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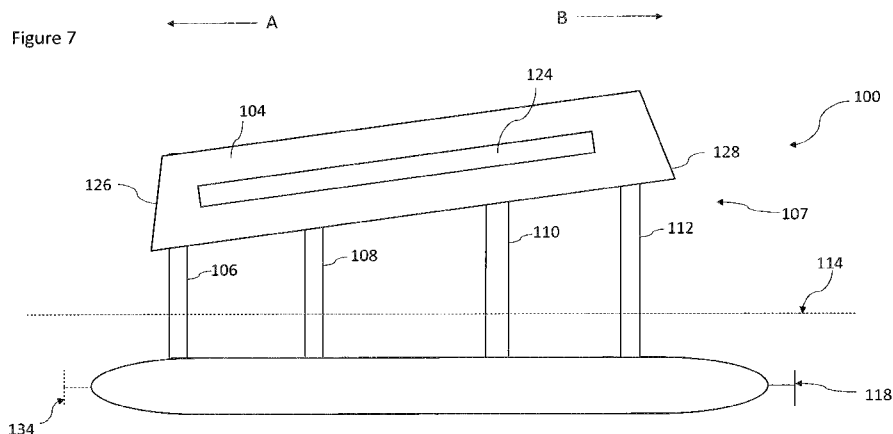
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(57) Abstract: A marine vessel (100) comprising: propulsion means (118, 134); a hull section (102); a body section (104) connected to said hull section via at least one stanchion (106, 108, 110, 112); and the body section and the hull section being movable relative to each other via said at least one stanchion.



Marine vesselField of the Invention

5 The present invention relates to a marine vessel. More particularly it relates to a marine vessel having more than one configuration.

Background

10 Known marine vessels include boats and catamarans. Such vessels may be susceptible to capsizing during manoeuvres that place the vessel under excess acceleration or deceleration, such as braking and turning or in high seas.

 Known marine vessels including boats and catamarans may also have difficulties in loading/unloading cargo in that it is time consuming and difficult to load individual items of
15 cargo on to the vessels. This can take long periods of time while the vessels are docked in ports, which can be expensive.

Summary of invention

20 In a first aspect there is provided a marine vessel comprising: propulsion means; a hull section; a body section connected to said hull section via at least one stanchion; and the body section and the hull section being movable relative to each other via said at least one stanchion.

 According to some embodiments, said body section is movable on the at least one
25 stanchion.

 According to some embodiments, said body section is vertically movable on the at least one stanchion relative to the hull section.

 According to some embodiments, the marine vessel comprises a plurality of stanchions.

30 According to some embodiments, the body section is movable on the plurality of stanchions so as to tilt the body section relative to the hull section.

According to some embodiments, the body section is configured to be tilted during acceleration and/or braking of the marine vessel.

According to some embodiments, a degree of tilt of the body section is dependent upon a magnitude of the acceleration or braking force.

5 According to some embodiments, the body section is configured to selectively tilt towards a first end or a second end of the marine vessel.

According to some embodiments, the body section is configured to selectively tilt towards a first side or a second side of the marine vessel.

10 According to some embodiments, said hull section comprises one or more ballast and trim tanks operable to prevent the marine vessel from floating unevenly.

According to some embodiments, said ballast tank is configured to control a centre of gravity of said marine vessel.

15 According to some embodiments, said marine vessel comprises one or more vertical thrusters located in or on the hull section for driving the hull section down to an operating depth.

According to some embodiments, said marine vessel comprises one or more ailerons and/or elevators on the hull section to provide control of the hull when the vessel is in motion.

According to some embodiments, an angle of attack of the one or more ailerons and/or elevators is variable so as to control the hull.

20 According to some embodiments, the body section comprises one or more areas for holding people and/or cargo.

According to some embodiments, the body section comprises a bridge portion for accommodating a crew of the marine vessel.

25 According to some embodiments, the body section comprises a passenger holding area.

According to some embodiments, the marine vessel comprises an attachment mechanism for attaching at least one detachable module.

According to some embodiments the body section comprises the attachment mechanism.

30 According to some embodiments, the marine vessel comprises a detachable module mounted to the attachment mechanism.

According to some embodiments, said marine vessel is configured to mount said detachable module between said body section and said hull section.

According to some embodiments, said body section is configured to be lowered on to said detachable module so as to attach thereto.

5 According to some embodiments, said marine vessel has a first end and a second end, each of said first and second ends capable of acting as a bow or a stern of the marine vessel in an interchangeable manner and in dependence on a direction of travel of the marine vessel.

According to some embodiments, said propulsion means comprises a water jet.

According to some embodiments, the hull section comprises a single section.

10 According to some embodiments, the hull section of said marine vessel is wider than the body section.

According to some embodiments, the width of the hull section is double, or about double, the width of the body section.

15 According to some embodiments, a length to height ratio of the hull section is 8:1 or greater.

According to some embodiments, the hull comprises an air film emission slot for creating an air film on the hull section.

According to some embodiments, the side profile of the hull section comprises an aerofoil shape.

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Brief description of Figures

Figure 1 is a side view of a marine vessel having a body section and a hull section separated by stanchions, according to an embodiment of the invention.

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Figure 2 is a front view of the marine vessel depicted in Figure 1.

Figure 3 is a side view of a marine vessel having a body section and a hull section separated by stanchions, which shows how the body section of the marine vessel is vertically movable on the stanchions.

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Figure 4 is a side view of a marine vessel as depicted in Figure 1 and a detachable module, where the marine vessel and detachable module are in a first configuration.

Figure 5 is a side view of a marine vessel as depicted in Figure 1 and a detachable module, where the marine vessel and detachable module are in a second configuration.

Figure 6 is a front view of a marine vessel and detachable module in the second configuration of Figure 5.

Figure 7 is a side view of the marine vessel where the body section is angled on the stanchions relative to the hull portion.

Figure 8 is a side view of the marine vessel where the body section is angled on the stanchions relative to the hull portion, in the opposite direction to that shown in Figure 7.

Figure 9 is a front view of the marine vessel where the body section of the marine vessel is tilted in a first direction relative to the hull section.

Figure 10 is a front view of the marine vessel where the body section of the marine vessel is tilted in a second direction relative to the hull section.

Figure 11 is a front view of a marine vessel according to an embodiment, where the marine vessel has a body section and a hull section separated by stanchions positioned side by side, where the hull section is wider than the body section.

Figure 12 is a front view of a marine vessel according to an embodiment, where the marine vessel has a body section and a hull section separated by stanchions positioned centrally on the hull section, where the hull section is wider than the body section.

Figure 13 is a front view of a marine vessel as depicted in Figure 12 with detachable modules, wherein the detachable modules are in a first configuration.

Figures 14 a) - d) are side views of a marine vessel according to an embodiment of the invention.

Figure 15 schematically shows a displacement control system according to an embodiment of the invention.

Figure 16 is a side view of the starboard side of a marine vessel having a body section and a hull section separated by stanchions according to an embodiment of the invention.

Figure 17 is a front view of a marine vessel according to an embodiment of the invention, wherein the marine vessel has continuous air film emission slots.

Figure 18 is a side view of an aerofoil shape used in embodiments for the hull section of the marine vessel.

Figure 19 is a front view of a marine vessel powered by sail according to an embodiment of the invention.

Figure 20 schematically shows computer hardware according to an embodiment.

Detailed description

Figure 1 is a side view of a marine vessel 100 according to an embodiment. The marine vessel comprises a hull section 102 and a body section 104. The hull section 102 and body section 104 are separated by stanchions 106, 108, 110 and 112. In some embodiments there may be a first bank of stanchions on the port side of the marine vessel 100, and a corresponding set of stanchions on the starboard side of the vessel (see Figure 2). Therefore in the embodiment of Figure 1, four stanchions on the port side are shown, which in the view of Figure 1 obscure another four stanchions on the starboard side, giving eight stanchions in total. It will of course be understood that a different number of stanchions can be provided, on either or both sides. Transverse and/or longitudinal spacing between stanchions may also differ between embodiments. In one embodiment a single stanchion may be provided. In

such an embodiment the single stanchion may be centrally located along the hull section 102 and body section 104. This embodiment is schematically shown in Figure 13.

The water line is shown by dotted line 114. As shown in this embodiment, the hull section 102 can be completely submerged below the water line 114. For example the hull section 102 can be submerged to an extent that a top surface 116 of the hull 102 is a distance x below the water line 114. The hull can be submerged to a depth such that the hull is positioned below the most turbulent areas of the water. This helps to maintain the hull, and consequently the stanchions and body section 104, in a relatively stable manner, even in rough seas. The water line 114 may be considered a nominal water line, in as much as in reality there will usually be waves or swell and the water line will not be completely horizontal. The "surface of the sea" is typically graded according to wave height, i.e. from 0 to 9, and swell character from low to heavy. Typically sea state 5, rough, has wave heights from 2.5 to 4.0 metres. Sea state 7 may have wave heights in the region of 6 to 9 metres in height. Sea states above this may have bigger waves again. In some embodiments the vessels may be graded as to which sea states they can operate in. For example only larger vessels may be allowed to operate in the higher sea states. For example the determination of whether the vessel can operate in certain sea states may be dependent upon a height upon which the main body (and optionally module – see Figure 5) can be lifted above the waves on the stanchions. Referring back to Figure 1, in a condition of sea state 5 where the waves are between 2.5 and 4 metres in height, then the sea may be considered reasonably non-turbulent at a depth of 3 metres below the nominal surface of the sea. In such a case the hull may be lowered in the water to a depth where $x = 3\text{m}$, by way of example.

The hull 102 may comprise one or more chambers into and out of which water can be selectively pumped to provide variable ballast. Such a chamber is shown schematically at 109, connected to pump 111. To this end the hull section 102 may be considered a submarine section. In some conditions the variable ballast can be varied to an extent that the hull is raised to a relatively high position in the water, so that the top surface 116 is just below, or even above, the water line 114. This may be useful in shallow waters.

The marine vessel comprises propulsion means for driving or propelling the marine vessel through the water. In the embodiment of Figure 1 the propulsion means is in the form of a propeller 118 located on the hull section 102 at end 132 of the vessel. The propeller can be driven selectively in forward and reverse directions, to enable the marine vessel to be

selectively driven in forward and reverse directions. The propulsion means may also be selectively angled so as to steer the marine vessel 100. Although the embodiment of Figure 1 shows the propulsion means in the form of a propeller, it will of course be understood that other forms of propulsion may be provided. For example the propulsion may be additionally or alternatively provided by one or more jets. Where a jet is used a deflector plate, or nozzle, may also be provided in conjunction with the jet so that the water from the jet can be directed which can impart a sideways movement to the marine vessel, effectively acting like a rudder. Additionally a mechanical "bucket" may be provided which drops over the water jet and promptly diverts the water jet forwards (or in a direction opposite to that of the initial water jet thrust), which effectively counteracts the forward motion of the vessel and eventually reverses the direction of motion of the vessel. In one embodiment the vessel is provided with a water jet at each longitudinal end of the vessel, which can act in opposition with each other. This allows the water jets to be selectively activated so as to selectively drive the vessel in a forward or reverse direction. Lloyds Register, various International Marine Organisations have set up requirements for new vessels such that they must show their ability to 'Return to Port' in case of accident and provide duplication of as much equipment as possible. In embodiments where two reversible propulsion means are provided both can be used together to gain higher speeds whilst still being able to drive and brake should one of them completely fail. With directional nozzles fitted to both water jets comprehensive manoeuvrability can be obtained. For example the vessel can turn in its own length or move sideways parallel to a dock if necessary.

The propulsion means (e.g. the driving means 118) may be powered by an engine, shown schematically at 115. In some embodiments the engine is a diesel engine. The engine may also power other aspects of the ship, for example the ship's electrical system.

One or more hydroplanes may be provided on the vessel. For example Figure 1 schematically shows hydroplanes 120 and 122. These can guide the hull as it is being driven through the water. The direction can be up or down. In some embodiments the angle of attack of the hydroplanes 120 and 122 can be adjusted so that the hull can be controlled and kept horizontal. Of course, the opposite side of the hull to that shown in Figure 1 will also be provided with an equivalent set of hydroplanes. By adjusting the hydroplanes the depth of the hull in the water can be trimmed as required. Therefore it may be considered that the hydroplanes effectively act like horizontal rudders guiding the hull. In embodiments the

hydroplanes are configured to automatically keep the hull horizontal in the water.

The body section 104 may comprise one or more areas for holding people and/or cargo. These areas may be substantially enclosed. The body section 104 may comprise a passenger area 124. The passenger area 124 may comprise one or more seating areas, as well as other amenities such as cafes, restaurants, cinemas etc. The body section 104 may also comprise a bridge section 126 of the marine vessel 100. The bridge 126 comprises a room, platform or area from which the marine vessel 100 can be commanded by the ship's Captain and crew. The body section can also comprise one or more further sections. For example a vehicle loading bay may be provided in the body section 104. Additionally or alternatively one or more cargo and/or luggage bays may be provided. The body section 104 may also comprise one or more outdoor areas, such as a viewing deck and/or one or more walkways. In some embodiments a length of the body section 104 is approximately the same as a length of the hull section 102. In some embodiments a breadth of the body section 104 is approximately the same as a breadth of the hull section 102.

In some embodiments, the marine vessel 100 may comprise a second bridge section 128 at an opposite end of the body section 104 from the first bridge section 126. This means that the marine vessel 100 can be driven in either direction, without having to turn the ship around in harbour. The crew can simply move from one bridge section to the other dependent upon which direction the ship is being driven. For example the marine vessel 100 may be considered to have a first end 130 and a second end 132. The first and second ends 130 and 132 can interchangeably act as the front (bow) and rear (stern) of the marine vessel 100. That is both directions A and B may selectively be forward or reverse. The marine vessel 100 may be substantially symmetrical about a centre line Y-Y of the marine vessel 100. The propulsion means 118 may provide for the motion in direction A and direction B, for example by being selectively rotated or driven in reverse or opposite directions. Alternatively or additionally a further propulsion means 134 (shown in phantom in Figure 1) may be provided at the first end 130 of the marine vessel, opposite the second end 132 where the propulsion means 118 is located. In such an embodiment the propulsion means 118 can be driven to drive the marine vessel 100 in the direction of arrow A, and the propulsion means 134 can be driven to drive the marine vessel 100 in the direction of arrow B.

Figure 2 shows the marine vessel 100 viewed from the first end 130 in the direction of arrow B. The marine vessel 100 comprises a first side 136 and a second side 138. The first

and second sides 136 and 138 can interchangeably be considered port and starboard sides dependent upon a direction of travel, as previously discussed.

First and second rows or banks of stanchions are shown at 106 and 106'. The two banks of stanchions are separated by a distance C, which may be considered a transverse distance across the breadth of the vessel. The first bank of stanchions 106 is provided on the first side 136, and the second bank of stanchions 106' is provided on the second side 138 of the marine vessel 100. In embodiments where there is a single stanchion, or a single bank of stanchions, then such a stanchion or bank of stanchions may be centrally located in the breadth direction of the hull 102.

In the embodiments shown in Figures 1 and 2 the hull section 102 is of generally unitary construction (although of course may be made up of one or more sections connected together, for example by welding or riveting). Therefore as shown in Figure 2 the hull section 122 generally spans the entire width of the marine vessel 100.

