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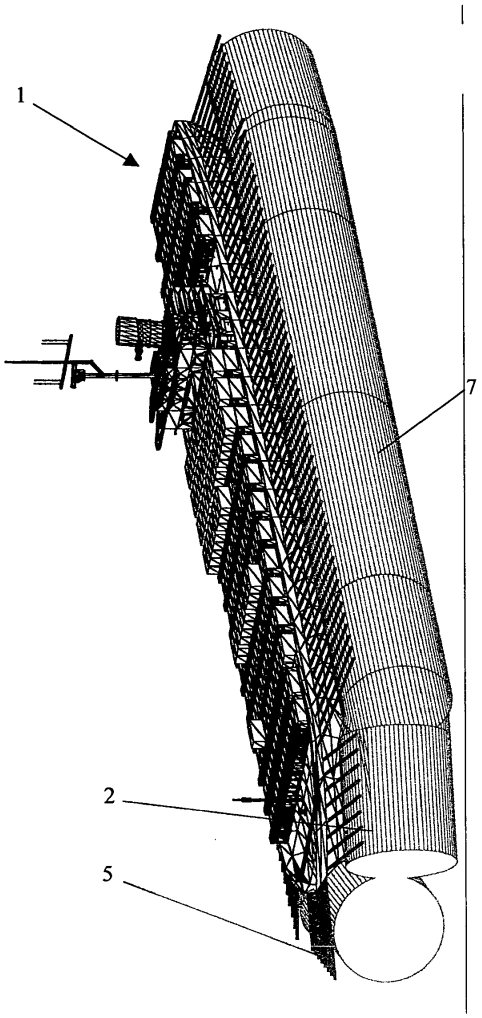
(54) Antisinking system for large-sized vessels

(57) The present invention relates to a system capable of rendering a large-sized vessel (1) unsinkable, to the use of the system for preventing a large-sized vessel (1) from sinking and to a large-sized vessel (1) comprising such a system.

Fig. 4



EP 2 330 028 A1

Description

Field of the invention

[0001] The present invention relates to a system capable of rendering a large-sized vessel unsinkable, to the use of the system for preventing a large-sized vessel from sinking and to a large-sized vessel comprising such a system.

Technological background

[0002] Archimedes' principle states that the net upward or buoyancy force exerted on a body is equal to the magnitude of the weight of fluid displaced by said body. This principle is widely applied in the construction of vessels, where a waterproof construction is used to enclose an air filled chamber or hull, i.e. the vessel floats at a depth such that the weight of water displaced balances the weight of the vessel enabling the object to float.

[0003] When vessels floating in water suffer damage to their hull for example by collision with an iceberg, torpedoes, sea mines, other vessels, by running aground etc., water may enter the hull or chamber and replaces the air. The thus added weight of water eventually causes the vessel to weigh more than its volume of water, and in accordance with the Archimedes' principle sinking of the vessel results.

[0004] In the art, several attempts have been made to provide devices or system for preventing vessels from sinking, e.g. by devices which inflate automatically or manually to provide additional buoyancy in the event of a water leakage into the vessel. For example, US 4,817,555 discloses a boat containing a canister of compressed air which is automatically actuated by the rising of a float inside the boat. Upon opening of the canister, longitudinal bags along the top of the hull outside the boat are inflated to keep the boat afloat. US 3,121,888 discloses a protected inflatable member present along the top of the outside surface of the hull. When needed, this inflatable member is filled with gas from a pressurized air cylinder in order to provide a buoyant bag along the top of the boat to keep the boat afloat. DE 41 14 356 A1 relates to a floating body such as a boat, platform etc., which has a hollow chamber providing the necessary buoyancy. DE 199 64 185 A1 describes an air bag for a ship which reduces the risk of sinking and comprises elastic and fireproof or fire-resistant materials. It can be filled with gas to reduce the specific weight of the ship to the point that the risk of sinking is considerably lessened. JP 7117791 A relates to a ship having a means to prevent a violent inclination or sinking of the hull. JP 62131897 A describes a device to prevent the sinking of a small-sized vessel. US 1,375,055 relates to the utilization of a series of inflatable bags at each side of the vessel or ship, which under normal conditions are deflated and stowed in compact form along the outboard rail of the ship's side. CA 281 341 A relates to a device comprising pontoons attached to a ship and a means of lowering the said pontoons during rough weather or a heavy sea so as to prevent the sinking or capsizing of the ship.

[0005] Basic formulas for the calculation of the respective statics can be gathered, for example, from Gdoutos et al., Mechanics of solids, National Technical University of Xanthi, 1st Edition, Xanthi, 1981, pages 557 and 769; Nitsiotas et al., Static of Constructions, National Technical University of Thessalonikh, 1st Edition, Thessalonikh, 1977, page 456; Galousis et al., Calculations of Structural Elements made of Steel, National Technical University of Xanthi, 2nd Edition, Xanthi, 1985, pages 308 and 313; Kalevras et al., Lessons of Armed concrete, National Technical University of Xanthi, 2nd Edition, Xanthi, 1979, pages 450 and 500.

Summary of the invention

[0006] There is a need in the art for systems capable of rendering large-sized vessels unsinkable and which are easy to use and inexpensive in their application and which provide large-sized vessels with a higher safety standard.

[0007] The invention provides a system for a large-sized vessel, a use and a vessel according to the independent claims. Advantageous embodiments of the inventive system are defined in the corresponding sub-claims.

[0008] According to one aspect of the present invention a system capable of rendering a ship, preferably a large-sized vessel, unsinkable has been developed, wherein the system comprises:

a) an inflatable air sack,
b) an air sack chamber housing for holding the inflatable air sack in an uninflated condition and which is adapted to be opened for allowing the inflatable air sack to expand upon inflation,
c) an air compressor adapted to feed air in the inflatable air sack for expanding the inflatable air sack,
d) bars comprising concrete, and
e) bar chamber housings for holding the bars inside the large-sized vessel and adapted to be opened and thereby moving the bars outward of the large-sized vessel into a position capable of suppressing a floating-up of the inflatable air sack in the inflated condition.

