiling wall 203B to row with the oar 440, a clutch (not illustrated) may be attached to the ceiling wall 203B or the handrail 280. Note that FIG. 23 illustrates a state in which an unexpected external force acts on the box-shaped structural body 406 and in which the outer wall 203D or the like is separated from the framework structural body and scattered on the water surface. Even in such a state, the ceiling wall 203B functions as a raft, and the minimum safety of the evacuee may be secured.

6.4. Stabilizer Board

FIGs. 24 to 27 illustrate the stabilizer boards 450 to 452 that enhance the stability of the box-shaped structural body 406. As illustrated in FIG. 24, each of the stabilizer boards 450 to 452 may be pivotally supported on, for example, the outer wall 203D of the box-shaped structural body 406 and may be housed in a vertically arranged state. Thus, the inside of the evacuation structure 400 is not occupied by a housing space of a plurality of the stabilizer boards 450 to 452. Furthermore, the plurality of stabilizer boards 450 to 452 is housed so as to be spaced apart from either one of the two outer walls 203D, so that the drain outlet of the other end of the drain pipe 91 attached to the outer wall is not blocked.

As illustrated in FIG. 25, it is possible to further have a locking part 460 that locks at least one of the stabilizer boards 450 to 452, for example, the stabilizer board 450 in a vertically arranged state, and a release operation part 470 that is operated inside the box-shaped structural body 406 to release the state of the stabilizer board 450 being locked by the locking part 460. As illustrated in FIG. 26, the locking part 460 locks a locked part 453 attached to an upper part of the stabilizer board 450. The locking part 460 is pivotable. In order to operate the locking part 460 inside the box-shaped structural body 406, the release operation part 470 can include a handle 471 and a wire 472 that couples the handle 471 and a pivot part of the locking part 460. Thus, the evacuee who has evacuated into the box-shaped structural body 406 at the time of evacuation, after confirming surfacing of the box-shaped structural body 406, operates the release operation part 470 inside the box-shaped structural body 406 and can protrude the stabilizer board 450 onto the water surface outside the box-shaped structural body 406. Thus, the box-shaped structural body 406 is stabilized on the water surface. At this time, as illustrated in FIG. 27, the pivot position of the stabilizer board 450 is regulated by a stopper 480, so that a situation in which the stabilizer board 450 rotates by, for example, 180° and in which the stabilization function cannot be performed is inhibited.

Note that in the evacuation structure of the invention, in consideration of its use in, in particular, seawater, the outer wall is preferably coated with a surface protection material. The surface protection material preferably has rust resistance, waterproofness, ultraviolet resistance, abrasion resistance, and/or designability, and, for example, aliphatic polyurea resin can be used.

REFERENCE SIGN LIST

	1, 1A	EVACUATION STRUCTURE
	2	FRAMEWORK STRUCTURAL BODY
5	2A	BEAM
	3	OUTER WALL
	3A	BOTTOM WALL
	3B	CEILING WALL
	3C, 3D	SIDE WALL
10	3E, 3F	END WALL
	4	HATCH DOOR
	5	HATCH FRAME
	6	BOX-SHAPED STRUCTURAL BODY
	10, 10A, 10A1, 10B, 10B1	FLOAT
15	20	FLOOR BOARD
	20A	DISCHARGE PORT (THROUGH HOLE)
	21	FLOOR SURFACE
	30	EVACUATION ROOM
	40	DRAIN STORAGE ROOM
20	50	DRAIN PIPE
	50A	ONE END (INLET)
	50B	OTHER END (DRAIN OUTLET)
	60	CHECK VALVE
	61	VALVE
25	62	HINGE
	63	COVER
	70	WEIGHT
	80	HANDRAIL
	81	HINGE

	82	COUPLER
	90	ADDITIONAL DRAIN PIPE
	90A	INLET
	90B1 to 90Bm	DRAIN OUTLET
5	91	DRAIN PIPE
	91A	ONE END
	91B	OTHER END
	92	VALVE
	93	FLOW PATH OPENING
10	94	VALVE STOPPER
	100	EVACUATION STRUCTURE
	102	FRAMEWORK STRUCTURAL BODY
	103A	BOTTOM WALL
	103B	CEILING WALL
15	103C, 103D	SIDE WALL
	104	HATCH DOOR
	106	BOX-SHAPED STRUCTURAL BODY
	110	FLOAT
	120	FLOOR BOARD
20	150	DRAIN PIPE
	150A	ONE END (INLET)
	150B	OTHER END (OUTLET)
	160	CHECK VALVE
	161	VALVE
25	170	WEIGHT
	180	HANDRAIL
	200	EVACUATION STRUCTURE
	202	FRAMEWORK STRUCTURAL BODY
	203A	BOTTOM (BOTTOM WALL)

	203B	APEX (CEILING WALL)
	203C, 203D	SIDE WALL
	204	HATCH DOOR
	206	BOX-SHAPED STRUCTURAL BODY
5	210	FLOAT
	220	FLOOR BOARD
	250	DRAIN PIPE
	260	CHECK VALVE
	270	WEIGHT
10	280	HANDRAIL
	300	EVACUATION STRUCTURE
	290	SHADE MATERIAL
	310	STABILIZER BOARD
	311, 312	FIRST, SECOND STABILIZER BOARD
15	400	EVACUATION STRUCTURE
	406	BOX-SHAPED STRUCTURAL BODY
	410	LADDER
	420	FIXED CHAIR
	421	MOVEABLE CHAIR PLATE
20	422	HINGE
	430	ATTACHMENT PART
	431	SCREW
	432	DOOR
	440	OAR
25	450, 451, 452	STABILIZER BOARD
	453	LOCKED PART
	460	LOCKING PART
	470	RELEASE OPERATION PART
	471	HANDLE

472 WIRE

480 STOPPER

LML LOAD WATER LINE

MLWL MAX LOAD WATER LINE

5

CLAIMS

1. An evacuation chamber comprising:
an incompletely watertight box-shaped structural body including at least one hatch door;
a float provided to the box-shaped structural body;
at least one drain pipe having one end open into an inside of the box-shaped structural body, the at least one drain pipe having the other end open into an outer wall of the box-shaped structural body at a position above a load water line of the box-shaped structural body;
a check valve attached to the at least one drain pipe to prevent an inflow of water to the inside of the box-shaped structural body, the check valve including a valve that opens when water pressure at a time of drainage from the inside of the box-shaped structural body acts; and
a floor board disposed inside the box-shaped structural body and having a floor surface at a position above the load water line,
wherein the one end of the at least one drain pipe is open at a height equal to or lower than the floor surface of the floor board.
2. The evacuation chamber according to claim 1, wherein the float has a volume that does not completely submerge the box-shaped structural body even when the box-shaped structural body is filled with flood.
3. The evacuation chamber according to claim 1 or 2, further comprising a drain storage room disposed inside the box-shaped structural body at a position below the floor board,
wherein the floor board includes a through hole penetrating in an up-down direction, and the one end of the at least one drain pipe is open into the drain storage room.
4. The evacuation chamber according to any one of claims 1 to 3, wherein a weight that imparts a restoring force to the box-shaped structural body is disposed below the load water line.
5. The evacuation chamber according to claim 4, wherein a contour of a transverse cross-section of the box-shaped structural body is formed in a polygon having horizontal widths of a bottom and an apex narrower than a horizontal width at a position between the bottom and the apex.

6. The evacuation chamber according to any one of claims 1 to 5, wherein the box-shaped structural body has a framework structural body and a ceiling wall attached to an upper surface of the framework structural body, and

the ceiling wall has a handrail disposed so as to surround a top surface area that allows an escape from the at least one hatch door attached to the ceiling wall.

7. The evacuation chamber according to any one of claims 1 to 6, wherein the box-shaped structural body includes an attachment part for attachment of a propulsion device that imparts propulsion to the box-shaped structural body.

Almex Technologies Inc.

