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(54) Title: SYSTEM FOR CONTROLLING THE FLOWS OF FLUIDS IN CONTAINERS AND HULLS

(57) Abstract: System for controlling the flows of fluids in containers and hulls, consisting of: A) slots (2), installed in a first closed, watertight configuration, capable of assuming a second irreversibly open configuration when the external pressure exceeds a predetermined tolerance threshold, the second open configuration being adapted to let air out of the internal space and to let in water from the outside, said at least two slots (2) being positioned in proximity to two opposite edges belonging to two lateral surfaces (1.1) of a container (1); B) a support (2.1) that surrounds each slot (2) and adheres to the lateral surface (1.1) of the container (1), by means of a coupling system (2.2) adapted to guarantee impermeability; C) protection grills (2.3) placed one on the external side and one on the internal side of each slot (2), adapted to protect against impacts and foreign objects that could compromise the operation thereof.

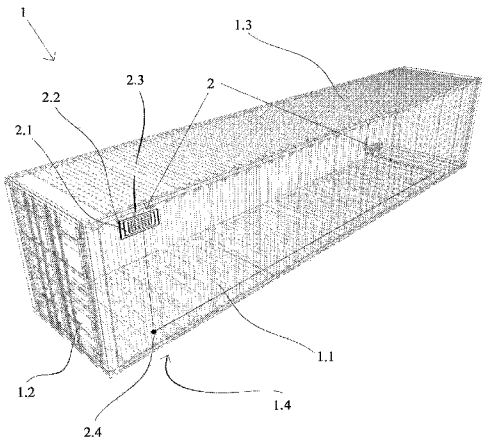

Fig. 1

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"System for controlling the flows of fluids in containers and hulls"

Description

Field of the invention

The present invention relates to the field of maritime transport, in particular of goods, even more in detail in the field of containers and cargo ships.

Prior art

The introduction of the container dates back to an invention of 1956, the year in which an American entrepreneur in the field of transport realized how much faster it was to use a transport system in which the goods are loaded only once inside the container and are transported together with the latter. In this way the load is less damaged, the logistic operations are optimized and the loading and unloading of the means of transport is made faster.

At the beginning of the seventies the standards of the sector were defined, today arrived at the definition of the ISO container: it is a metal parallelepiped whose measures have been established in 244 cm X 259 cm X 610 or 1220 cm. The attachments on the corners of the container are also homogeneous, specific for fixing on the various means of transport. In this way, by means of forklifts, overhead cranes or cranes, they are easily transferable between a ship, a wagon or a truck. The features of these attachments, combined with the intrinsic robustness of the container, allow them to be stacked one on top of the other, improving the use of piers, docks and warehouses.

For particular uses, ISO tank containers, refrigerators, with opening roofs or opening side walls have also been prepared.

Currently, the importance of containers in the field of maritime transport has reached such a level that about 90% of goods are transported by sea through the use of about 200 million containers per year.

The main problem concerning the trips made by all these containers consists in that for various

reasons, some containers fall into the sea during transport and begin to float on the surface of the water for days and days, without being seen by radar. On average, a container floats 60 to 170 days before sinking, depending on the size of the cargo. During this time, they cover enormous distances, posing a great danger to other ships and to oil and gas bases located at sea.

Various solutions are already known which help the buoyancy of lost containers in order to speed up costly search and recovery operations.

For example, the Chinese patent CN 103381943 A of 2013 describes a particular type of container provided with a flotation device that inflates automatically when it detects the presence of water. Actually, however, these containers lost at sea are left adrift until their natural sinking, given the very high costs to be incurred to recover them.

The object of the present invention is to propose a device applicable to all existing containers and, possibly, to any hull, capable of allowing the automatic sinking of these objects lost at sea, in order to avoid the danger for ships and maritime bases.

Description of the invention

According to the present invention, an automatic sinking device for containers and hulls lost at sea is provided with the aim of sinking ISO containers of any size and any boats missing at sea, for example racing hulls, in a safe and fast manner, making maritime navigation free of floating obstacles.

Advantageously, said sinking device consists of at least a pair of slots 2 positioned in proximity to two opposite edges belonging to two lateral surfaces 1.1 of any container 1. This positioning is due to the fact that, given the impossibility of predicting the final buoyancy configuration of a dispersed container 1, there will in any case be at least a slot 2 located near the sea level. This feature advantageously allows the air to escape from inside the container until it sinks.