[0009] According to another aspect, the present invention refers to the use of said system for preventing large-sized vessels from sinking, in particular large-sized vessels selected from passenger ships, cruise liner, cargo ships, passenger cargo ships, container ships, tankships, towboats, warships, frigates or aircraft-carriers. According to another aspect of the present invention, a large-sized vessel is provided, wherein said large-sized vessel comprises the inventive system.

[0010] According to another embodiment of the inventive system, the air sack chamber housing is positioned on the starboard, port side and/or stem side of the large-sized vessel.

[0011] According to another embodiment of the inventive system, the the air sack chamber housing is positioned on a side of the large-sized vessel.

[0012] According to another embodiment of the inventive system, the air sack chamber housing is positioned inside the large-sized vessel.

[0013] According to another embodiment of the inventive system, the inflatable air sack in the inflated condition is positioned at the starboard and/or the port side of the large-sized vessel.

[0014] According to another embodiment of the inventive system, the bar chamber housings are positioned inside the large-sized vessel.

[0015] According to another embodiment of the inventive system, the bar chamber housings are positioned relative to the air sack such that the bars in the moved out position are above the inflatable air sack in the inflated condition.

[0016] According to another embodiment of the inventive system, the bars in the moved out position are provided all around the large-sized vessel.

[0017] According to another preferred embodiment of the inventive system, the bars in the moved out position are in a horizontal position.

[0018] According to another embodiment of the inventive system, the bars in the moved out position are secured in a fixture provided in the bar chamber housings.

[0019] According to another embodiment of the inventive system, the bars further comprise steel.

[0020] According to another embodiment of the inventive system, the steel is in the form of flakes, chippings, wires, wire mesh, nettings, tubes and/or pipes.

[0021] According to another preferred embodiment of the inventive system, the system further comprises:

a control unit 601 for detecting a state of emergency and for automatically triggering at least one of:

a) opening the air sack chamber housing,
b) inflating the inflatable air sack,
c) opening the bar chamber housings, and
d) moving the bars outward of the large-sized vessel.

[0022] The system according to the present invention may thus provide more safety for large-sized vessels in the event the vessel's hull suffered a damage for example by a collision with an iceberg, torpedoes, sea mines, other vessels, by running aground etc. which ensures the vessel's safe arrival to the next harbor. Furthermore, the loss of equipment and loading of the vessel may be considerably increased, and loss of passenger's and crew's life may be prevented. Additionally, the system of the present invention may be used in a simple way, highly cost-saving and retrofittable to existing vessels. Furthermore, the system of the present invention may be used without delimiting the space for passengers and/or loadings on the vessel.

Brief description of the drawings

[0023] Below, for further explanation and for improved understanding of the present invention, exemplary embodiments are described in more detail with reference to the enclosed drawings.

Fig. 1 shows a diagrammatic top view of bar chamber housings 6 for holding the bars 5 inside a large-sized vessel 1 and an air compressor 4 adapted to feed air in the inflatable air sack 2;

Fig. 2 shows a diagrammatic side view of an air sack chamber housing 3 for holding the inflatable air sack 2 in an uninflated condition;

Fig. 3 and Fig. 4 show a diagrammatic side view of an inflatable air sack 2 in the inflated condition 7 and bars comprising concrete 5 in the moved out position;

Fig. 5 shows a diagrammatic top view of bar chamber housings 6 for holding the bars comprising concrete inside a large-sized vessel 1, an inflatable air sack 2 in the inflated condition 7 and bars comprising

concrete 5 in the moved out position.

Fig. 6 shows a control unit 601 with sensors 602, 603, 604 and actuators 605, 606, 607, 608 according to an exemplary embodiment of the invention.

[0024] Similar or identical components in different figures are provided with the same reference signs. The illustrations in the figures are diagrammatic and not to scale.

Detailed description of exemplary embodiments

[0025] The present invention is directed to a system for use within a ship, preferably a large-sized vessel 1, capable of preventing said vessel from sinking after the hull suffered a damage for example by collision with an iceberg, torpedoes, sea mines, other vessels, by running aground etc. thereto.

[0026] A system used for small-sized vessels can typically not be transferred to large-sized vessels where size and weight are considerably higher and thus in the event the hull of a large-sized vessel suffered a damage, its weight would for example burst used airbags resulting in sinking of said vessel. Thus, in the present invention, the parts of the system comprise an inflatable air sack 2, an air sack chamber housing 3 for holding the inflatable air sack 2 in an uninflated condition, an air compressor 4, bars comprising concrete 5 and bar chamber housings 6 for holding the bars inside the large-sized vessel.

[0027] The inventive system is preferably capable of rendering large-sized vessels 1 unsinkable. A large-sized vessel 1 in the meaning of the present invention defines a vessel having a gross tonnage (GT) of more than 75.000, preferably of more than 100.000, more preferably of more than 125.000, and most preferably of more than 150.000. In this respect, it is to be noted that the term "gross tonnage" refers to a unitless index related to a vessel's overall internal volume as defined by *The International Convention on Tonnage Measurement of Ships,* and adopted by the International Maritime Organization. In particular, the term "large-sized vessel" 1 in the meaning of the present invention refers to a vessel selected from the group consisting of passenger ships, cruise liner, cargo ships, passenger cargo ships, container ships, tank ships, towboats, warships, frigates or aircraft-carriers.

[0028] The inflatable air sack 2 provided in the present invention is a large airbag made of a tear- and puncture-resistant material. A wide variety of materials can be used to prepare the inflatable air sack, for example, materials made of metal foil such as aluminum foil, multi-ply rubber, canvas and aromatic polyamides (para-aramide) such as KEVLAR® and TWARON®, available from DuPont or Teijin, noted for its strength and ability to resist punctures. However, it is to be noted that any material may be used for the inflatable air sack 2 which is capable of withstanding the high forces exerted on the inflatable air sack 2 if said air sack is in the inflated condition 7. Thus, depending on the material used, the inflatable air sack 2 may have one layer or may have multiple layers.