The provision of a singular, wide hull is strong mechanically and therefore can be of light construction. The hull design can also carry relatively more dead weight ballast thus lowering the centre of gravity and improving the stability of the vessel. The hull design also provides a more stable platform i.e. a large flat surface area resulting in a more stable ride thus requiring less energy to control. The hull shape is also suitable for applying supercavitation, in which air bubbles are emitted from the hull and attach themselves to an outer surface thereof. This allows the top and under surfaces of the hull to be covered with a thin film of air in use. This may improve the speed and efficiency of the vessel when travelling. The hull section may have a height h which is less than its width w. In some embodiments the height h is considerably less than the width w. For example the height h may be approximately a fifth of the width w. This slim design is hydrodynamically efficient.

In embodiments, the hull section 102 and body section 104 are movable relative to each other via the one or more stanchions. In some embodiments the body section 104 can be raised and lowered on the stanchions so as to move the body section 104 towards the hull section 102, or away from the hull section 102. This enables the height of the body section 104 above the water line 114 to be adjusted. In other embodiments the hull section may additionally or alternatively be movable on the stanchions to effect the relative movement between the hull and main body section.

This is shown for example in Figure 3. The main body portion 104 is shown in solid

lines at a first position or configuration where an underside 105 of the body portion 104 is a height h_1 above the water line 114. This may be considered a fully extended position or configuration of the body portion 104, where the body portion 104 is at its fully extended position away from the hull section 102. The body portion 104 is also shown in phantom in a second position where the underside of the body portion 104 is a height H_2 above the water line 114. This may be considered a fully retracted position of the main body portion 104, where it is at a minimum distance from the hull section 102. Height h_2 is less than H_1 . The body portion 104 can of course take any position between the fully extended and fully retracted positions. The fully retracted position may also be closer to the hull 102 than shown in phantom in Figure 3. In some embodiments, in the fully retracted position the body portion 104 may be proximate to or flush with the hull section 104. In some embodiments this configuration may only be permitted when at least a top surface of the hull 104 is clear of the water line. The retracted configuration can provide a compact overall outline of the ship. This may be useful in certain situations, for example when the vessel 100 needs to pass under a bridge.

Embodiments are not limited to any particular manner in which the main body portion and hull portion 102 can be moved relative to each other. For example movement of the body portion 104 can be effected by one or more electric, pneumatic or hydraulic motors. The power source for those motors may in some embodiment be the ship's main power source e.g. the diesel engine located in the hull portion 102. In one embodiment a rack and pinion system is used to effect movement between the body 104 and a hull 102. In one such embodiment, each stanchion comprises a rack portion, which correspond with one or more pinion wheels located on the body portion 104. The body portion 104 can therefore lift and lower itself on the stanchions via the rack and pinion system. Of course, in another embodiment the rack can be provided on the body portion 104, with the pinion wheels on the stanchions. Once the body portion 104 is at the desired height above the hull 102, then it can be securely maintained at this height. This may be by means of a locking means or locking system which locks the body portion 104 at the desired height once it has been reached. An automated fail-safe system may also be provided which ensures that the body portion 104 cannot unexpectedly fall or slip on the stanchions. In some embodiments the fail-safe system comprises the locking means or locking system.

The body portion 104 can be raised and lowered to suit the given conditions. For

example, in harbour the body portion 104 may be set at its fully extended state to give the pilot a commanding view of the surroundings. In high crosswinds and/or on the open seas the body portion 104 may be lowered to reduce swaying of the marine vessel in the wind and to give a more aerodynamic outline. The height of the body portion above the water line 114 may also be adjusted to account for wave heights. In embodiments the height of the body portion 104 can be adjusted on the move or “on-the-fly”. The height of the body portion 104 may also be adjusted to facilitate the attachment of attachable and detachable modules. The raising and lowering mechanism is generally referenced 107. This is discussed further below.

According to some embodiments the body section 104 can pitch and/or roll relative to a longitudinal axis of the marine vessel 100. This pitching and/or rolling motion can counteract acceleration, deceleration, and side to side movements of the vessel when in use. This makes for a more comfortable experience for passengers in the passenger area 124, as well as preventing or reducing undesired movement of other items in the passenger area or bridge, such as furniture, cutlery etc. This is described in more detail in Figures 7 to 10.

Figure 4 shows a marine vessel 100 as previously described adjacent to a port or dock 140. Located on the dock 140 is a module 142. The module 142 is attachable to and detachable from the marine vessel 100. In embodiments, the module 142 is attachable to and detachable from an underside 105 of the body section 104.

In this embodiment the marine vessel 100 approaches the port in the direction of arrow A, collects the module 142, and then departs the port 140 in the direction of arrow B. In some embodiments, the module 142 comprises a vehicle carrying module. Cars and/or other vehicles can be driven into the container module 142 at port before the marine vessel 100 arrives. When the vessel arrives it can then pick up the vehicle carrying module 142 before beginning its journey. Therefore the time-consuming step of vehicle loading can be carried out whilst the ship is remote from the port. Once the module 142 is securely attached to the body section 104, passengers can alight their vehicles and move from the module 142 to the passenger area 124 of the body section 104, via appropriately provided stairways and/or elevators.

In some embodiments, the port comprises an appropriate inlet area enabling the marine vessel to drive over and substantially surround the container module 142 before picking it up. The body section 104 can then be lowered onto the module 142 by lowering

the body portion 104 on the stanchions as previously discussed. Suitable attachment means are provided on the module 142 and the body section 104 for attachment.

Alternatively, the marine vessel can approach the port until the vessel is proximate to and longitudinally aligned with the module 142. The module can then be slid in the direction of arrow B onto suitable attachment means on the body portion 104, until the module 142 is securely attached to the underside of the body section 104.

In one embodiment the port 140 comprises a pontoon. The pontoon will be approximately module sized, and will move up and down with the tide. In one embodiment, for a ferry sized marine vessel an approximate maximum vertical height between the top surface of the hull and the underside of the body will be at least ten metres. A typical two-storey module height would be in the region of 7 metres. A module 100 metres long by 30 metres wide could carry possibly 50 articulated trucks weighing 44 tonnes each maximum load. A typical weight of the module including full cargo would be in the region of 2500 tonnes. A pontoon 120 metres long by 30 metres wide and 1 metre deep could have a buoyancy capacity of at least 3,500 tonnes. This would be more than enough to support the module and its cargo. For pick-up the module could be loaded with cargo and closed-up, waiting on the pontoon to be picked up by a vessel.

In another embodiment, the same size of module could carry containers. The module in this case may consist of a simple platform, no roof, no walls, but locked to the stanchions.

The containers (for example one hundred of them) could be arranged as ten lanes of five per lane stacked two high. All containers may have a twist lock arrangement to secure them to a flat bed and similarly lock to each other when stacked. Typically shipping containers come in several 'standard sizes'.

Some embodiments may utilise the most popular sizes, 20 feet and 40 feet lengths. Widths and heights are the same for both. Therefore a 100 metre by 30 metre container platform could carry three hundred and twenty (320) 20 feet containers, stacked two high, or one hundred and sixty (160) 40 feet containers, stacked two high.

Figure 5 shows the detachable module 142 securely attached to the marine vessel 100, on the underside 105 of the body section 104.

A process of detaching the module 142 when arriving at or returning to port is a reverse of the process of attaching a module. For example, a marine vessel 100 comprising

passengers in the passenger area 124 and vehicles in the detachable module 142 can arrive at a first docking area of a port to drop off the detachable module 142. The passengers will of course be instructed to return to their vehicles in the detachable module 142 before the detachable module is detached from the marine vessel 100. The marine vessel 100 can then
5 drive to a second dock at the port to pick up a new container module 142 containing pre-loaded vehicles. The marine vessel 100 can then start a new voyage and so on.

Figure 6 is a view from the first end 130 of the vessel 100, with the detachable module 142 attached in place on the underside 105 of the body portion 104. The detachable module 142 is positioned above the water line 114. The detachable module 142 is in this view
10 bounded by the stanchions, the hull 102 and the body section 104.

Although Figure 6 shows a marine vessel 100 with stanchions placed on either side of the body section 104 of the marine vessel, it can of course be appreciated that modules can be attached and detached similarly for a marine vessel having one or more stanchions positioned centrally along the hull section. A front view of a marine vessel according to such
15 an embodiment is shown in Figure 13.

Figure 7 shows a marine vessel 100 travelling (or about to travel) in the direction of arrow A. A propulsive force or further propulsive force is provided by propulsion means 118 to effect this movement. This causes acceleration of the marine vessel 100 in the direction of arrow A. Any loose items (including passengers) in the body section 104 will tend to be “left
20 behind” during this accelerative movement, and these loose items will seem to move relative to the frame of reference of the marine vessel. In order to counteract this, the body section 104 is caused to be tilted such that one end is lowered relative to the other. In this example end 126 is lowered relative to end 128. This can be achieved by lowering or raising the body portion 104 on respective stanchions.

Turning to Figure 8, the same principle can be used when the ship undergoes a braking or deceleration force. This is shown for example in Figure 8 where the marine vessel 100 is initially travelling in the direction of arrow A. Marine vessel 100 is then subjected to a deceleration force in the direction of arrow B. This braking force may for example be the result of reverse thrust from the propulsion means 118. This causes people or items in the
30 passenger area 104 to experience a force in the direction of arrow B. To counteract the effects of this force, the body section 104 is tilted such that the end 126 is raised relative to end 128. This can again be achieved by raising/lowering the different portions of the body portion 104

on the respective stanchions.

Figures 9 and 10 show this principle applied to side to side movements of the marine vessel 100. In Figure 9 the marine vessel has experienced a side force in the direction of arrow E. This could for example be due to the vessel turning or a cross wind. This causes people and items in the body section 104 to experience a force in the direction of arrow D. In order to counter this, the side 138 of the body portion 104 is raised relative to side 136.

The reverse of this is shown in Figure 10 where the marine vessel 100 experiences a side force in the direction of arrow D. This causes passengers and items in the body section 104 to experience a force in the direction of arrow E. In order to counter this the side 138 of the vessel 100 is lowered relative to side 136.

It will be understood that the body section 104 can tilt in more than one direction simultaneously. For example, the body section can pitch in one of the directions of Figures 7 and 8 at the same time as rolling in a direction as shown in one of Figures 9 and 10. This may occur when the marine vessel experiences multiple forces simultaneously.

In order to facilitate the tilting of the body section 104 on the stanchions, the connections between the stanchions and the body portion 104 (and/or the hull 102) may comprise one or more articulated joints to enable this movement.

Although the detachable module 142 is not shown in Figures 7 to 10, it will be understood that the body section 104 can be tilted as described in Figures 7 to 10 whilst the module 142 is attached. This also helps to counteract movement of items in the detachable module (such as vehicles) when forces such as acceleration and deceleration are applied.

It will be understood that the angle to which the body section 104 is tilted in Figures 7 to 10 may be dependent upon a size of the detected force. For example a small force may result in a relatively small tilt angle, whereas a larger force may result in a larger tilt angle. It will also be understood that the tilt angles may be greater or less than those shown in Figures 7 to 10. By way of example, if the marine vessel accelerated to 40 knots from a standing start in 20 seconds that would be approximately 0.1g. To balance this horizontal acceleration the marine vessel would tilt by approximately 6 degrees to the horizontal. Similarly if a marine vessel of length 100 metres (by way of example) brakes to a halt in twice its own length that would be a deceleration of 1 metre per second per second, again requiring a tilt of 6 degrees. This is equivalent to a slope of approximately 1 in 10.

Some embodiments of the invention provide a marine vessel separated into three

sections. Thus the marine vessel may be considered modular.

The first section is a hull section. The hull section may comprise one or more of: an engine room, ballast tanks, trim tanks, fuel tanks, fresh water tanks, propulsion means, steering means, engines, generators and batteries.

5 The second section is a body section. The body section may comprise one or more of: a navigation bridge, controls, crew's quarters, navigation equipment, lightweight transportable items such as passengers or mail, passenger's accommodation and comfort rooms. The second section may be attached to the first section via one or more stanchions, as previously described.

10 The third section is a module section. The module section may comprise cargo. The module section may be used to store heavy transportable items such as vehicles and/or containers. The modules can be attached to and removed from the vessel for transport.

Embodiments of the invention connect these three sections together via mechanisms to achieve greater versatility, capability and utility as well as increased reliability and safety.

15 The three sections can be connected together by one or more adjustable stanchions.

In some embodiments of the invention, the hull section of the marine vessel may be wide in relation to the body section of the marine vessel. For example, the hull section may be wider than the body section. For example, the hull section may be twice as wide as the body section. A marine vessel 300 according to such an embodiment is shown in Figure 11. Figure 11 shows a front view of this embodiment. The marine vessel 300 comprises a hull section 302 connected to a body section 304 via stanchions 306 and 307. As Figure 11 is a front view, it should be appreciated that further stanchions may be positioned behind stanchions 306 or 307. Alternatively, there may be no further stanchions positioned behind stanchions 306 and 307, so that stanchions 306 and 307 are the only stanchions of the marine vessel. The water line is shown by the dotted line 314. The width of the hull section 302 is shown schematically as w_1 . The height of the hull section 302 is shown schematically as h . The width of the body section is shown schematically as w_2 . In some embodiments, the ratio of the length of the hull section 302 of the marine vessel 300 to the width, w_1 , of the hull section 302 may be less than 4:1. For example, the ratio of the length of the marine vessel 300 to the width, w_1 , of the hull section 302 may be 2:1.

By providing a wide hull section 302, the stability of the hull section 302 as a platform for the body section 304 is increased, and rocking and heaving motions of the marine vessel

300 in use may be reduced.

In some embodiments of the invention where there is a need for the body section 304 to be higher, a wider hull section 302 can be provided.

In some embodiments, the length to height ratio of the hull section 302 is more than 8:1. By having a relatively thin hull section 302, drag is reduced, as there is a reduced surface area at the front of the hull section 302 in contact with the water as the marine vessel is propelled forward. The thin shape of the hull section 302 therefore enables the marine vessel to travel at higher speeds than would be possible with a thick hull section. The thin shape of the hull section 302 is hydrodynamically efficient.

In some embodiments, the hull section 302 of the marine vessel 300 may be considered or termed a "submarine". The hull section 302 may be a complete submarine with no crew.

In some embodiments, the body section 304 may be considered or termed a superstructure. The body section 304 may comprise controls for operating the marine vessel 300. The controls may be operable to control the submarine or hull section 302.

In some embodiments, the hull section 302 can be rectangular in plan view.

In some embodiments, one or more stanchions may be centrally positioned along the hull section and body section. Such an embodiment is shown in Figure 12. Figure 12 shows a front view of this embodiment. As Figure 12 is a front view, it should be appreciated that further stanchions may be positioned behind stanchion 306. The one or more stanchions 306 are positioned centrally along the hull section 302. Alternatively, there may be no further stanchions positioned behind stanchion 306 so that stanchion 306 is the only stanchion of the marine vessel. In some embodiments, detachable modules can be attached to the marine vessel as described above in relation to Figures 3, 4, 5 and 6.

Referring now to Figure 13, two detachable modules 342 and 344 are attached either side of the central stanchion 306 using a similar method to that described above in relation to Figures 4, 5 and 6. Although two detachable modules are shown in Figure 13, any suitable number of detachable modules can be attached. Furthermore, if the marine vessel is loaded unevenly, for example with more weight or more detachable modules on either the port or starboard side of the marine vessel, sensors can be used to detect this imbalance to control a mechanism to balance the marine vessel. Such mechanisms are described in detail later in this description.

