



(51) International Patent Classification:
B63B 43/10 (2006.01) *B63B 43/16* (2006.01)

(21) International Application Number:
PCT/EP2018/051437

(22) International Filing Date:
22 January 2018 (22.01.2018)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
20170104 24 January 2017 (24.01.2017) NO

(71) Applicant: PRO SØR GEIR EDVARD KARLSEN
[NO/NO]; Bellevue 27, N-4616 Kristiansand S (NO).

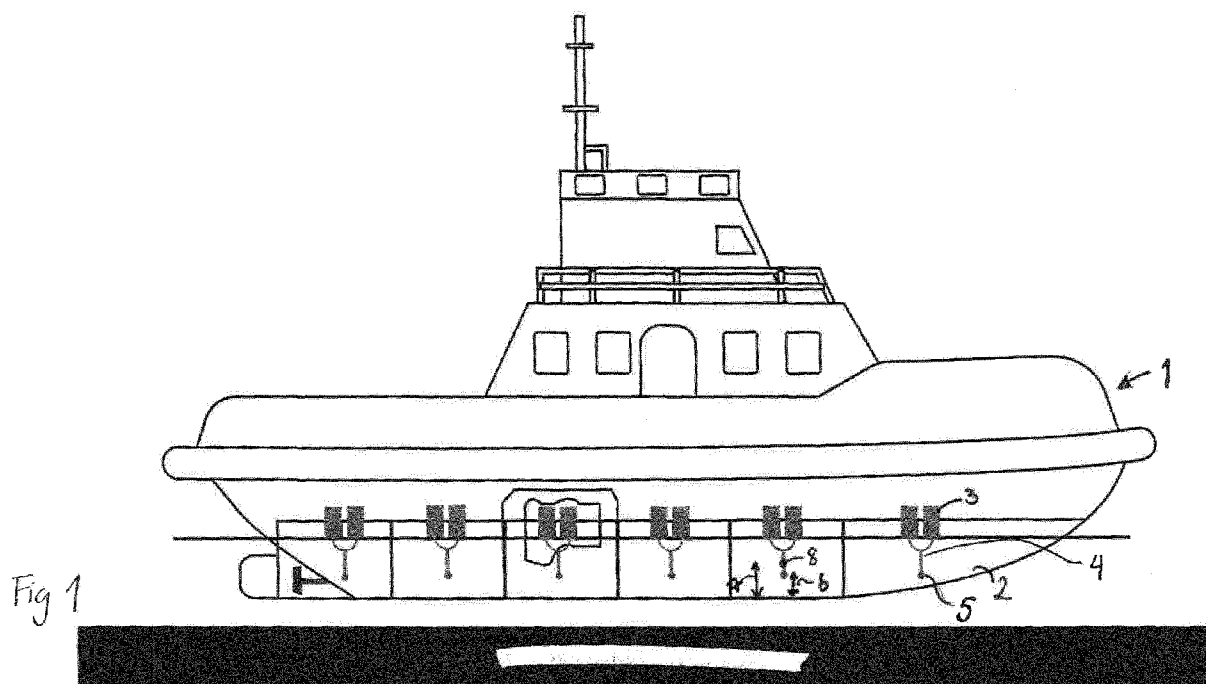
(72) Inventor: KARLSEN, Geir, Edvard; Bellevue 27,
N-4616 Kristiansand S (NO).

(74) Agent: ONSAGERS AS; P. O. Box 1813, Vika, N-0123
Oslo (NO).

(81) Designated States (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK,

(54) Title: A SAFETY SYSTEM FOR A VESSEL



(57) Abstract: The invention concerns a safety system for a vessel comprising a source of foamable material and a passageway for distribution of the foamable material. The actuation device is arranged to control a flow of foaming material from the source of foamable material and through the passageway. The actuation device is provided operable in response to an preset water level in a compartment of the vessel. In use the actuation device is positioned in the compartment corresponding to preset water level in the compartment and the actuation device is provided operable to allow the foaming material into the compartment through the passageway when an actual water level in the compartment reaches the preset water level. The invention also concerns a vessel comprising a safety system.

EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV,
MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM,
TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW,
KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

- *as to the identity of the inventor (Rule 4.17(i))*
- *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*
- *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*
- *of inventorship (Rule 4.17(iv))*

Published:

- *with international search report (Art. 21(3))*

A SAFETY SYSTEM FOR A VESSEL

TECHNICAL FIELD

The present invention relates to the field of safety or protective systems for a vessel, ship or other floating structures. The invention may also be installed on an aeroplane as safety measure in case of a crash into water.

In particular the present invention is applicable for leisure boats and fishing boats, but in general the workings of the safety system makes the system suitable for all kind of vessel and ships independent of size and use.

More specifically, the invention relates to a safety system for detecting a rising water level in a compartment of a vessel (and a plane) and subsequently providing a material into the compartment that is buoyant and/or simply capable of filling the compartment to prevent further water entrance in order to keep the vessel floating in an emergency.