Patent Attorneys for the Applicant/Nominated Person

SPRUSON & FERGUSON

FIG.2

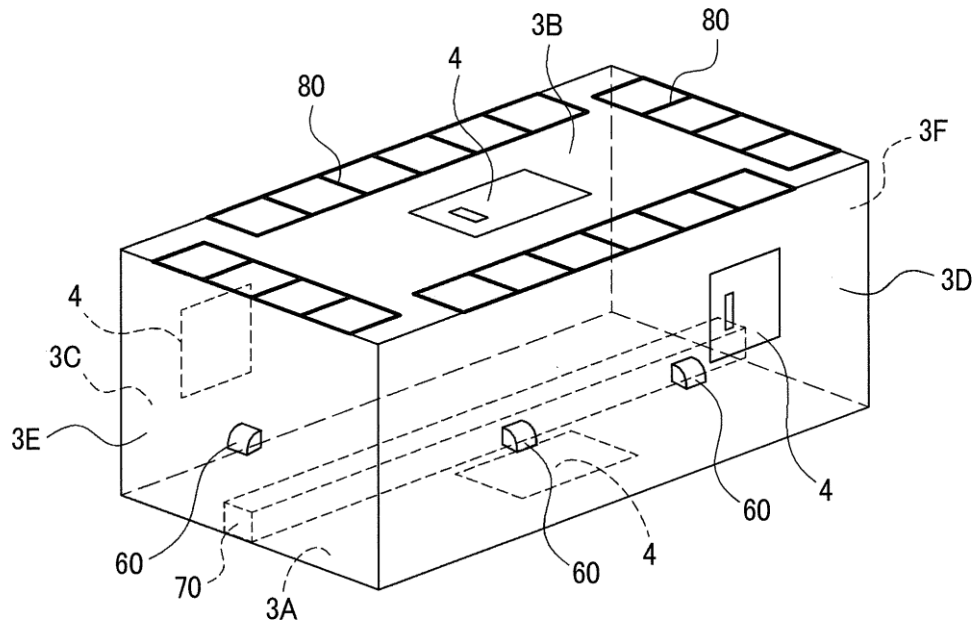


FIG.3

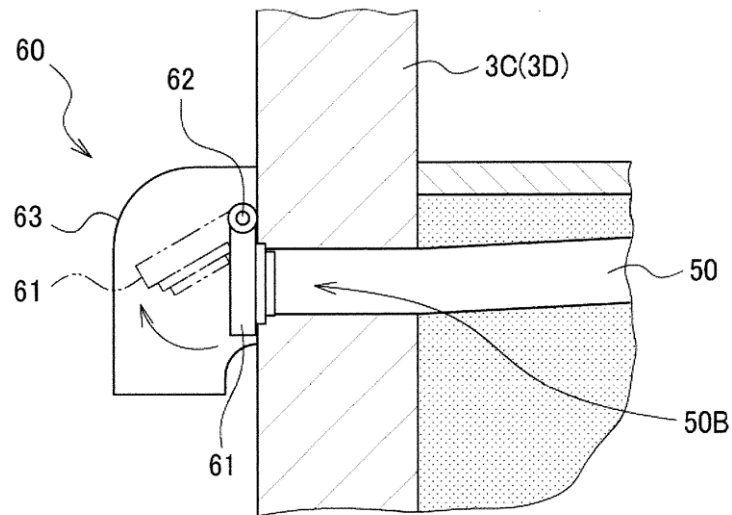


FIG. 5

