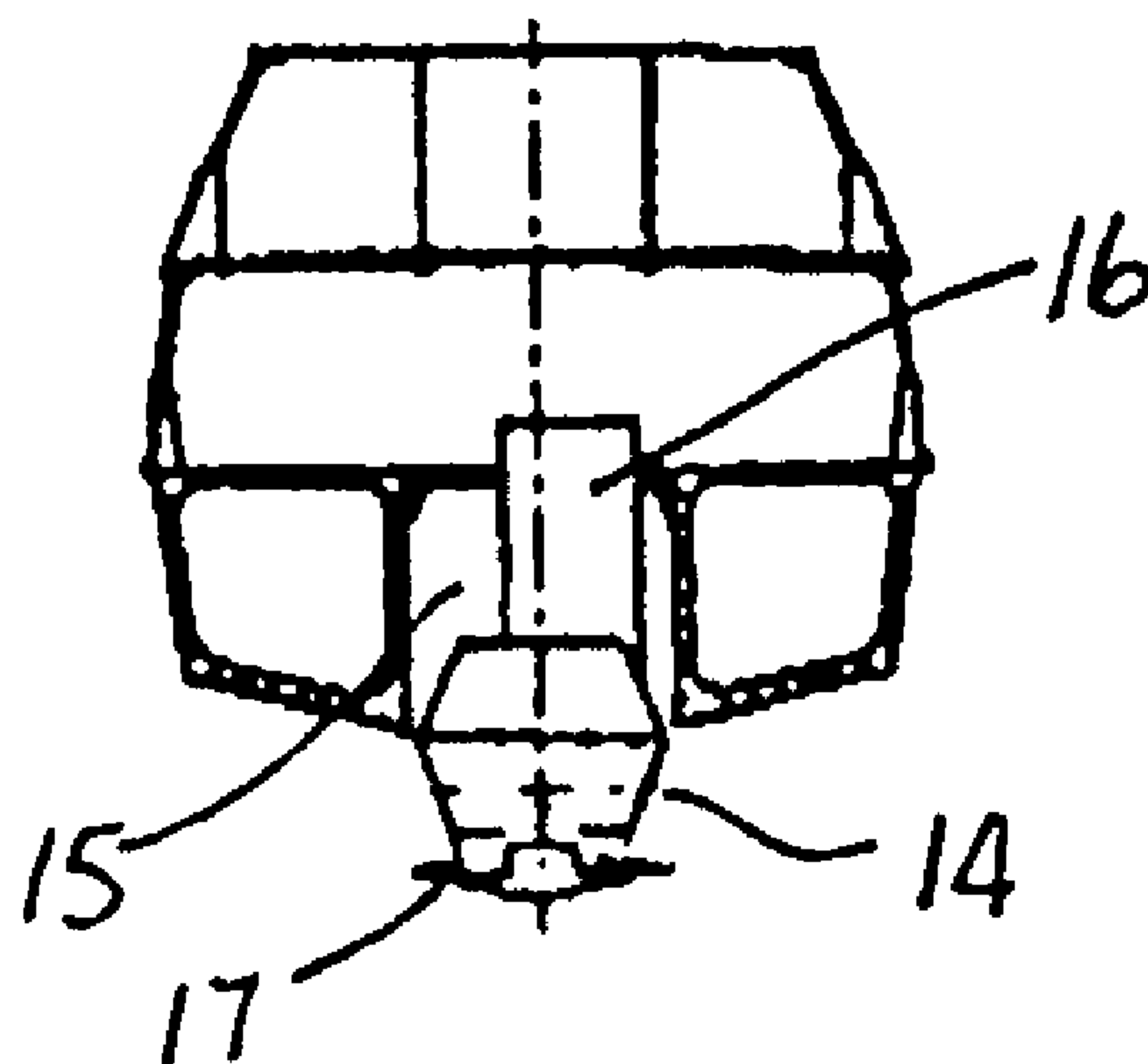




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(54) **BATEAU D'OBSERVATION SOUS-MARINE**  
(54) **UNDERWATER VIEWING VESSEL**



(57) La présente invention a trait à un bateau monocoque (10) pourvu d'une partie flottante (11) et d'une nacelle d'observation (14) déployable sélectivement et montée à l'intérieur de la partie flottante (11). La nacelle (14) passe à travers une ouverture (15) ménagée dans la coque (11) de la partie flottante jusqu'à une première position de déploiement au moins partiellement à l'extérieur de la coque (11), et une seconde position dans laquelle la nacelle d'observation (14) se trouve à l'intérieur de la coque (11) de la partie flottante. L'ouverture (15) est fermée de manière étanche lorsque la nacelle (14) se trouve dans la seconde position. La construction et la disposition de la nacelle (14) permettent l'observation sous-marine et l'accueil de passagers.

(57) A monohull watercraft (10) having a floating portion (11) and a selectively deployable viewing pod (14) positioned within the floating portion (11) and movable through an opening (15) in the hull (11) of the floating portion to a first deployed position at least part way outside the hull (11) and second position wherein the viewing pod (14) is within the hull (11) of the floating portion. The opening (15) is closed in a watertight fashion when the pod (14) is in the second position and the pod (14) is constructed to allow for underwater observation and is arranged to accommodate passengers.

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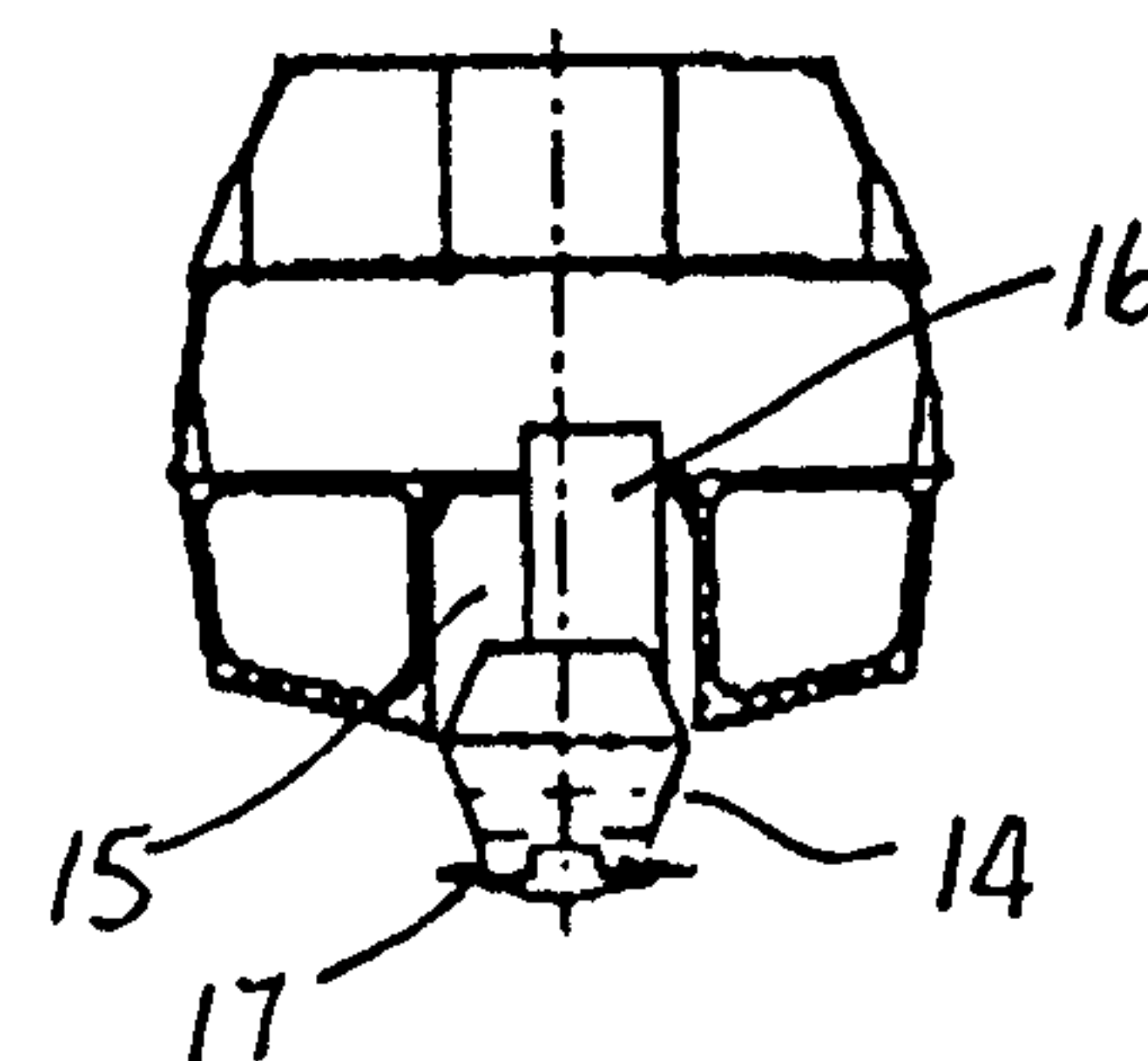
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(54) Title: UNDERWATER VIEWING VESSEL

