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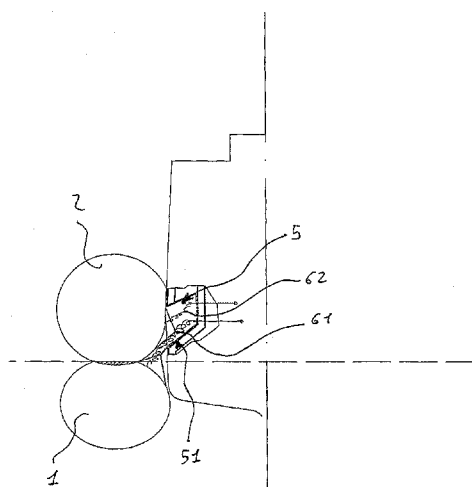


Fig.8

(57) Abstract: The object of the present invention is a fixed safety device to be installed on board of a watercraft, which can be activated when a leak occurs that could sink the vessel. The device provides for the insertion of floats (1, 2) within compartments (85) located on the sides of the watercraft that when activated are expelled from their housings and inflated with gas coming from tanks positioned within the hull of the watercraft. The flotation elements (1, 2), when inflated, are positioned in two parallel lines, that is from a first top row, which is formed by top flotation elements (2), and a second row lower than the first one, formed by bottom flotation elements (1), said top flotation elements (2) being suitable for imparting a downward boost to said bottom flotation elements (1) so as to position the latter below the waterline.



DESCRIPTION**ANTI-SINKING EMERGENCY DEVICE BY AUTOMATIC EJECTION AND INFLATION OF BALLOONS**

5 The object of the present invention is to provide a device designed for the safeguard and rescue of floating crafts for civil and/or mercantile use in situations of emergency, breakdown, accidental collision or any situation in which the hull loses the condition of buoyancy.

As is known, the floating crafts of any type, which are designed to transport persons and goods, and of any tonnage and dimension are equipped with safety devices whose main aim is that of
10 safeguarding the life of the passengers and crew. Said devices are usually comprised of life belts, life jackets, and lifeboats.

By necessity, or rather in the event of an Abandon Ship Order, said lifesaving devices must be present on the floating craft in sufficient quantity to be distributed, in the case of life jackets, to all of the passengers and members of the crew, or have available a sufficient number or seats in
15 the case of lifeboats.

Said devices, though effective for saving the lives of the persons, are not designed to prevent the sinking of the floating craft on which they are located.

By contrast, emergency devices aiming to prevent or at least delay the sinking of the floating craft in the event of serious damage to the hull, upon collision with other floating bodies, such as
20 an iceberg or other ships, or with the sea bottom or simply with emerging rocks, are known.

Said known devices consist of a series of flotation elements employed with various systems below the waterline of the floating craft, and supplying a supplementary hydrostatic boost sufficient to guarantee the buoyancy of said craft when needed while they are inflated.

The emergency devices of the type described, however, present a series of difficulties, the most
25 prominent of which is surely that deriving from the fact that the flotation elements, when they are not in use and, therefore, deflated, are stored in compartments situated on the hull, which is that part which lies below the waterline. As a consequence, in the event that upon a collision a hole is found in that part of the hull where the flotation elements are located, the latter would also be damaged, and, as a result, no longer suitable for the purpose for which they were
30 designed and installed on board.

A further drawback of the prior art consists of the fact that the flotation elements are located exclusively on the sides of the watercraft or the boat and, therefore, still are not suitable for preventing the sinking of the floating craft from the stern or from the bow.

5 A further problem of the known devices results from the location of the flotation elements; in fact, when they are not located in suitable compartments situated on the hull of the floating craft, their presence on board ends up being cumbersome and of dubious aesthetics.

The object of the present invention is to provide a device suitable for ensuring the buoyancy of a floating craft, even in the event of a serious collision that results in the craft taking on water.

10 A further object is that of supplying an emergency device in which the flotation elements, when not in use, are stored in protected compartments placed above the waterline in such a way as not to undergo any damage and a resulting leak in the hull and, by contrast, are completely submerged and therefore below the waterline in such a way as to guarantee maximum hydrostatic boost when inflated.

15 A further object is that of supplying a supplementary flotation device and preventing the sinking of the floating craft by capsizing from the bow or from the stern.

20 Yet another object is, more generally, the supply of a device that makes the lifesaving devices on board of the floating craft useless or at least not important thereby avoiding their handling in emergency situations, the result of which is not always smooth or predictable, and preventing the human factor, which in certain critical situations can give rise to panic, crush, crowd, etc., from compromising the rescue operations.

Finally, a last object is that of supplying a device that can be activated completely automatically by the captain of the floating craft by a pushbutton located on the bridge or inside the control cabin.

25 These and other objectives are achieved by the anti-sinking emergency device, by automatic ejection and inflation of balloons for floating crafts of the present invention, which is described below in a preferred embodiment with reference to the attached drawings, which illustrate:

Fig. 1, a side view of a ship equipped with the device, wherein the inflating circuit for the flotation elements and the gas storage and supply tanks are visible;

Fig. 2, a cutaway view A-A of the ship of figure 1;

30 Fig. 3, the first view of a sequence of four, of a side of a ship wherein the supply circuit of the flotation elements is shown, the latter still deflated within the containment compartments;

Fig. 4, the second view of the sequence of four, in which the storage compartments of the flotation elements are open, and the latter are in the first step of inflation;

Fig. 5, the third view of the sequence of four, in which the flotation elements are in an advanced step of inflation;

5 Fig. 6, the fourth and final view of the sequence of four, in which the flotation elements are completely inflated;

Fig. 7, a cutaway view of the ship wherein a containment compartment for the flotation elements when deflated is visible;

10 Fig. 8, the same view as in figure 7 but with flotation elements out of the containment compartment and completely inflated;

Fig. 9, the first view of a sequence of nine, showing the behavior of a ship in the case of listing caused by the craft taking on water following a leak on the left side of the hull and its subsequent realignment after the activation of said emergency device, said first figure representing a section of a hull under conditions of normal navigation;