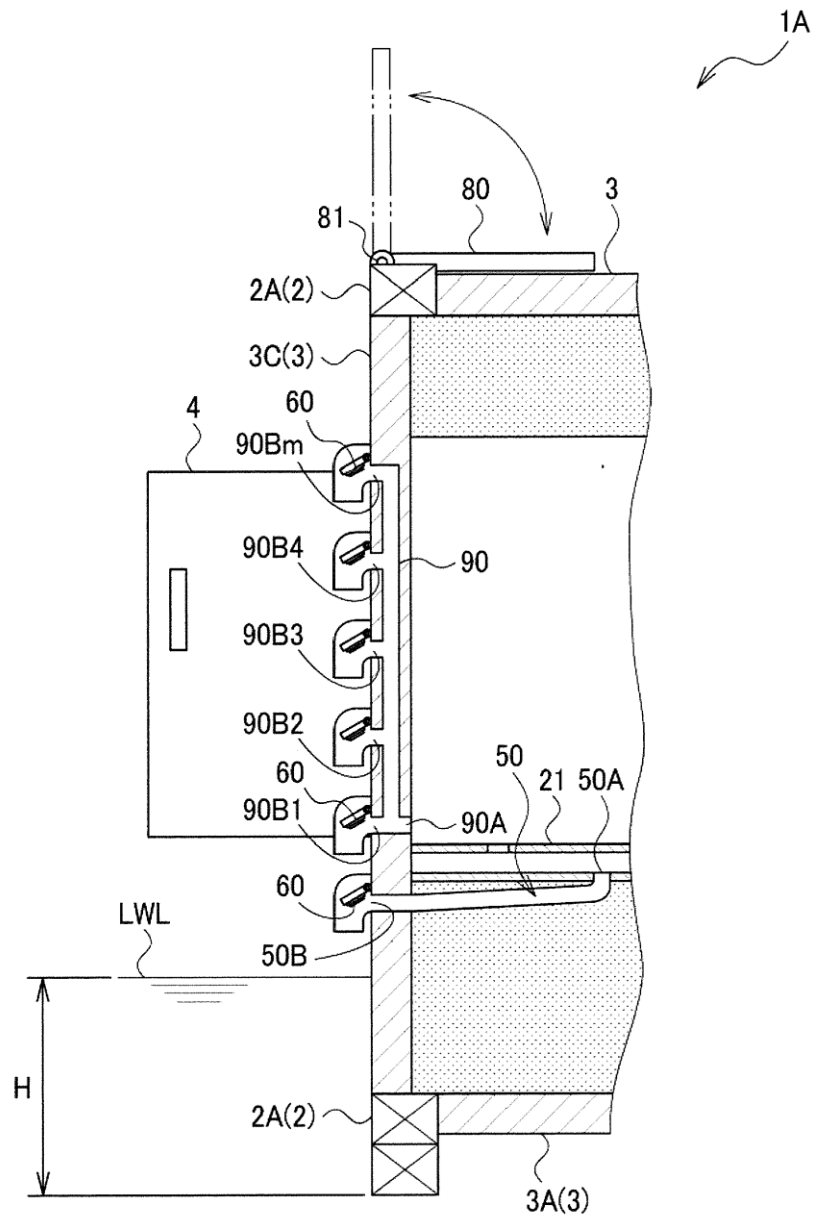


FIG. 6

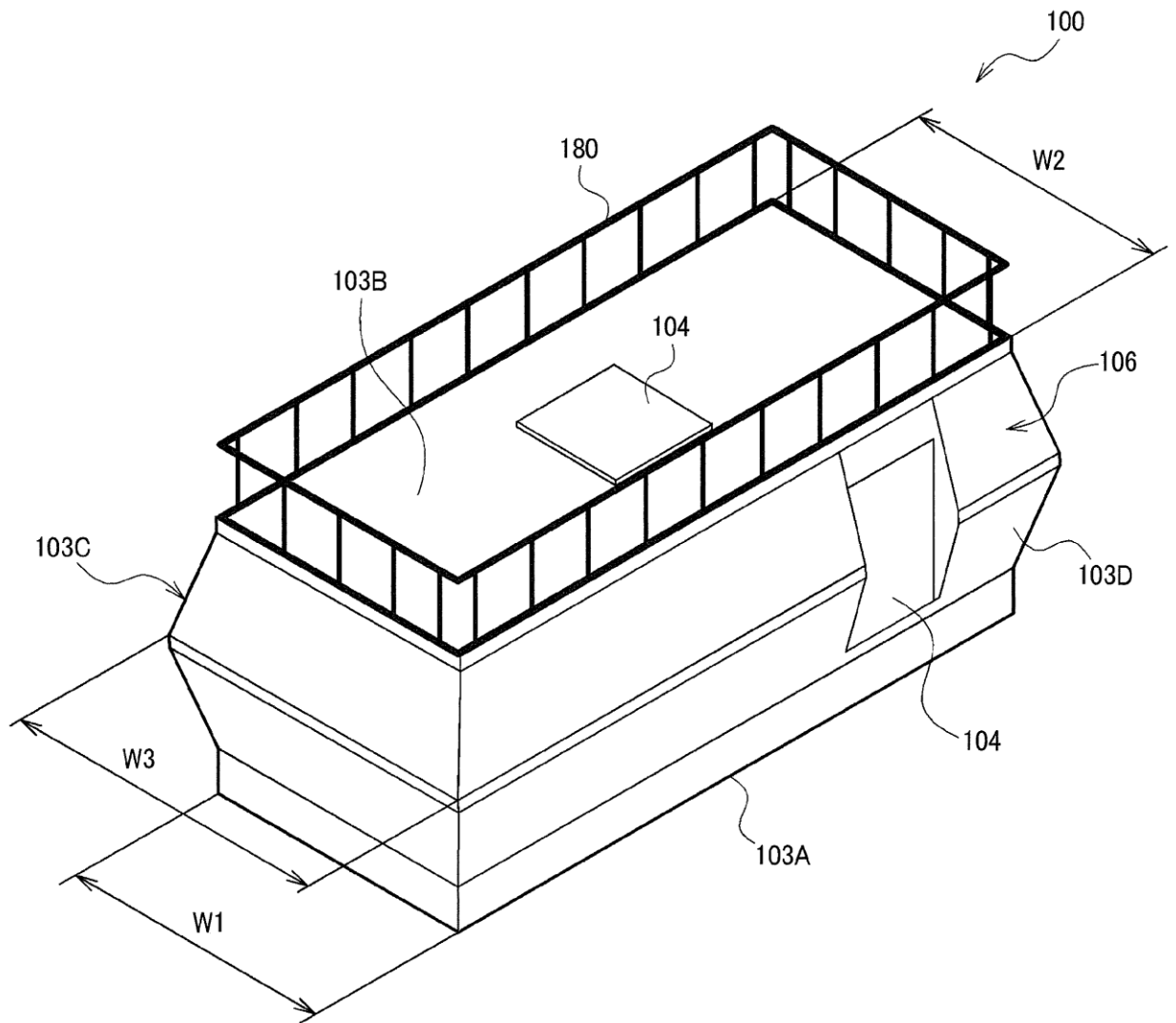


FIG. 7

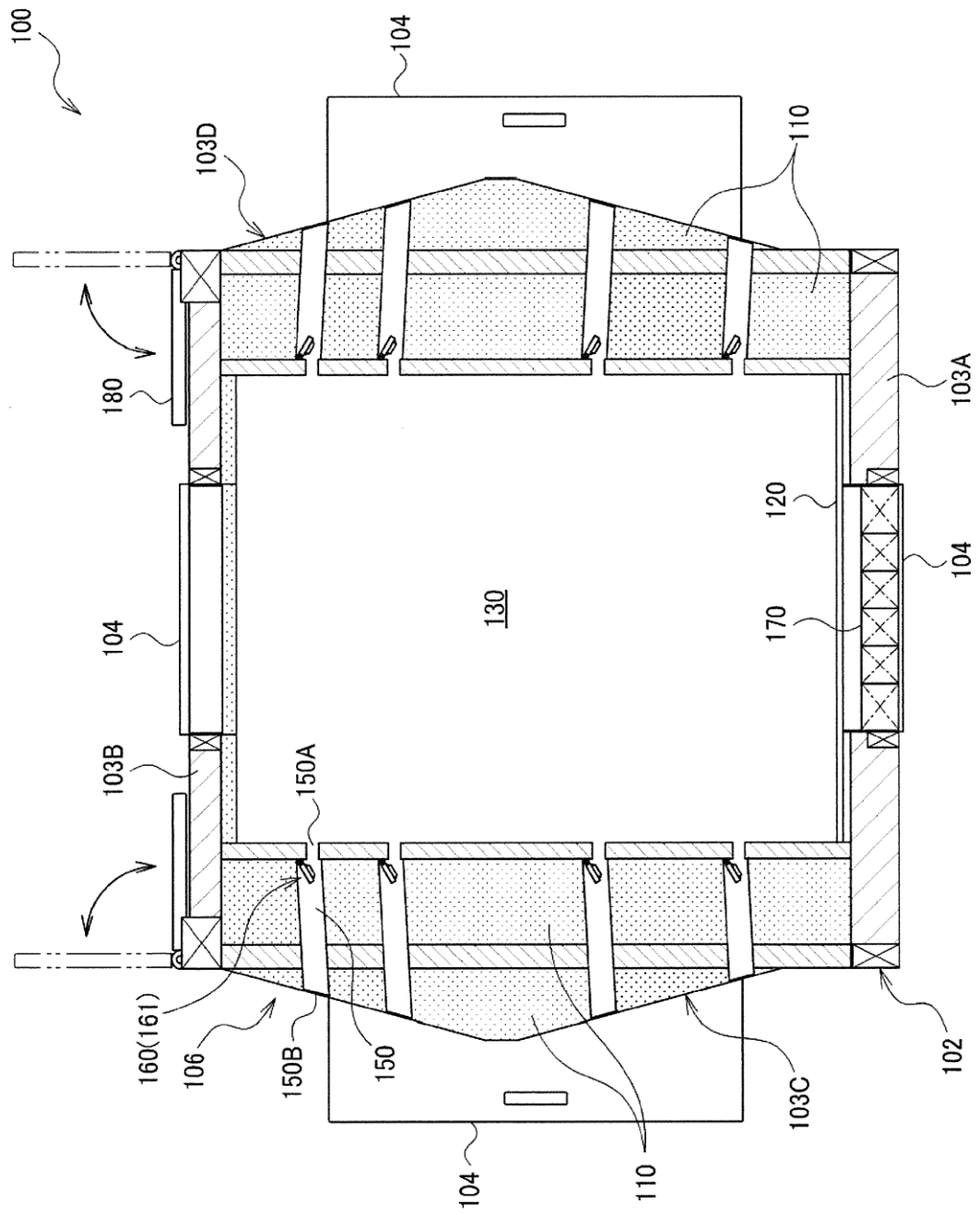


FIG. 8

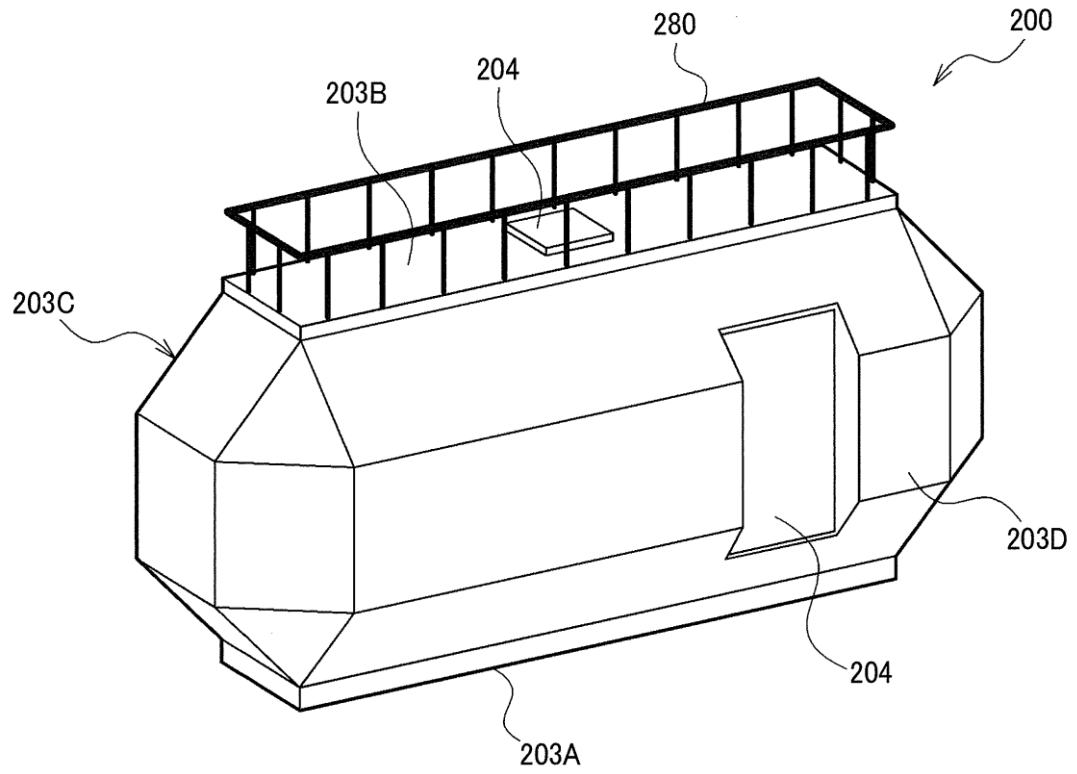