Advantageously, said slots 2 are installed in a first closed configuration, which guarantees the watertight seal of the container 1, and are capable of irreversibly assuming a second open

configuration when the external pressure exceeds a predetermined tolerance threshold.

Said second irreversibly open configuration is advantageously adapted to allow the water to enter the container 1 and the air to exit towards the outside, up to a condition of equilibrium between the two fluids, given by the total sinking of container 1.

Advantageously, said slots 2 can be connected to a centralized pressure sensor 2.4, adapted to make all the slots 2 installed simultaneously assume the second open configuration, when a pressure beyond a certain tolerance threshold is detected. Said tolerance threshold will be such as to determine the opening of the slots 2 only when the whole container 1, or part of it, is immersed in a liquid, specifically in the sea.

Advantageously, other slots 2 can be placed in a free position both on the lateral surfaces 1.1 and on the opening surface 1.2, on the cover 1.3 and on the base 1.4.

In the event that at least a pair of the already described slots 2 is installed on a hull 3, they will be advantageously connected to a remote control device 5 of a user. In this way, in case of abandonment of the boat for any reason, the user can cause the sinking of the hull 3, by acting on said control device 5 which, at a distance, is able to cause the irreversible opening of the slots 2 and therefore the entry of water into the hull 3 and the escape of air.

Advantageously, even in the case of a hull 3, the positioning of the slots 2 will be diametrically opposite to each other so that, whatever the positioning of the hull 3 on the water, there is always at least a slot 2 positioned at the sea level.

Advantageously, more than two slots 2 can be installed on any part of a hull 3.

In the case of installation of said slots 2 on a hull 3, these can be advantageously connected to an activation device 4, remotely connected to said control device 5, capable of causing irreversible and simultaneous opening of all slots 2 present on the boat. One of the further advantages of this possible embodiment consists in that it is possible to connect several activation devices 4, installed on different hulls 3, to the same remote control device 5, so as to be able to cause the sinking of all the hulls of a multihull boat.

Advantageously, said slots 2 are mounted on a support 2.1 which completely surrounds them and connects them stably and irreversibly to the container 1 or to the hull 2 by means of a

common coupling system 2.2. Said support 2.1 can advantageously be made of any natural or synthetic polymer, endowed with sufficient mechanical resistance and to the action of chemical and atmospheric agents, preferably, a polymer similar or equal to the surface of the container 1 or of the hull 3 on which the slot 2 is installed will be used.

Advantageously, said common coupling system 2.2 may consist of a welding, of a connection by means of rivets or pins, of a bonding by means of resin or glue or of any other system known to a person skilled in the art, adapted to irreversibly fix said support 2.1 to the container 1 or hull 3.

Advantageously, each of said slots 2 is protected by a pair of grills 2.3 placed one on the external side and one on the internal side of said slot 2 and adapted to protect the relative slot from impacts and foreign bodies that could get stuck there.

Description of the figures

The invention will hereinafter be described in at least a preferred embodiment thereof by way of non-limiting example with the aid of the accompanying figures, in which:

- FIGURE 1 illustrates a three-dimensional view of a container 1 consisting of three lateral surfaces 1.1, an openable surface 1.2, a cover 1.3 and a base 1.4, in which two slots 2 are seen placed on the opposite edges of two lateral surfaces 1.1 and consisting of a support 2.1, a coupling system 2.2 and related grills 2.3; also the pressure sensor 2.4 connected to both slots 2 can be seen;
- FIGURE 2 illustrates a plurality of two-dimensional drawings representing the elevations of a container provided with the sinking device, in particular FIG. 2A shows the cover 1.3 on which four circular slots 2 are installed at the four corners; FIG. 2B shows a longitudinal lateral surface 1.1 on which four circular slots 2 are installed at the four corners; FIG. 2C shows the base 1.4 on which no slots 2 are installed; FIG. 2D shows the openable surface 1.2 on which no slots 2 are installed; FIG. 2E shows the lateral transversal surface 1.1 on which four circular slots 2 are installed at the four corners;
- FIGURE 3 shows a three-dimensional view of a hull 3 provided with two slots 2 connected to an activation device 4 remotely connected to a control device 5; each slot 2 consists of a

support 2.1, a coupling system 2.2 and a pair of protection grills 2.3.

- FIGURE 4 shows in detail the structure of the slots 2 positioned on the surface of the container 1.

Detailed description of the invention

With reference to FIG. 1, a common ISO container 1 provided with the automatic sinking system object of the present invention is shown.