The marine vessel 300 is arranged to have built in positive buoyancy. As the marine vessel is loaded, its displacement may increase as it sinks lower into the water. At the marine vessel's maximum displacement, where it is not to sink any lower, the marine vessel still has a positive buoyancy, so that it will not completely sink.

5 Figures 14(a) to 14(d) show preparation of a marine vessel 300 for voyage, according to an embodiment.

Figure 14 a) shows a side view of marine vessel 300. The marine vessel 300 has a built in positive buoyancy. The hull section 302 comprises one or more ballast tanks and one or more trim tanks situated around the hull section 302. The ballast tanks and trim tanks can be
10 operated to prevent the marine vessel floating unevenly. If one side of the marine vessel is lower than the other, the buoyancy on the low side is increased by using the trim tanks and ballast tanks to bring the hull section 302 level by displacing sea water with air. The marine vessel 300 can therefore be kept level using the ballast and trim tanks. This can be performed when the marine vessel 300 is static.

15 The ballast tanks may be made of neoprene or butyl rubber. The ballast tanks may be bags. The ballast may be sea water.

The trim tanks may be made of neoprene or butyl rubber. The trim tanks may be bags.

Figure 14 b) shows a side view of the marine vessel 300 of Figure 14 a), where the marine vessel 300 has been loaded with detachable module 342. Loading of the marine vessel
20 300, for example with passengers in the body section and/or with cargo in the module section, may cause the marine vessel 300 to be inclined to float "lopsided" so that one side is lower than the other. The marine vessel 300 may also be inclined to float with one corner down, where one corner of the marine vessel is lower than the others. To prevent the marine vessel 300 floating unevenly, the ballast and trim tanks can be used to bring the hull section 302
25 level by displacing sea water with air at one or more suitable areas of the hull section 302. The marine vessel 300 can therefore be kept statically level using the ballast and trim tanks during the loading stage.

The ballast tanks and trim tanks can be used to balance the marine vessel 300 before it starts a journey. The ballast and trim tanks can be used to balance the marine vessel 300
30 when it is in port.

In some embodiments, when the marine vessel 300 is fully loaded, the top surface of the hull section 302 can be level with the sea level 314 so that the top surface of the hull

section 302 is "awash". The marine vessel 300 can then be driven down to its operating depth, d , using vertically mounted thrusters 360a, 360b.

Figure 14 c) shows a side view of marine vessel 300, where the marine vessel 300 is driven down to its operating depth, d , using vertically mounted thrusters 360a and 360b.

5 Vertically mounted thrusters can be positioned in corners of the hull section. When the hull section is rectangular or similar in plan view, there can be four vertically mounted thrusters, with one situated in each corner. For example, vertically mounted thrusters may be mounted with one at the port bow of the hull section, one at the port stern of the hull section, one at the starboard bow of the hull section and one at the starboard stern on the hull section, each
10 equidistant from the centre of gravity of the hull section.

In some embodiments the vertically mounted thrusters will be located in the thickness of the hull section. When the marine vessel is propelled using propulsion means 304, the vertically mounted thrusters may be turned off, as discussed below. Covers may then slide across any inlets and outlets of the vertically mounted thrusters. In some embodiments, this
15 ensures that uninterrupted surfaces of the hull section are maintained for continuous air film emission, which is discussed further below.

The vertically mounted thrusters can be operated to keep the marine vessel level as it is driven down to its operating depth. For example, if a first side of the marine vessel 300 is higher than a second side, the vertically mounted thrusters on the first side can be operated
20 with more thrust to balance out the marine vessel, so that the marine vessel is driven down to its operating depth evenly at a horizontal attitude. When the marine vessel 300 has been driven down to its operating depth, d , the marine vessel 300 can be held at the operating depth using the vertically mounted thrusters. The marine vessel can be maintained at a horizontal attitude using the vertically mounted thrusters.

25 Figure 14 d) shows a side view of marine vessel 300, where the marine vessel 300 is propelled in a first direction using propulsion means 318. As the marine vessel 300 moves in a first direction, one or more of ailerons 320a and 320b, one or more front elevators 324 and one or more rear elevators 322 can be operated to keep the hull section 320 level. The ailerons and elevators can be used to keep the hull section 302 at its operating depth when
30 the marine vessel is moving. The vertically mounted thrusters 360a and 360b can therefore be turned off when the marine vessel 300 is moving.

If at any time marine vessel 300 becomes stationary at sea, the vertical thrusters can

come into operation and maintain the marine vessel at its operating depth.

The marine vessel 300 may comprise one or more propulsion means 318. In some embodiments of the invention, the one or more propulsion means 318 are water jets.

5 Elevators 322 and 324 are movable control surfaces for controlling the pitch of the hull section. Ailerons are movable control surfaces for controlling the roll or tilt of the hull section 302. Elevators and ailerons can be provided on hinges in some embodiments. The one or more ailerons and one or more elevators may operate independently or synchronously.

10 Referring now to Figure 15, the hull section 302 may comprise fuel tanks 382 and/or fresh water tanks 384. The fuel tanks 382 and/or fresh water tanks 384 may be provided as bags. The fuel tanks 382 and/or fresh water tanks 384 may be made of neoprene or butyl rubber.

15 In order to compensate for the changing amount of fuel and/or fresh water as they are used up by the marine vessel 300, in some embodiments of the invention, the marine vessel 300 comprises a displacement control system 380. The displacement control system can ensure that the hull section 302 remains level despite the unbalancing effects of fuel and/or fresh water usage. The displacement control system 380 can control accurate volumetric replacement of the fuel and/or fresh water with sea water and/or air when the fuel and/or fresh water is used, by a balanced replacement with air into or out of the trim
20 tanks 388 or sea water into or out of the ballast tanks 386. The trim tanks 388 and ballast tanks 386 are disposed so as to correct any tendency of the hull section to tilt. Ballast tanks 386 can be charged with sea water from the sea and discharged back to the sea. Trim tanks 388 can be charged with air from a compressed air tank and discharged to the sea.

25 By keeping the hull section 302 level, this minimises loading effects on ailerons and elevators of the marine vessel 300.

By maintaining the hull section 302 at its operating depth, d , this can minimise loading effects on ailerons and elevators of the marine vessel 300.

30 The sealed volume of the engine room can be used as a fixed volume storage tank for air at a useful pressure, for example at 2 to 4 bar (30 to 60 psi). The engine room (compressed air tank) can be kept topped up automatically with air drawn from the atmosphere via air ducts in one or more stanchions 306, 307 of the marine vessel 300. This air can be supplied to the one or more trim tanks 388 as necessary.

In some embodiments, the marine vessel 300 can comprise sensors to measure the depth of the hull section 302 below the sea level 314. Sensors may be used to measure the depth of certain areas of the hull section. These sensors may comprise pressure sensors. These sensors may be situated in the hull section 302. Measurements from these sensors can be used by computer apparatus 400 as described with respect to Figure 20. Using these measurements, the computer apparatus can control one or more of the one or more of: the ailerons 320a, 320b, the one or more rear elevators 322 and the one or more front elevators 324, to control the pitch and/or roll of the hull section 302 when the marine vessel 300 is moving. Measurements from these sensors may be used to control vertical thrusters 360a and 360b. The displacement control system 380 can be controlled based on measurements from these sensors.

In some embodiments, the marine vessel 300 may comprise sensors for measuring the pitch and/or roll of the hull section 302. These sensors may comprise accelerometers and/or gyroscopes. These sensors can be situated in the hull section 302. Measurements from these sensors can be used by computer apparatus 400 as described with respect to Figure 20. Using these measurements, the computer apparatus can control one or more of the: ailerons 320, rear elevator 322 and front elevator 324, to control the pitch and/or roll of the hull section 302. Measurements from these sensors may also be used to control vertical thrusters 360a and 360b. The displacement control system 380 can be controlled based on these measurements.

In some embodiments, the hull section 302 further comprises continuous air film emission (CAFE) slots 346 and 348, as shown in Figures 16 and 17. These slots are positioned across the front of the hull section, from port to starboard. The slots may span the entire breadth, or beam, of the hull section 302, or may instead span only part of the breadth of the hull section. From these slots 346 and 348, air can be emitted which can form a continuous air film 350 surrounding the top and/or under surfaces of the hull section 302. By separating these two surfaces of the hull section 302 from the water, drag can be significantly reduced.

Figure 16 shows a side view of an embodiment of the marine vessel having stanchions 306, 308, 310 and 312.

The continuous air film 350 may use the Coanda effect, which causes a film of high pressure air to stick to an adjacent surface. The air that is emitted from the continuous air film emission slots 346 and 348 may be any suitable mixture of gases. For example, exhaust

gases from engines of the marine vessel may be used. To this end suitable piping may be provided to transfer exhaust air to the slots.

In some embodiments, walls 352 and 354 are supplied on the port and starboard sides of the hull section 302. This is shown in Figure 17. These walls can be used to contain the continuous air film surrounding the top and under surfaces of the hull section 302. In some
5 embodiments, one or more of the propulsion means 318, elevators 322 and ailerons 320 are supplied on the outside of these walls, allowing them to operate outside of the continuous air film.

In some embodiments, the side profile of the hull section 302 may have an aerofoil shape. This is shown in a side view of the hull section 302 in Figure 18. The aerofoil shape may be defined according to National Advisory Committee for Aeronautics (NACA) standards. The NACA 00xx sections provide shapes that advantageously can travel smoothly through fluid. In Figure 18, the NACA 0012 aerofoil is shown, however different aerofoils may be used in different embodiments of the marine vessel. On a large ship, for example a cross channel
10 ferry, the NACA 0005 may be more suitable. The aerofoil shape is hydrodynamically efficient.

In some embodiments, the aerofoil may be symmetrical, giving neither positive nor negative lift to the hull section 302.

In some embodiments, across the bow of the hull section 302, the front of the hull section 302 is tapered so that the front of the hull section 302 is very thin. From the front of
20 the hull section 302 a blade may project. The blade may be considered or termed as a “knife edge”. In embodiments of the invention which use continuous air film emission, this blade ensures a separation of the upper and lower air films.

In some embodiments, the marine vessel 300 may be propelled by wind acting on sails. Figure 19 shows a front view of a marine vessel powered by wind acting on sails 372,
25 which are supported by masts 374. A crew deck 370 is provided spanning the width between the two masts 374. In some embodiments, the wind-powered marine vessel may also be propelled by propulsion means as described above.

The hull section 302 may have a retractable undercarriage, so that a trailer is not needed when transporting the marine vessel 300 on land. In some embodiments, as the
30 marine vessel 300 rises to the surface (sea level), it may partially lower its body section. As the marine vessel 300 approaches, for example, a slipway, it can lower and lock its undercarriage. The undercarriage may be powered. For example, the undercarriage may be

electrically powered. In some embodiments, as the undercarriage touches a slipway it can power itself up the slipway out of the water.

In some embodiments, when the marine vessel 300 is on land, the marine vessel 300 may be placed such that the body section 304 can lower itself onto a framework and lock
5 itself in place. The framework may be substantially metal. In some embodiments of the marine vessel 300, a person or a team of people can disconnect the stanchions from the hull section 302 when the body section 304 is locked in place on the framework. The body section 304 could then lift the stanchions clear of the hull section 302 allowing the hull section 302 to be driven forward and away for maintenance and de-fouling in a suitable environment.
10 Subsequently, a reconditioned hull section 302 can be fitted in place before the marine vessel 300 returns to the water.

In some embodiments, the marine vessel 300 may be manoeuvred into place so that the body section 304 can lower itself onto a framework using a powered undercarriage.

Marine vessel 100 may comprise any of the features of marine vessel 300. Marine
15 vessel 300 may comprise any of the features of marine vessel 100.

Computer apparatus 400 may be provided to provide or enable various functionalities of the marine vessel 300 or the marine vessel 100. An example of such computer apparatus is shown in Figure 20. The computer apparatus 400 comprises at least one memory 402 and at least one processor 404. Together, the memory and processor can carry out one or more
20 computer aided tasks. The memory 402 may have loaded thereon one or more computer programs enabling those tasks. The computer hardware is operable to control one or more aspects of the marine vessel. For example the computer apparatus may control the propulsion means 318 and/or propulsion means 118 and 134. The computer hardware may also control the raising and lowering mechanism 107, and accordingly the computer hardware
25 may control the tilting of the main body portion as described in Figures 7 to 10. The computer apparatus 400 can also receive feedback. For example the computer apparatus 400 may receive information from the propulsion means, for example information of their current power output. The computer apparatus 400 may also receive information from the raising and lowering mechanism 107, for example information of an extent of raising, lowering
30 and/or tilting. The computer apparatus 400 may also be in communication with one or more sensors 406. These sensors may provide further information to the computer hardware such as direction of travel of the marine vessel, speed of travel, depth of the hull, weather

conditions including wave height, wind speed etc. The sensors may comprise one or more of: an accelerometer, a gyroscope, a global positioning system and a pressure sensor.

In some embodiments of the invention, the sensors can supply measurements indicating the pitch of the hull section 302. In some embodiments of the invention, the sensors can supply measurements indicating the roll of the hull section 302. In some embodiments of the invention, the sensors can supply measurements indicating the depth of the hull section 302.

The computer apparatus 400 can also control the displacement control system 380 based on measurements from sensors 406.

The computer apparatus 400 is also connected to or comprises a display 408 for displaying information. This information may be displayed to staff on the bridge, such as the captain. Input means 410 is also provided which enables one or more inputs to be provided to the computer apparatus 400. For example the input means may comprise a steering wheel, joystick, keyboard etc. enabling crew on the bridge to control the marine vessel 300. The computer apparatus 400 receives these inputs, processes them and provides the necessary outputs to the various mechanisms such as the propulsion means and the raising and lowering mechanism.

The computer apparatus 400 may also enable a degree of automation, or even full automation, of the marine vessel. For example the pilot may be able to program in a destination for the vessel, using which the computer apparatus can plot a course for the marine vessel to follow. The computer apparatus 400 may also act to maintain the hull in a generally horizontal position to maintain stability of the marine vessel 300. It may do this for example by controlling the control surfaces (e.g. ailerons and elevators) and receiving feedback therefrom as part of a control loop. This automatic control can be based on measurements from gyroscopes and accelerometers indicating the pitch and/or roll of the hull section 302. In some embodiments there is no manual override with respect to the aspects of maintaining the hull in a level orientation.

In some embodiments, the computer apparatus can automatically control the vertical thrusters 360 to keep the hull section 302 at its desired operating depth. This automatic control can be based on measurements from pressure sensors. This may be performed when the marine vessel is stationary.

In some embodiments, the computer apparatus can automatically control the vertical

thrusters 360 to keep the hull section 302 level. This automatic control can be based on measurements from gyroscopes and accelerometers indicating the pitch and/or roll of the hull section 302. This may be performed when the marine vessel is stationary.

In some embodiments, the marine vessel 300 can comprise solar panels and/or wind
5 turbines. For example, in an embodiment of the marine vessel where the marine vessel is a cross channel ferry having a length of, say, 100 metres and a beam 50 metres wide, solar panels could charge batteries with 5000 kilowatt hours of energy per day, on average. The computer apparatus 400 can be powered using solar panels and/or wind turbines.