FIG. 9

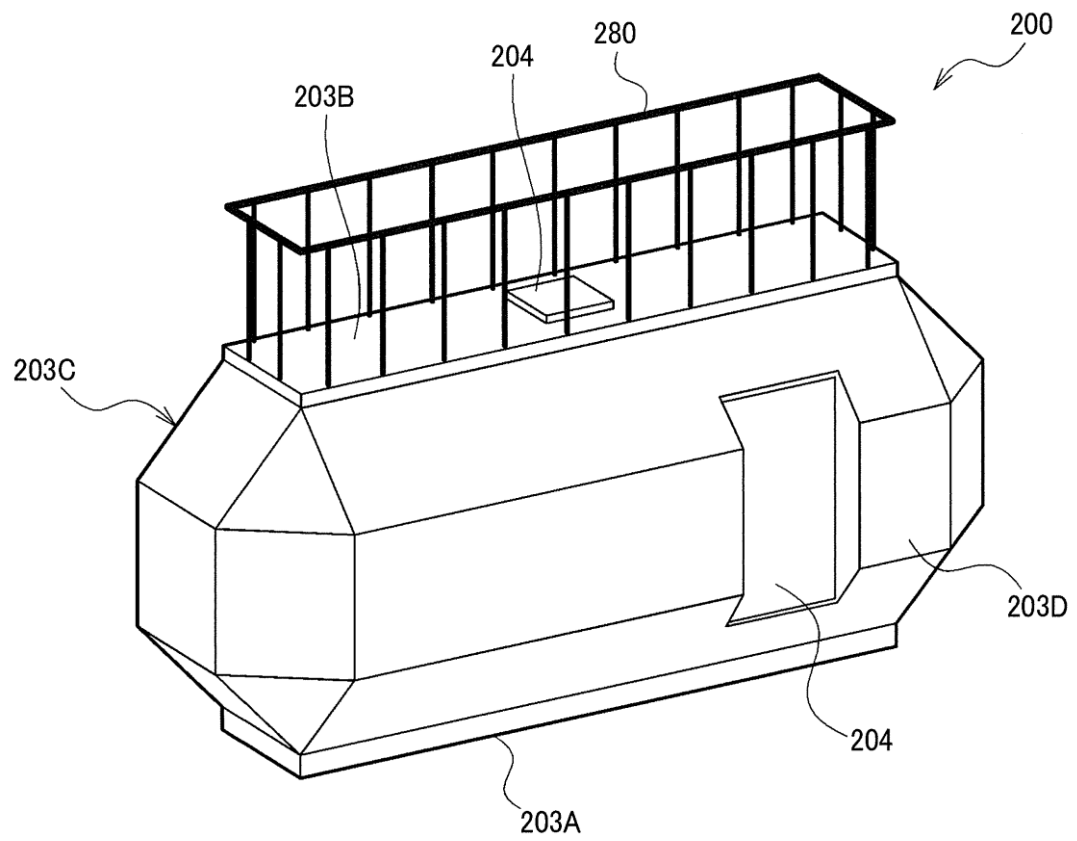


FIG. 11

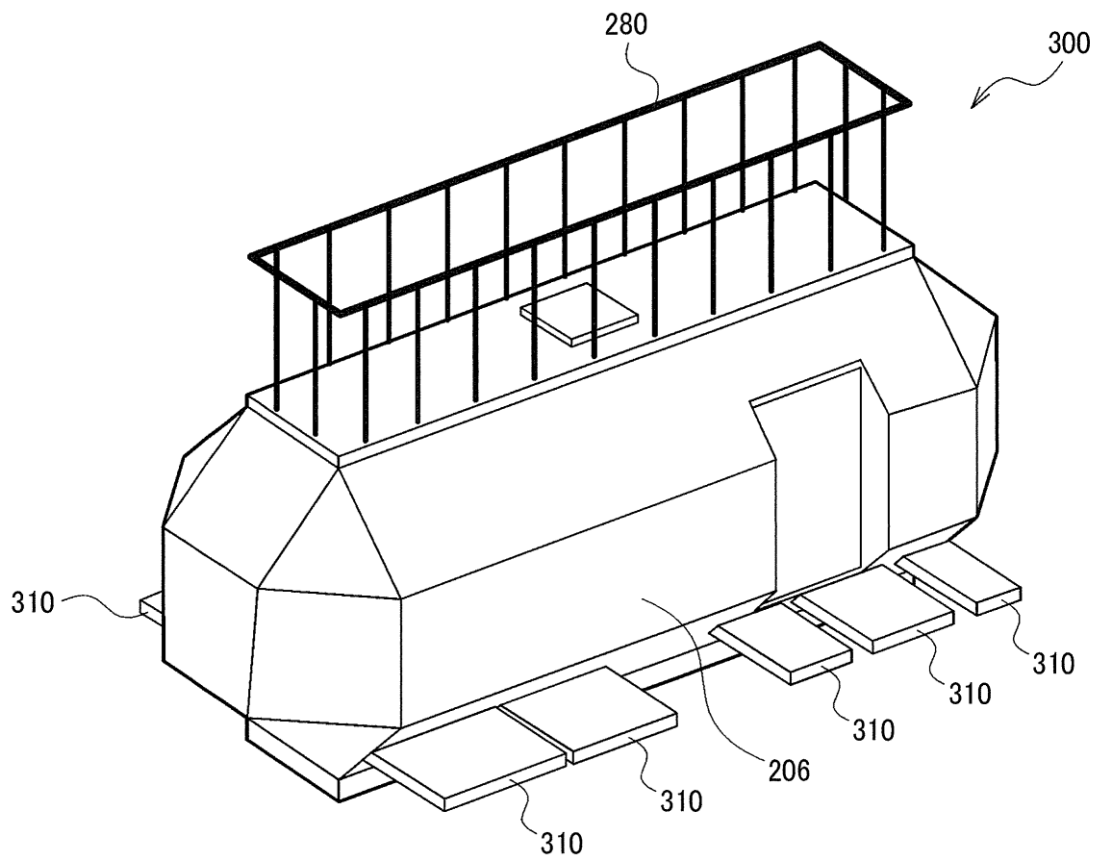


FIG. 12

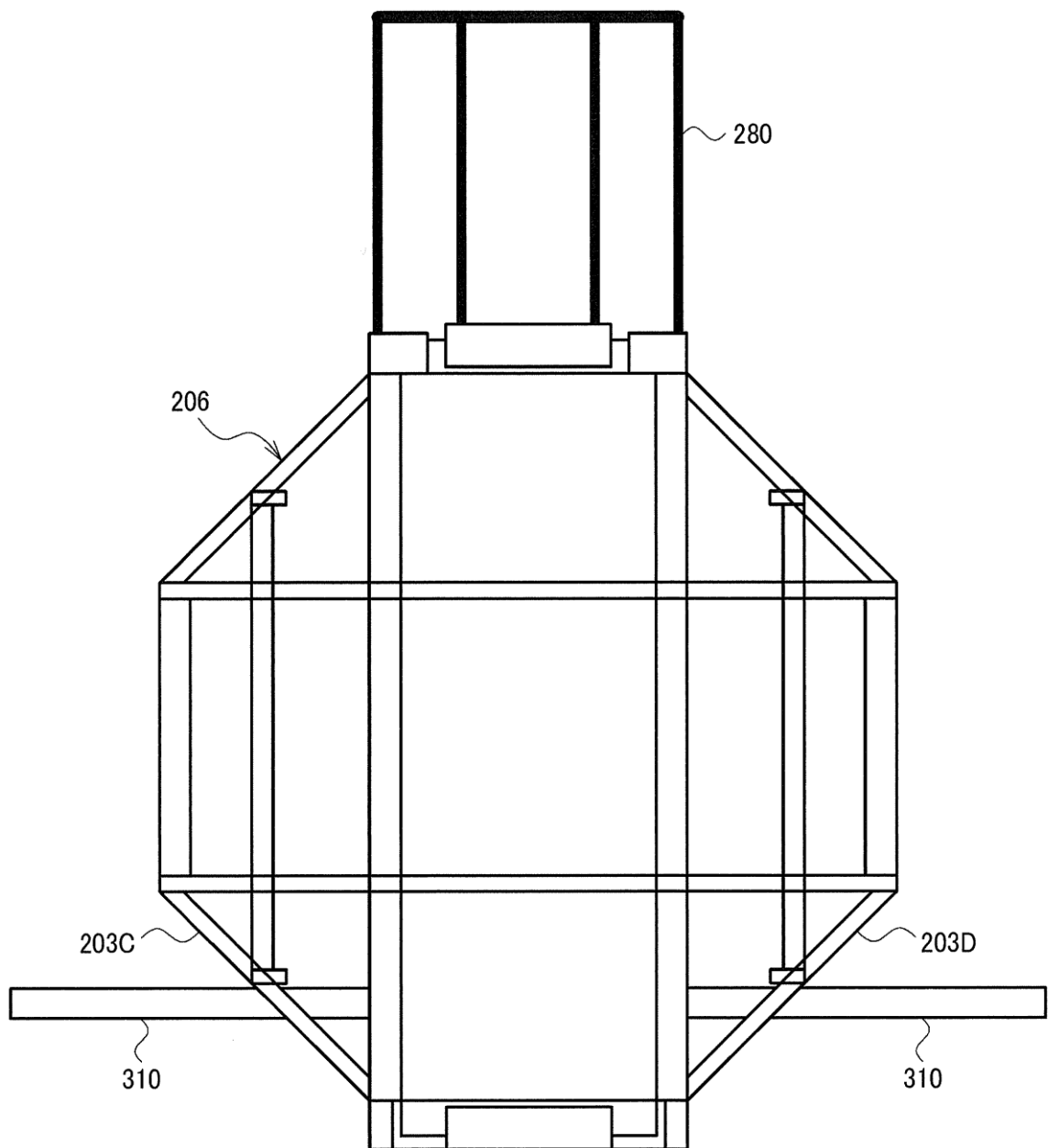


FIG.1 3A

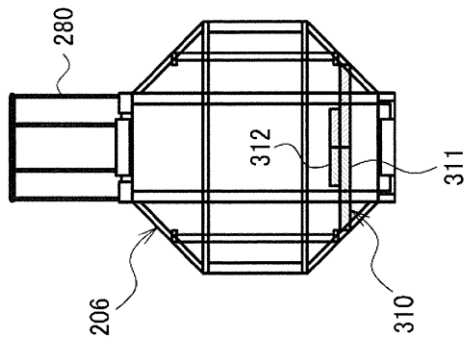