15 Fig. 10, the second view of the sequence of nine, wherein the walls of the containment compartments of the flotation elements are opened and withdrawn toward the ship via a rope or chain;

Fig. 11, the third view of the sequence of nine, wherein the listing of the ship resulting from taking on water is shown;

20 Fig. 12, the fourth view of the sequence of nine, wherein the lower flotation elements have been expelled from the containment compartments;

Fig. 13, the fifth view of the sequence of nine, wherein the flotation elements are in contact with the water because the ship is starting to sink;

25 Fig. 14, the sixth view of the sequence of nine, wherein also the upper flotation elements are expelled;

Fig. 15, the seventh view of the sequence of nine, wherein the flotation elements are partially inflated;

Fig. 16, the eighth view of the sequence of nine, wherein the flotation elements are completely inflated;

30 Fig. 17, the ninth and final view of the sequence of nine, showing the realignment of the ship after the flotation elements expulsion and inflation;

Fig. 18, the first view of a sequence of four, of one side of a ship where the location of the flotation elements, the inflation circuit and the positioning of the gas tanks are shown;

Fig. 19, the second view of the sequence of four, in which the collision of the hull of the boat with a rock outcropping or another floating craft is simulated;

5 Fig. 20, the third view of the sequence of four, in which the shattering of the hull of the ship following the collision is simulated;

Fig. 21, the fourth and final view of the sequence of four, in which the inflated flotation elements supplied from separate circuits are visible.

The device of the present invention comprises a system designed to guarantee the condition of
10 buoyancy of any type of floating craft in which the hull should be irreparably damaged because of a collision or in all those situations in which a buoyancy support is needed.

The emergency device allows to avoid abandoning the floating craft both for the primary purpose of safeguarding the safety of the passengers and the crew and, in a second stroke, where possible, to save the floating craft from sinking.

15 As illustrated in the attached figures, the anti-sinking emergency device of the present invention comprises three main components:

- a series of floating elements 1 and 2 of any form and size to be defined based on the tonnage of the floating craft, its size and on geometric/logistical factors;
- a gas and/or gas-foam plant, which is identified as a whole by the number 3, consisting of
20 high pressure storage tanks 31, tubes 32, valves 33 and pressure reducers 34;
- an ignition system 4 that, in the event of a risk of sinking upon a collision, allows for arming the device, thereby permitting the inflation of the flotation elements 1 and 2.

More specifically, the flotation elements 1, to which the task of making up for the lack of hydrostatic boost (by Archimedes' principle) on the part of the damaged hull is assigned, play an
25 important role.

Said flotation elements 1, are located within compartments 5 obtained on the side of the floating craft above the waterline; also located within said compartments 5 are a second series of flotation elements 2 whose main function is not that of contributing to the buoyancy of the floating craft but rather that of preventing the flotation elements 1 from emerging, increasing their efficiency
30 and, only if the latter are damaged, contributing to the buoyancy of the craft.

Said flotation elements 1 and 2, are equally distributed around the perimeter of the floating craft and are suitable, when inflated, both for preventing the craft from rolling over, and therefore

from listing onto its side, and for preventing the pitching and, thus, the sinking of the craft from the stern or from the bow.

5 Flotation elements 1 and 2 are made, preferably, with a rubber or plastic matrix, formed in two or more layers with glass, carbon or aramidic reinforcement fibers or combinations thereof, by geometric type and manner of composition, to create a structure of composite material, as already specified, housed in special compartments 5 of appropriate dimensions enclosed by watertight bulkheads 8 present on the same sides.

10 Flotation elements 1 and 2 are linked, as shown in figure 8, to the supporting structure of the floating craft via cables or chains 61 and 62 for the purpose of ensuring its appropriate support when inflated.

The emergency device comprises one or more plants 3 whose function is that of permitting the inflation of flotation elements 1 and 2 with nitrogen gas or inert gas in general.

Said plants 3 comprise:

15 - a series of storage tanks 31 proportional to the dimensions and to the number of flotation elements 1 and 2; a single tank having a capacity of 10 liters will be sufficient for small watercrafts; by contrast, for cruise ships, cargo ships or oil tankers, tank packages having a total capacity of at least 500 m³ will be necessary.

20 In said tanks 31 it is provided that the gas is stored at a pressure from 200 to 400 bar, for the purposes of rendering the gas usable; plant 3 provides one or more pressure reducers 34 designed to bring the pressure from the storage pressure (200-400 bar) up to the pressure for inflating flotation elements 1 and 2.

- rigid and/or flexible tubes 32 situated along the dorsal of the floating craft suitable for conducting the gas from pressure reducers 34 to flotation elements 1 and 2.

25 In the case in which plant 3 provides for the use of nitrogen gas only, flotation elements 1 and 2 are inflated and pressurized only by means of the assistance of pressurizing gas; by contrast, in the case in which the employment of gas and foam is provided, the gas is added to a quantity of foam that is used to fill flotation elements 1 and 2, guaranteeing their buoyancy even in the case of accidental puncture.

30 The ignition of the safety device is activated by means of an ignition system 4 situated in the control cabin or on the bridge. However, a failure of the control system can be overcome by activating the system remotely by auxiliary pushbuttons located close to the storage tanks 31.

A control unit 7 constitutes the preferred organ for controlling the device; it communicates with ignition systems for the expulsion of the watertight bulkheads 8 and with gas plant 3.

Ignition systems 4, when activated from control unit 7 and/or auxiliary pushbuttons, remove bulkheads 8 and permit flotation elements 1 and 2 to come out.

- 5 Plants 3 for the inflation of flotation elements 1 and 2 can be one or more than one, one can be completely independent from the other and can be activated via one or more emergency pushbuttons, connected or not to control unit 7.

- Plants 3 can be separated also as a function of flotation elements 1 and 2 to be inflated in such a way that there is a plant 3 dedicated only to the inflation of flotation elements 1 and an
10 independent plant dedicated to the inflation of flotation elements 2 only.

The emergency device herein described is always activated by the captain of the floating craft or by one of his delegates following a visual inspection of the real damage suffered by the hull upon the collision.