In some embodiments, the marine vessel 300 may comprise collision avoidance
10 devices, such as sonar equipment.

In some embodiments the various elements of the vessel are easily detachable from each other. For example the hull, main body portion and stanchions can all be detached from each other for maintenance. For example the hull and/or stanchions can be removed for de-fouling and regular maintenance. The main body can then be attached to a reconditioned hull.
15 A typical out-of-service time may be in the region of 24 hours. Damaged items, the hull, stanchions, propulsion elements, depth keeping units (e.g. ballast, hydroplanes etc) could be dealt with in the same way, in order to reduce the amount of out-of-service time of the main body and modules to a minimum.

It will of course be understood that the embodiments described are by way of example
20 only and are not intended to limit the scope of the invention. The term "marine vessel" does not place any limitations on the size or application of the vessel. For example the marine vessel may be a cruise ship, cross-channel ferry, fishing boat etc. The marine vessel may be provided at different scales. The marine vessel could be used as a super yacht or oil tanker. The marine vessel may be used in seas, lakes, rivers etc. The marine vessel may also be in the
25 form of a toy, for example a remote controlled boat. The Figures are schematic in nature and not necessarily drawn to scale. It will be further understood that aspects of the described embodiments can be combined in any way.

Claims

1. A marine vessel comprising:
5 propulsion means;
a hull section;
a body section connected to said hull section via at least one stanchion; and
the body section and the hull section being movable relative to each other via said at
least one stanchion.
10
2. A marine vessel as set forth in claim 1, wherein said body section is movable on the at
least one stanchion.
3. A marine vessel as set forth in claim 2, wherein said body section is vertically movable
15 on the at least one stanchion relative to the hull section.
4. A marine vessel as set forth in claim 2 or claim 3, wherein the marine vessel comprises
a plurality of stanchions.
- 20 5. A marine vessel as set forth in claim 4, wherein the body section is movable on the
plurality of stanchions so as to tilt the body section relative to the hull section.
6. A marine vessel as set forth in claim 5, wherein the body section is configured to be
tilted during acceleration and/or braking of the marine vessel.
25
7. A marine vessel as set forth in claim 6, wherein a degree of tilt of the body section is
dependent upon a magnitude of the acceleration or braking force.
8. A marine vessel as set forth in any of claims 5 to 7, wherein the body section is
30 configured to selectively tilt towards a first end or a second end of the marine vessel.

9. A marine vessel as set forth in any of claims 5 to 8, wherein the body section is configured to selectively tilt towards a first side or a second side of the marine vessel.

10. A marine vessel as set forth in any preceding claim, wherein said hull section comprises one or more ballast and trim tanks operable to prevent the marine vessel from floating unevenly.

11. A marine vessel as set forth in claim 10, wherein said ballast tank is configured to control a centre of gravity of said marine vessel.

12. A marine vessel as set forth in any preceding claim, comprising one or more vertical thrusters located in or on the hull section for driving the hull section down to an operating depth.

13. A marine vessel as set forth in any preceding claim, comprising one or more ailerons and/or elevators on the hull section to provide control of the hull when the vessel is in motion.

14. A marine vessel as set forth in claim 13, wherein an angle of attack of the one or more ailerons and/or elevators is variable so as to control the hull.

15. A marine vessel as set forth in any preceding claim, wherein the body section comprises one or more areas for holding people and/or cargo.

16. A marine vessel as set forth in any preceding claim, wherein the body section comprises a bridge portion for accommodating a crew of the marine vessel.

17. A marine vessel as set forth in any preceding claim, wherein the body section comprises a passenger holding area.

18. A marine vessel as set forth in any preceding claim, wherein the body section comprises an attachment mechanism for attaching at least one detachable module.

19. A marine vessel as set forth in any preceding claim, comprising a detachable module mounted to the attachment mechanism.

20. A marine vessel as set forth in claim 19, wherein said marine vessel is configured to mount said detachable module between said body section and said hull section.

21. A marine vessel as set forth in claim 19 or claim 20, wherein said body section is configured to be lowered on to said detachable module so as to attach thereto.

22. A marine vessel as set forth in any preceding claim, wherein said marine vessel has a first end and a second end, each of said first and second ends capable of acting as a bow or a stern of the marine vessel in an interchangeable manner and in dependence on a direction of travel of the marine vessel.

23. A marine vessel as set forth in any preceding claim, wherein said propulsion means comprises a water jet.

24. A marine vessel as set forth in any preceding claim, wherein the hull section comprises a single section.

25. A marine vessel as set forth in any preceding claim, wherein the hull section is wider than the body section.

26. A marine vessel as set forth in claim 25, wherein the width of the hull section is double, or about double, the width of the body section.

27. A marine vessel as set forth in any preceding claim, wherein a length to height ratio of the hull section is 8:1 or greater.

28. A marine vessel as set forth in any preceding claim, wherein the hull comprises an air film emission slot for creating an air film on the hull section.

29. A marine vessel as set forth in any preceding claim, wherein in side profile of the hull section comprises an aerofoil shape.

AMENDED CLAIMS

received by the International Bureau on 31 August 2017 (31.08.2017)

1. A marine vessel comprising:
5 propulsion means;
a hull section;
a body section connected to said hull section via at least one stanchion; and
the body section and the hull section being movable relative to each other via said at
least one stanchion; and
10 the marine vessel comprising one or more vertical thrusters located in or on the hull
section configured for driving the hull section down to an operating depth such that the hull
can be completely submerged in use;
wherein the hull section comprises a single section that is wider than the body section
and a length to height ratio of the hull section is 8:1 or greater, and in side-profile the hull
15 section comprises an aerofoil shape.
2. A marine vessel as set forth in claim 1, wherein said body section is movable on the at
least one stanchion.
- 20 3. A marine vessel as set forth in claim 2, wherein said body section is vertically movable
on the at least one stanchion relative to the hull section.
4. A marine vessel as set forth in claim 2 or claim 3, wherein the marine vessel comprises
a plurality of stanchions.
25
5. A marine vessel as set forth in claim 4, wherein the body section is movable on the
plurality of stanchions so as to tilt the body section relative to the hull section.
6. A marine vessel as set forth in claim 5, wherein the body section is configured to be
30 tilted during acceleration and/or braking of the marine vessel.

7. A marine vessel as set forth in claim 6, wherein a degree of tilt of the body section is dependent upon a magnitude of the acceleration or braking force.

8. A marine vessel as set forth in any of claims 5 to 7, wherein the body section is configured to selectively tilt towards a first end or a second end of the marine vessel.

9. A marine vessel as set forth in any of claims 5 to 8, wherein the body section is configured to selectively tilt towards a first side or a second side of the marine vessel.

10. A marine vessel as set forth in any preceding claim, wherein said hull section comprises one or more ballast and trim tanks operable to prevent the marine vessel from floating unevenly.

11. A marine vessel as set forth in claim 10, wherein said ballast tank is configured to control a centre of gravity of said marine vessel.

12. A marine vessel as set forth in any preceding claim, comprising one or more ailerons and/or elevators on the hull section to provide control of the hull when the vessel is in motion.

13. A marine vessel as set forth in claim 12, wherein an angle of attack of the one or more ailerons and/or elevators is variable so as to control the hull.

14. A marine vessel as set forth in any preceding claim, wherein the body section comprises one or more areas for holding people and/or cargo.

15. A marine vessel as set forth in any preceding claim, wherein the body section comprises a bridge portion for accommodating a crew of the marine vessel.

16. A marine vessel as set forth in any preceding claim, wherein the body section comprises a passenger holding area.

17. A marine vessel as set forth in any preceding claim, wherein the body section comprises an attachment mechanism for attaching at least one detachable module.

18. A marine vessel as set forth in any preceding claim, comprising a detachable module
5 mounted to the attachment mechanism.

19. A marine vessel as set forth in claim 18, wherein said marine vessel is configured to mount said detachable module between said body section and said hull section.

10 20. A marine vessel as set forth in claim 18 or claim 19, wherein said body section is configured to be lowered on to said detachable module so as to attach thereto.

21. A marine vessel as set forth in any preceding claim, wherein said marine vessel has a first end and a second end, each of said first and second ends capable of acting as a bow or a
15 stern of the marine vessel in an interchangeable manner and in dependence on a direction of travel of the marine vessel.

22. A marine vessel as set forth in any preceding claim, wherein said propulsion means comprises a water jet.

20 23. A marine vessel as set forth in any preceding claim, wherein the width of the hull section is double, or about double, the width of the body section.

24. A marine vessel as set forth in any preceding claim, wherein the hull comprises an air
25 film emission slot for creating an air film on the hull section.