FIG.1 3B

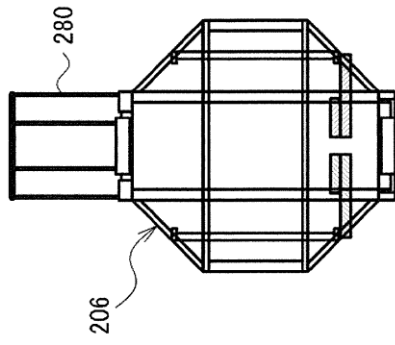


FIG.1 3C

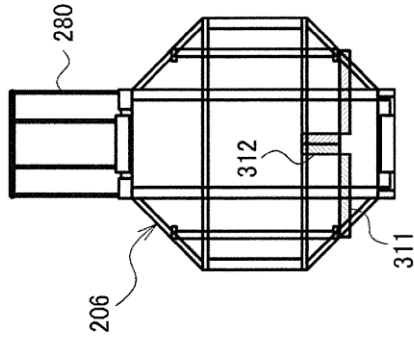


FIG.1 3D

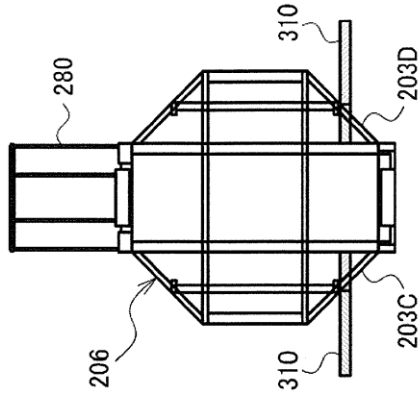


FIG. 14