- The device activation is irreversible because it will no longer be possible to activate the system
15 while in the sea but will require resetting by qualified operators and shipyards.

Activation of the arming device causes the automatic expulsion of bulkheads 8 by the ignition devices present on the sides of the floating craft and the pressurization of gas plant 3 by tanks 31 is operated via pressure reducers 34 and therefore tubes 32 up to flotation elements 1 and 2.

- In a preferred embodiment, the expulsion of flotation elements 1 and 2 is accomplished by
20 gravity, having the bottom 51 of the containment compartments 5 an inclination sufficient to make flotation elements 1 and 2 slide from said compartments 5.

To avoid spreading bulkheads 8 in the sea, they are tied to the floating craft by means of a rope or chain 9.

- In the event of a collision, the tear of the hull could partially damage one or more bulkheads 8,
25 thereby causing the failed intervention of a certain number of flotation elements, but the failed functionality of several bulkheads 8 does not compromise the operation of the device; in fact, the plant will continue to function partially (allowing the flotation elements to inflate) since both plant 3 and flotation elements 1 and 2 are independent from each other. Furthermore, the safety device is oversized by a safety factor greater than 2; this means that even just half of the flotation
30 elements present on board would ensure buoyancy.

As illustrated in figures 20 and 21, the appropriate separation of the plant allows the operation of the device even when the hull is completely shattered. This situation is often observed on oil tankers and/or cargo ships, which, if they lose control can run aground or drift onto rocks.

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CLAIMS

1. Anti-sinking emergency device by automatic ejection and inflation of balloons for a floating craft, comprising flotation elements (1, 2), means for anchoring (61, 62) said flotation elements (1, 2) to the structure of the floating craft, one or more inflation devices (3) of said flotation
5 elements (1, 2), which are in turn connected via a pneumatic and/or hydraulic device to one or more storage tanks containing inert gas of whatever type, mixtures thereof or simply compressed air, a control unit (7) for activating and controlling said inflation devices (3), means for opening the bulkheads (8) of the compartments (5) containing said flotation elements (1, 2), a system for the expulsion of said flotation elements (1, 2) from said compartments (5), characterized in that
10 said flotation elements (1,2), when inflated, are positioned in two parallel lines, that is from a first top row, which is formed by top flotation elements (2), and a second row lower than the first one, formed by bottom flotation elements (1), said top flotation elements (2) being suitable for imparting a downward boost to said bottom flotation elements (1) so as to position the latter below the waterline.
- 15 2. Device according to claim one, characterized by bottom flotation elements (1) and top flotation elements (2), wherein the bottom flotation elements (1) are partially or totally immersed when inflated, and the top flotation elements (2) are totally or partially surfaced when inflated, the aforesaid flotation elements (1, 2) being positioned one over the other when they are operational and being automatically controlled by a single or by two pneumatic and/or hydraulic
20 inflation devices (3).
3. Anti-sinking emergency device according to the preceding claims, characterized in that the compartments (5) are arranged above the waterline of the floating craft in a quantity of four or more until they cover the entire external perimeter of the floating craft, said compartments (5) being hermetically sealed off from the interior of the hull of the floating craft.
- 25 4. Anti-sinking emergency device according to the preceding claims, characterized in that the bottom (51) of the compartments (5) is inclined with respect to the horizontal axis by the degrees required to allow the flotation elements (1, 2) to slide into the sea in a condition where the bulkheads (8) are open, said sliding occurring in the sequence of bottom flotation elements (1), top flotation elements (2), the expulsion of the flotation elements (1, 2) being enabled or not by a
30 boosting mechanism, the latter being locally and remotely actuated.
5. Anti-sinking emergency device according to one or more of the preceding claims, characterized in that the bulkheads (8) are kept in a closed position by means of a latch or other similar device, the opening of which is controlled via a remote controlled servomechanism, or via a kinematic motion that can be locally activated.

6. Anti-sinking emergency device according to claims 1 and 2, characterized in that the flotation elements (1, 2) are equipped, or not, with inflation devices (3) that are automatically and independently activated when they are expelled from the compartments (5), said inflation occurring in the following order:

- 5 - partial inflation of the bottom flotation elements (1) until they are totally extended on the open surface of the water;
- total inflation of the top flotation elements (2);
- completion of the inflation of the bottom flotation elements (1) until stabilization of the floating craft is achieved;
- 10 the total and/or partial inflation of the flotation elements (1, 2) being managed by an electronic control unit according to the draft of the unit, the angle of roll and the angle of pitch.

7. Anti-sinking emergency device according to one or more of the preceding claims, characterized in that the control of the inflation operation for the flotation elements (1, 2) and their pressure is managed by a control unit (7).

- 15 8. Anti-sinking emergency device according to the preceding claims, characterized in that the length of the anchoring means (61, 62) of the flotation elements (1, 2) to the structure of the floating craft can be adjusted by a remote control device.

9. Device according to the preceding claims, characterized in that both of the flotation elements (1, 2) or just the top ones (2) are inflated with foam or with a mixture of gas and/or air and/or
- 20 foam.

10. Device according to the preceding claims, characterized in that the activation of the safety device can be activated either via an ignition system (4) located within the control cabin or at the bridge, and/or via a remote system located close to the tanks (31) and/or locally via a mechanical or servo-assisted device that is positioned in proximity to each compartment (5).