## (57) Abstract

A monohull watercraft (10) having a floating portion (11) and a selectively deployable viewing pod (14) positioned within the floating portion (11) and movable through an opening (15) in the hull (11) of the floating portion to a first deployed position at least part way outside the hull (11) and second position wherein the viewing pod (14) is within the hull (11) of the floating portion. The opening (15) is closed in a watertight fashion when the pod (14) is in the second position and the pod (14) is constructed to allow for underwater observation and is arranged to accommodate passengers.



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## TITLE: UNDERWATER VIEWING VESSEL

## TECHNICAL FIELD

The present invention relates to a monohull watercraft which incorporates a  
5 submersible pod to enable underwater viewing.

## BACKGROUND ART

Various types of underwater viewing craft have been used in the past and several  
of these are discussed below.

Australian Patent No. 554,889 discloses a craft which has a lower underwater  
10 observation compartment which remains submerged when the craft is ballasted for  
normal operation. The craft suffers the disadvantage that it has a large displacement and,  
as a consequence, cannot travel at high speeds. This means that the craft cannot  
conveniently travel a large distance to a location where underwater observation is  
desired.

15 Australian Patent No. 569,919 discloses a submersible craft which includes three  
hulls which are interconnected by lever systems. One of the hulls is submersible with  
respect to the other two, with articulation of the lever systems, when the craft has  
reached a location at which an underwater observation is desired to be made. Thus,  
displacement related problems do not arise. However, a difficulty with the craft which is  
20 disclosed in Patent No. 569,919 is that passengers are at all times accommodated in the  
confined space of the submersible hull. There is no access between the main,  
submersible, hull and the interconnected secondary hulls and it is thought that this could  
give rise to problems if the craft were required to travel long distances.

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Australian Patent No. 644 152 discloses a twin hull craft with a submersible cabin movable between a raised and submersed position between the hulls. The submersible cabin has upward extension to enable access to and from the catamaran at all times.

Twin hull vessels when combined with central submersible cabin have been found  
5 less suitable for safe high speed transport and low speed manoeuvrability than monohull vessels. The present invention seeks to provide all the advantages of the system disclosed in Australian Patent No. 644, 152 with the advantages provided by a monohull design and certain additional benefits.

#### DISCLOSURE OF THE INVENTION

10 The present invention provides, in one aspect, a monohull watercraft having a floating portion and a selectively deployable viewing pod positioned within the floating portion and movable through an opening in a hull of the floating portion to a first deployed position at least part way outside the hull and second position wherein the viewing pod is within the hull of the floating portion, and means for sealingly closing  
15 said opening when the pod is in said second position, the pod being constructed to allow for underwater observation and being arranged to accommodate passengers.

Preferably, said viewing pod is provided with means which allow passenger access thereto from said floating portion both in said first and second positions. For preference, said means for sealingly closing said opening comprises a portion of said viewing pod  
20 which sealingly engages said opening in said second position.

Preferably, the craft is provided with forward, sideways and aft propulsion means. For preference, the vessel is provided with a precision satellite positioning system (GPS) and auto-pilot system, said systems being operable in conjunction with said propulsion

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means to enable to vessel to automatically maintain a selected position, independent of the need for anchoring or moorings

Typically, the watercraft is preferably a high-speed transit craft having a top speed of 25-35+ knots with the viewing pod only being deployed when the craft is travelling at  
5 low speeds of the order of 2 knots.

#### BRIEF DESCRIPTION OF DRAWINGS

The invention will be more fully understood from the following description of a preferred embodiment which is illustrated, by way of example only, in the accompanying drawings, in which:

10 Figure 1 is a side elevation view of a water craft according to one aspect of the invention;

Figure 2 is an end elevation view of the craft of Figure 1;

Figure 3 is a plan view of the craft of Figure 1;

Figure 4 is end sectional view taken on line 4-4 of Figure 1 with the viewing pod  
15 retracted;

Figure 5 is end sectional view taken on line 4-4 of Figure 1 with the viewing pod deployed;

Figure 6 is sectional plan view of the craft of Figure 4 taken on line 6-6;

Figure 7 is sectional plan view of the craft of Figure 4 taken on line 7-7;

20 Figure 8 is a isometric view of the stairway arrangement for access to the viewing pod from the floating portion of the craft;

Figure 9 is an enlarged sectional view of the sealing arrangement between the viewing pod and the hull of the floating portion of the craft of Figure 1; and

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Figure 10 is an enlarged sectional view showing the hydraulic rams used for raising and lowering the viewing pod.

#### MODES FOR CARRYING OUT THE INVENTION

The vessel 10 is fairly conventional in nature having a monohull 11 and upper  
5 deck 12 and lower deck 13. The monohull underwater viewer vessel 10, best and most safely, combines the requirements for a high speed marine passenger transport vessel (typically 25-35 knots) with the requirement for underwater viewing at slow speeds (typically 1-3 knots). The means by which this is accomplished, in the preferred embodiment of the invention, is by way of an hydraulically driven retractable viewing  
10 pod or cabin 14, best constructed as depicted in Figures 4 and 5 of the accompanying drawings.

The cabin or pod 14 sits generally in the middle of the vessel's hull 11 and is raised and lowered within a cavity 15 in the hull 11. The pod 14 has a stairway arrangement 16 projecting upwardly to allow passenger access in both the raised and  
15 lowered positions. The lower part of the pod has a pair of wings 17 extending outwardly around the periphery of the base of the pod 14 which serve to close off the cavity 15 within the hull 11 when the pod 14 is raised to its retracted position as shown in Figure 4. A seal arrangement, which will be described later, seals the cavity 15 when the pod 14 is in a retracted position and wings 17 serve to provide a smooth, continuous, planing  
20 hull bottom and to protect the internal seals.

The viewing pod 14 needs no additional ballast, in the preferred embodiment, and is vertically pushed and pulled through approximately 1.5 metre distance by four

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hydraulically actuated rams 18 as shown in Figure. 10. The positive buoyancy of the pod 14 allows it to retract quickly and safely in case of system failure.

In the fully retracted and locked position, the vessel 10 is a conventional hard chine planing craft with speed determined by size of engines chosen for propulsion to  
5 overcome hull drag in seaway conditions.