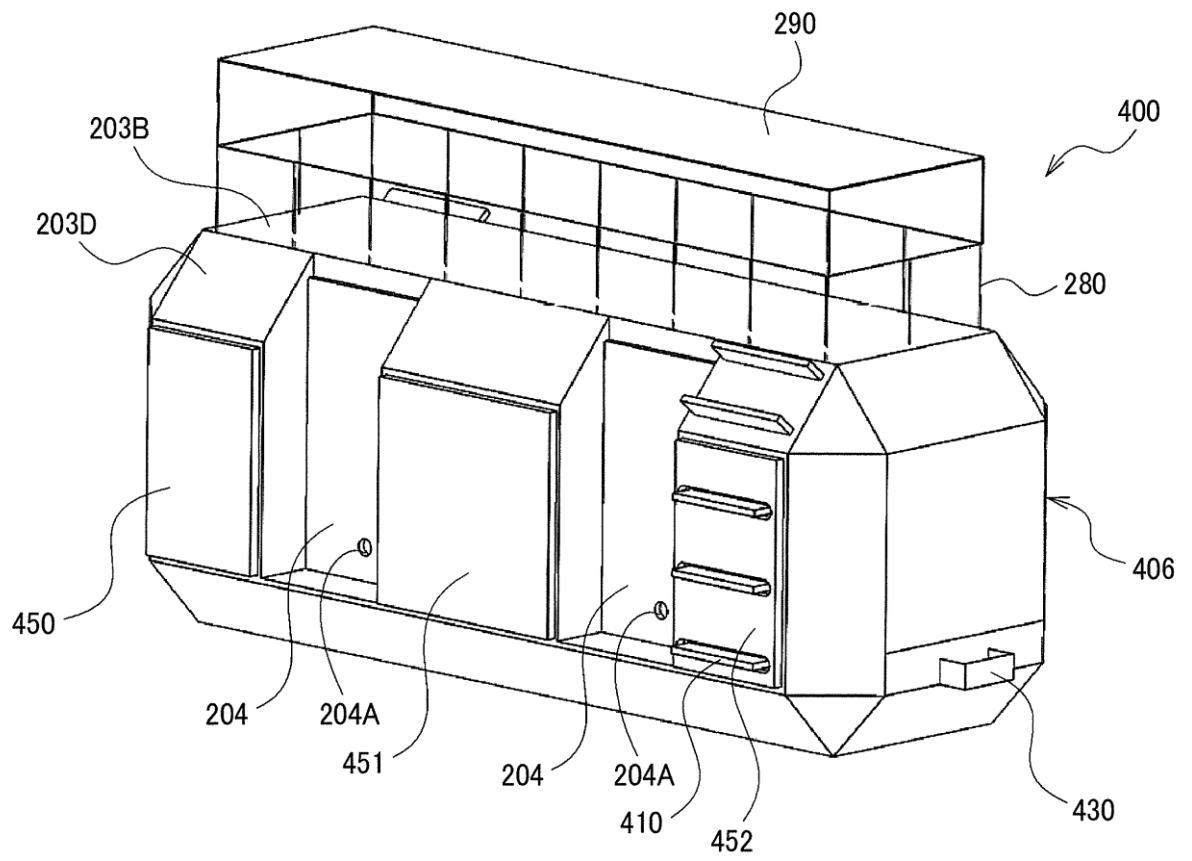


FIG. 15

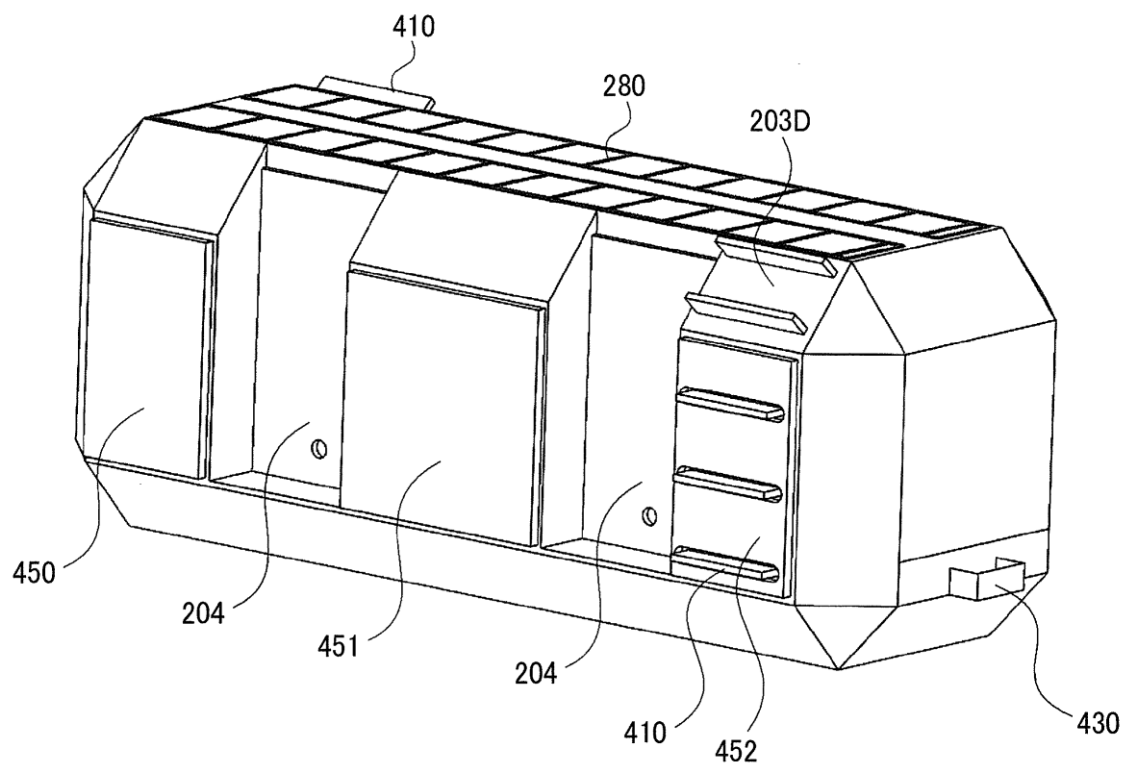


FIG. 16

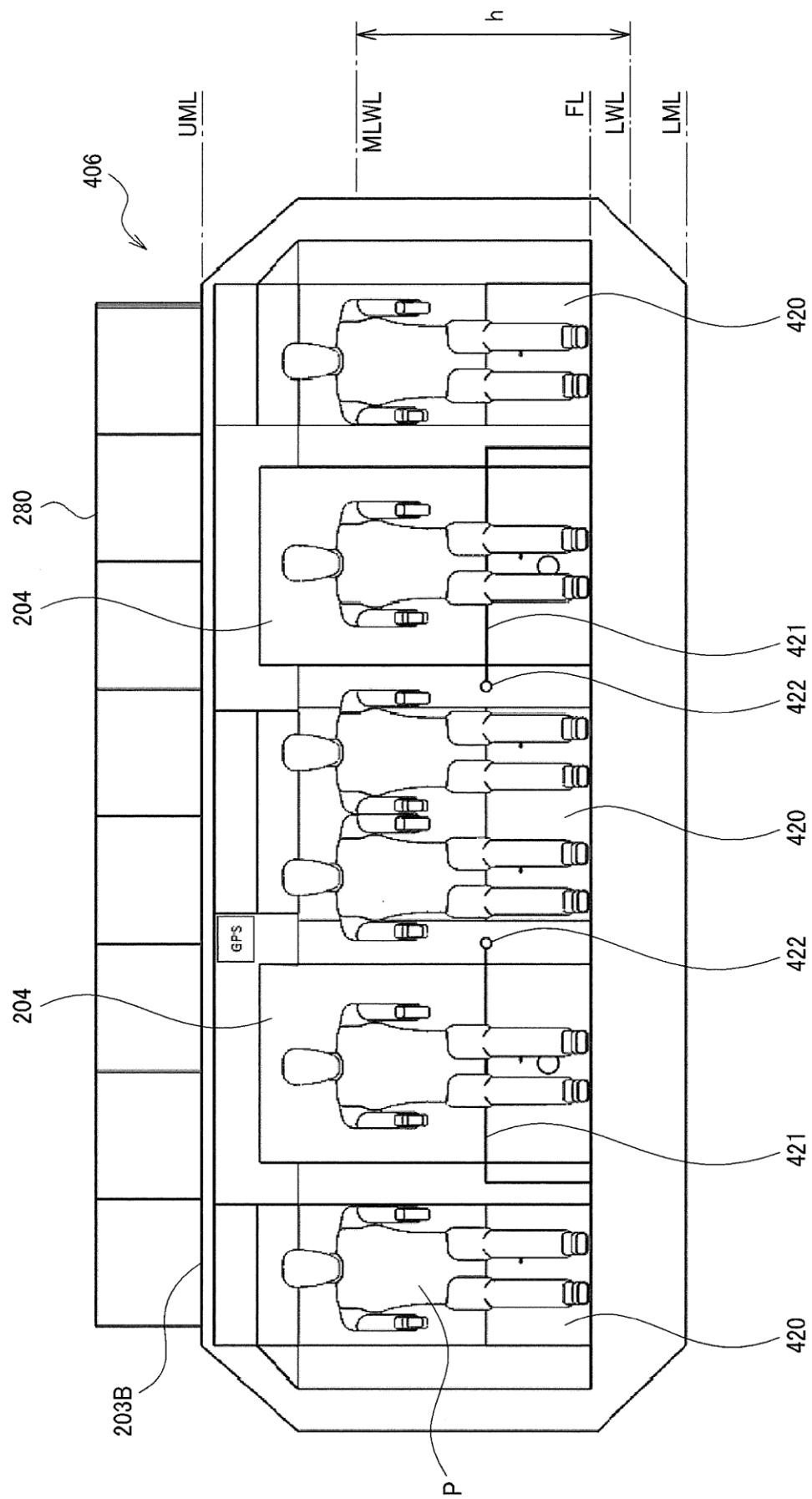


FIG. 17

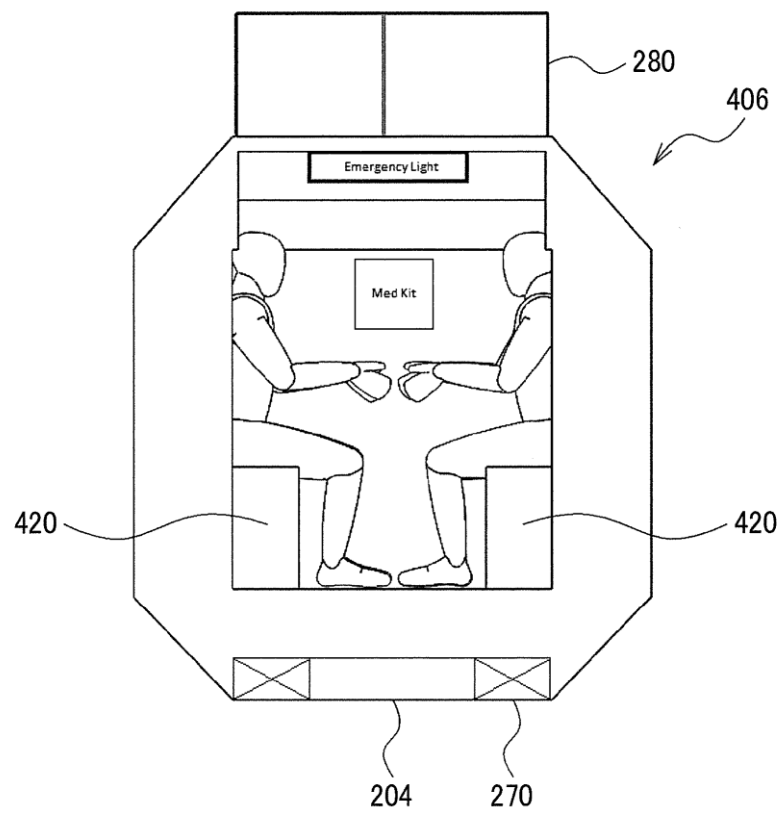