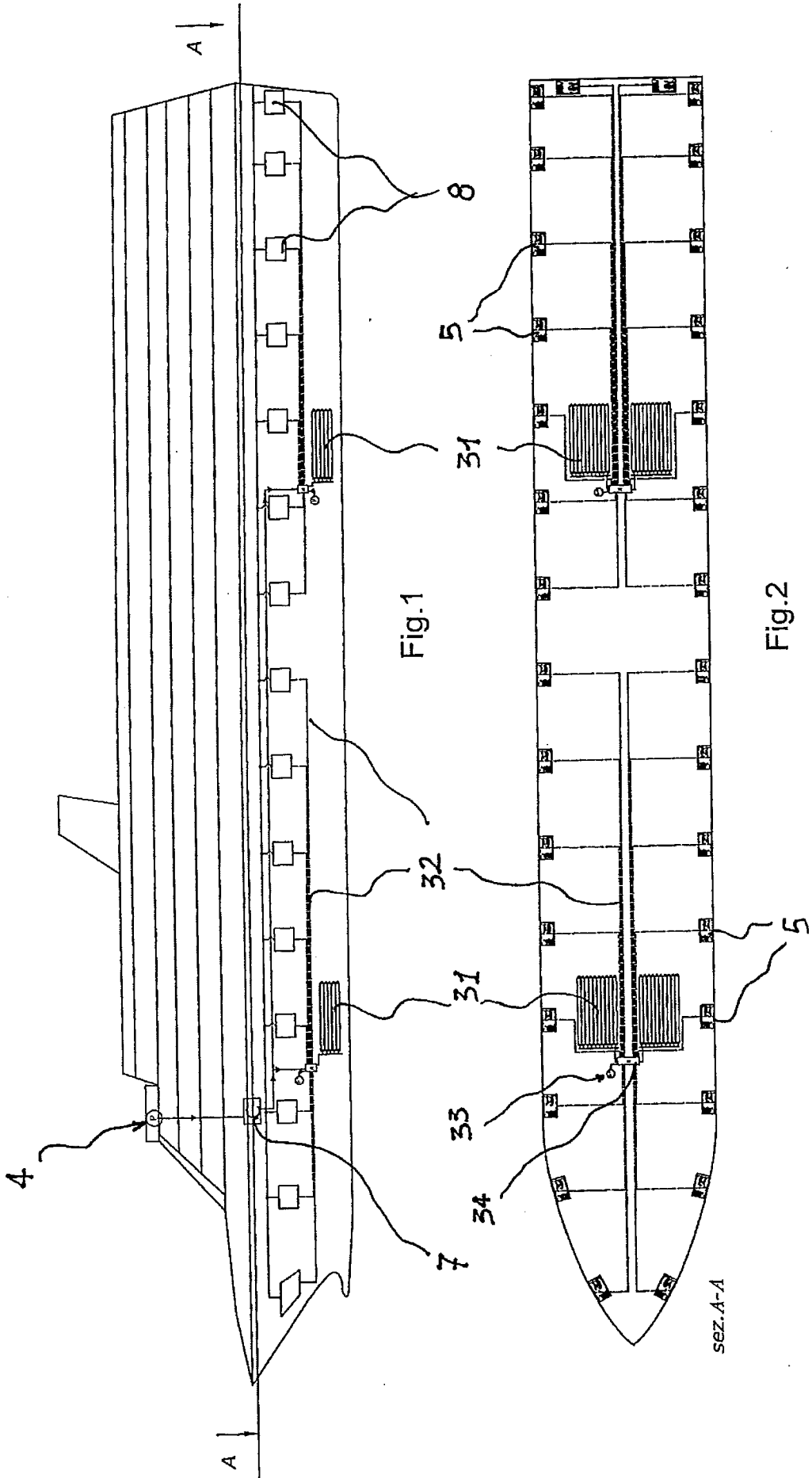
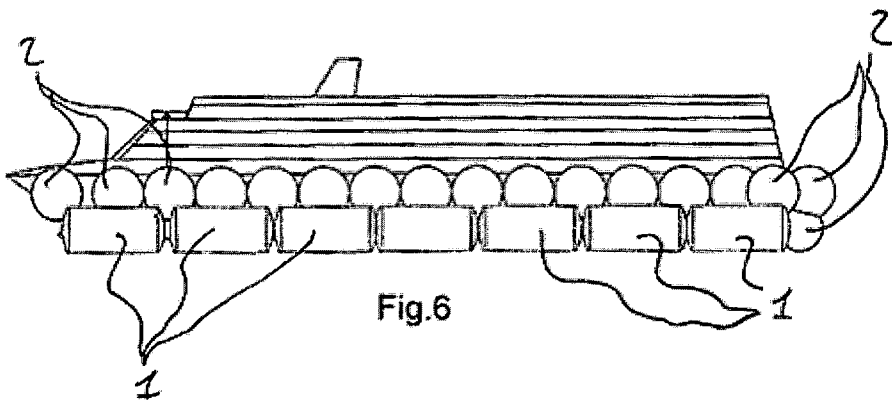
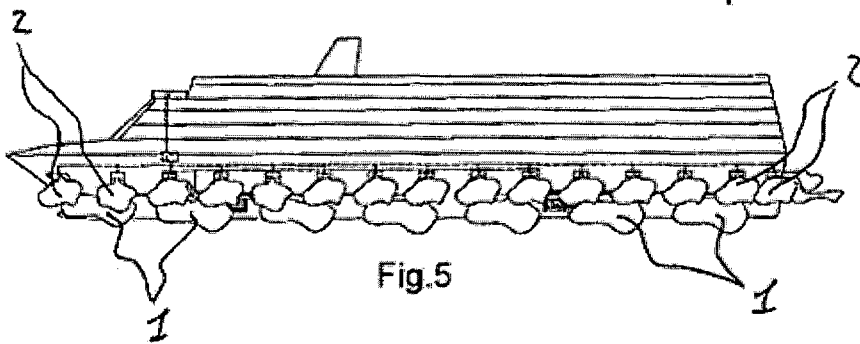
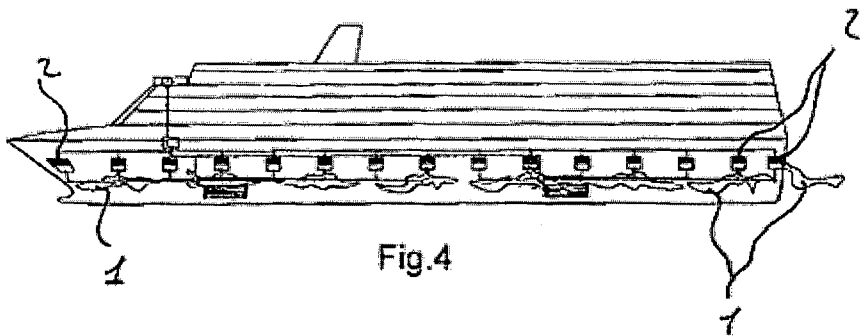
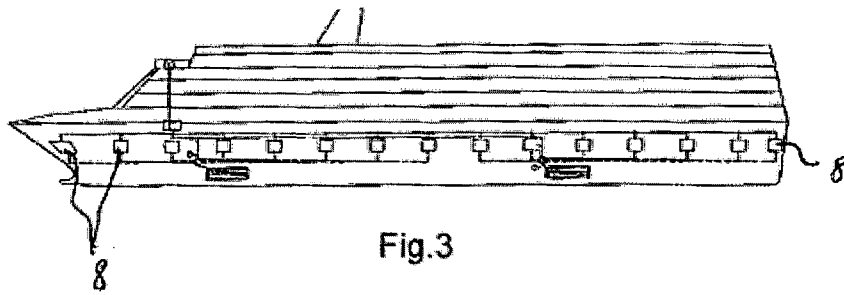