BACKGROUND

For all marine activity such as in the commercial fleet and for leisure boating a continuously effort has been put into increasing the safety for both crew and passengers.

A main focus of attention when regarding safety at sea has been the risk of fire. However, recent surveys have shown that the risk of colliding with a rock or grounding is larger than the risk of fire, especially for fishing and leisure boats. While equipment to extinguish fire is compulsory on all fishing and leisure boats, a safety system to prevent the boat from sinking is not considered a necessity on these boats, despite the aforementioned risk of sinking. Based on this the effort to provide efficient working safety systems to reduce the risk of possible sinking of a vessel or a boat would represent a considerable contribution to save human lives.

The possible serious consequences of damages to the hull of a vessel resulting in water entrance into the interior of the hull have incurred various safety and protective systems for preventing the sinking of vessels.

In accordance with prior art such as disclosed in WO 88/00882 expandable and inflatable devices are provided to prevent the sinking of ship by displacing water leaking through a breach in ship hull. The system as disclosed in WO 88/00882 is to be activated by manual operation.

US 6098563 describes an extensive system for detecting a leak through a breach in the hull, and thereafter initiating an operation for sealing off the breach to withstand the force of water working on the breach. The system includes a sensor system for

detection of a breach in the hull and a control system to control and monitor the injection of a foam to seal the breach, as well as a distribution system to inject the foam into compartments where the breach occurs.

5 This system and its operational method has certain disadvantages. Firstly, the system is intended for use on a tanker or cargo ship and the described protection system is elaborate and complex. The sensing system as suggested in US 6098563 includes sensing means integrated in the hull for detecting of breaches in the hull and these sensing means may comprise pressure detecting means for capturing
10 compression of substances accommodated in a compartment. These compressions are induced by the breaching of the hull. Further the system requires both a control system and an elaborate distribution system to coordinate the delivery of the foaming material in dependence on the input of signals from the sensors. But again this system is especially suitable for a large cargo ships and in this perspective a complex system appears suitable for ensuring an overall monitoring of the large hull
15 and enabling the sealing at all possible places of the large hull where breaching may occur.

Further prior art documents include BE 630137, DE 202012000799, FR 2476588, CN 202879764 and KR 20140098361 which describes various arrangements for preventing the sinking of ships by introducing expandable foam into a compartment
20 to dispose of water as leaked into the compartment.

An object of the present invention is to solve, or at least substantially alleviate, the above-described disadvantages of the prior art protection systems.

A further object is to provide a versatile safety system that is reliable and suitable in various boats and vessels and that also may be suitable for retrofitted instalment.
25 It is further an object for the invention that the construction is simple and that working of the safety system is rapid.

SUMMARY

The invention is defined in the independent claims. Further additional features are set forth in the dependent claims.

30 The invention provides a safety system for a vessel comprising a source of foamable material and a passageway for distribution of the foamable material and an actuation device arranged to control a flow of foaming material from the source of foamable material and through the passageway. The safety system is prepared to be installed on the vessel when building the vessel or later on, as an after
35 installment carried out by a professional operator or by the owner himself. The actuation device, which may comprise sense and response means, is provided operable in response to exposure of water. The actuation device is arranged operable to allow the foaming material into the compartment through the

passageway. In use, when installed on the vessel, the actuation device is arranged in the compartment of the vessel at a position corresponding to a preset water level in the compartment. The preset water level represents a threshold value for initiation the operation of the actuation device. When an actual water level in the
5 compartment reaches the preset water level, the actuation device is exposed to water and triggers the actuation device to allow the delivery of the foaming material into the compartment through the passageway.

The invention may in one aspect concern a vessel comprising the safety system.

10 As mentioned previously, the safety system may also be suitable for use on an aircraft such as an aeroplane, and all explanations and descriptions of the safety system as provided for a vessel are also applicable for the safety system as employed on an aircraft. In the context of this document the term vessel should be
15 understood to include both an aircraft and all kind of boats and ships.

When used on an aeroplane, the safety system will be installed in a compartment in the aeroplane, preferably a compartment in proximity to the bottom of the plane. The safety system for a plane then comprises a source of foamable material and a
20 passageway for distribution of the foamable material and an actuation device arranged to control the flow of foaming material from the source of foamable material and through the passageway. The actuation device, which may comprise sense and response means, is provided operable to exposure of water. The actuation device is arranged operable to allow the foaming material into the compartment
25 through the passageway. . In use, when installed on the aero plane, the actuation device is positioned in the compartment of the plane corresponding a the preset water level in the compartment and the actuation device is operable to allow the foaming material into the compartment through the passageway when an actual water level in the compartment reaches the preset water level. This inventive
30 aspect may also concern a plane comprising the safety system.

If an emergency arises the pilot may control the actuation of the safety system. The actuation device may then be operable in response to a signal from a control panel to allow an operator to control the release of foaming material into at least one
35 compartment independent of the water level of the compartment.