FIG. 18

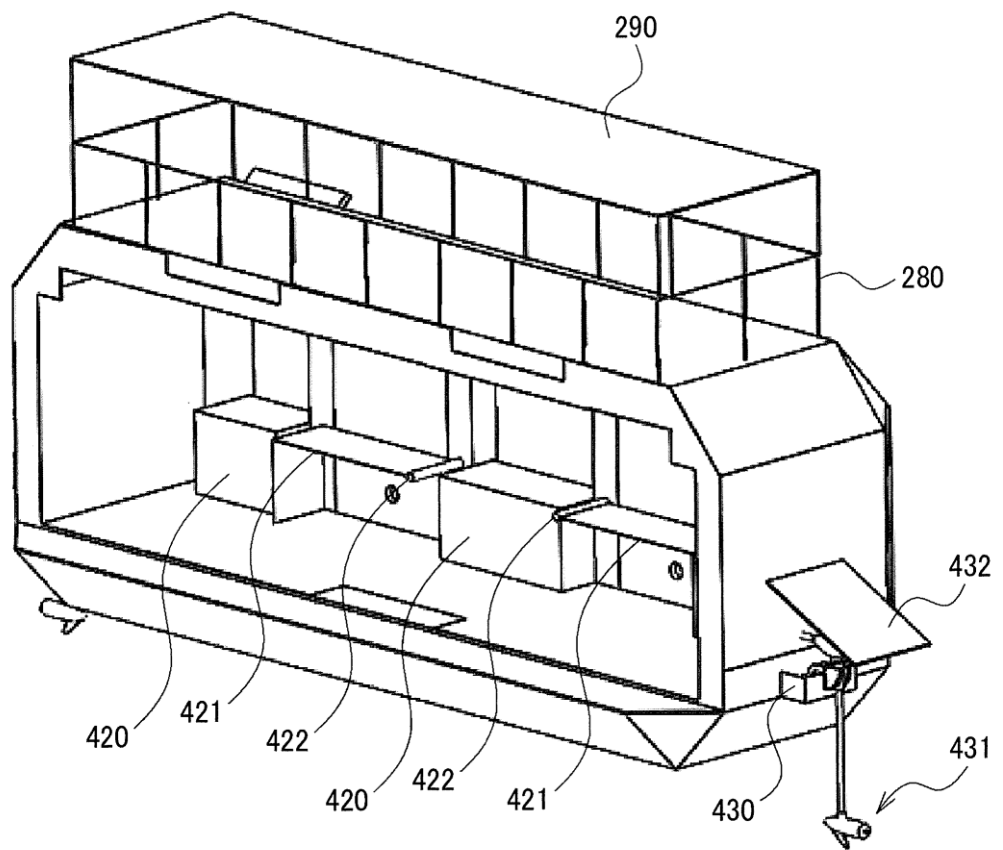


FIG. 19

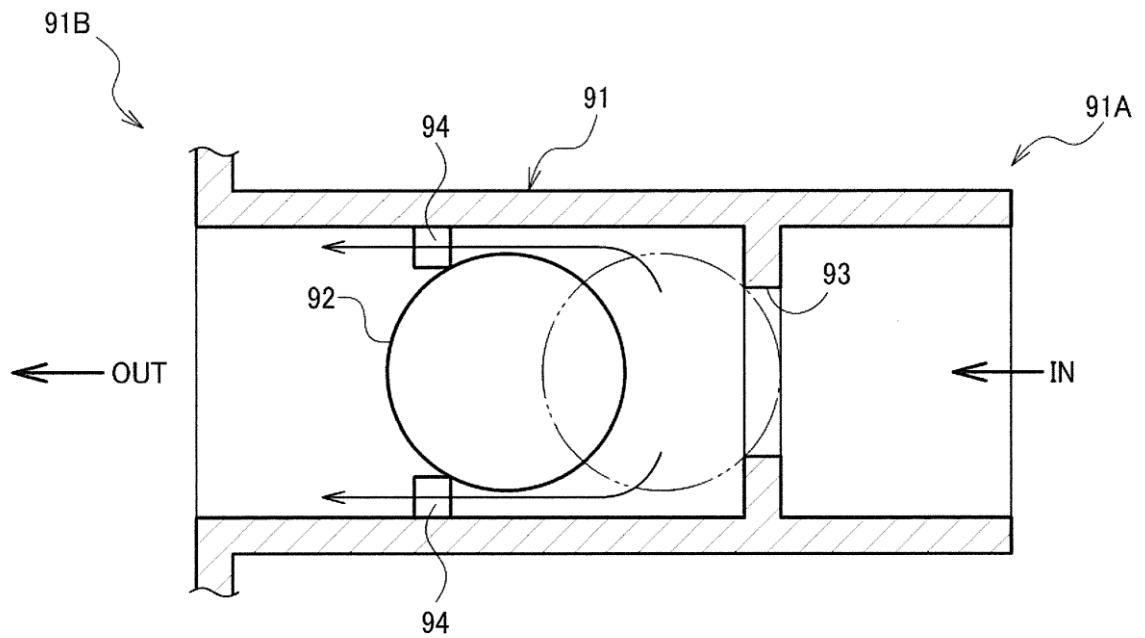


FIG.20

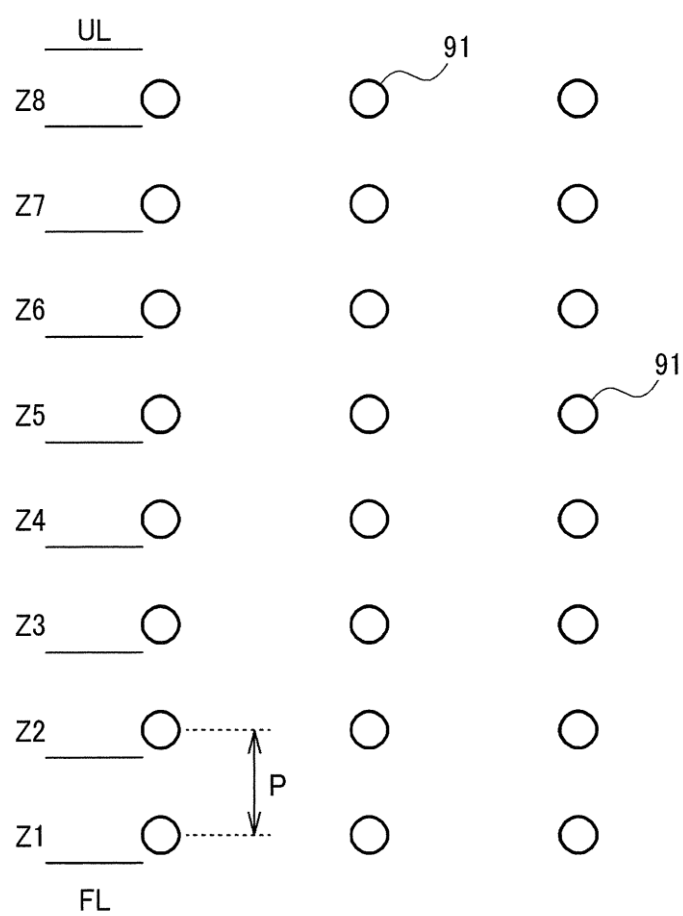


FIG.23