Fig.1

Fig.2



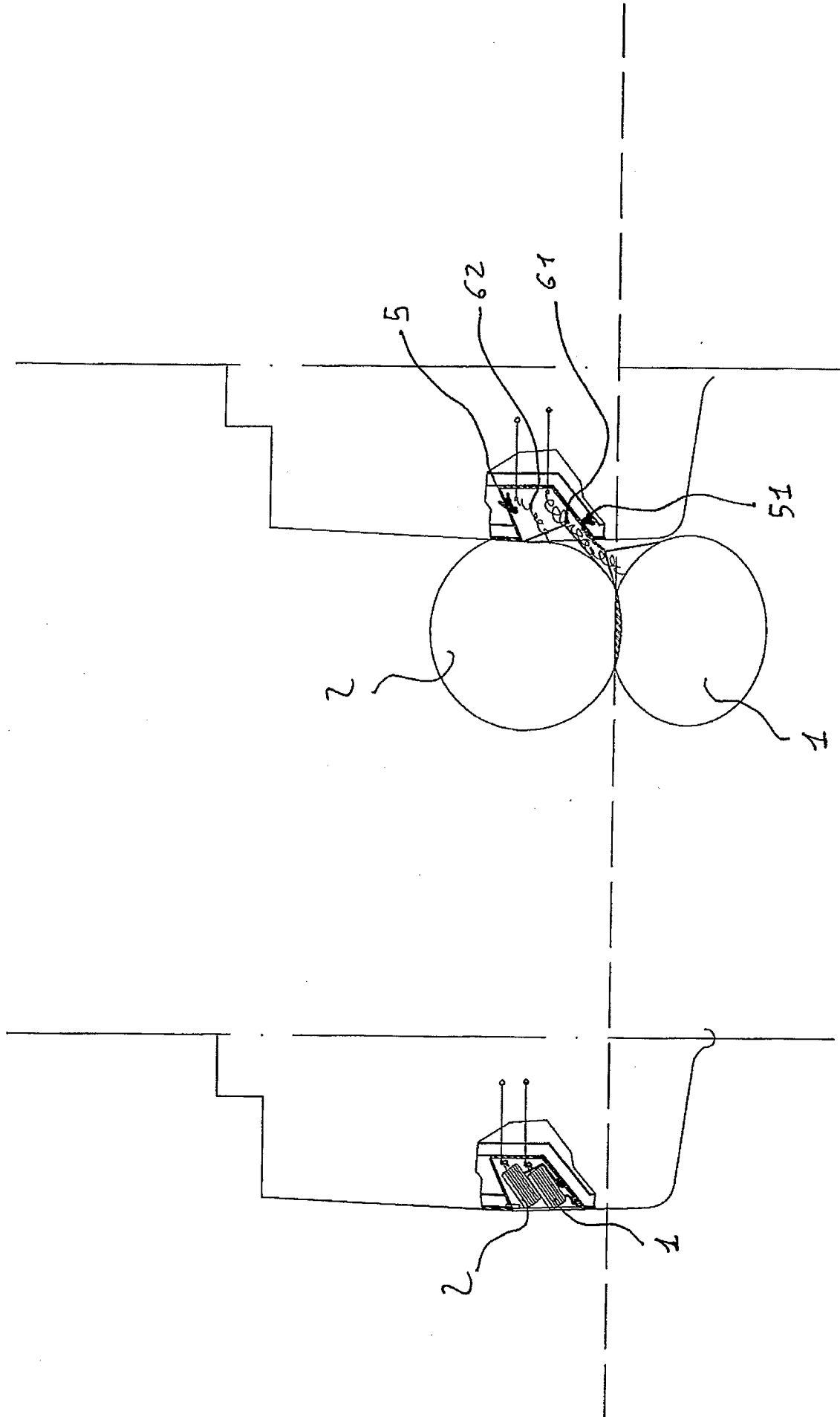


Fig.8

Fig.7

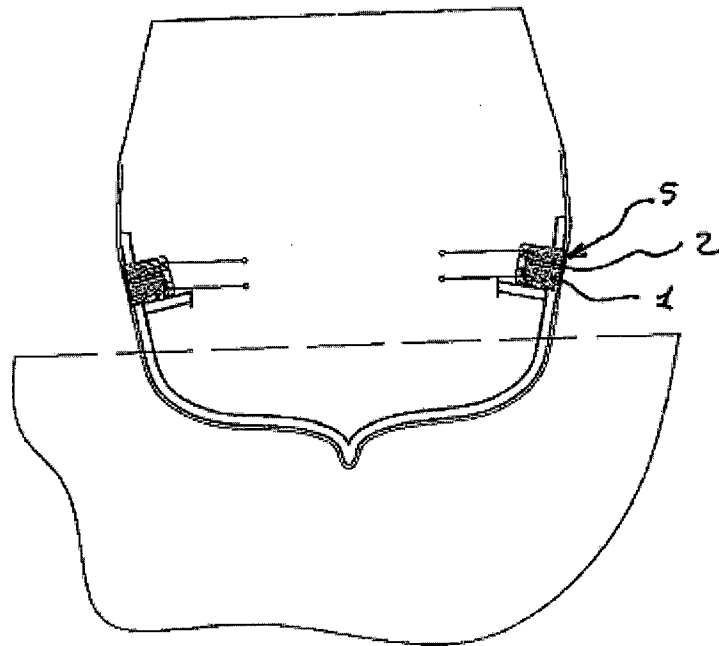


Fig.9

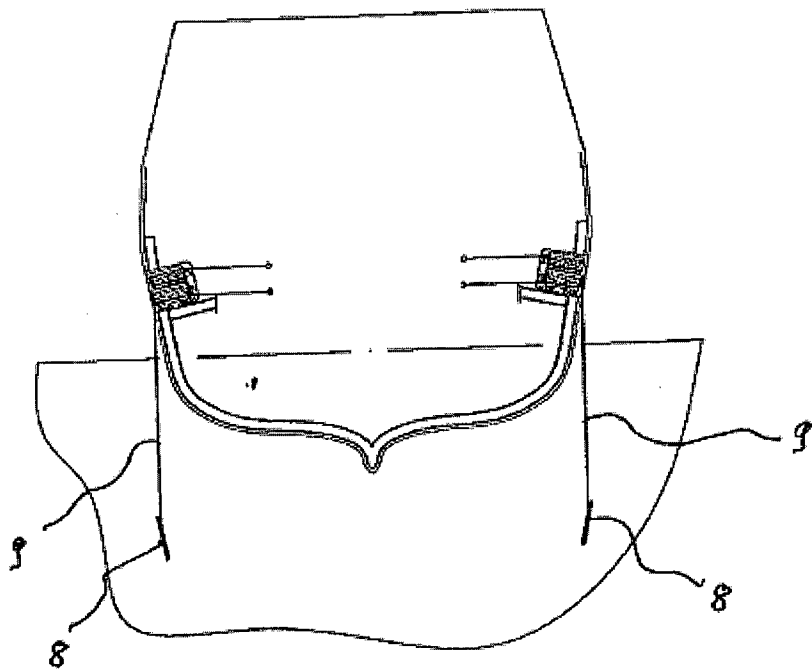


Fig.10

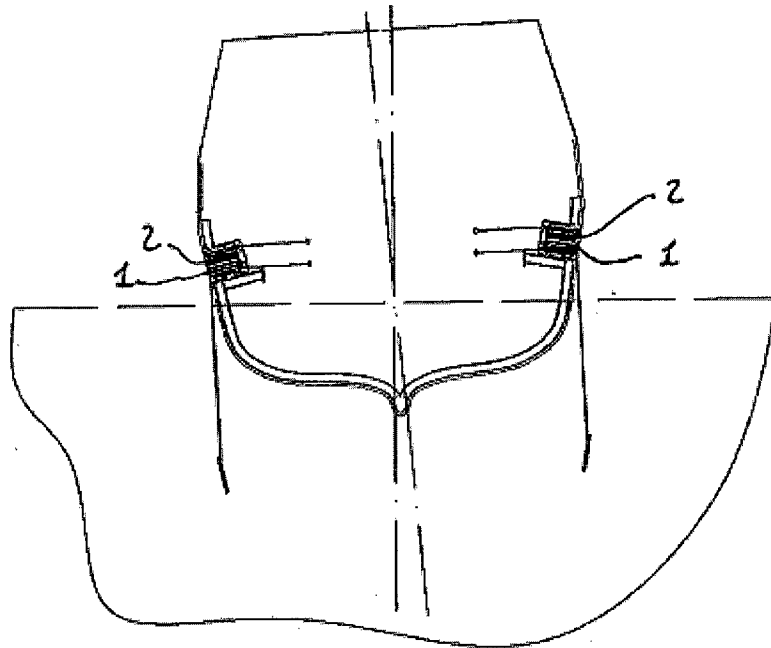


Fig.11

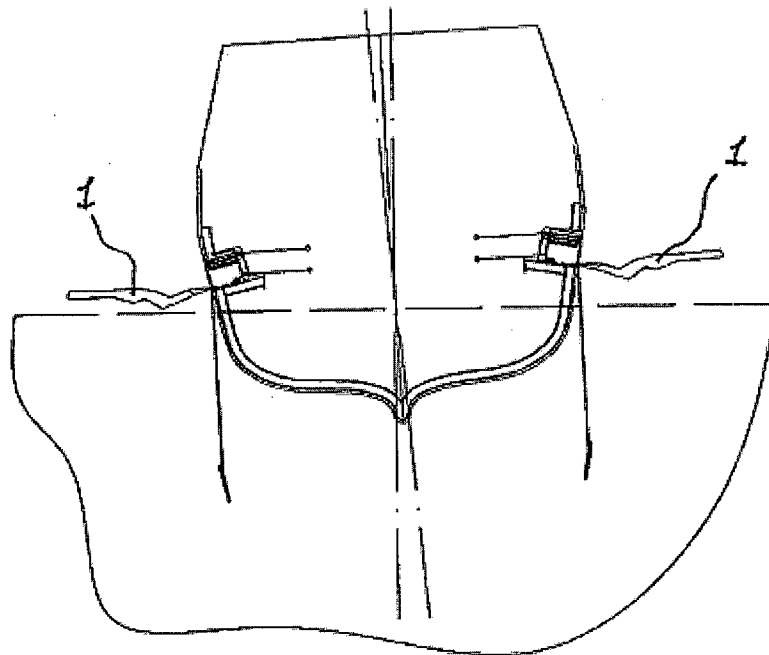


Fig.12

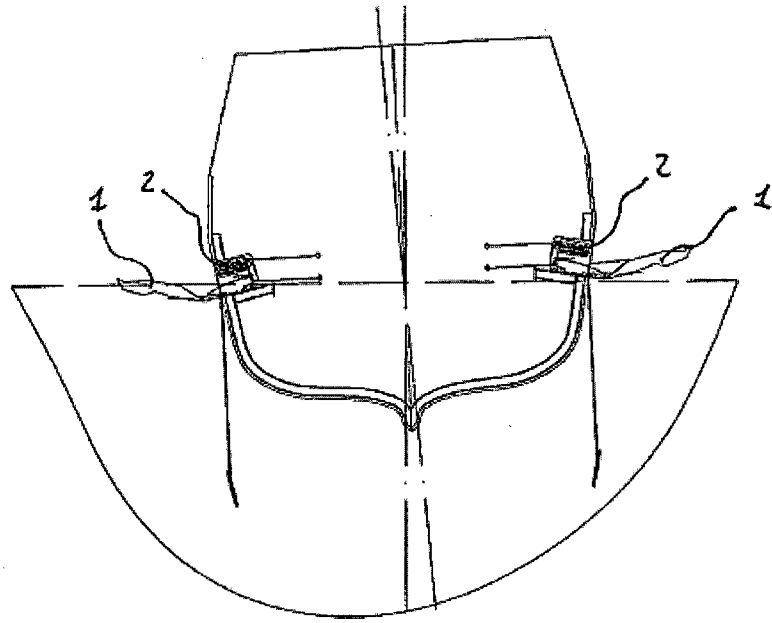


Fig.13

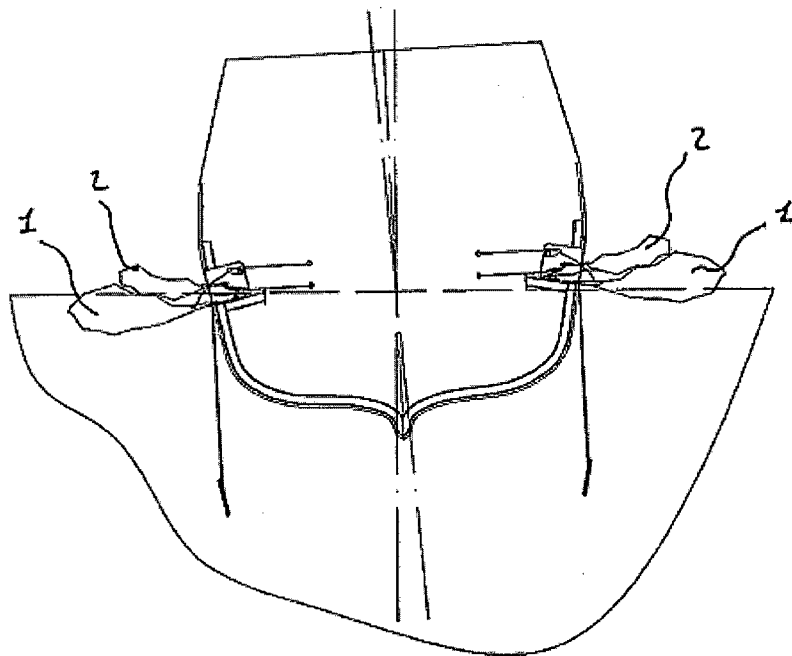


Fig.14

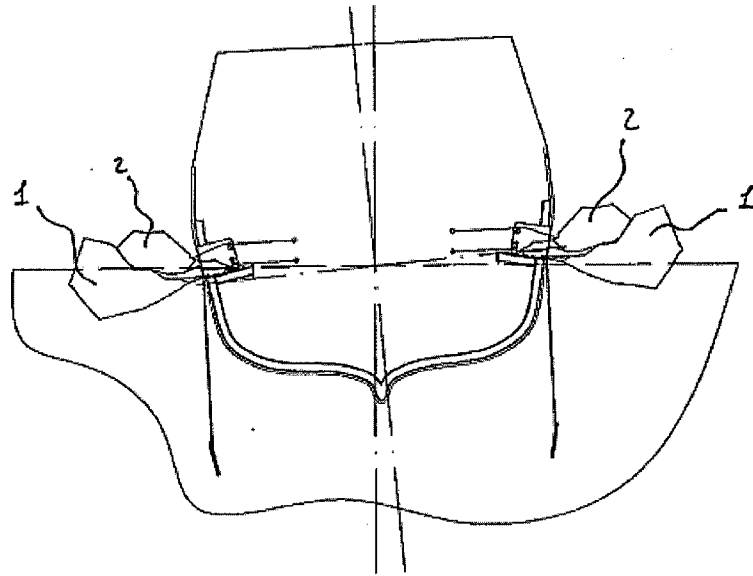


Fig.15

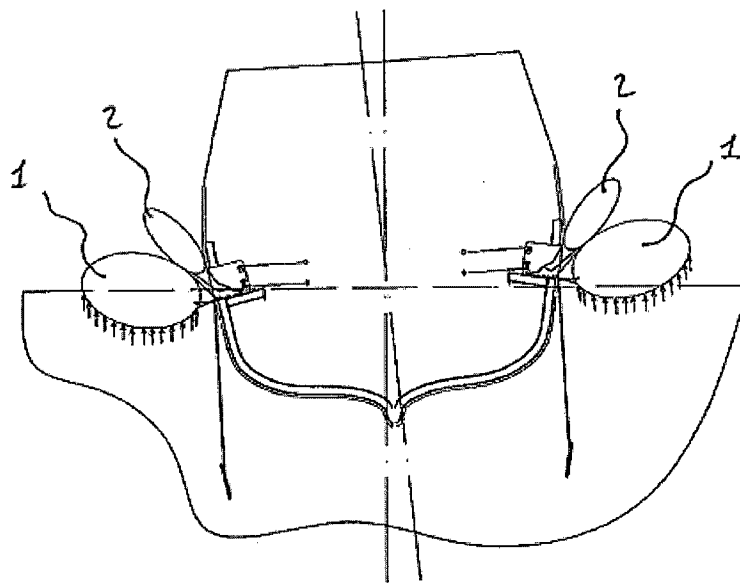


Fig.16

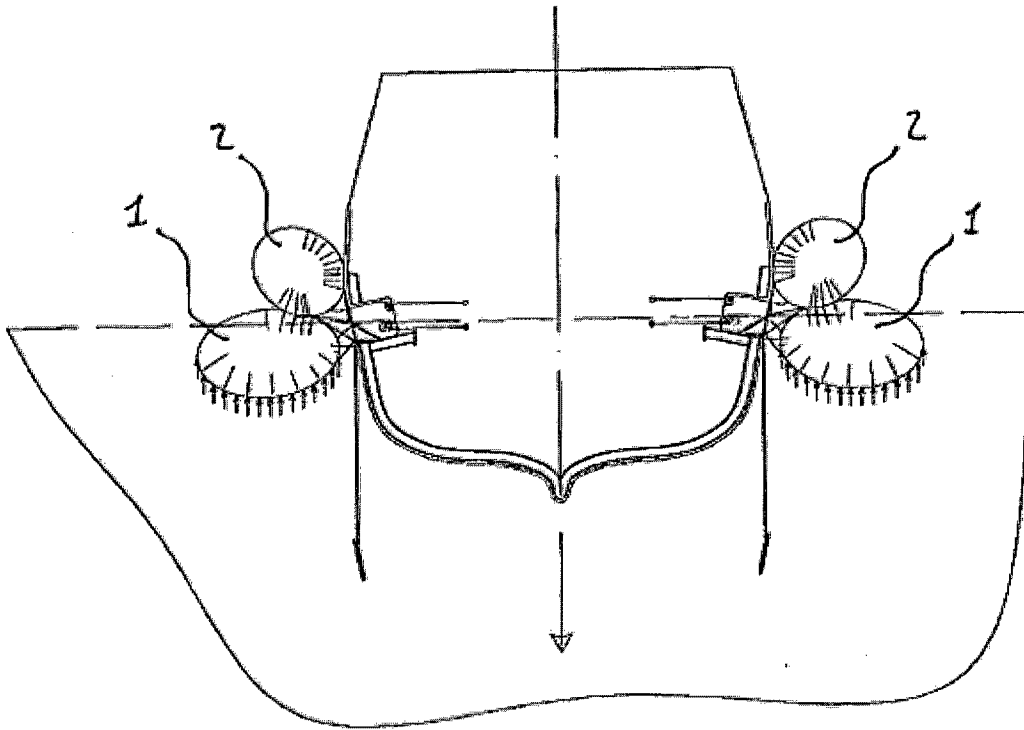


Fig.17

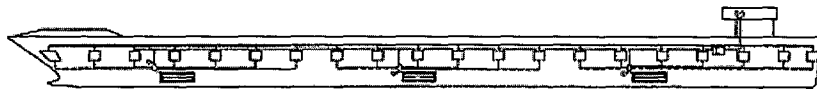


Fig. 18

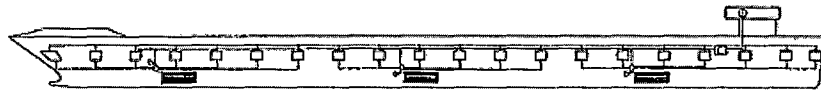


Fig. 19

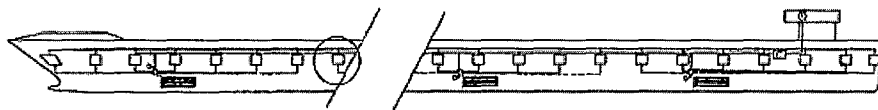


Fig. 20