This system consists of at least two slots 2 placed at the opposite edges of two lateral surfaces 1.1 of a container 1. Said slots 2 consist of an external part 12 mounted on the external surface of the container 1 and an internal part 11 mounted on the internal surface of the container 1; a thin membrane 13 is positioned inside said slots 2 and is designed to prevent the passage of water from the outside to the inside of the container 1 and the passage of air from the inside to the outside. In the event that the external pressure exceeds a certain established value, said thin membrane 13 is capable of irreversibly breaking, allowing the air to escape from the container 1 and the passage of water inside it, leading to the sinking of the container 1 itself.

Said slots 2 are surrounded by a support 2.1, preferably made of the same material as the surface on which it adheres by means of a common coupling system 2.2. Specifically, if the slot 2 is installed on the lateral surface 1.1 of a container 1, the support 2.1 will preferably be made of sheet metal; if instead the slot 2 is installed on a hull 3, the support 2.1 will be in aluminum or fiberglass depending on the construction method of the hull 3 itself. The object of said support 2.1 is to provide mechanical resistance to atmospheric agents and chemical agents to the entire slot 2.

Depending on the construction material of both the support 2.1 and the container 1 or the hull 3, said slot 2 will be provided with the appropriate coupling system 2.2 that irreversibly connects it to the container 1 or to the hull 3. Said coupling system 2.2 can be, by way of non-limiting example, a weld, a plurality of pins or rivets or any glue.

With reference again to FIG. 1, it can be seen that both the internal surface and the external

surface of the slot 2 are protected by a grill 2.3 which, in addition to providing resistance to accidental impacts, prevents any foreign object from entering the open slot 2, blocking the flow of air or of water.

Said slots 2, which may also obviously be present in a number greater than two, are capable of opening automatically when they detect an external pressure that exceeds a certain tolerance threshold. The opening, which is irreversible, causes the entry of water and the exit of air from inside the container 1 or the hull 3 and causes it to sink rapidly.

With reference to FIG. 2, the six sides that make up a common ISO container 1 are shown. In this preferred embodiment, by way of non-limiting example, cylindrical slots 2 are used which are positioned at the four corners of the cover 1.3 and at the four corners of all lateral surfaces 1.1, both the two longitudinal ones and the one bottom transversal one. The only two surfaces on which slots 2 are not installed are the openable surface 1.2 and the base 1.4 of container 1.

To be sure of the operation of the device, it is also possible to install double slots 2, i.e. consisting of two separate openings, capable of irreversibly opening when a pressure higher than a tolerance threshold is detected. In this way, in the event of failure of one of the two openings, for any reason, the operation of the slot 2 will be guaranteed by the opening of the other.

Said membrane 13, contained within said slots 2, can also be made in a saline version capable of melting and allowing the passage of water inside and the escape of air in the event of constant and prolonged contact with water, making the container 1 sink.

In the case of a container 1, which in normal conditions travels out of the water, it is possible to connect the opening of the slots 2 to a pressure sensor 2.4 which, when it detects an external pressure beyond the tolerance threshold, simultaneously and irreversibly opens all slots 2.

Said pressure sensor 2.4 is not applicable to a hull 3 since the latter is always at least partially immersed in water. As shown in FIG. 3, the slots 2 of an automatic sinking system applied to a hull 3 are connected to an activation device 4 which simultaneously and irreversibly opens all the slots 2 upon the remote command of a control device 5 operated by a user.

If the boat consists of more than one hull 3 (in the case of a catamaran or a trimaran) the control

device 5 can be remotely connected to more than one activation device 4, each located in a different hull 3 and connected to the slots 2 relating to that hull 3. In this way, in the event of a naval disaster, after having rescued all the crew, it is possible to decide the sinking of the hull 3 or the hulls 3 of a boat, to avoid their wandering at sea from constituting a danger for navigation.

Finally, it is clear that modifications, additions or variants that are obvious to a person skilled in the art can be made to the invention described so far, without thereby departing from the scope of protection provided by the appended claims.