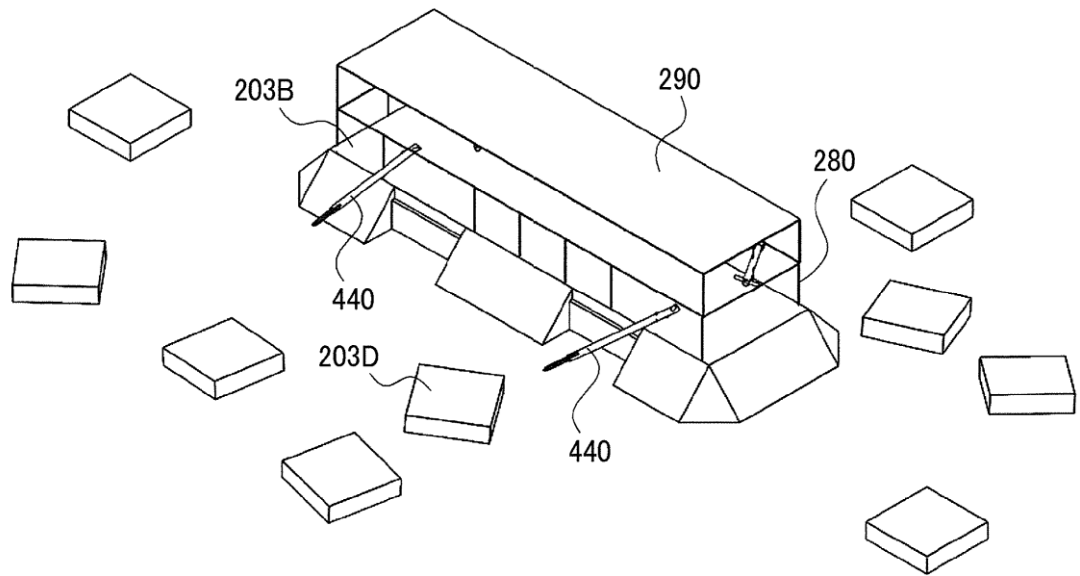


FIG.24

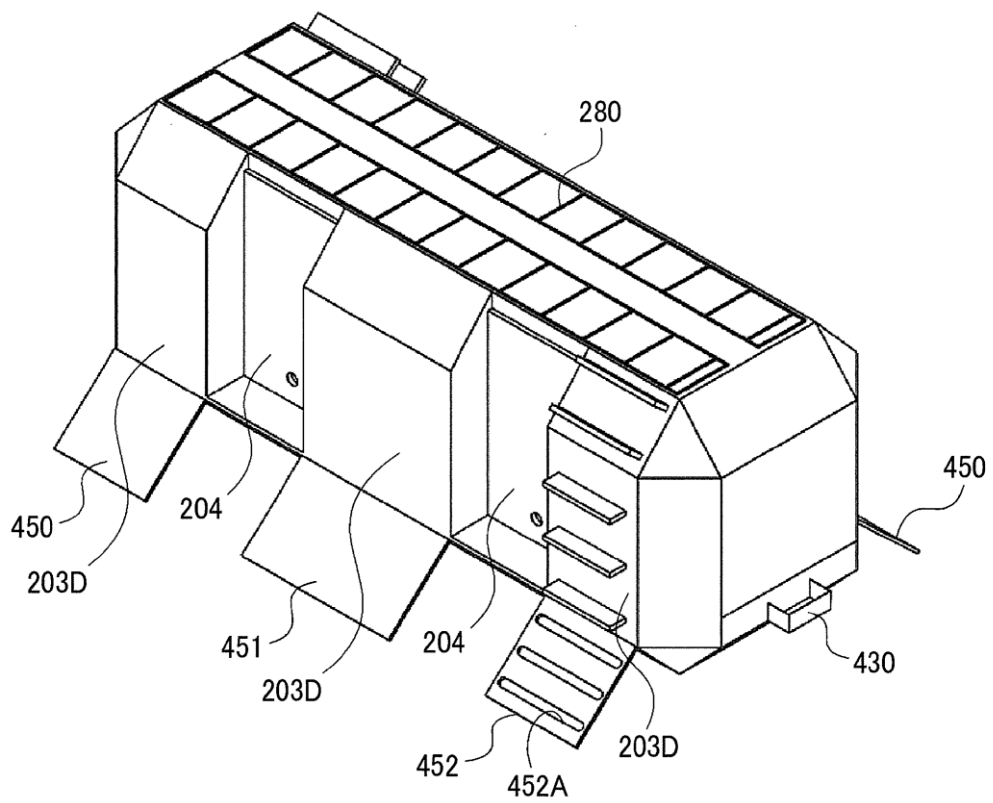


FIG.25

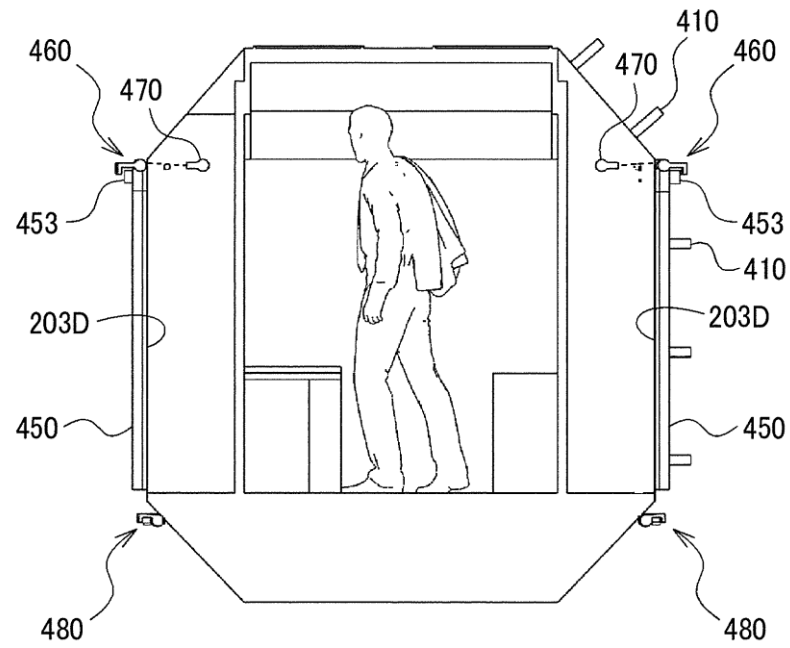


FIG.26

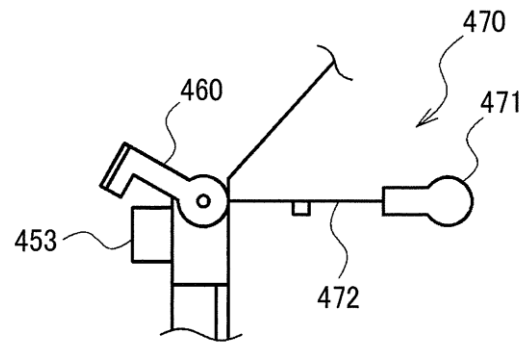


FIG.27