In the fully extended and locked down position, the vessel 10 becomes a semi-submersible underwater viewer with a capacity to enable passengers, from above, to access the viewer seating areas, via two stairwells 20, 21 that are open to the above water deck area 13, as best shown in Figure 8. These stairwells 20, 21 (fore and aft) can be  
10 accessed in both the raised and the lowered positions, and in a preferred form, via safety doors 22, 23 that preclude access in any other position, to protect passengers during their movement between hull/deck 13 and viewer pod 14. In order to provide access in both raised and lowered positions, a pair of doors 22, 23 are provided at each forward and aft stairwell 20, 21. One door of the pair 23 being located at a higher level and being used  
15 when the pod 14 is in the lowered position and vice versa with door 22.

Typically, the viewer pod 14 would accommodate 25% of the maximum total passenger complement at any one time and passengers can move between floating hull and viewer pod/cabin 14 at any time in the extended viewer position, via central walkways 24 alongside the seated passengers (see Figures 6 and 7).

20 The hydraulically actuated viewer pod lift and lower system as shown in Figure 10, is driven via a ringmain which has backup emergency pumping capacity, should it be required, off an independent electrical auxiliary power source.

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The seal arrangement between the hull 11 and viewer pod 14 is shown in Figure 9. The seal arrangement comprise a moulded neoprene™ (or similar material) seal 25 mounted on in the inner wall 26 of the cavity 15 and extending around the periphery of the cavity 15. An upper internal surface 27 of the wings 17 bears against the seal 25 when the pod 14 is raised and locked. The retracted viewer pod 14 desirably effects a good seal against hull bottom 28 to minimise drag and to allow for the evacuation of entrapped water in the hull cavity 15 containing the pod when locked against the seal 25. The weight of this entrapped water is detrimental to the objective of high speed planing during transit mode and is removed quickly by venturies and ballast water pumps (not shown). The novel and protected seal 25 is designed to minimise water wear at high planing speeds and to effect an adequate water seal, as best shown in Figure 5. By adequate we mean water escape exceeds water ingress so emptying cavity.

The extended viewer pod or cabin 14 is buoyant and in one form needs to be counterbalanced by taking on board ballast water to allow vessel to maintain trim, stability and waterline level. The ballast water is typically pumped into tanks 29 prior to or as the viewer pod 14 is extended downwards. Ballast tanks 29 are always filled with the pod 14 down as a necessary safety requirement.

The operational safety requirements of this vessel are more demanding than conventional fast passenger ferries when the pod is extended, to the extent that the vessel is required to manoeuvre in very close proximity to coral reefs, to maximise viewing opportunity of the passengers, while not contacting these reefs in a way that might cause damage to either the vessel or the fragile reefs. For this reason the following safety features have been incorporated in the vessel.

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- i) A full width bridge deck with 3 control situations - one central and one either side, to facilitate bridge command viewing of adjacent reef as vessel loiters alongside at 1-3 knots speed.
  - ii) A bow thruster, which will allow steerage at these low speeds in strong  
5 currents, and high winds.
  - iii) Underwater video viewing from pod forward window, to permit bridge command to more effectively see obstacles the pod may encounter. This video also relays a view to passengers in deck lounge.
  - iv) A depth sounder with forward ranging sensor, to alert bridge of shallow  
10 water and approaching bomboras.
  - v) Digital Global Positioning System technology in conjunction with accurate satellite images of target reefs, to permit precise electronic navigation on a repeat basis on plotter/screen.
  - vi) The vessel can also be provided with automatic control of position which  
15 enables the vessel to automatically "maintain/hold station" via the digital global positioning system, auto pilot, water jets and bow thruster. This configuration enables passengers to safely participate in in-water activities (swimming/snorkelling) as well as dry viewing in the pod without the need for environmentally damaging reef anchoring or mooring of the vessel.
- 20 Normal marine safety concerns are addressed by design to appropriate class and survey requirements. Additional to the normal hull structural requirements of a fast ferry operating in a hostile offshore marine environment with normal static and dynamic loadings; this vessel has additional structural integrity built into it to accommodate the

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pendulum effect of the extended and loaded viewing pod when vessel is underway in seaway conditions that involve heel ( $\pm 30^\circ$ ) and pitch (3 metre seas) together with effects of vessel acceleration. Differing sea conditions require differing structural specification, however, the preferred embodiment is designed to meet the conditions  
5 prevailing around many of the worlds offshore coral reefs, that are located within a 1-2 hour high speed transit from shoreline or passenger cruiser liner.

Typically this high speed transit capability will permit a commercial operator to quickly and conveniently take passengers to offshore underwater viewing locations such as coral reefs. Once at such a location the craft deploys the viewing pod while it loiters  
10 in close proximity to the reef. Passengers access the viewing pod, seat themselves, and see the underwater panorama.

Additionally, in the automatic position holding mode passengers may use the after dive platform of the vessel for in-water sports.

The combination of experiences that the vessel according to the present invention  
15 provides passengers is traditionally provided by a combination of three vessels and with considerably higher capital and operating costs, plus significant environmental hazards, attributable to hurricane/cyclones in the case of the permanently anchored reef pontoons and conventional slow moving underwater viewers breaking away and causing damage to the delicate reef structures.

20 The vessel can therefore provide passengers a superior underwater viewing experience in a shorter time, with a minimum of transfers, at a lower cost, with greater viewing site flexibility and with reduced risk of reef damage. These attributes are important to viable, sustainable, tourism operations in the marine parks of the world.

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The present invention seeks to provide, at least in its preferred embodiments, a monohull watercraft combining high speed passenger transit to offshore reefs, with a capability of slow speed navigation of these reefs with an underwater viewing chamber projected from the monohull so as to effect minimal environmental impact on delicate coral reef structures and provide a more environmentally sustainable reef viewing technology.

It will be appreciated that further embodiments and exemplification of the invention are possible without departing from the spirit or scope of the invention described.