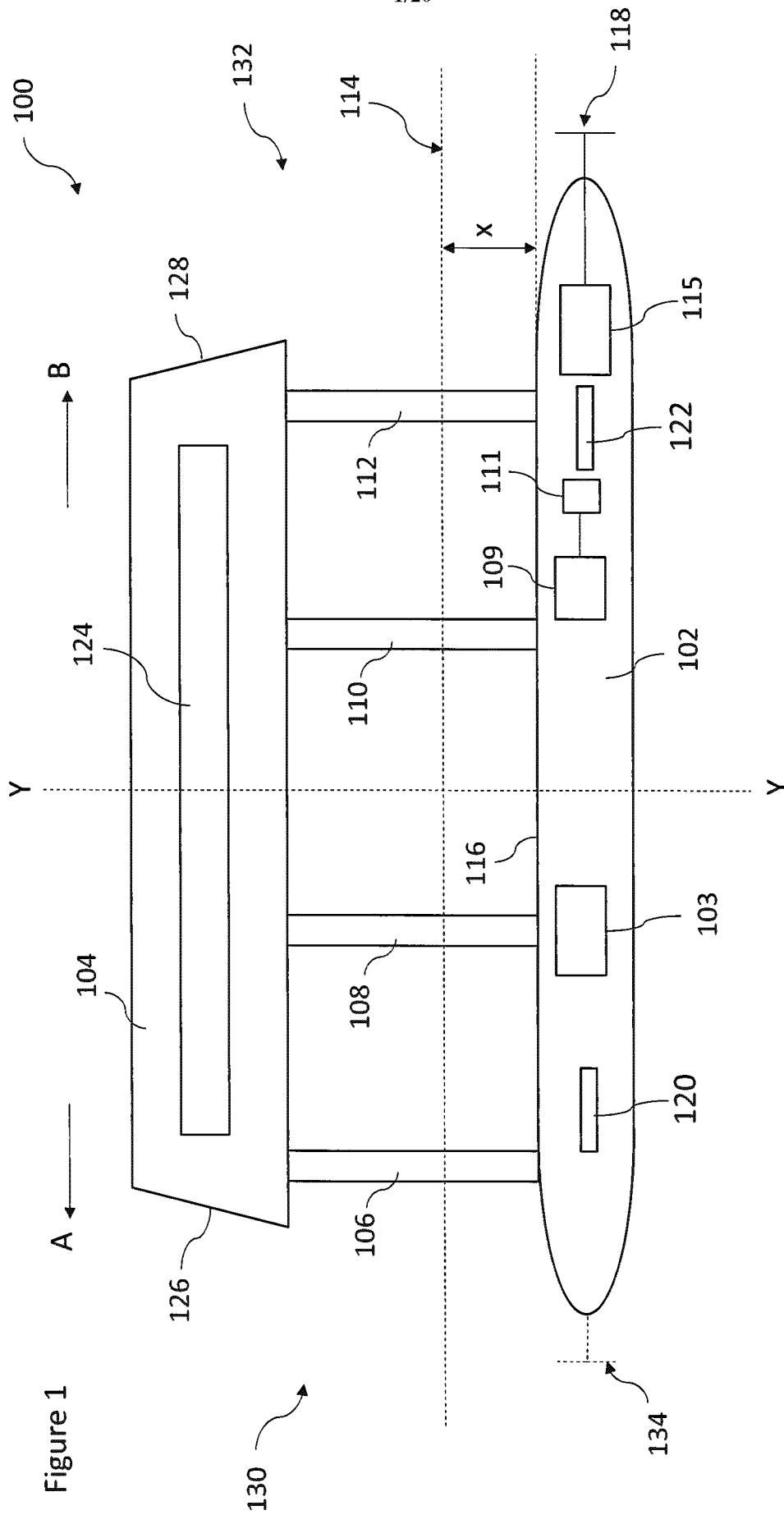


Figure 1

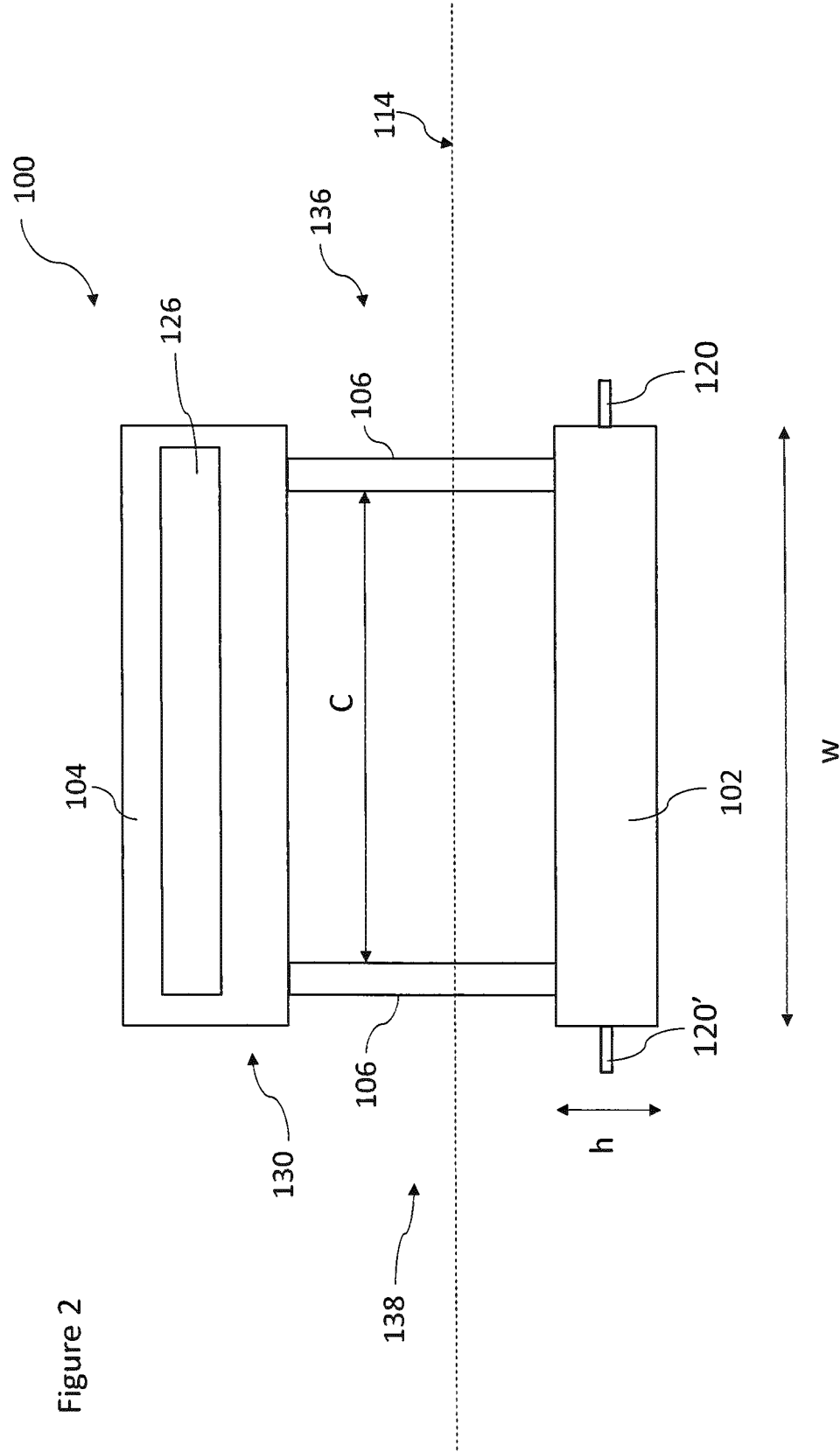


Figure 2

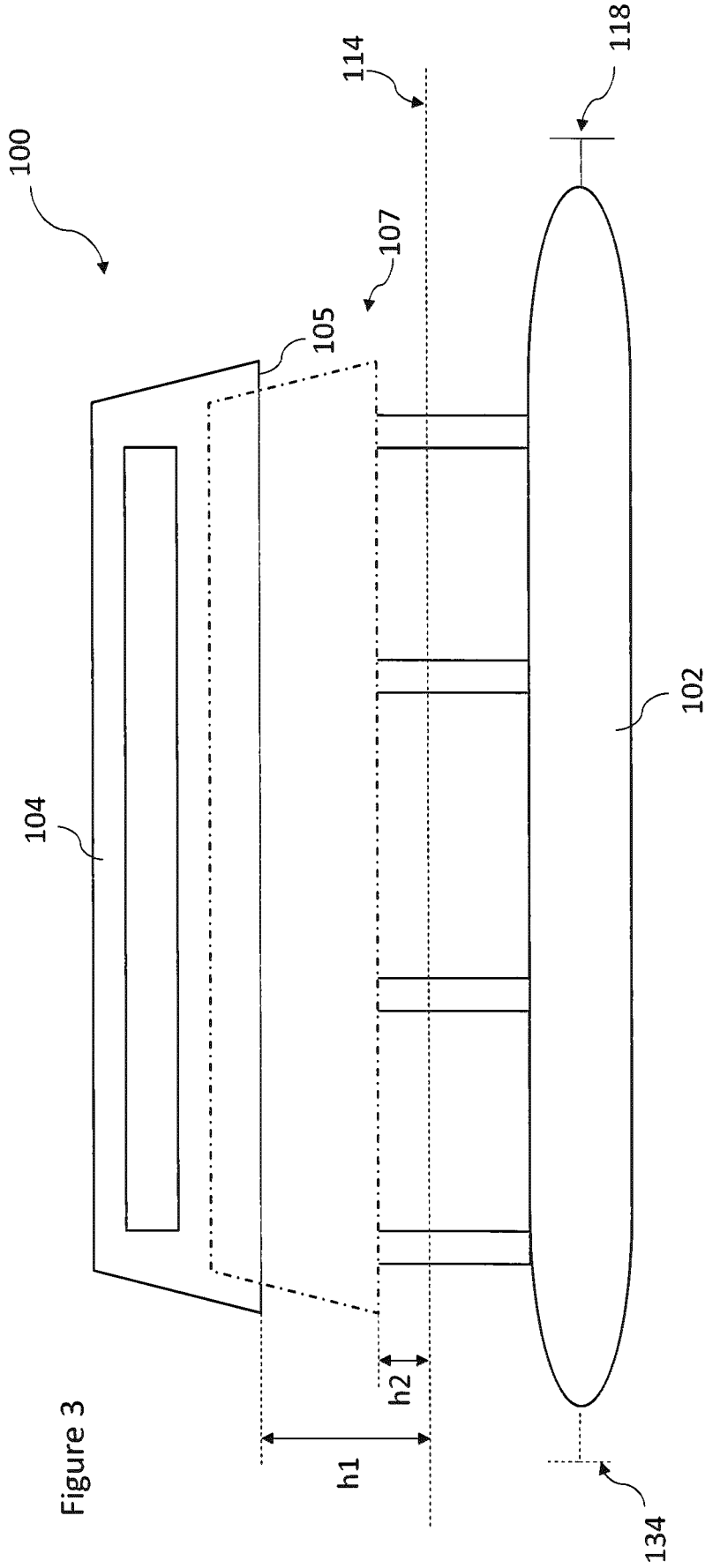


Figure 3