[0029] Furthermore, the inflatable air sack 2 may consist of only one compartment or may be provided in the form of an inflatable air sack 2 having a plurality of compartments. In one preferred embodiment, an inflatable air sack 1 is provided having a plurality of compartments. A "plurality of compartments" in the meaning of the present invention refers to an inflatable air sack 2 which is subdivided into several compartments of the same size or, optionally, of different sizes. In this regard, the inflatable air sack 2 having a plurality of compartments can be subdivided by dividers which are preferably made of the material as used for the inflatable air sack 2. In an optional embodiment, the material of the dividers differs from the material as used for the inflatable air sack 2. Furthermore, the plurality of compartments can be preferably adapted in that said compartments are independent from each other so that a failure of, for example, one compartment does not result in the failure of the entire inflatable air sack 2.

[0030] Additionally or alternatively, the inflatable air sack 2 consists of one inflatable air sack or more. In the case where one inflatable air sack 2 is provided, the air sack in the inflated condition 7 is preferably provided all around the large-sized vessel 1. In case more than one inflatable air sack 2 is provided, the inflatable air sacks 2 are adapted such that sufficient buoyancy is provided in the event of a leakage caused by a damage of the hull. In one preferred embodiment, the inflatable air sack 2 consists of two inflatable air sacks. In this embodiment, the inflatable air sacks 2 in the inflated condition 7 are positioned at the starboard and the port side of the large-sized vessel 1.

[0031] In any case, the inflatable air sack 2 is adapted to be inflated from an outside source with air for expanding the inflatable air sack 2. Thus, in the event the large-sized vessel 1 suffered a damage in the hull, the inflatable air sack 2 can be filled with air by connecting an air compressor 4 and feeding air in the inflatable air sack 2 for expanding the inflatable air sack and to add buoyancy to the large-sized vessel 1. Such air compressor 4 can be any conventional air compressor known to the skilled person and thus they need not to be further detailed. Additionally or alternatively, the inflatable air sack 2 may be inflated and expanded by using the exhaust gases from the large-sized vessel's engine.

[0032] The inflatable air sack 2 in the uninflated condition is stored in an air sack chamber housing 3 for holding the inflatable air sack 2 in an uninflated condition and which is adapted to be opened for allowing the inflatable air sack 2 to expand upon inflation. Said air sack chamber housing 2 is positioned on the starboard, port side and/or stem side of

the large-sized vessel 1. In one preferred embodiment, the air sack chamber housing 3 is positioned on the stem side of the large-sized vessel 1. In the case where the air sack chamber housing 3 is positioned on the stem side of the large-sized vessel 1, the air sack chamber housing 3 is, for example, positioned near the drive screw or even above the drive screw of the large-sized vessel 1.

[0033] Additionally or alternatively, the air sack chamber housing 3 is positioned on the starboard and/or the port side of the large-sized vessel 1. In this case, the air sack chamber housing 3 is positioned on a side of the large-sized vessel 1, i.e. the air sack chamber housing 3 is positioned underneath the railing of the large-sized vessel 1 but above the usual sea level. It is to be noted that such position is defined for the intact form of the large-sized vessel 1. In this regard, it is further to be noted that the air sack chamber housing 3 is not positioned on the deck of the large-sized vessel 1 in order to provide more space for passengers and loadings on the deck of said vessel.

[0034] In another embodiment, the air sack chamber housing 3 is positioned inside the large-sized vessel 1. In this embodiment, the air sack chamber housing 3 is built into the hull.

[0035] In accordance with the present invention, the bars 5 used in the inventive system comprise concrete as it is lighter in weight than metal of a corresponding strength and thus considerably reduces the weight of the bars. In addition thereto, the use of concrete also effectively reduces the costs for preparing the system of the present invention. Concrete in the meaning of the present invention is understood to be a material which is selected from the group consisting of a concrete, a concrete-like material and mixtures thereof.

[0036] In one embodiment, said material is selected from concrete, which is a construction material consisting of cement such as Portland cement and other cementitious materials such as fly ash and slag cement, aggregates, which are in general coarse aggregates such as gravel, limestone or granite, additionally a fine aggregate such as sand or manufactured sand, water and chemical admixtures such as plasticizers, accelerators, retarders and corrosion inhibitors. In the present invention concrete selected from the group consisting of regular concrete, ready-mix concrete, high-strength concrete, high-performance concrete, self-compacting concrete, shotcrete, pervious concrete, cellular concrete, cork-cement composites, roller-compacted concrete, glass concrete, asphalt concrete, rapid strength concrete, polymer concrete and mixtures thereof are suitable as the concrete material of the present invention. For example, the concrete is selected from concretes having a compressive strength of C16/20, C20/25, C25/30, C30/37, C35/45, C40/50, C45/55 and/or C50/60 as described e.g. in DIN-1045.

[0037] By contrast, a concrete-like material comprises cements, mortars and mixtures thereof. In case the concrete-like material is in the form of cement, the cement preferably comprises all cements as described e.g. in DIN-EN 197-1, wherein the main classes such as portland cement (CEM I), portland composite cements (CEM II), blast-furnace cement (CEM III), pozzolan cement (CEM IV), composite cement (CEM V) and all subclasses are suitable as concrete-like material of the present invention. Cements for special needs such as road cement, white cement, water-resisting cement or sulfate-resisting cement are also encompassed as concrete-like material by the present invention.