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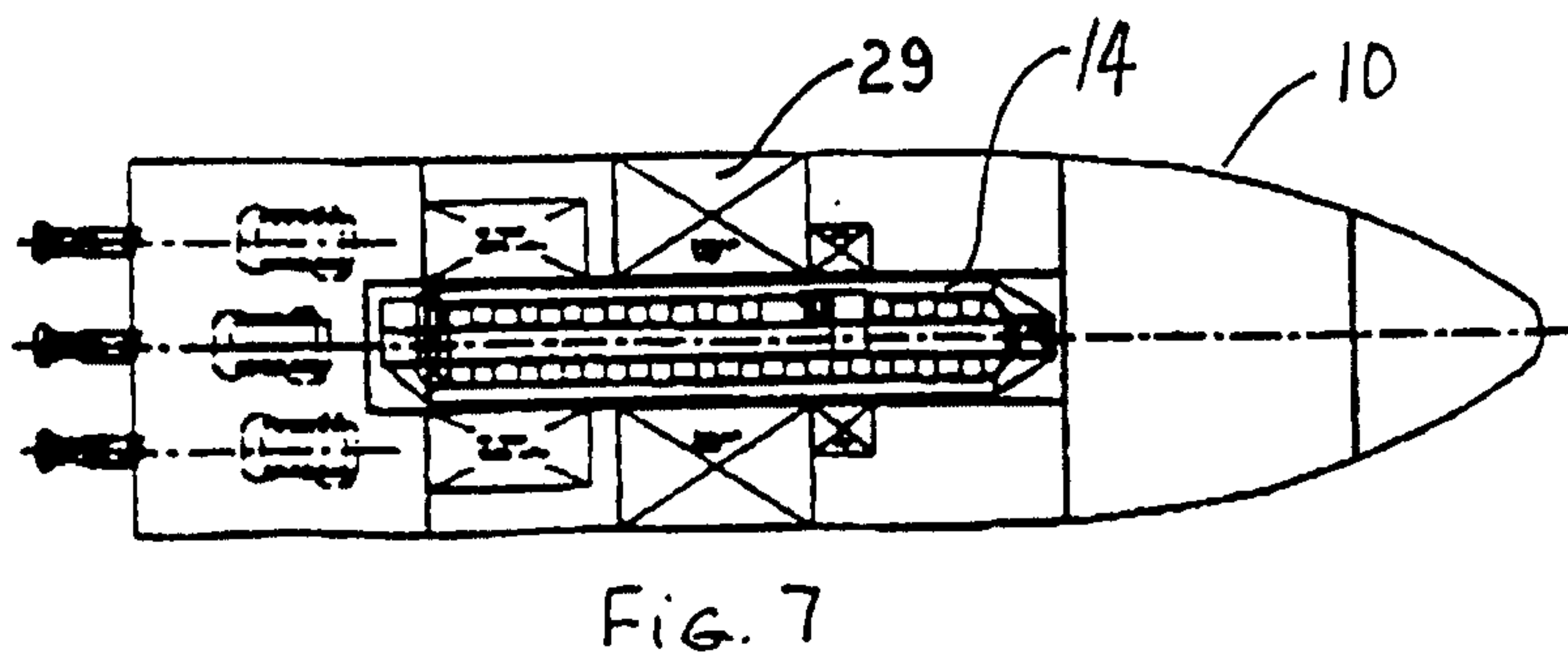
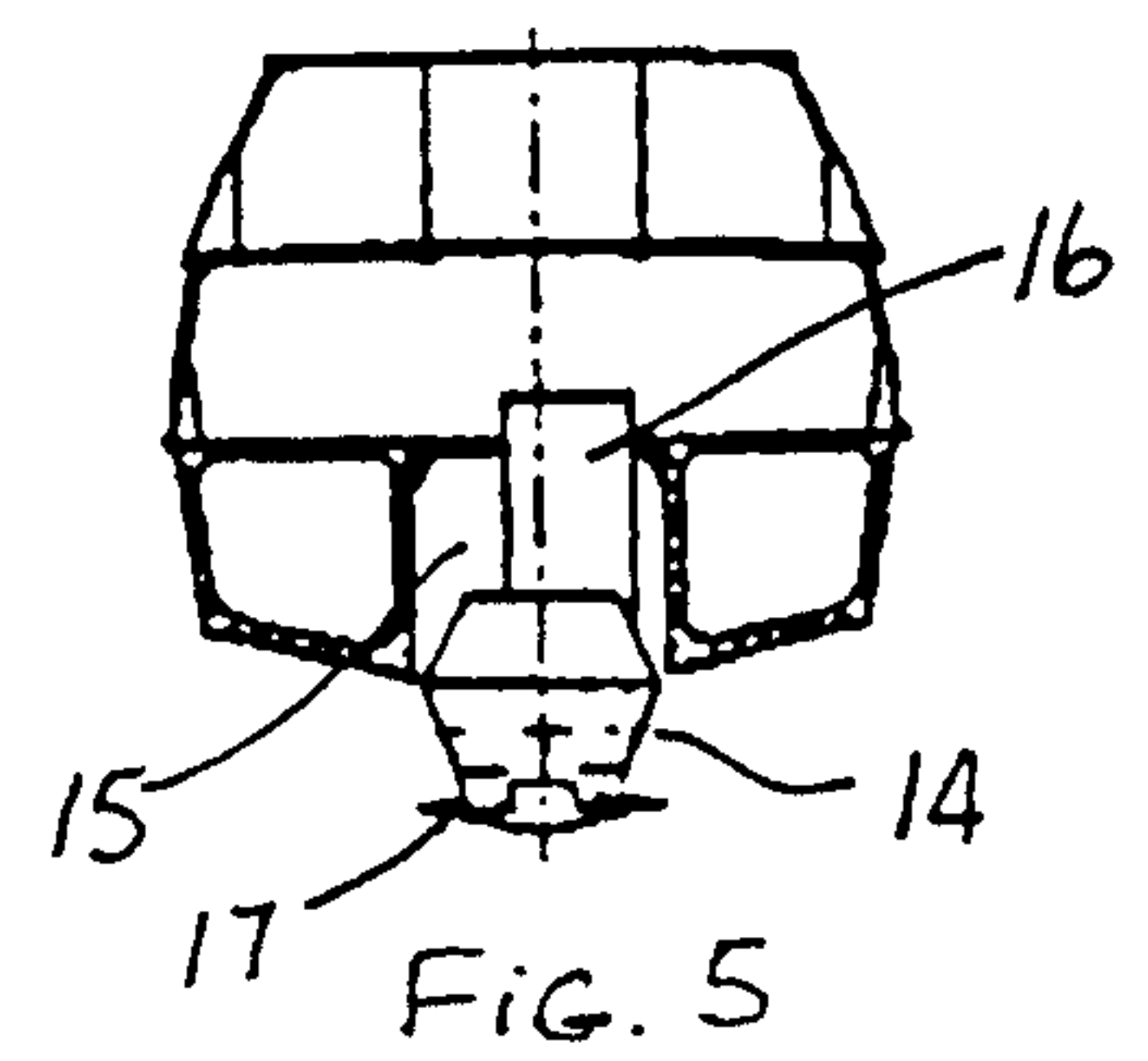