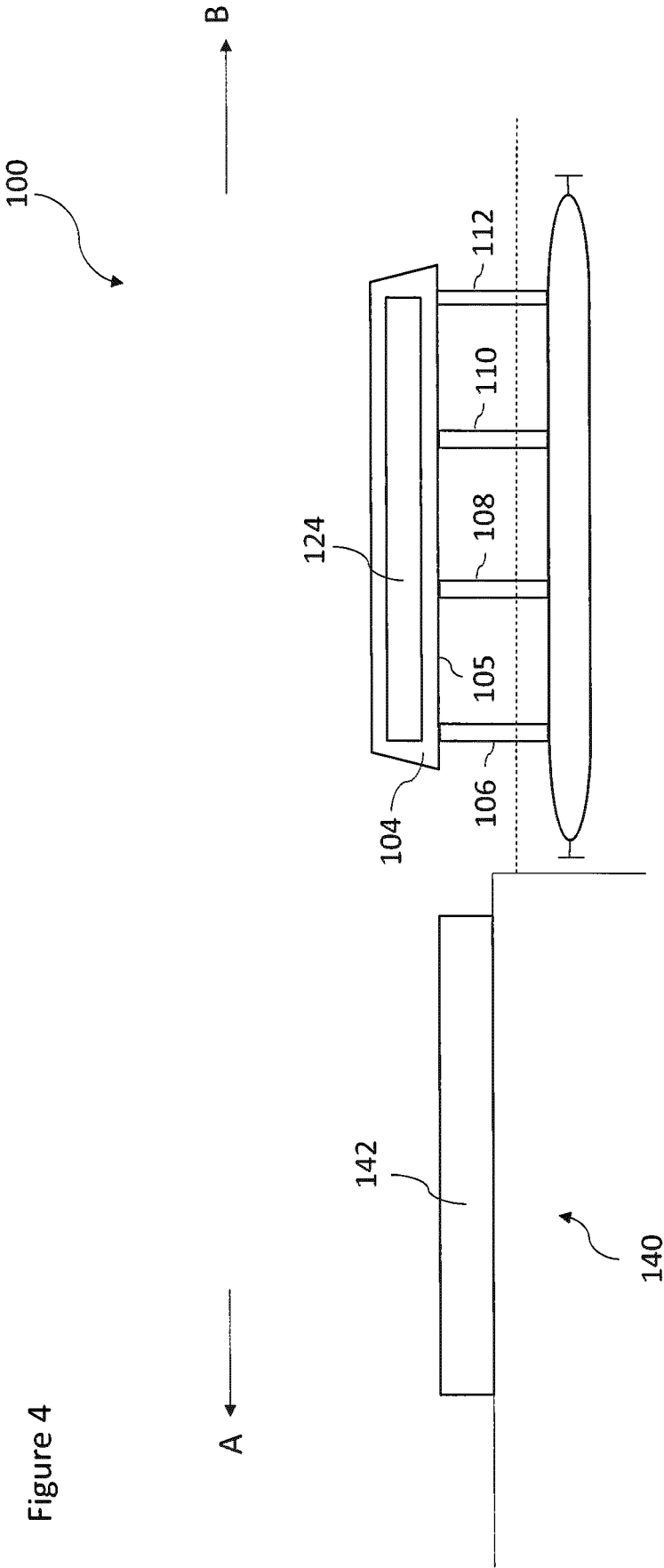
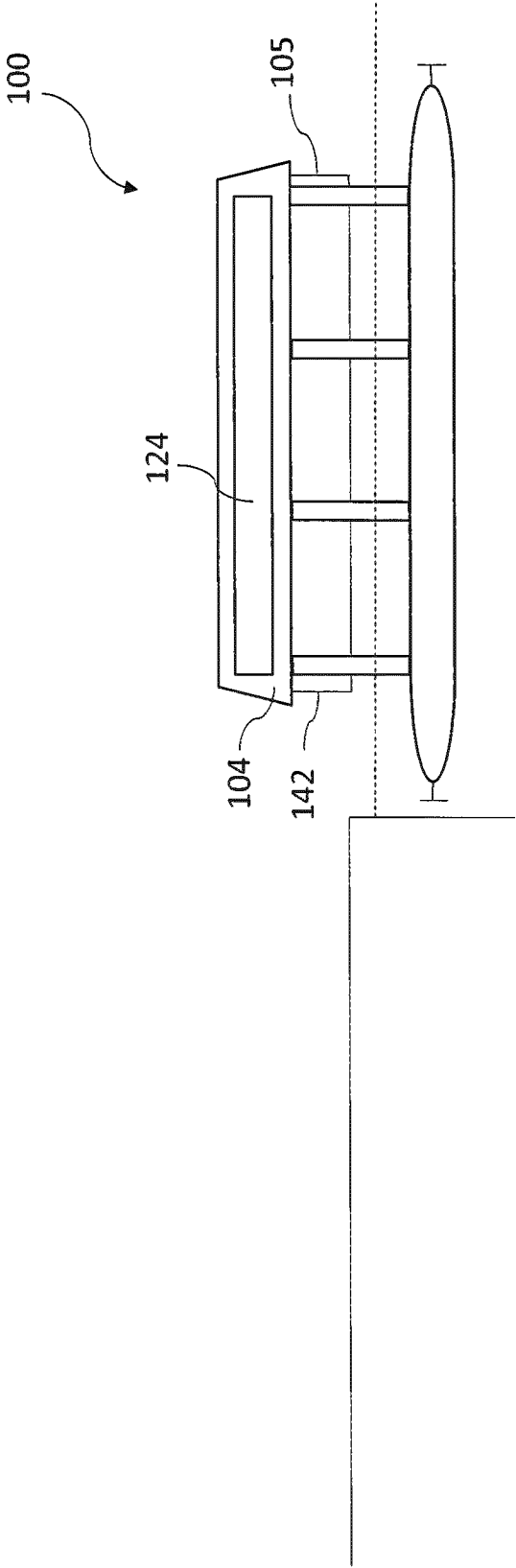
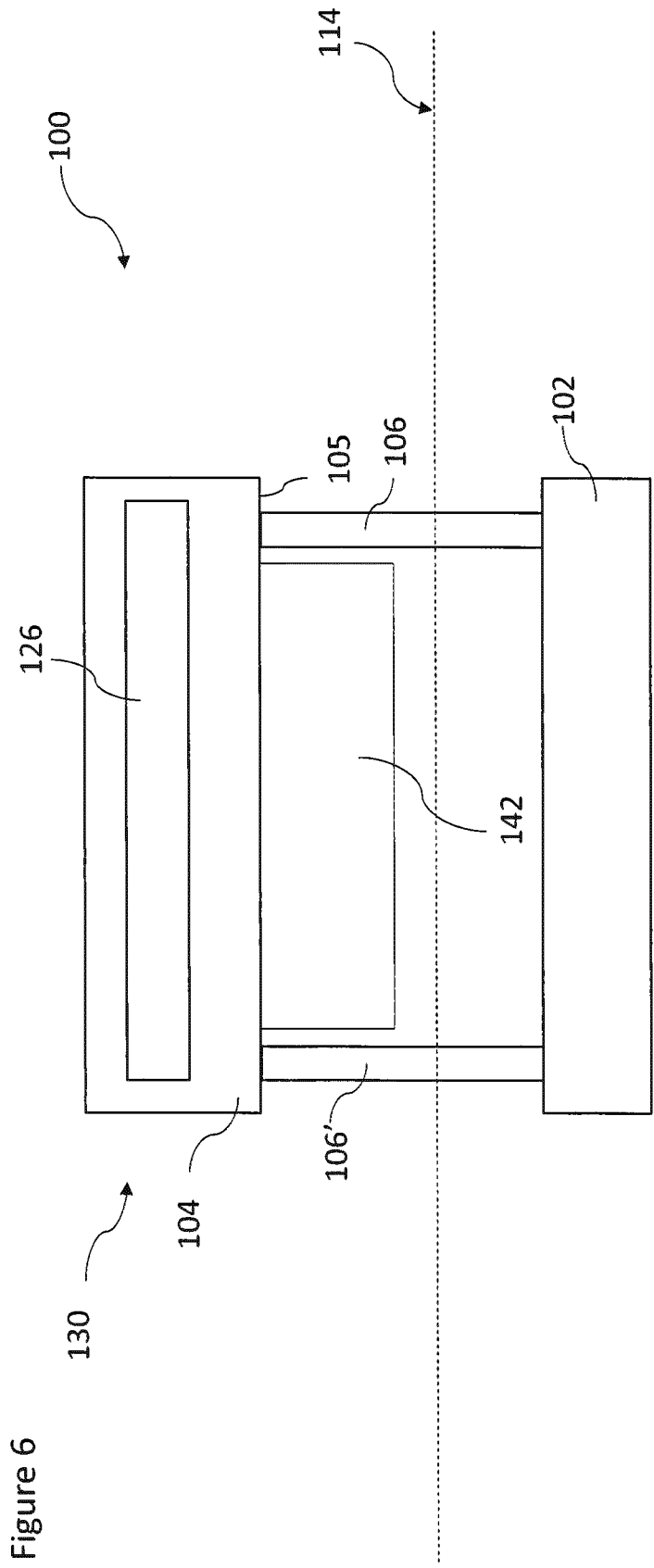
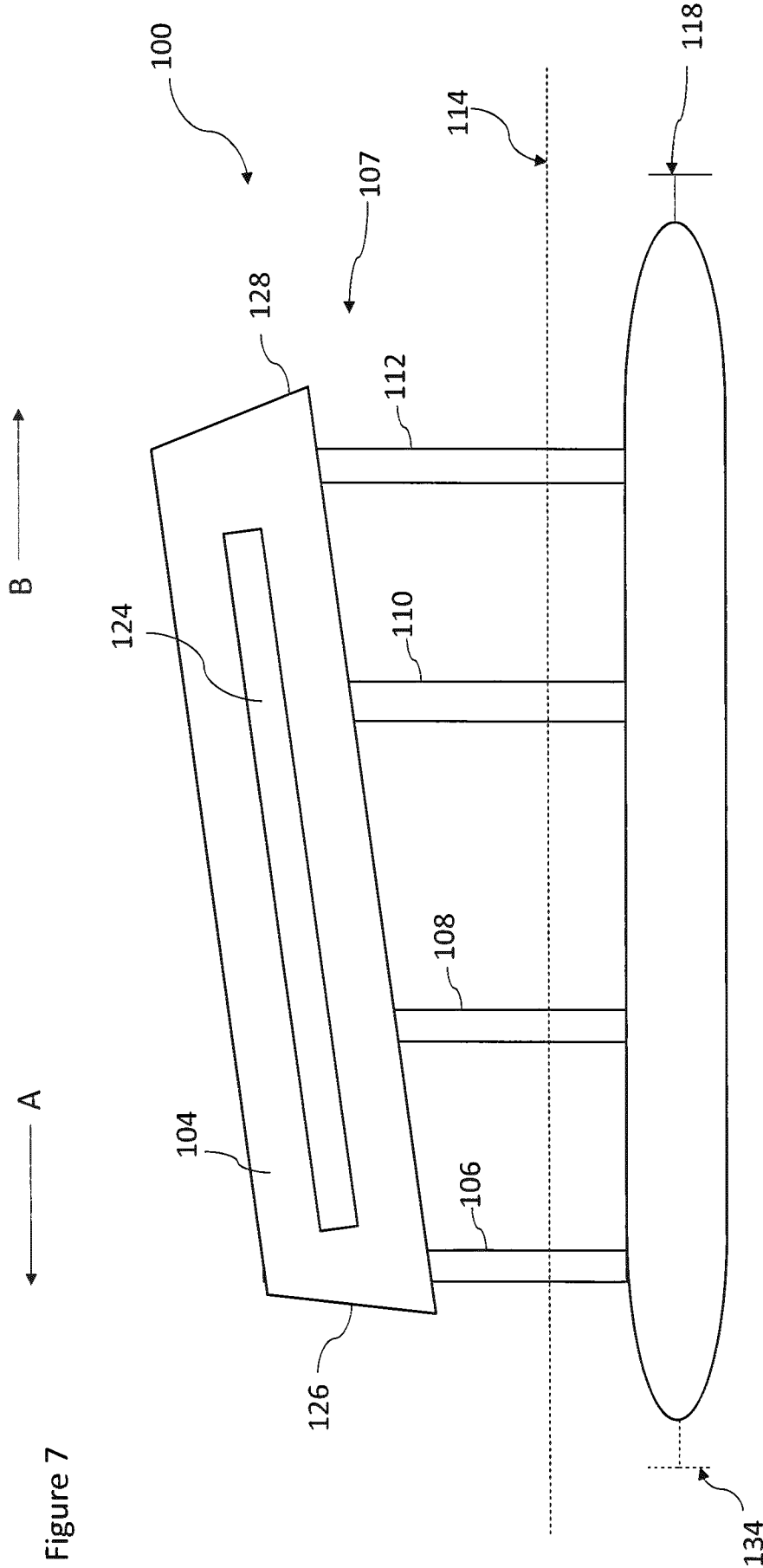