[0038] In case the concrete-like material is in the form of mortar, said material is essentially a mixture of Portland cement with sand and water, but it can also be based on other cement/binder types and contain other materials such as lime or air-entraining admixtures. Mortar suitable as concrete-like material of the present invention comprises mortar selected from the group consisting of Portland cement mortar and cement-sand mortar; cement-sand (plasticised) mortar; masonry cement-sand mortar; cement-lime-sand mortar, lime mortar, hydraulic lime mortar, pozzolano mortar, firestop mortar and mixtures thereof.

[0039] In addition, the specific properties can be enhanced by, for example, altering the recipe of the concrete and concrete-like material, respectively.

[0040] Plain concrete or concrete-like material does not easily withstand forces such as tensile and shear stresses exerted on the bars 5 if the bars 5 are in a position capable of suppressing a floating-up of the inflatable air sacks 2 in the inflated condition 7. Therefore, the bars 5 are preferably made of a composite material in which the bars 5 further comprise steel. For example, the steel may be in the form of flakes, chippings, wires, wire mesh, nettings, tubes and/or pipes. However, it is to be noted that the steel may have any form as long as the composite material comprising concrete and steel is capable of withstanding the forces exerted on the bars 5 if the bars 5 are in a position capable of suppressing a floating-up of the inflatable air sacks 2 in the inflated condition 7.

[0041] In one embodiment, the steel is provided in the form of tubes or pipes. The bars 5 may be adapted in that the concrete is incorporated inside the tubes or pipes of a desired strength, i.e. the concrete is covered by the tube or pipe made of steel. Additionally or alternatively, the tubes or pipes are embedded in the concrete in order to form the inventive bars 5. In another preferred embodiment, the inventive bars 5 comprise a plurality of tubes or pipes made of steel; i.e. said plurality of tubes or pipes is embedded in concrete to form a single bar. Furthermore, the tubes or pipes are preferably of a strength and length which are capable of suppressing a floating-up of the inflatable air sack 2 in the inflated condition 7.

[0042] In accordance with the present invention, a plurality of bars 5 is provided. In this regard, it is to be noted that the number of bars depends on the size and weight of the large-sized vessel 1 as well as the material used for preparing the inventive bars 5. For example, if the large-sized vessel is a vessel having a gross tonnage (GT) of less than 100.000, a smaller number of bars is required in comparison to a vessel having a GT of more than 100.000.

[0043] The inventive bars 5 can be stored in bar chamber housings 6 for holding the bars 5 inside the large-sized vessel 1. Accordingly, the bar chamber housings 6 are positioned inside the large-sized vessel 1. In one embodiment, a plurality of bar chamber housings 6 is provided so that each bar can be stored in a separate bar chamber housing 6. Alternatively, two or more bars 5 can be stored in one bar chamber housing 6. Preferably, two bars 5 are stored in one bar chamber housing 6. For example, two bars 5 which are arranged in a mirror-like position on the starboard side and the port side can be stored in one bar chamber housing 6, i.e. the respective bars are arranged in an opposite position to each other.

[0044] Each bar chamber housing 6 is adapted to be opened and thereby moving the bars 5 outward of the large-sized vessel 1 into a position capable of suppressing a floating-up of the inflatable air sack 2 in the inflated condition 7 and which is adapted to be opened for allowing the inflatable air sack 2 to expand upon inflation. For example, the bar chamber housings 6 are positioned relative to the inflatable air sack 2 such that the bars 5 in the moved out position are above the inflatable air sack 2 in the inflated condition 7. For securing the inventive bars 5 in the moved out position, the bar chamber housings 6 are provided with a fixture. Such fixture can be any conventional fixture known to the skilled person and thus they need not to be further detailed.

[0045] The inventive bars 5 in the moved out position are preferably provided all around the large-sized vessel 1. In this regard, the inventive bars 5 are preferably evenly distributed around the large-sized vessel 1. However, it is to be noted that the inventive bars 5 do not need to be arranged equispaced.

[0046] In accordance with the present invention, the bars 5 in the moved out position are for example in a horizontal position 8. The term "horizontal position" in the meaning of the present invention refers to bars 5 in the moved out position which are substantially perpendicular relative to the vessel's hull or which are positioned in that the average angle is smaller than a right angle (90°) relative to the vessel's hull. Preferably, the average angle of the bars 5 is between 45° and 90°, more preferably between 60° and 90° and most preferably between 75° and 90° relative to the vessel's hull.

[0047] Furthermore, the inventive system further comprises a control unit 601 for detecting a state of emergency and for automatically triggering of opening of the air sack chamber housing 3, inflating of the inflatable air sack 2, opening of the bar chamber housings 6 and/or moving the bars comprising concrete 5 outward of the large-sized vessel 1. For example, such control unit is in the form of a central processing unit comprising sensors 602, 603, 604 and actuators 605, 606, 607, 608. Additionally or alternatively, such control unit 601 can be triggered manually in the event the vessel's hull suffered a damage. Such control units 601 can be any conventional control unit known to the skilled person and thus they need not to be further detailed.

[0048] The inventive system may be used within a large-sized vessel 1, for example selected from the group consisting of passenger ships, cruise liner, cargo ships, passenger cargo ships, container ships, tank ships, towboats, warships, frigates or aircraft-carriers. In particular, the system can be used for preventing large-sized vessel from sinking after the hull suffered a damage for example by a collision with an iceberg, torpedoes, sea mines, other vessels, by running aground etc. thereto.

[0049] Fig. 1 shows a diagrammatic top view of a large-sized vessel 1 comprising a system according to an exemplary embodiment of the invention in which the inflatable air sack 2 is in the uninflated condition stored in the air sack chamber housing 3 and the bars 5 comprising concrete are stored in the bar chamber housings 6 inside the large-sized vessel 1. In this arrangement the air sack chamber housing 3 is positioned on a side of the large-sized vessel 1. In the event the vessel's hull suffers a damage, the system can be automatically or manually triggered by a control unit so that the air sack chamber housing 3 is opened, the inflatable air sack 2 is inflated and expanded by using an air compressor 4, the bar chamber housings 6 are opened, and the bars comprising concrete 5 are moved outward of the large-sized vessel 1.