Claims

1. System for controlling the flows of fluids in containers (1), **characterized in that** it comprises a container (1) provided with:

- at least a pair of slots (2) with airtight seal, installed on the surface of said container (1), adapted to be irreversibly opened in the case of external pressure exerted that exceeds a specific pre-established value; said slots (2) are constituted by an external part (12) mounted on the external surface of the container (1) and by an internal part (11) mounted on the internal surface of the container (1); within said slots (2), a thin membrane (13) is positioned that is adapted to prevent the passage of water from the outside to the interior of the container (1) and the passage of air from the interior to the outside; upon exceeding a certain pre-established value of the external pressure, said thin membrane (13) is adapted to be irreversibly broken, allowing the exit of air from the container (1) and the passage of water to its interior, leading to the sinking of the container (1) itself;
- a support (2.1) positioned inside the perimeter of each of said slots (2), stably adhering to the lateral surface (1.1) of the container (1), is adapted to ensure the impermeability; said support (2.1) is installed by means of any one coupling system (2.2) commonly found on the market;
- a pair of protection grills (2.3), one placed on the external side and one on the internal side of each slot (2), adapted to protect the corresponding slot (2) from accidental impact and preventing extraneous objects from being stuck at its interior, compromising the operation thereof.

2. System for controlling the flows of fluids in containers (1), according to claim 1, **characterized in that** said container (1) is provided with a plurality of slots (2) freely arranged on its lateral surfaces (1.1), on its openable surface (1.2), on its cover (1.3) and on its base (1.4), arranged in a manner such that, whatever the position of the container

(1) in the sea, at least a slot (2) is placed on the surface closest to the water surface.

3. System for controlling the flows of fluids in containers (1), according to any one of the preceding claims, **characterized in that** the support (2.1) of each slot (2) is constituted by any one natural or artificial polymer, adapted to resist mechanical stresses, chemical and weathering agents and adapted to be irreversibly fixed with the surface of the container (1) on which the slot (2) is installed, preferably the same type of plate will be used which constitutes the surfaces of the container (1).

4. System for controlling the flows of fluids in containers (1), according to any one of the preceding claims, **characterized in that** all the slots (2) installed on the same container (1) are connected to a pressure sensor (2.4) adapted to simultaneously open all said slots (2) at the moment in which an external pressure is detected that exceeds a specific tolerance threshold.

5. System for controlling the flows of fluids in hulls (3), **characterized in that** it is constituted by a hull (3) provided with:

- at least a pair of slots (2) with airtight seal, installed on the surface of said hull (3), adapted to be irreversibly opened in the case of external pressure exerted that exceeds a specific pre-established value; said slots (2) being constituted by an external part (12) mounted on the external surface of the hull (3) and by an internal part (11) mounted on the internal surface of the hull (3); within said slots (2), a membrane (13) being positioned that is adapted to prevent the passage of water from the outside to the interior of the hull (3) and the passage of air from the interior to the outside; once a predetermined value of the external pressure has been exceeded, said membrane (13) being adapted to be irreversibly broken, allowing the exit of air from the hull (3) and the passage of water to its interior, leading to the sinking of the hull (3) itself;
- a support (2.1) positioned within the perimeter of each of said slots (2), stably

adhering to the lateral surface of the hull (3), adapted to ensure the impermeability thereof; said support (2.1) being installed by means of any one coupling system (2.2) that can be commonly found on the market;

- a pair of protection grills (2.3), one placed on the external side and one on the internal side of each slot (2), adapted to protect the corresponding slot (2) from accidental impact and preventing extraneous objects from being stuck at its interior, compromising the operation thereof.

6. System for controlling the flows of fluids in hulls (3), according to claim 5, **characterized in that** said hull (3) is provided with a plurality of slots (2) freely arranged on its surface, arranged in a manner such that, whatever the position of the hull (3) in the sea, at least a slot (2) is placed at the free surface of the water, i.e. the float line of the hull (3).

7. System for controlling the flows of fluids in hulls (3), according to any one of the preceding claims 5 and 6, **characterized in that** the support (2.1) of each slot (2) is made of any natural or artificial polymer, adapted to resist mechanical stresses, chemical and weathering agents and adapted to be irreversibly fixed with the surface of the hull (3), and preferably the same polymer that constitutes the hull (3) will be used.

8. System for controlling the flows of fluids in containers (1) and hulls (3), according to any one of the preceding claims, **characterized in that** said slots (2) comprise a membrane (13) made of saline material, adapted to be dissolved in case of prolonged and continuative contact with water, thus allowing the passage of water to the interior and exit of air, leading to the sinking of the container (1) or of the hull (3).

9. System for controlling the flows of fluids in hulls (3), according to any one of the preceding claims 5 to 8, **characterized in that** all the slots (2) installed on the same hull (3) are connected to at least an activation device (4) adapted to simultaneously make all said slots (2) take on said second open configuration; said activation device (4) being

connected in a remote manner to a common control device (5) actuated by a user.