Figure 5







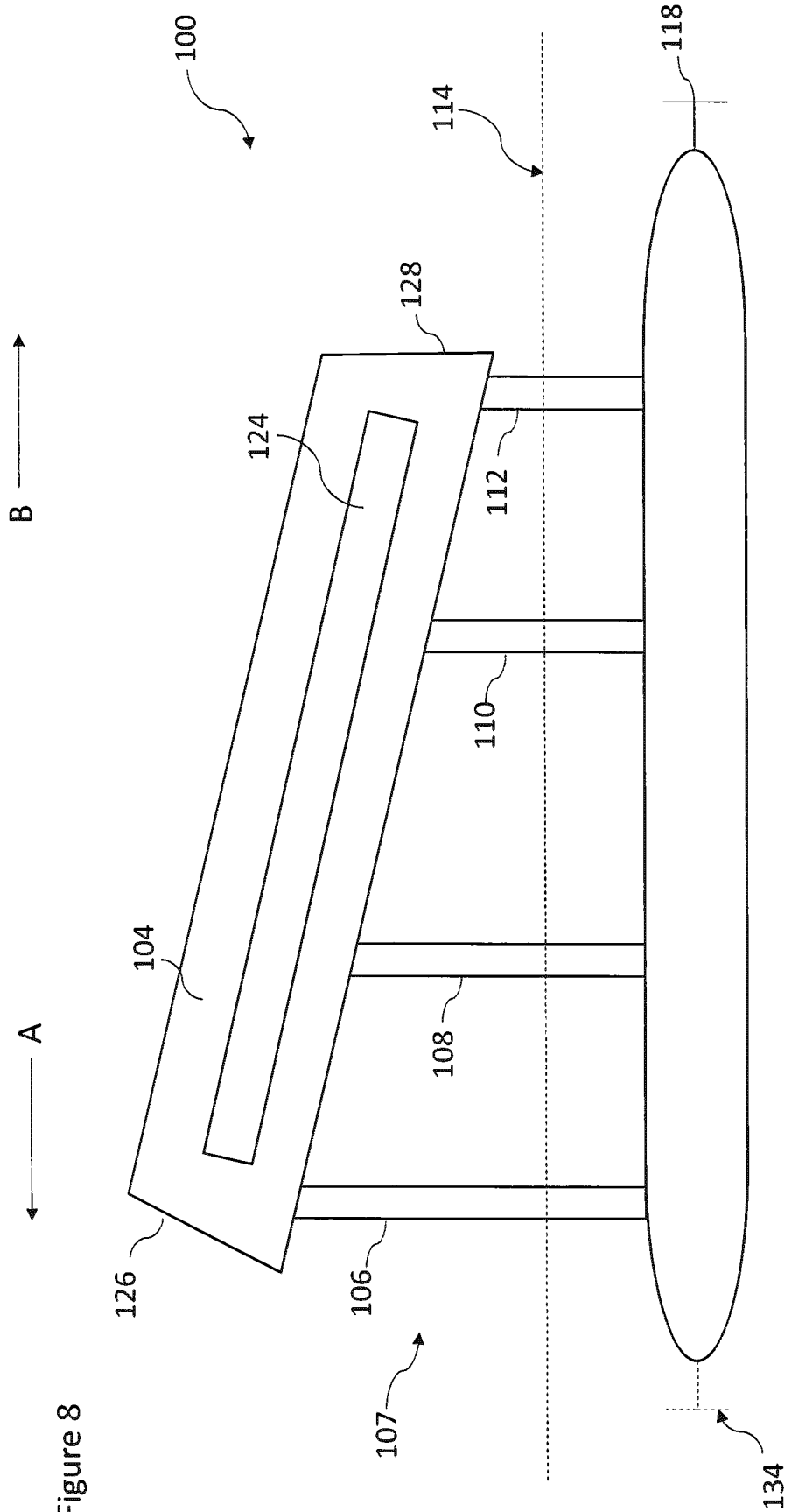


Figure 8

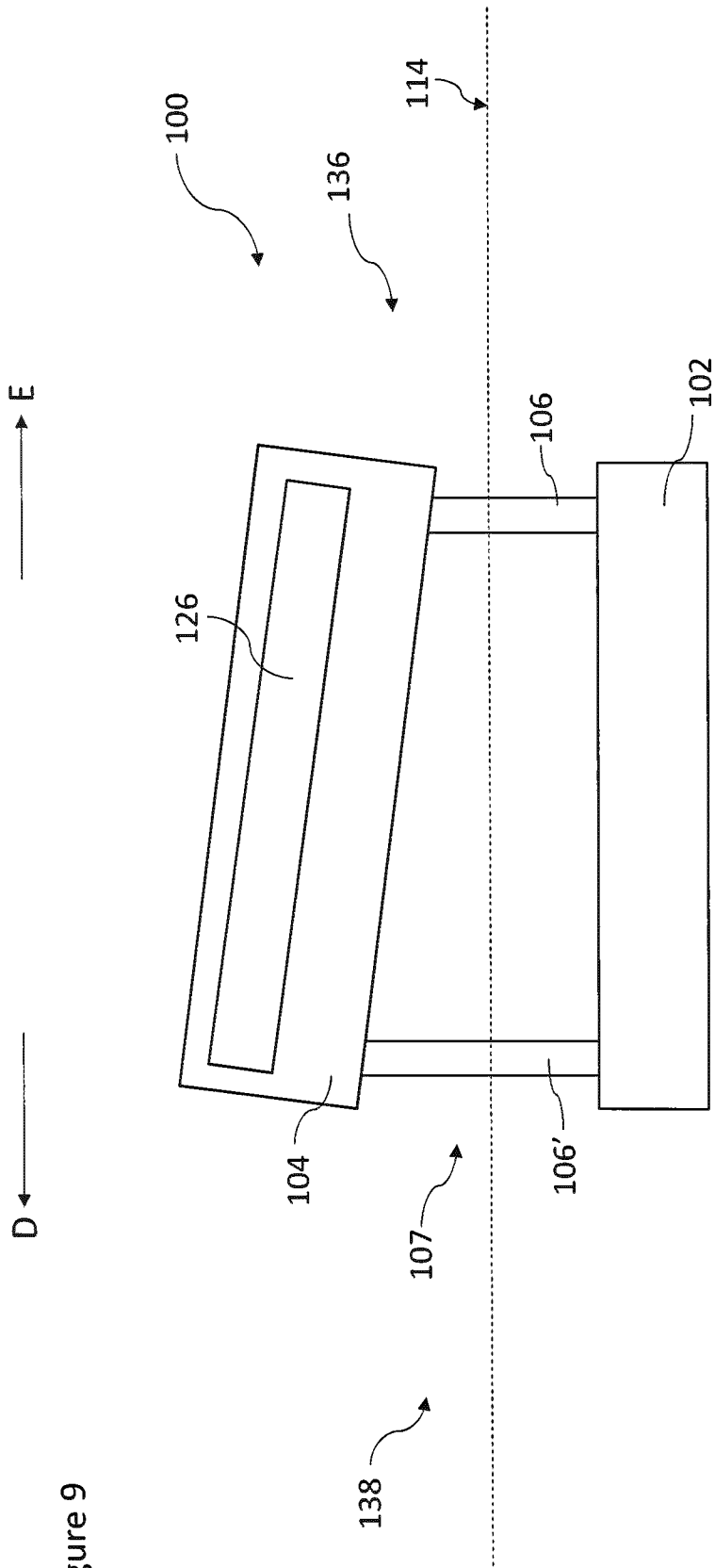


Figure 9

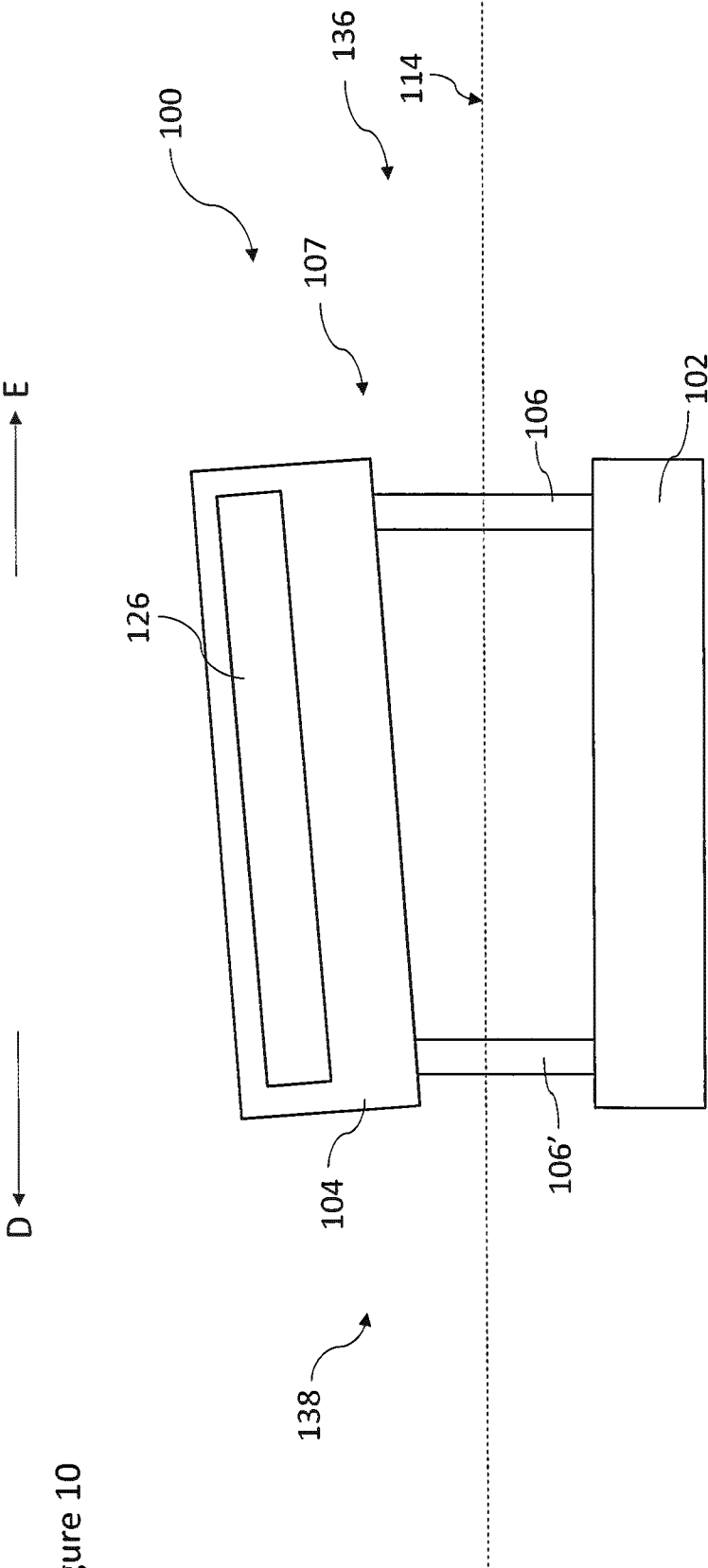


Figure 10

Figure 11

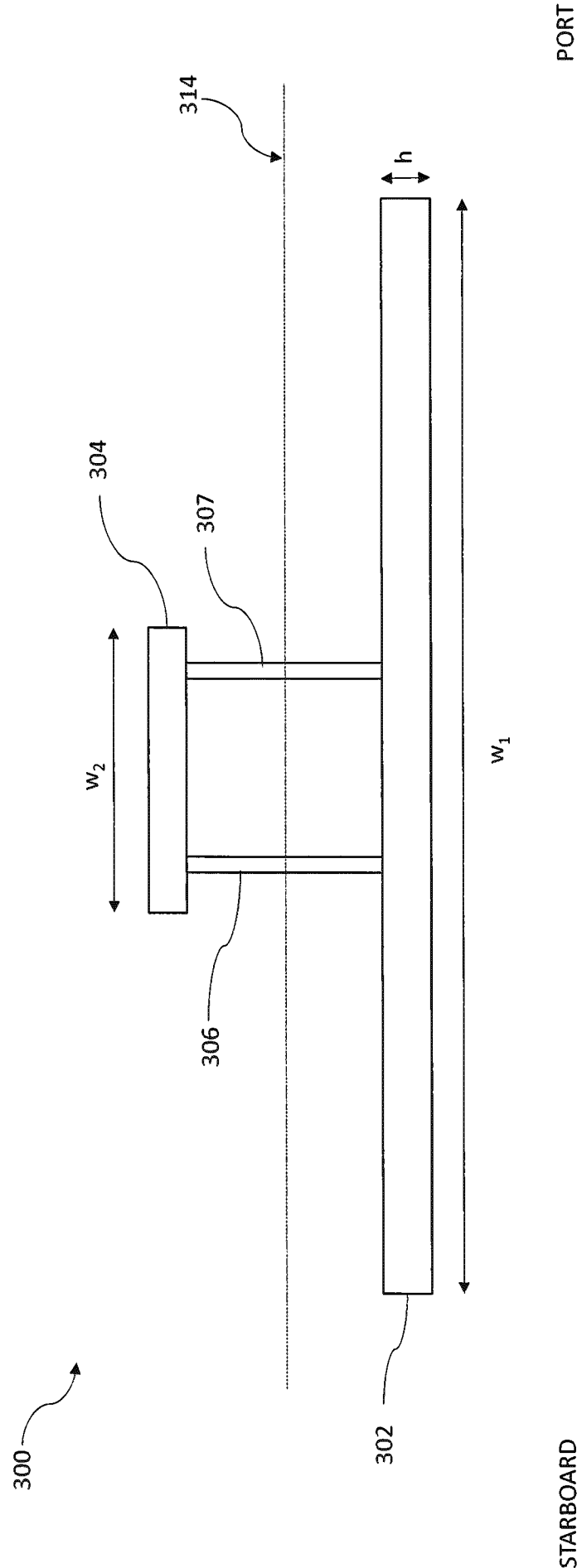


Figure 12

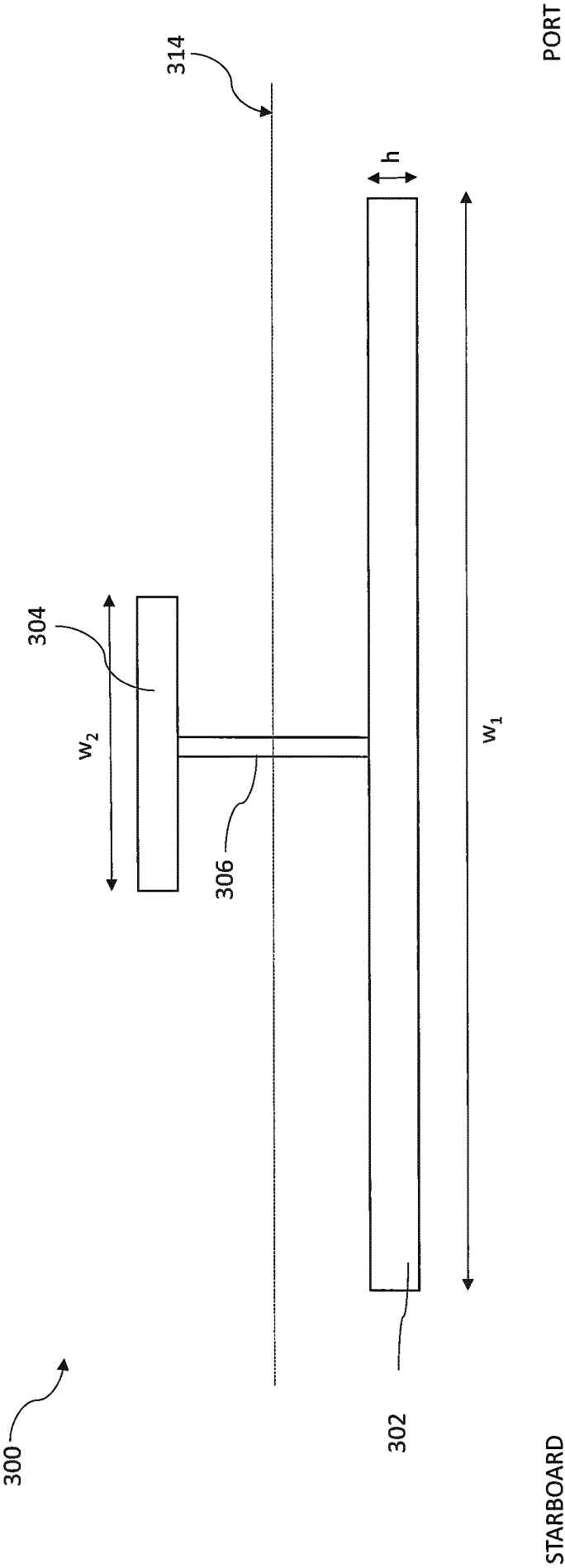


Figure 13

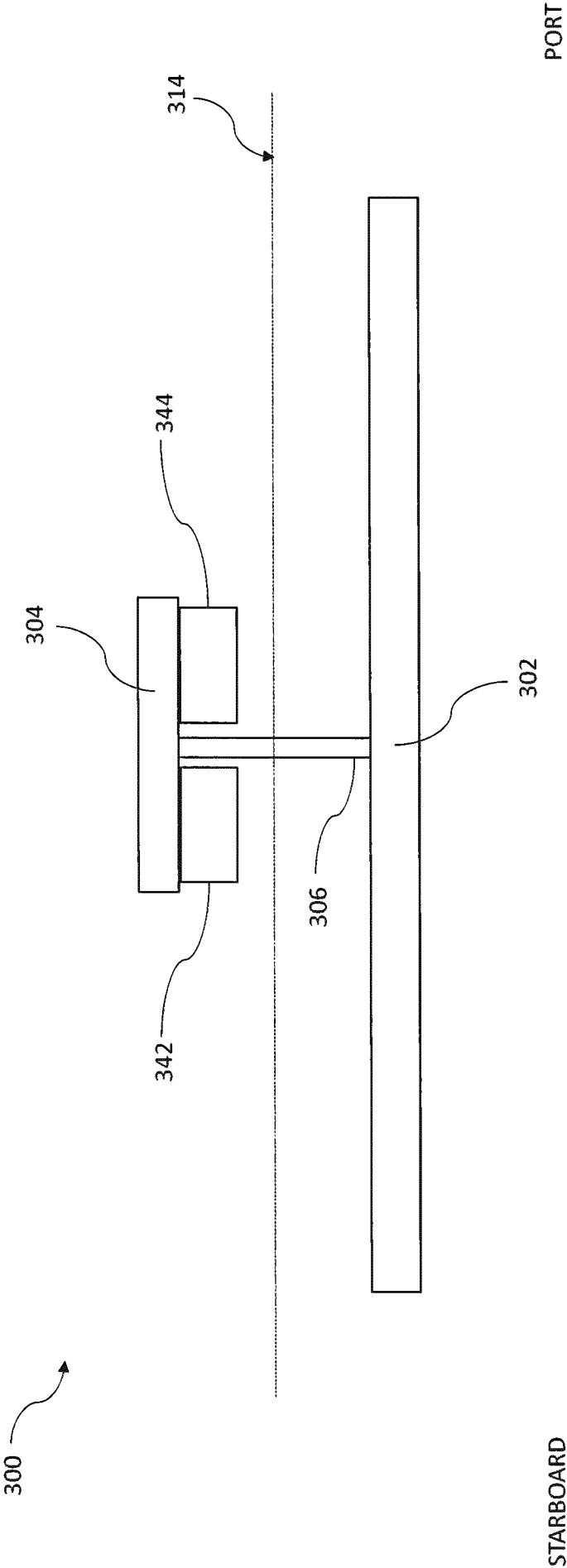


Figure 14 b)

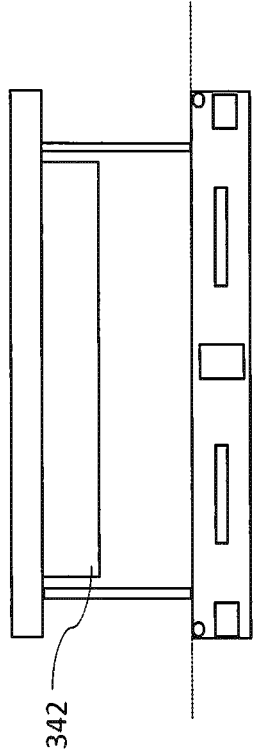


Figure 14 d)

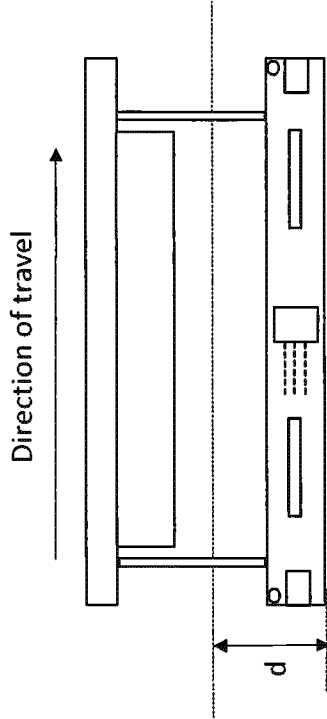


Figure 14 a)

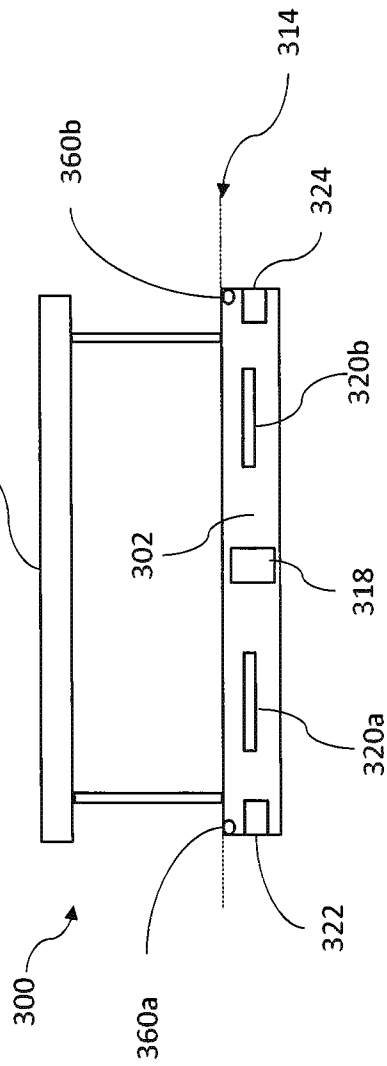


Figure 14 c)