[0050] Fig. 2 shows a diagrammatic side view of a large-sized vessel 1 comprising a system according to an exemplary embodiment of the invention in which the inflatable air sack 2 is in the uninflated condition stored in the air sack chamber housing 3 and the bars 5 comprising concrete are stored in the bar chamber housings 6 inside the large-sized vessel 1. In this arrangement the air sack chamber housing 3 is positioned on the starboard and the port side of the large-sized vessel 1.

[0051] Fig. 3 and Fig. 4 show a diagrammatic side view of a large-sized vessel 1 comprising a system according to an exemplary embodiment of the invention in which the inflatable air sack 2 is in the inflated condition and the bars 5 comprising concrete are in the moved out position. In this arrangement the bars 5 are positioned above the inflatable air sack 2 in the inflated condition 7. Fig. 3 and Fig. 4 show an inflatable air sack 2 having a plurality of compartments of different sizes which provides more safety in case of a failure of one compartment of the inflatable air sack 2 preventing a total failure of the inflatable air sack 2. The figures show that the bars 5 in the moved out position are provided all around the large-sized vessel 1. The bars 5 are secured in a fixture in the bar chamber housings 6 so that the bars are provided in an angle of between 45° and 90° relative to the vessel's hull. It becomes clear that the bars 5 are in a position capable of suppressing a floating-up of the inflatable air sack 2 in the inflated condition 7.

[0052] Fig. 5 shows a diagrammatic top view of a large-sized vessel 1 comprising a system according to an exemplary embodiment of the invention in which the inflatable air sack 2 is in the inflated condition and the bars 5 comprising

concrete are in the moved out position. In this arrangement two inflatable air sacks 2 in the inflated condition 7 are positioned on the starboard and the port side of the large-sized vessel 1. Said inflatable air sacks are provided with a plurality of compartments of different sizes. Fig. 5 shows that the inflatable air sack 2 in the inflated condition7 extends in the direction of the surroundings.

[0053] Fig. 6 shows a diagrammatic view of a control unit 601 according to an exemplary embodiment of the invention in which the control unit comprises sensors 602, 603, 604 and actuators 605, 606, 607, 608.

[0054] In addition, it should be pointed out that "comprising" does not exclude other elements or steps, and "a" or "one" does not exclude a plural number. Furthermore, it should be pointed out that features or steps, which have been described with reference to one of the above exemplary embodiments, can also be used in combination with other features or steps of other exemplary embodiments described above. Reference characters in the claims are not to be interpreted as limitations.

Claims

1. A system capable of rendering a large-sized vessel (1) unsinkable, the system comprising:

a) an inflatable air sack (2),
b) an air sack chamber housing (3) for holding the inflatable air sack (2) in an uninflated condition and which is adapted to be opened for allowing the inflatable air sack (2) to expand upon inflation,
c) an air compressor (4) adapted to feed air in the inflatable air sack (2) for expanding the inflatable air sack,
d) bars (5) comprising concrete, and
e) bar chamber housings (6) for holding the bars (5) inside the large-sized vessel (1) and adapted to be opened and thereby moving the bars (5) outward of the large-sized vessel (1) into a position capable of suppressing a floating-up of the inflatable air sack (2) in the inflated condition (7).

2. The system according to claim 1, wherein the air sack chamber housing (3) is positioned on the starboard, port side and/or stem side of the large-sized vessel(1).

3. The system according to any one of the previous claims, wherein the air sack chamber housing (3) is positioned on a side of the large-sized vessel (1).

4. The system according to one of claims 1 to 3, wherein the air sack chamber housing (3) is positioned inside the large-sized vessel (1).

5. The system according to any one of the previous claims, wherein the inflatable air sack (2) in the inflated condition (7) is positioned at the starboard and/or the port side of the large-sized vessel (1).

6. The system according to any one of the previous claims, wherein the bar chamber housings (6) are positioned inside the large-sized vessel (1).

7. The system according to any one of the previous claims, wherein the bar chamber housings (6) are positioned relative to the air sack such that the bars (5) in the moved out position are above the inflatable air sack (2) in the inflated condition (7).

8. The system according to claim 7, wherein the bars (5) in the moved out position are provided all around the large-sized vessel (1).

9. The system according to one of claims 7 or 8, wherein the bars (5) in the moved out position are in a horizontal position (8).

10. The system according to any one of claims 7 to 9, wherein the bars (5) in the moved out position are secured in a fixture provided in the bar chamber housings (6).

11. The system according to any one of the previous claims, wherein the bars (5) further comprise steel.

12. The system according to claim 11, wherein the steel is in the form of flakes, chippings, wires, wire mesh, nettings, tubes and/or pipes.

13. The system of any one of the previous claims, further comprising:

a control unit (601) for detecting a state of emergency and for automatically triggering at least one of:

a) opening the air sack chamber housing (3),
b) inflating the inflatable air sack (2),
c) opening the bar chamber housings (6), and
d) moving the bars (5) outward of the large-sized vessel (1).

14. Use of a system according to any one of claims 1 to 13 for preventing large-sized vessels from sinking, the group of large-sized vessels comprising passenger ships, cruise liner, cargo ships, passenger cargo ships, container ships, tankships, towboats, warships, frigates or aircraft-carriers.