10. System for controlling the flows of fluids in containers and hulls, according to any one of the preceding claims, **characterized in that** said coupling system (2.2) can be constituted by a welding, by a plurality of rivets or by any one glue that can be found on the market or by any other system adapted to irreversibly fix, in an airtight manner, the slot (2) with the relative support (2.1) to the surface of the container (1) or of the hull (3) and to maintain the impermeability and the resistance over time.

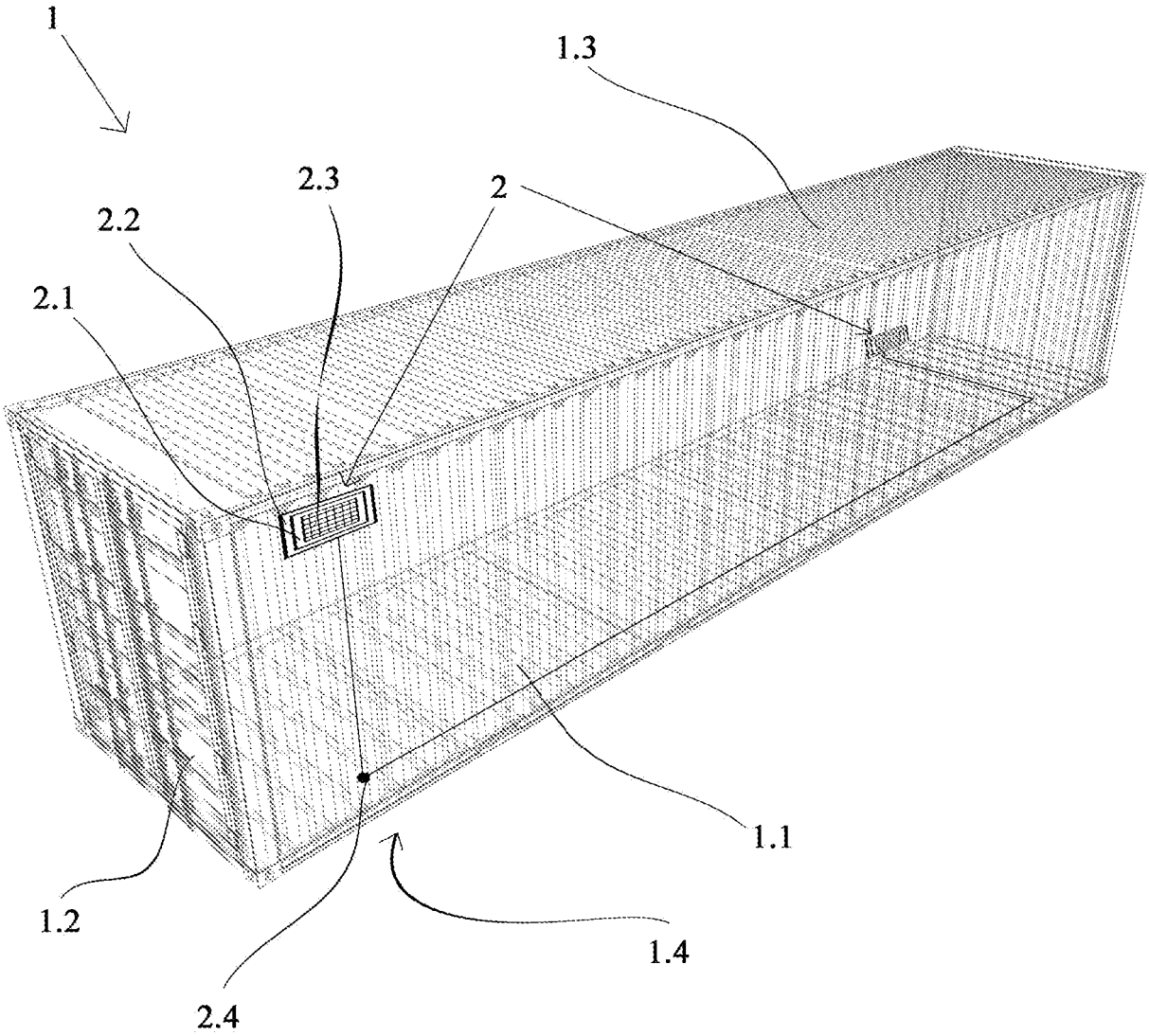

Fig. 1

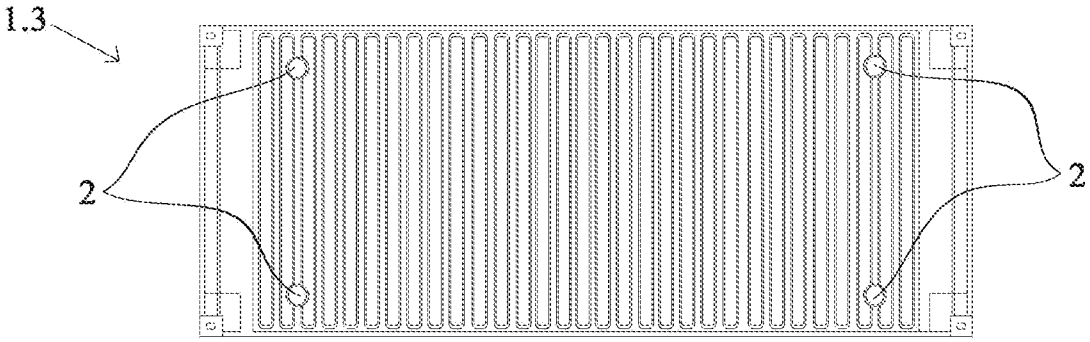