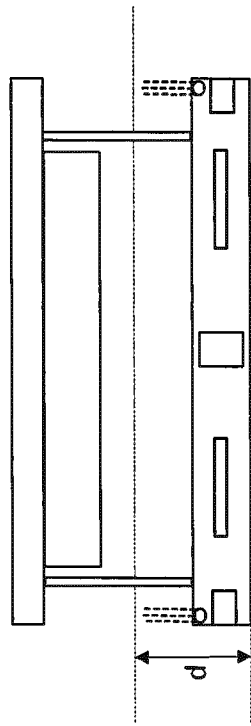


Figure 15

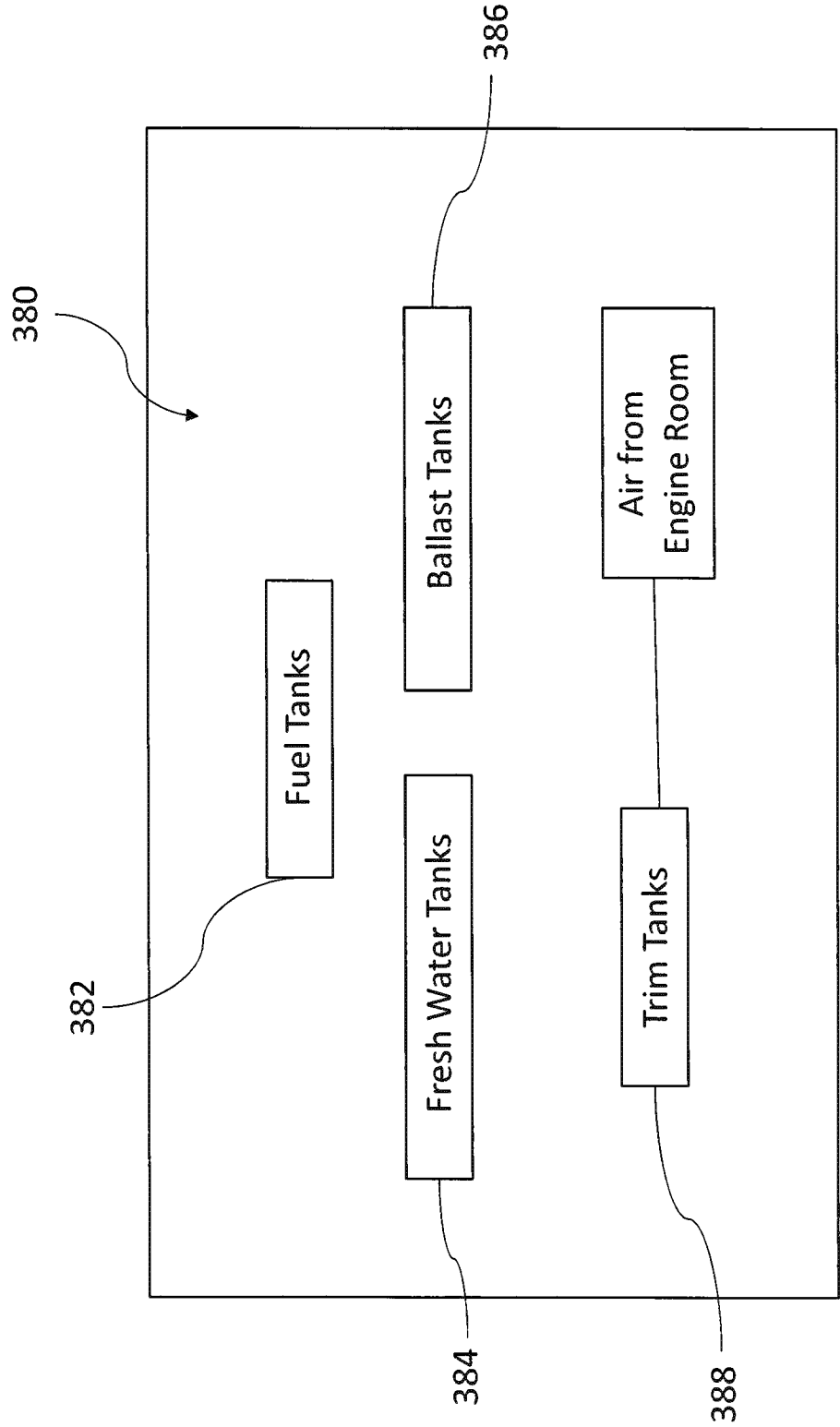


Figure 16

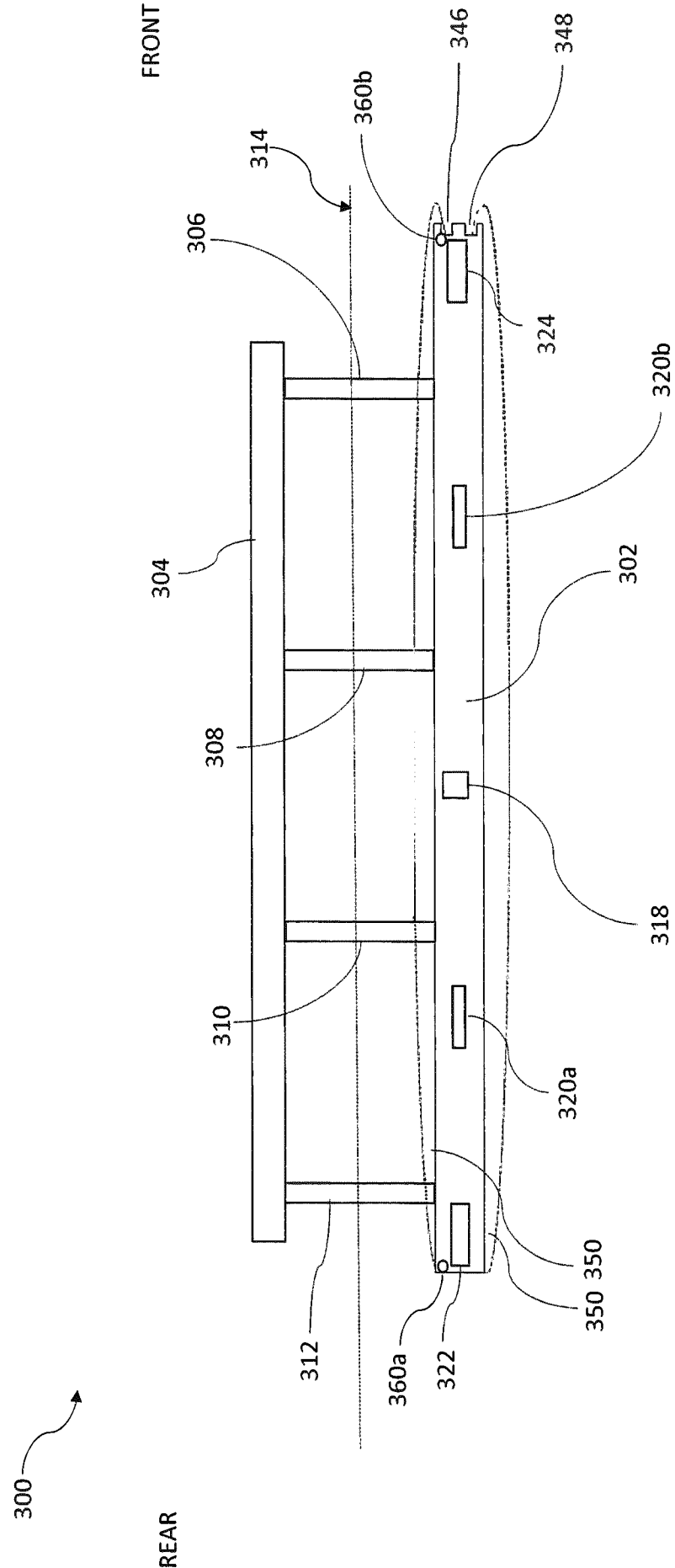


Figure 17

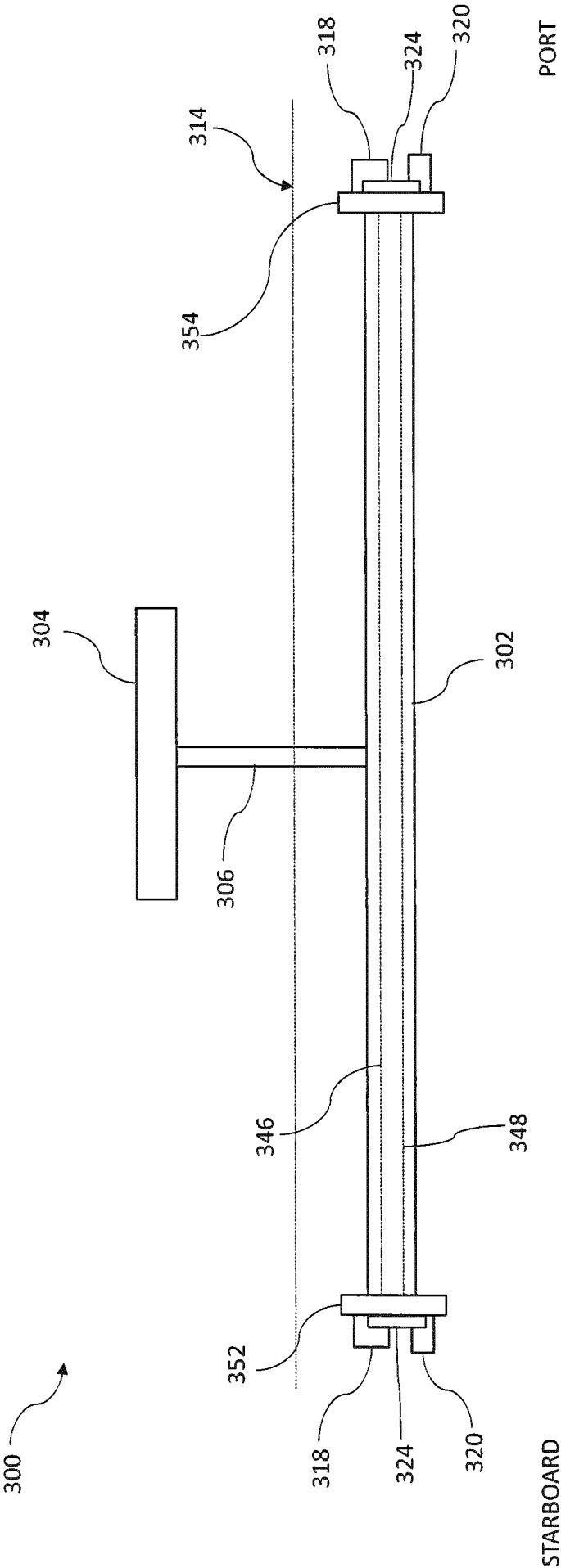


Figure 18

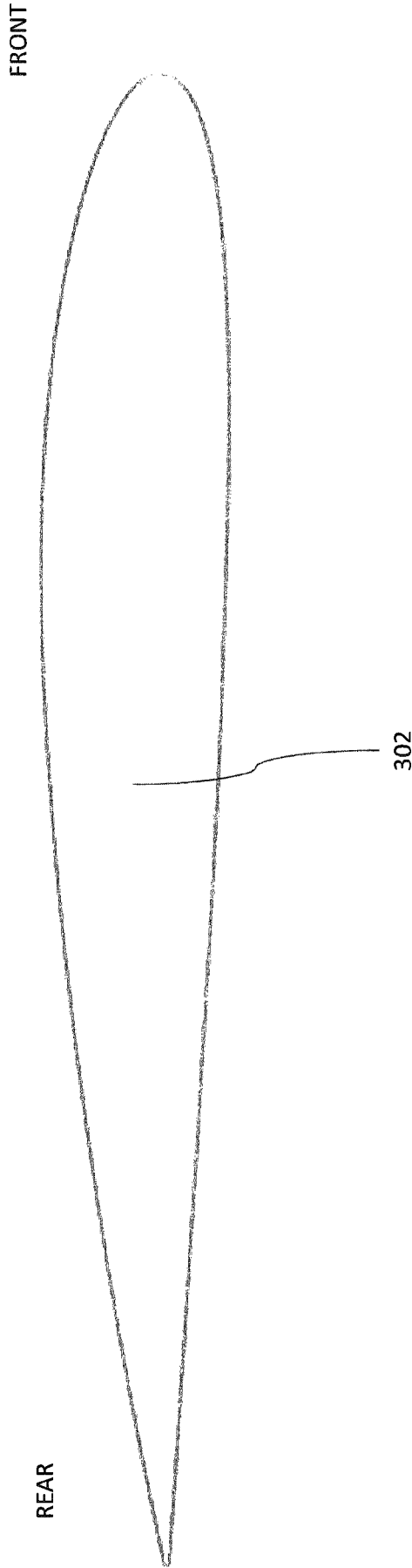
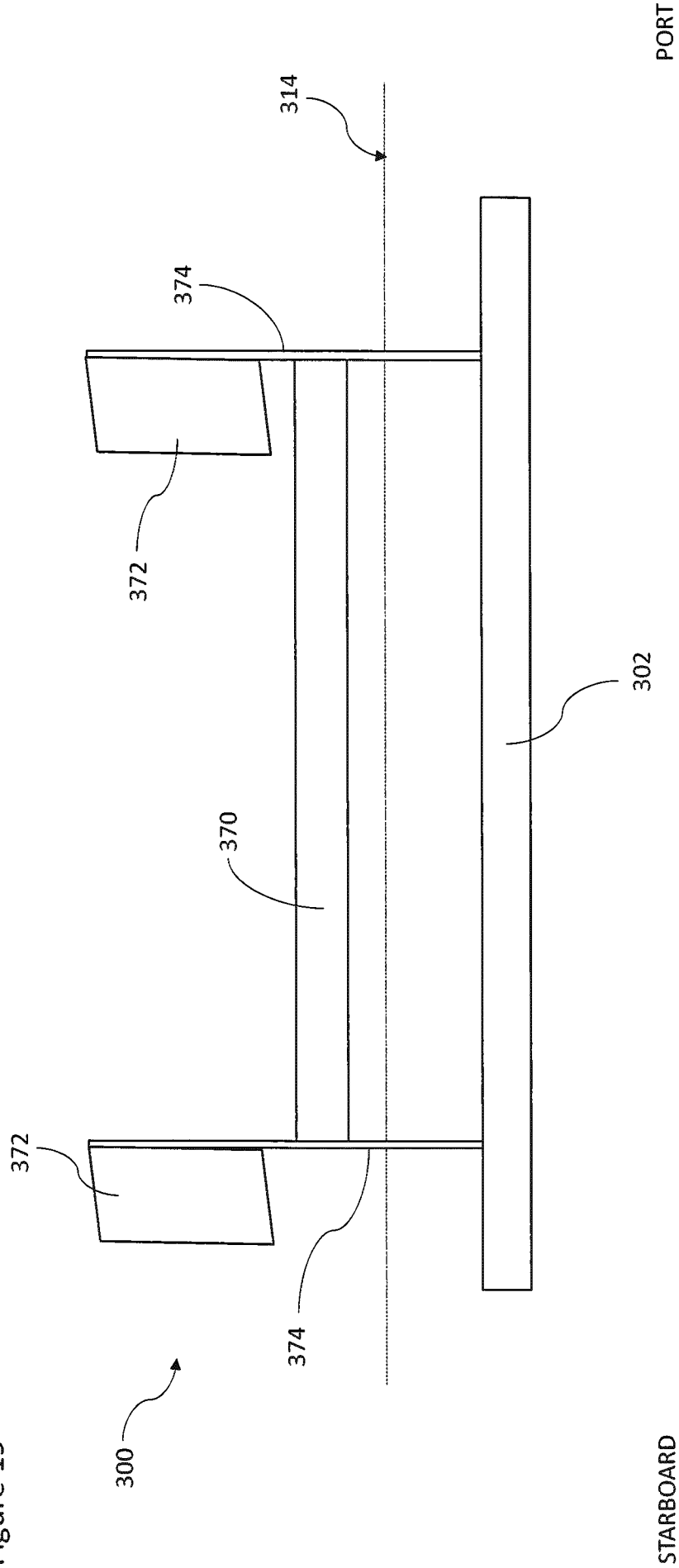
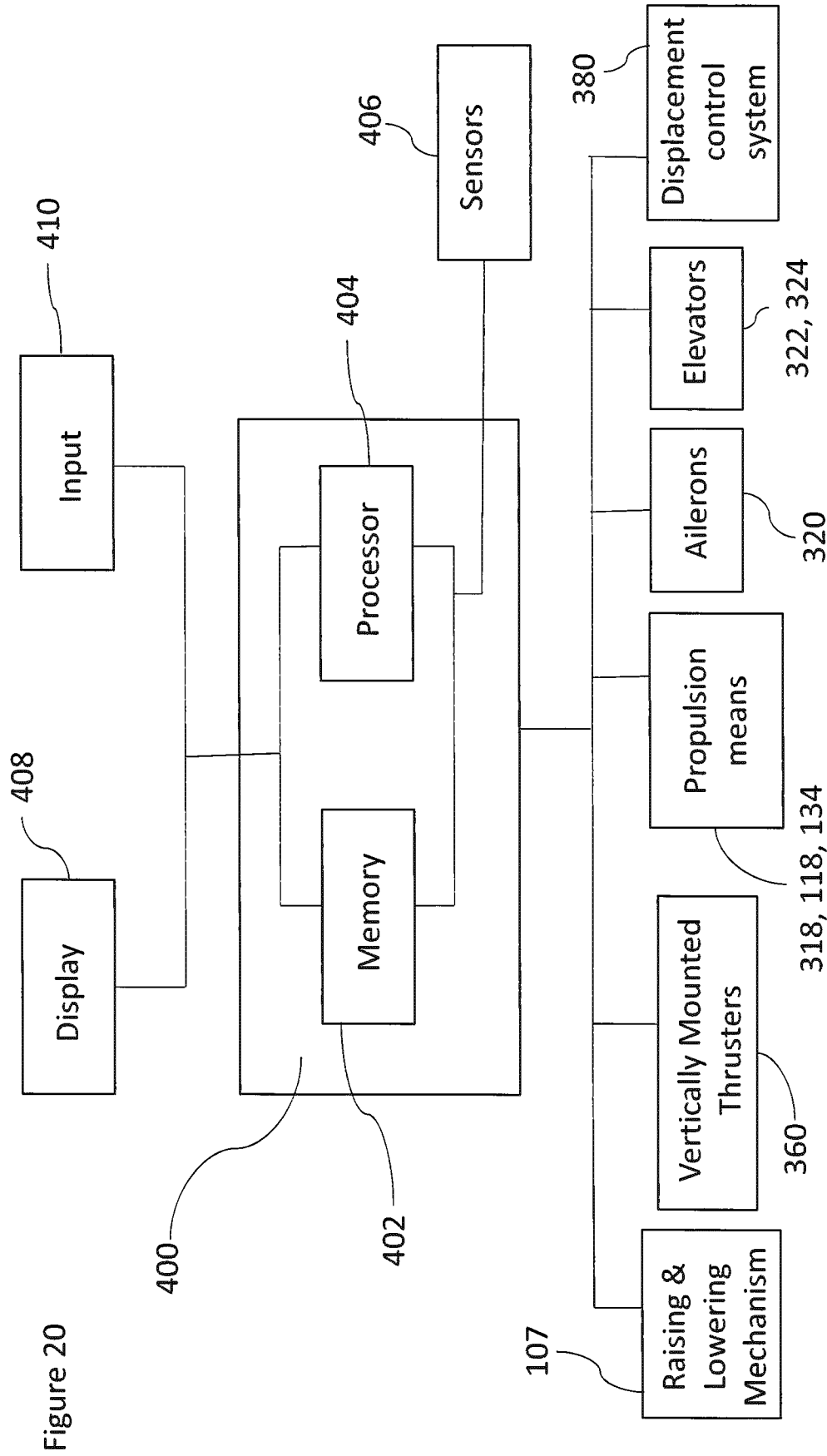


Figure 19





INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2017/057618

A. CLASSIFICATION OF SUBJECT MATTER
INV. B63B39/00 B63B1/38 B63B1/04
ADD.

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

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

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

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 167 829 B1 (LANG THOMAS G [US]) 2 January 2001 (2001-01-02) column 11 - column 15; figures -----	1-11, 13-29
X	WO 01/32500 A1 (KAY BLUEY [US]; KAY JOHN [GB]) 10 May 2001 (2001-05-10) page 5 - page 10; figures -----	1-7, 10-20, 22,24,27
X	US 3 898 946 A (ZADROZNY JAN ET AL) 12 August 1975 (1975-08-12) column 3 - column 5; figures ----- -/-	1-5, 10-22, 24,29



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

22 June 2017

Date of mailing of the international search report

04/07/2017

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Popescu, Alexandru

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2017/057618

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 36 14 291 A1 (LABENTZ PETER) 29 October 1987 (1987-10-29) the whole document -----	1-7, 9-17, 22-24, 27,29
X	US 2007/039537 A1 (MADDEN LEWIS D [US] ET AL) 22 February 2007 (2007-02-22) column 2 - column 4; figures -----	1-4, 10-12, 15-21, 24-27

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International application No

PCT/EP2017/057618

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