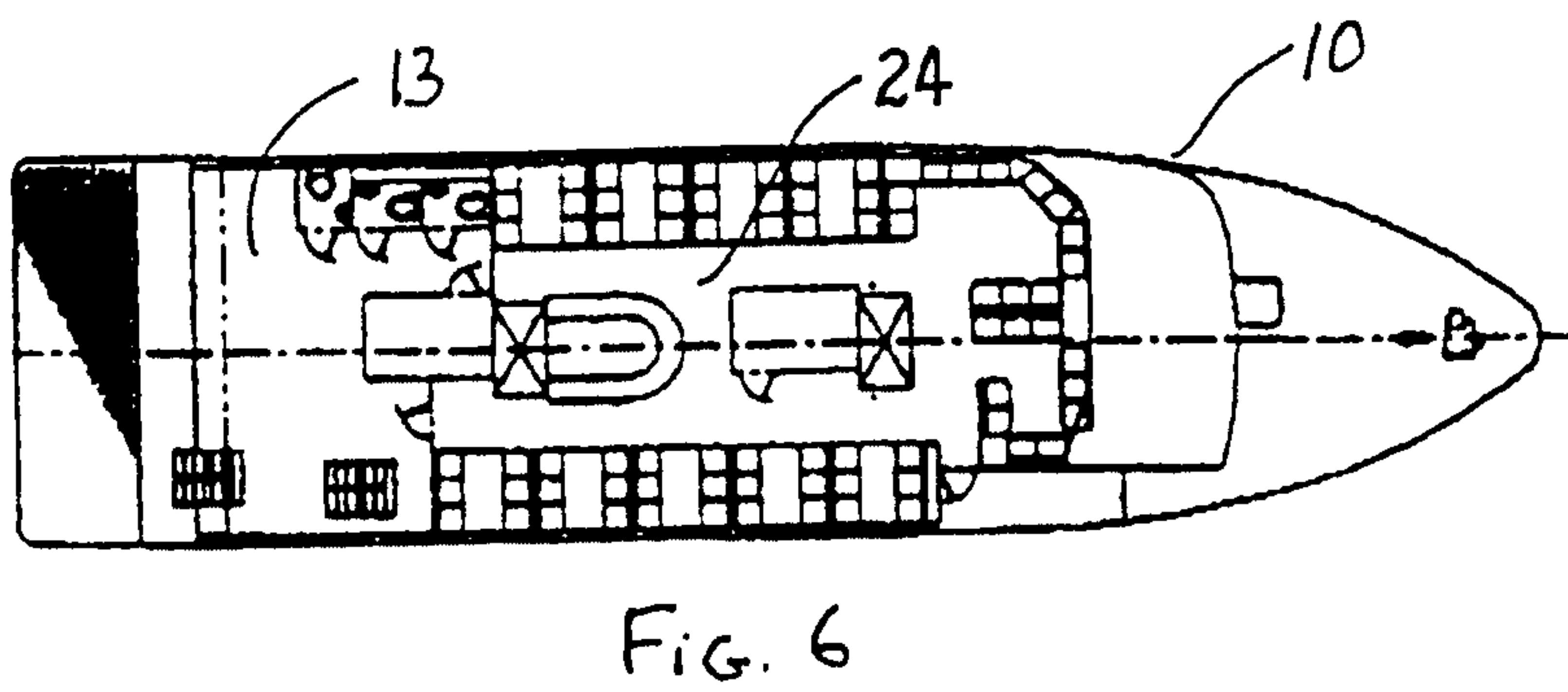
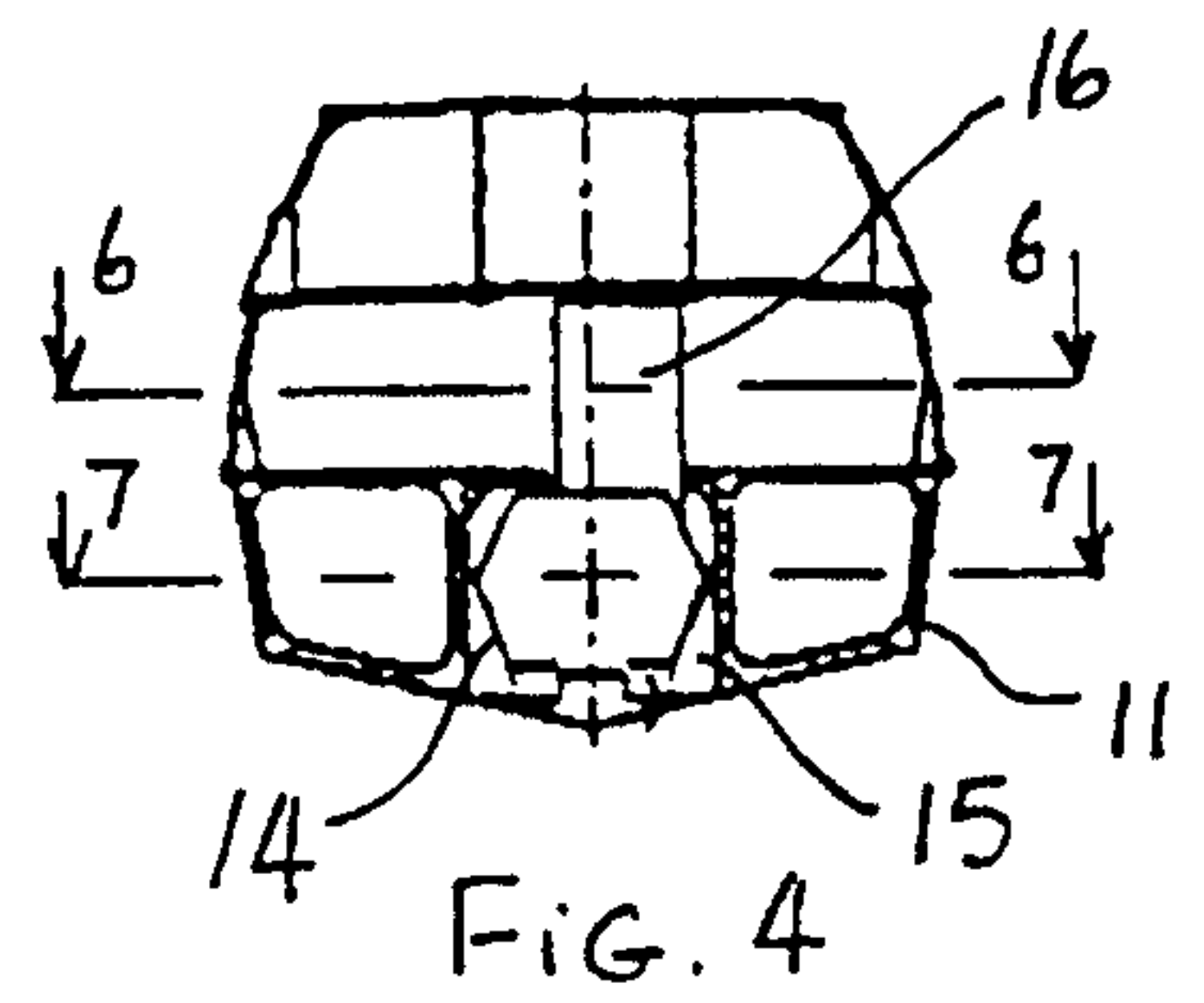
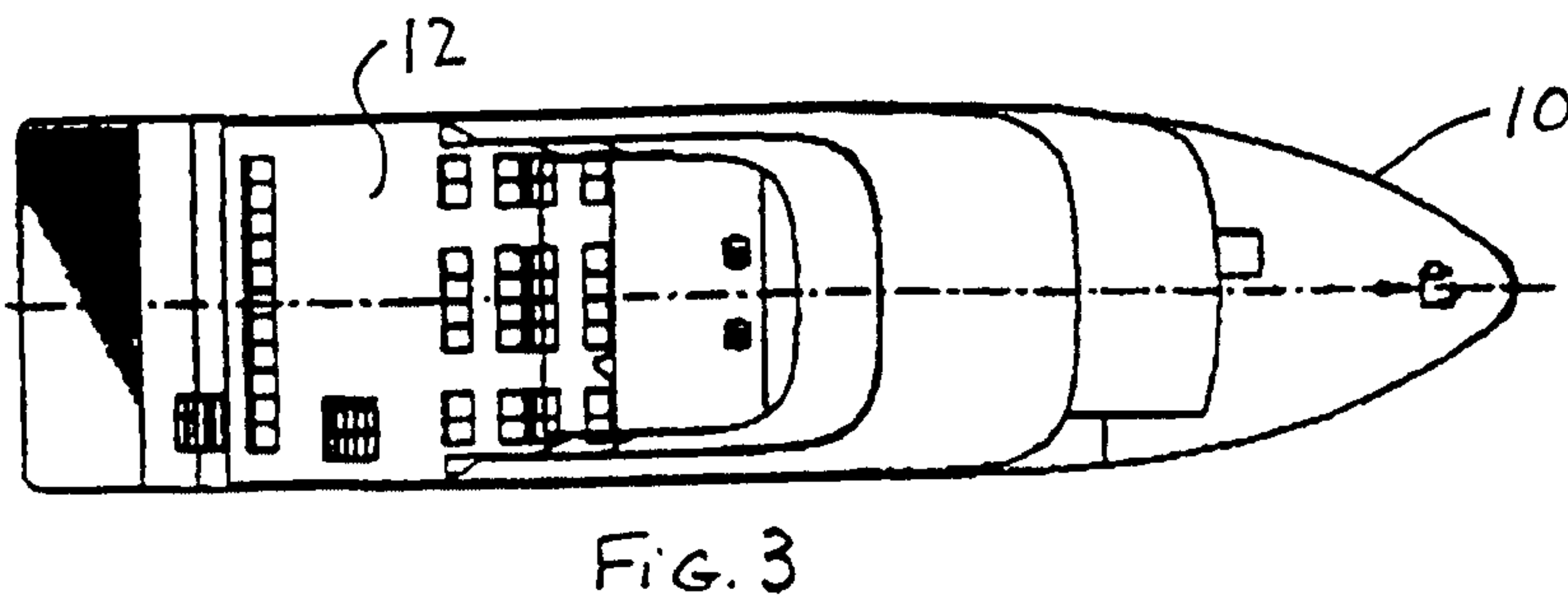