15. Large-sized vessel comprising a system according to any one of claims 1 to 13.

Fig. 1

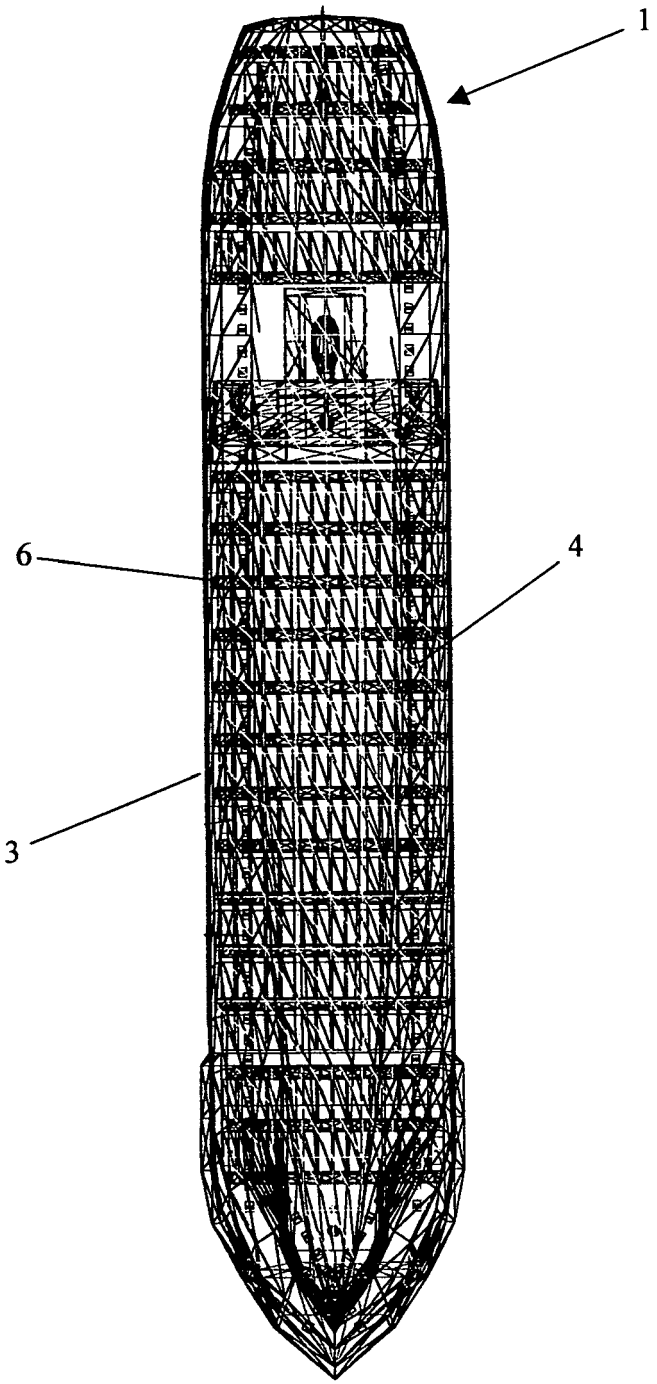


Fig. 2

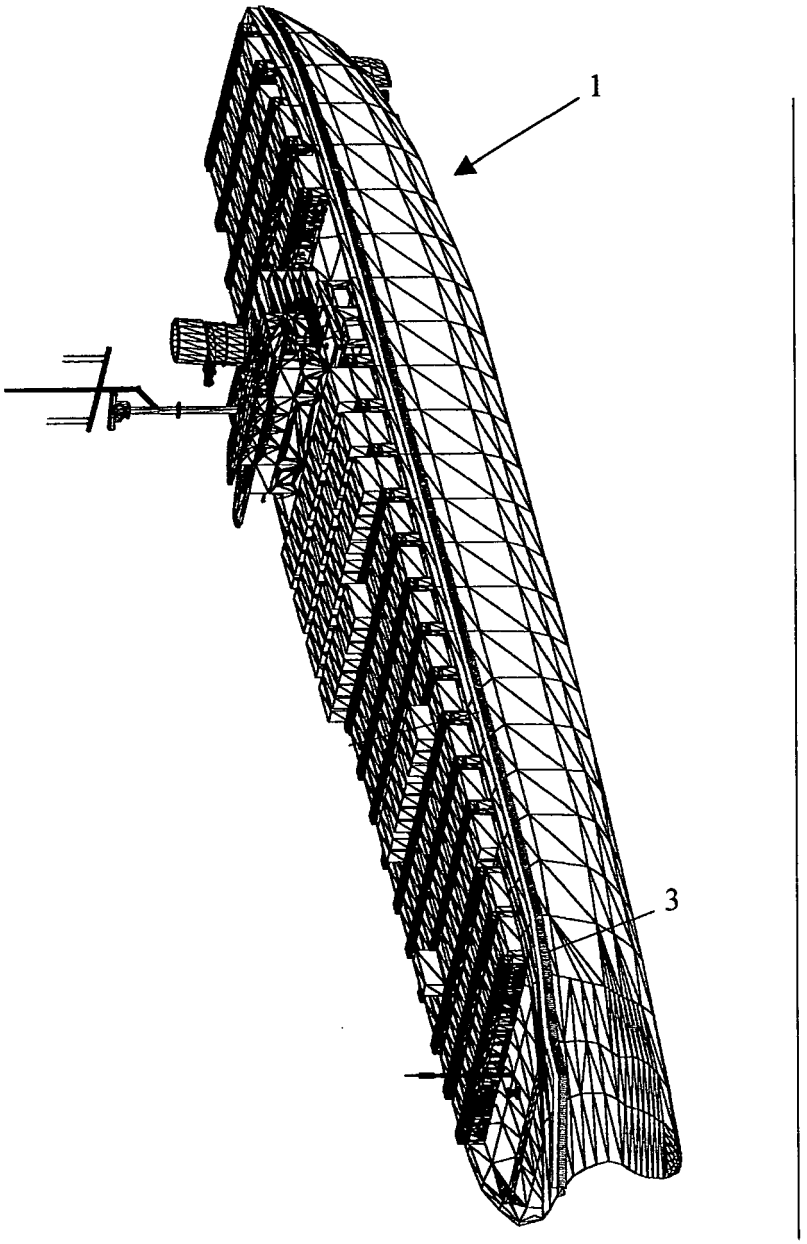


Fig. 3