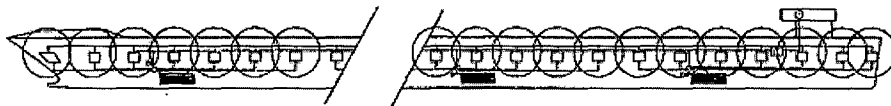


Fig. 21

INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
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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)
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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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2003/106478 A1 (MEARS TONY W [US] ET AL) 12 June 2003 (2003-06-12) paragraph [0057] - paragraph [0060] paragraph [0076] - paragraph [0082]; figures 1-41	1-10
A	----- GB 2 284 577 A (COOK JULIAN EDWIN [GB]) 14 June 1995 (1995-06-14) the whole document	1-10
A	----- GB 22271 A A.D. 1912 (BEGER ALFRED [GB]; FALKE HUGO [GB]) 3 July 1913 (1913-07-03) the whole document	1-10
A	----- EP 2 330 028 A1 (CHOLOGOUNIS DIMITRIOS [GR]) 8 June 2011 (2011-06-08) the whole document	1-10
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INTERNATIONAL SEARCH REPORT

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PCT/IB2013/000122

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 1 133 629 A (FOSTER FRELING C [US]) 30 March 1915 (1915-03-30) the whole document -----	1-10
A	GB 285 774 A (CARL GUSTAF FRIDHOLM) 23 February 1928 (1928-02-23) the whole document -----	1-10
A	US 1 448 607 A (MARTIN TWORSKI) 13 March 1923 (1923-03-13) the whole document -----	1-10
A	FR 455 760 A (CHARLES ARMAND EDGARD PUTOIS [FR]) 8 August 1913 (1913-08-08) the whole document -----	1-10

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IB2013/000122

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2003106478	A1	12-06-2003	AU 2003263877 A1 03-03-2004
			CA 2495764 A1 26-02-2004
			CN 1692055 A 02-11-2005
			EP 1534587 A2 01-06-2005
			KR 20050072416 A 11-07-2005
			US 2003106478 A1 12-06-2003
			WO 2004016500 A2 26-02-2004

GB 2284577	A	14-06-1995	AU 1116595 A 19-06-1995
			GB 2284577 A 14-06-1995
			WO 9515279 A1 08-06-1995

GB 191222271	A	03-07-1913	NONE

EP 2330028	A1	08-06-2011	EP 2330028 A1 08-06-2011
			WO 2011067109 A1 09-06-2011

US 1133629	A	30-03-1915	NONE

GB 285774	A	23-02-1928	NONE

US 1448607	A	13-03-1923	NONE

FR 455760	A	08-08-1913	NONE