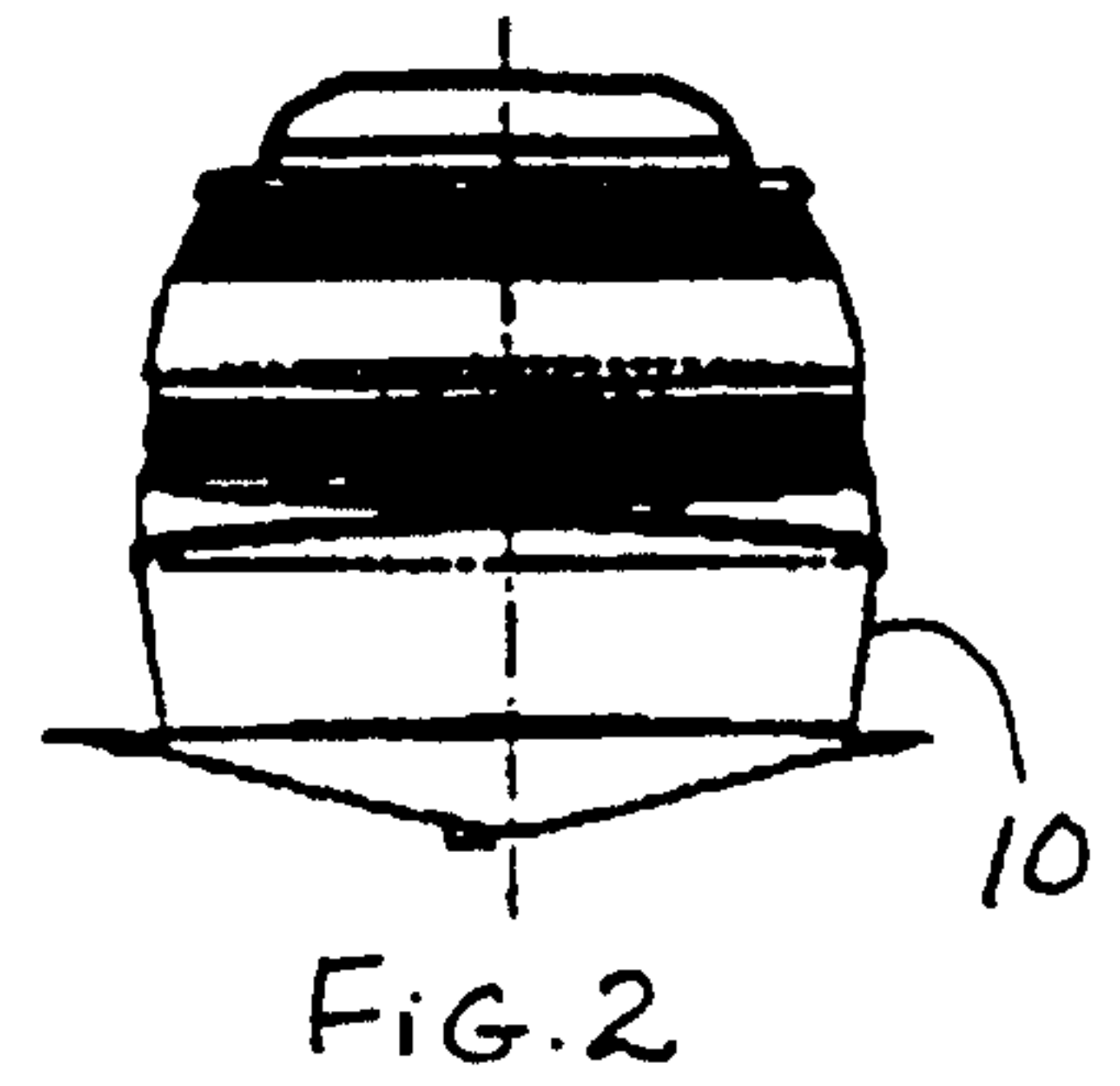
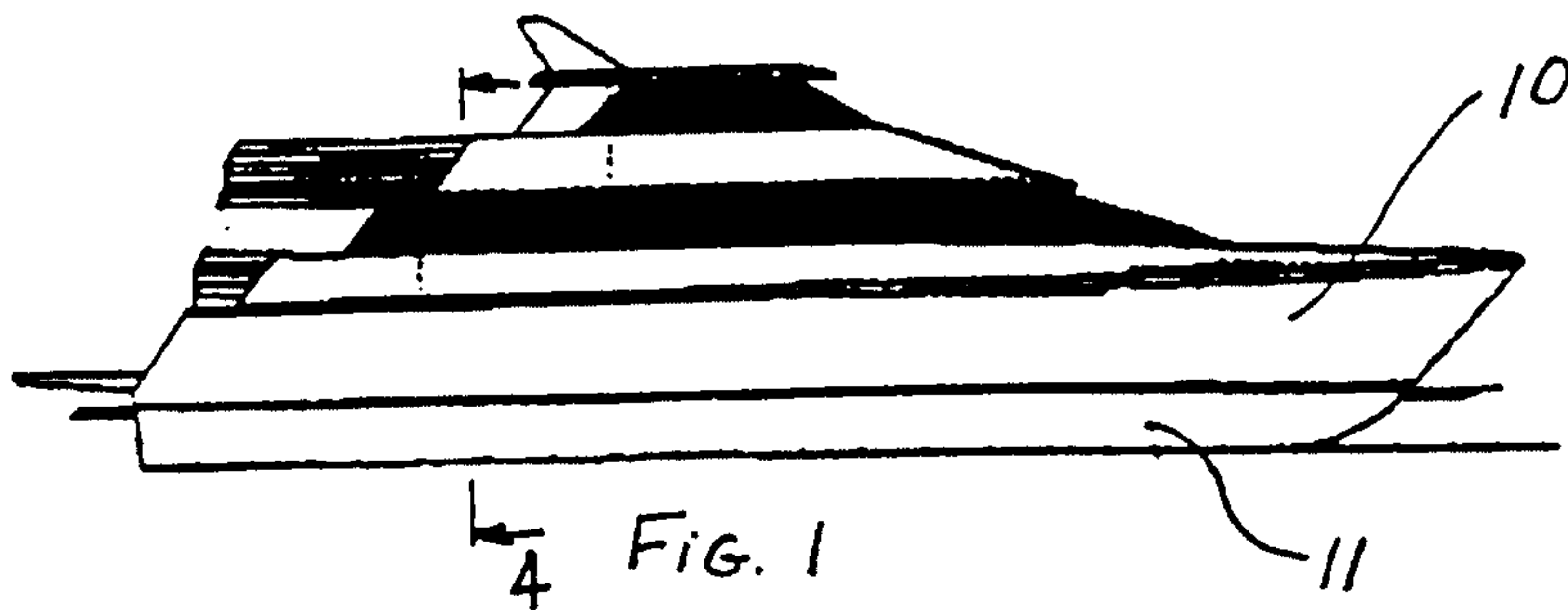
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**CLAIMS:-**