Fig. 2A

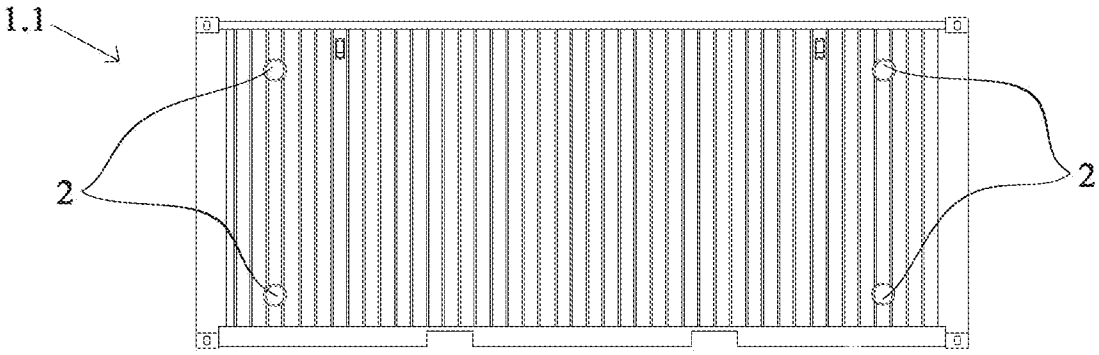

Fig. 2B

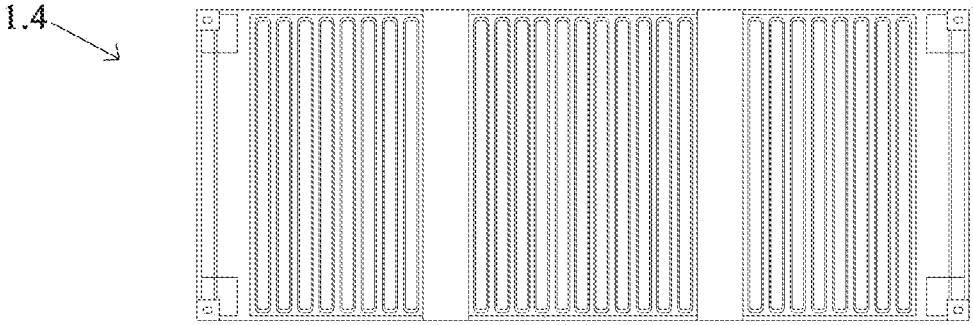

Fig. 2C

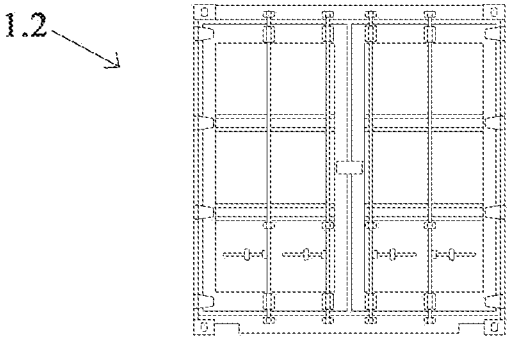

Fig. 2D

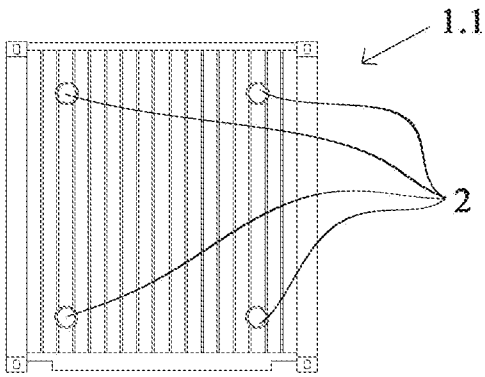

Fig. 2E

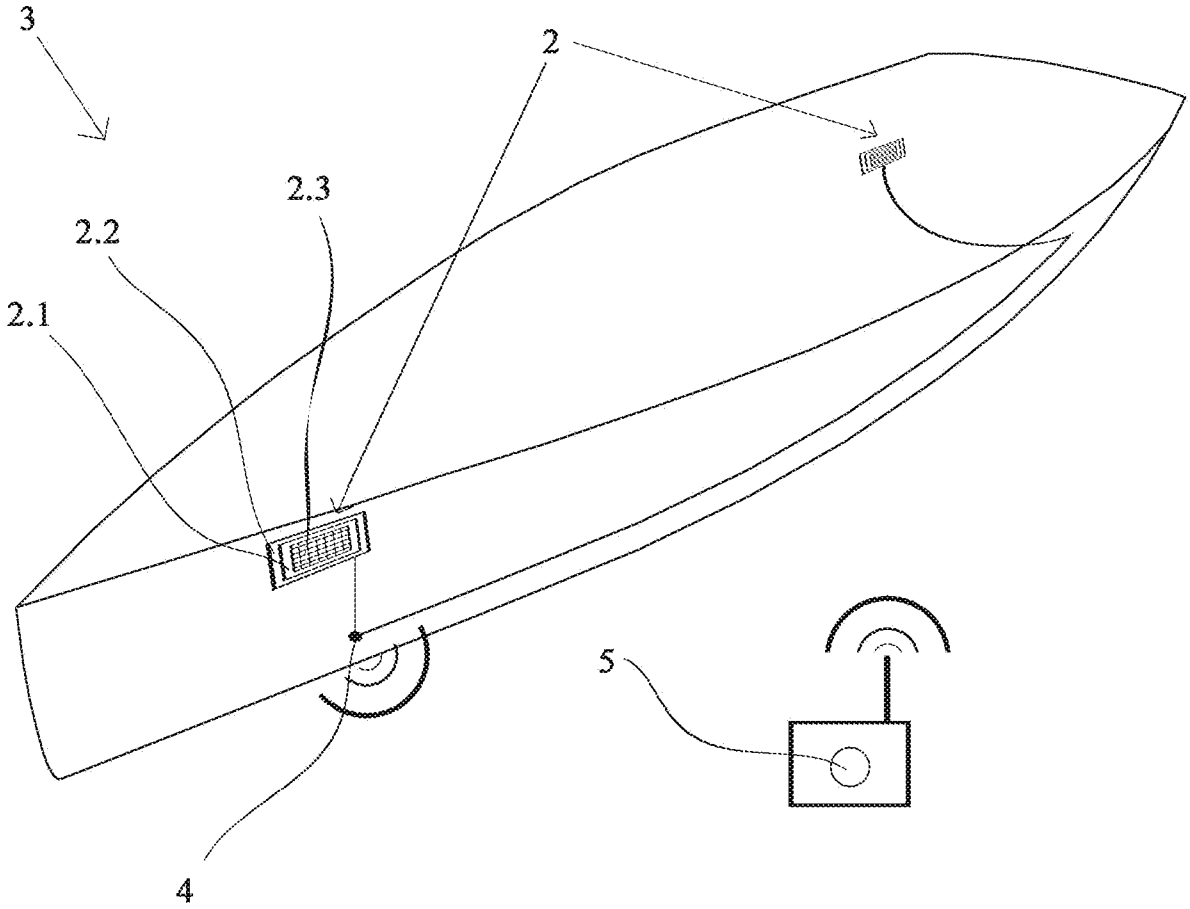

Fig. 3

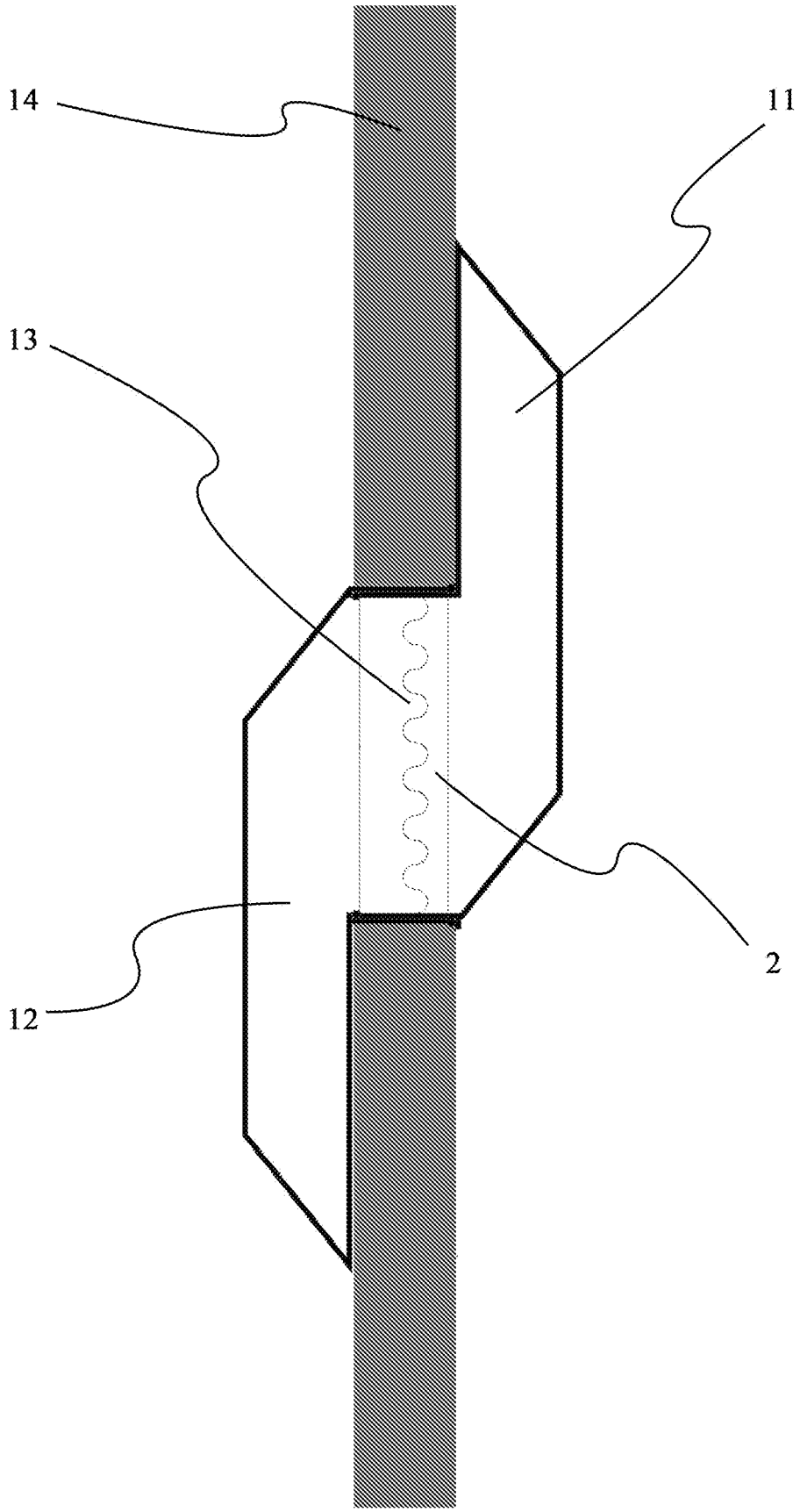

Fig. 4

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2021/062075

A. CLASSIFICATION OF SUBJECT MATTER
INV. B65D90/22 B65D90/48
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)
B65D

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	WO 2017/149411 A1 (CIALLELLA GIOVANNI [IT]; MULARGIA ALESSANDRO [IT]) 8 September 2017 (2017-09-08)	1-7,9,10
A	page 5, line 8 - page 7, line 3; figures 1-3	8
A	GB 2 459 683 A (PRIESTLY TOBY JONATHAN [GB]) 4 November 2009 (2009-11-04) page 3, line 27 - page 8, line 9; figures 1,2	1-10
A	WO 2010/061159 A1 (PRIESTLY TOBY [GB]) 3 June 2010 (2010-06-03) page 5, line 10 - page 14, line 13; figures 1-9	1-10

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[x] Further documents are listed in the continuation of Box C.

[x] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"X" document of particular relevance;; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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Date of the actual completion of the international search	Date of mailing of the international search report
27 January 2022	09/02/2022

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Lämmel, Gunnar

1

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2021/062075

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB 2 448 476 A (SAFE SEAS LTD [GB]) 22 October 2008 (2008-10-22) page 3, line 16 - page 7, line 17; figures 1-10b -----	1-10

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IB2021/062075

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