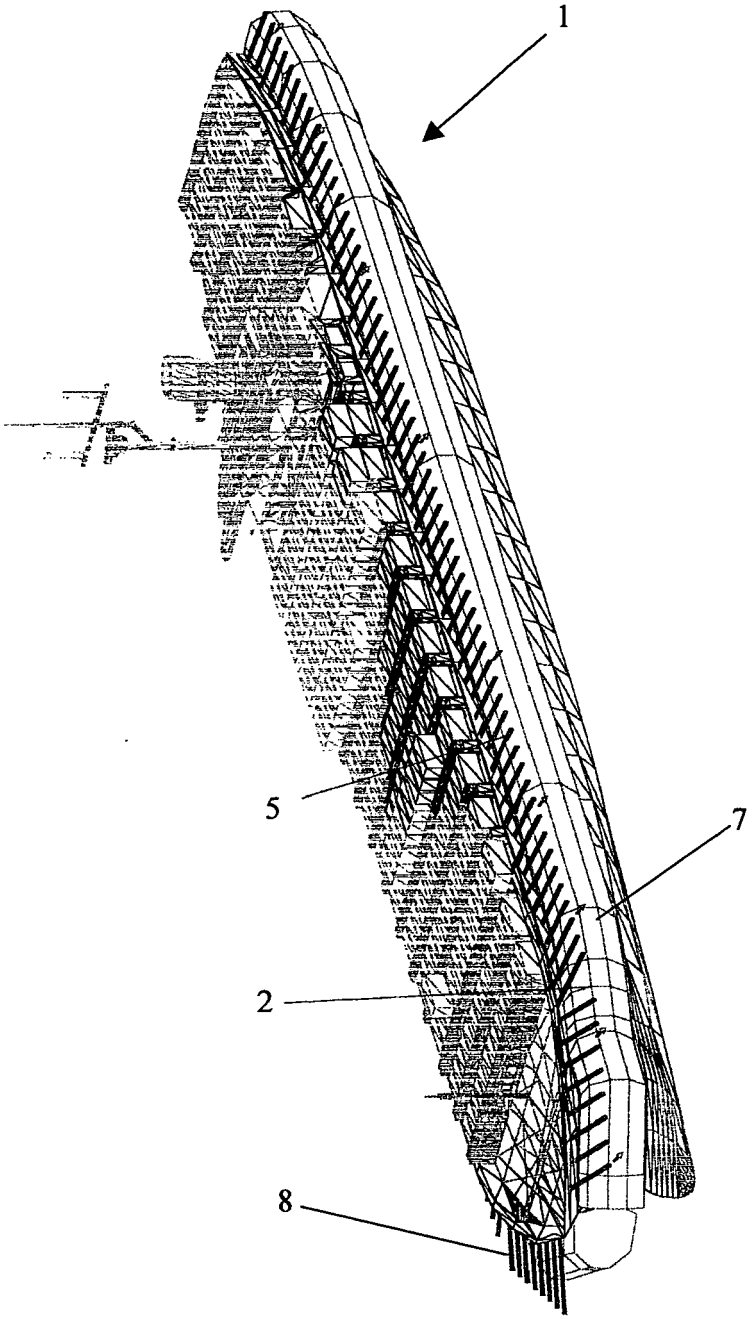


Fig. 4

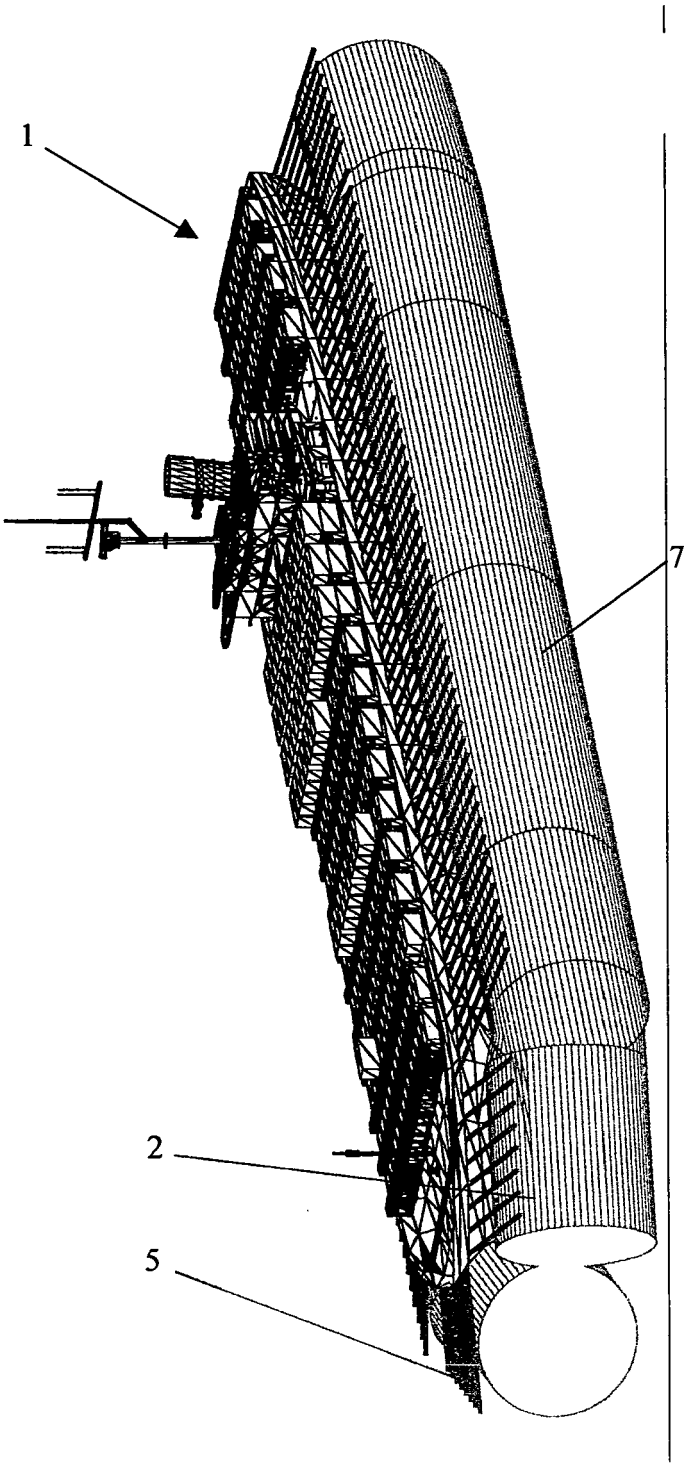


Fig. 5

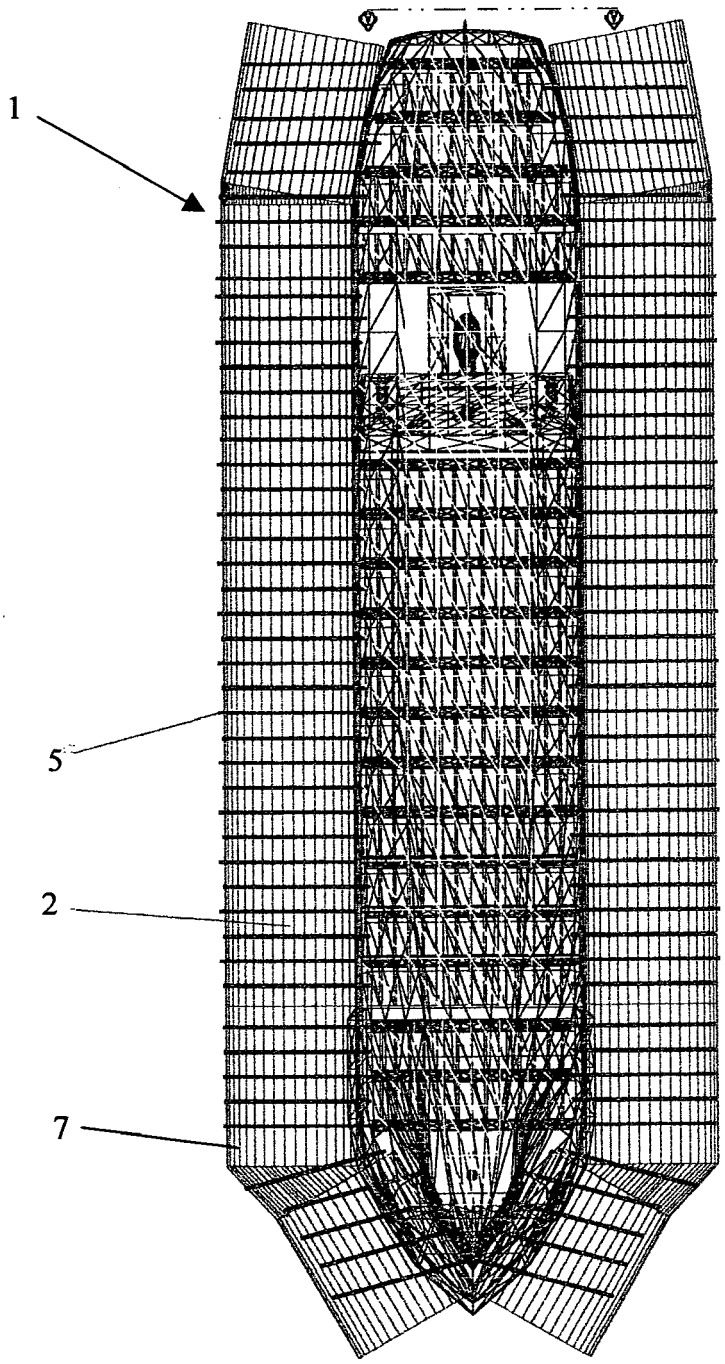
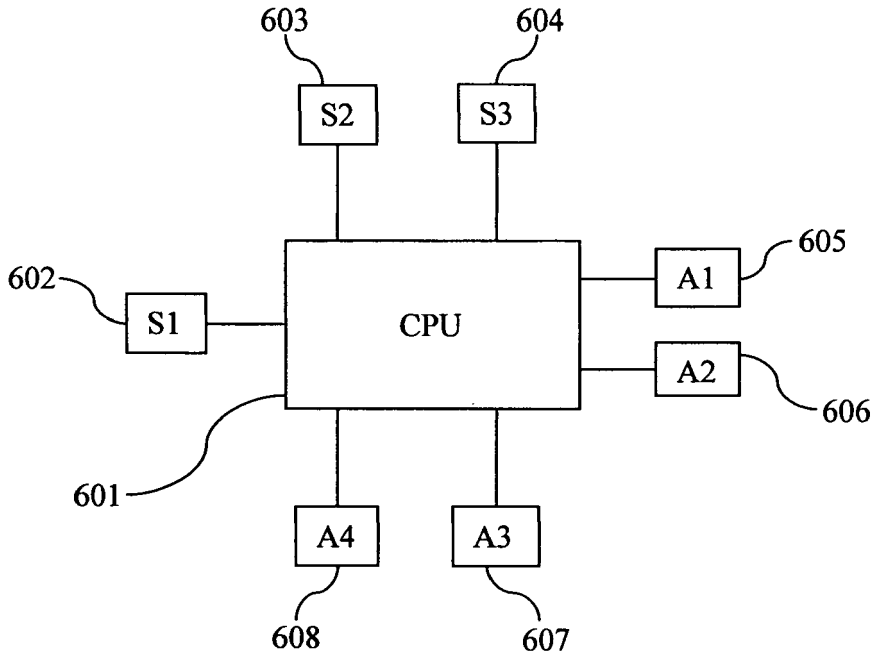


Fig. 6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EUROPEAN SEARCH REPORT

Application Number
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	18 June 2010	Lindner, Volker

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