1. A monohull watercraft having a floating portion and a selectively deployable viewing pod positioned within the floating portion and movable through an opening in a hull of the floating portion to a first deployed position at least part way outside the hull  
5 and second position wherein the viewing pod is within the hull of the floating portion, and means for sealingly closing said opening when the pod is in said second position, the pod being constructed to allow for underwater observation and being arranged to accommodate passengers.
2. A monohull watercraft according to claim 1 wherein said viewing pod is provided  
10 with means which allow passenger access thereto from said floating portion both in said first and second positions.
3. A monohull watercraft according to claim 1 wherein said means for sealingly closing said opening comprises a portion of said viewing pod which sealingly engages said opening in said second position.
- 15 4. A monohull watercraft according to claim 1 wherein the craft is provided with forward, sideways and aft propulsion means.
5. A monohull watercraft according to claim 4 wherein the vessel is provided with a precision satellite positioning system (DGPS) and auto-pilot system, said systems being operable in conjunction with said propulsion means to enable to vessel to automatically  
20 maintain a selected position.

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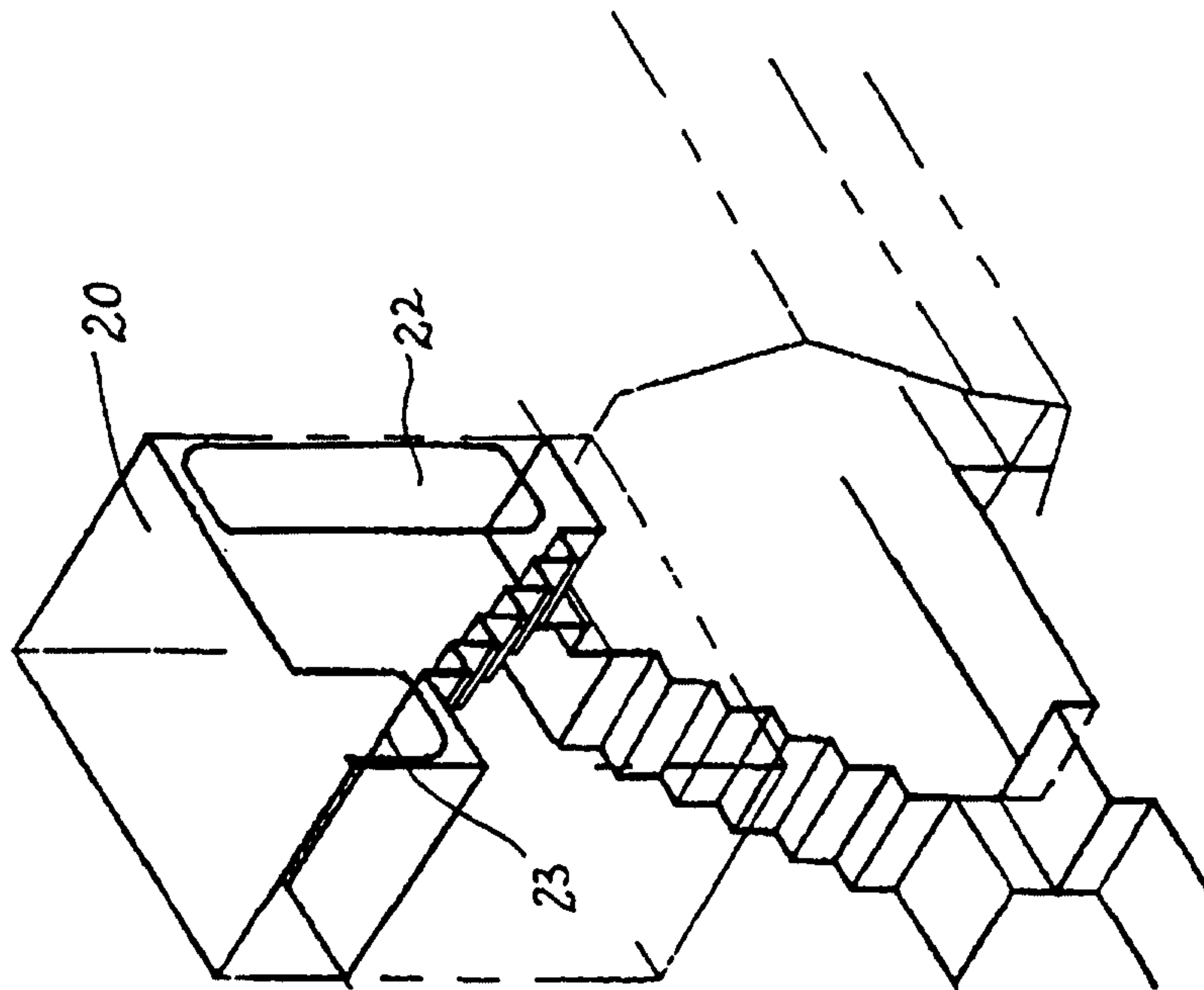
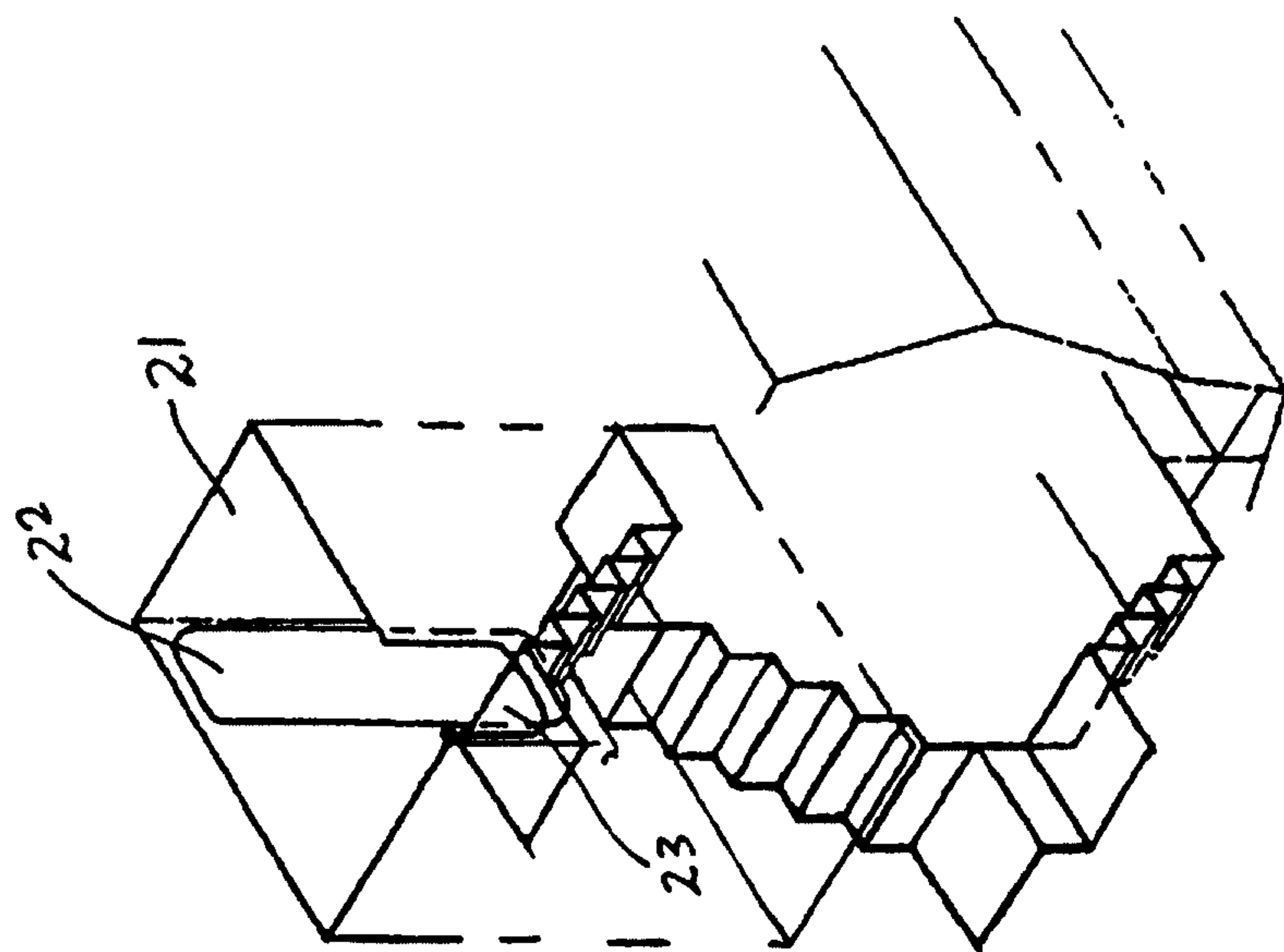
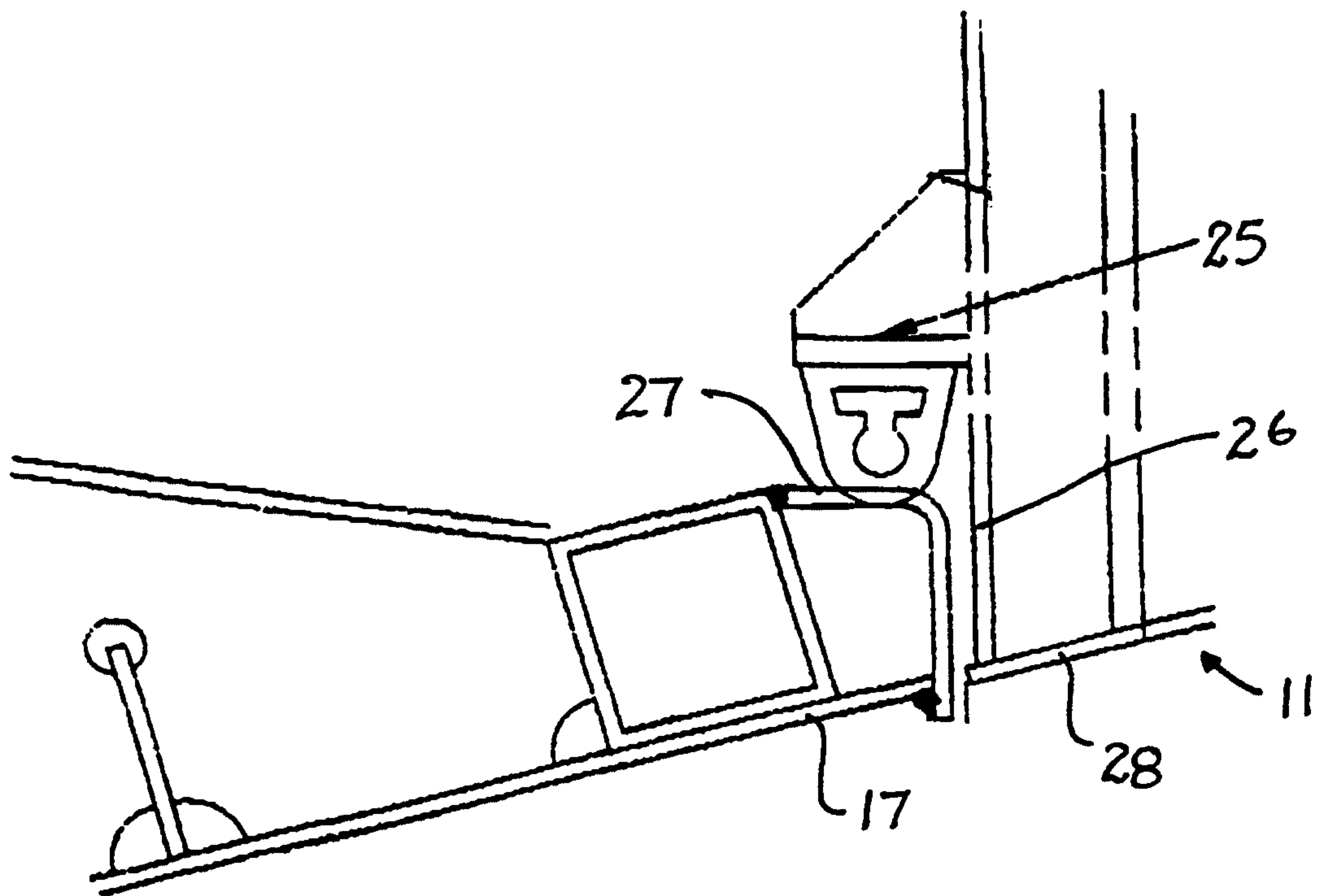


Fig. 8



FWD & AFT STAIRWAYS

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Fig. 9

4/4

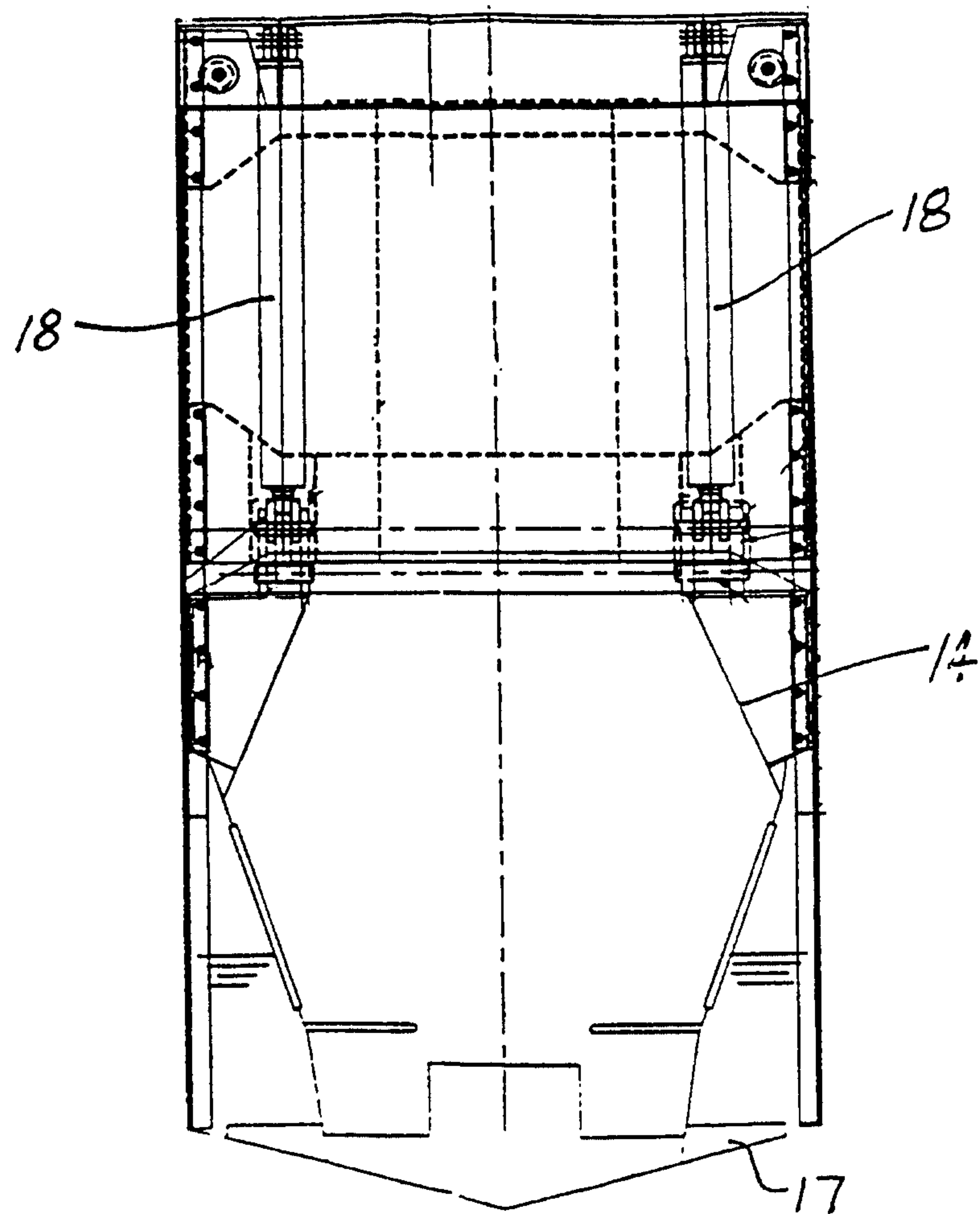


Fig. 10