By the arrangement of the safety system, the actuation device detects when the rising water level reaches a preset level and is then capable of opening the passageway for delivery of the foaming material into the compartment. The
40 actuation device is positioned in the compartment at a distance from the bottom of the compartment which corresponds to the preset water level, at which it is considered necessary to initiate the actuation device water level to ensure the safety

of the vessel. Usually when calculating the preset water level, this is determined including a safety measure to avoid the risk of sinking before the onset of the workings of the system. As the skilled person will realize, the included safety measure may vary from a minimum to a relatively large safety margin or no safety measure at all. The position of the actuation device or the preset water level may be the same or vary from compartment to compartment, if plural compartments are present in the same vessel.

The actuation device is provided operable in response to exposure of the water and could be said to be working according to an automatic principle as the exposure of the water triggers the rapid delivery of foam material into the compartment when the water level is rising above the preset level. As this safety system does not require a central control system nor various sensors in communication with the control system, the safety system when provided in a simplified version may be provided as an entity comprising the source of foamable material, passageway and the actuation device to be placed locally in or in close distance to the compartment. It is also possible to locate the entity distanced away from the compartment and extend the passageway from the installed location of this entity to the compartment in order to deliver the foaming material into the compartment. The workings of the actuation device provides for a rapid delivery of foaming material into a compartment with rising water level, and thus ensures that the unwanted intrusion of water through for instance a leak in the hull is stopped, and also if the foam material has buoyant characteristics, that additional buoyancy is added to the compartment when the foam material occupies the compartment.

Various materials may be used as the source of foamable material, the main goal of using a source of foamable material being that the foamable material occupies a small place when held in the source for instance pressurized in a tank. The foamable material is capable of filling a large volume when let out from the source in the state of foaming material to occupy the compartment. These tanks may be self contained tanks capable of the discharge of foamable material, independent of external energy or activation sources. The object of the foamable material when let into the compartment is for the foaming material to fill the compartment and cure into a foamed material. The foam material may then be capable of closing off a possible fracture or break through the hull offering a certain resistance to reduce or avoid entirely the further entrance of water. In addition the foamed material may have buoyant characteristics when delivered into the compartment with a rising water level. The foamable material may comprise a one component material or a two component material for instant a polymer or other constitutions where the material is capable of foaming and curing into a foam material with the aforementioned strength and buoyant characteristics when inhabiting the interior of the compartment upon release through the passageway into the compartment.

By positioning the actuation device in the compartment of the vessel or a plane corresponding to a preset water level in the compartment, it is ensured that the actuation device releases the foaming material into the compartment when the water is rising and reaches the preset level independent on the location of the possible hull fracture or the reasons for the elevated water level. The rising water could be caused by a leak in the compartment or in a neighbouring compartment, given that there is access between the compartments, or the water could be rising due to internal leak from some equipment in the boat. In the latter case, given that the foaming material has buoyant characteristics in a cured form, the release of curable foaming material would add to the total buoyancy of the vessel or the plane. When determining the position of the actuation device and the preset water level in the compartment, this must be balanced against the need for allowing some water to be present for instance on the floor, to avoid the unauthorized release of the foam material. The actuation device may be installed in a position 15-20 cm above floor, but this installation distance may vary in accordance with the type of vessel (or plane) and overall operating conditions.

Advantageously, the foam material may be non-flammable and/or have a working temperature of -40°C to 400°C.

The passageway of the safety system may be provided as pipe elements or other structures capable of forming a fluid path. However, the passageway may in some circumstances assume the form of an opening, in particular when the safety system is to be provided as a compact entity for instance a tank constituting the source and an opening in the tank providing the passageway and the actuation device being arranged to control the flow of foamable material out from the tank.

In one embodiment of the safety system the actuation device may comprises a sense and response means that is operable in response to the exposure of water for instance operable in response to a preset hydrostatic pressure. When the water rises in the compartment, the sensing means of the actuation device may detect the hydrostatic pressure corresponding to the preset water level and the actuation device is then set to respond accordingly.

The actuation device may also be operable in response to other working or triggering conditions than pressure for instance electrical conductivity or other water characteristics readily detected by simple sensing means.

The actuation device may comprise sensing means, where the response means is operable in response to the exposure of water as detected by the sensing means. The actuation device may be arranged as a valve device operable set to control the delivery of foam through the pathway and into the compartment by opening and closing the pathway, for instance operable in response to a preset hydrostatic

pressure. The valve device may comprise a valve body arranged for opening the pathway, as a response to the sensing means detecting water. The valve device may be arranged with a valve body initially positioned for closing the pathway. As a response to the sensing means detecting water, for instance a preset hydrostatic pressure, the valve body may be set in a position for opening the pathway,

The valve device may comprise a hydrostatic valve device which is operable when exposed to a hydro static pressure corresponding to a 10 cm water column or about 0,01bar. As such, when installed in the vessel, the actuation device may be provided as a hydrostatic valve device, and may be installed at a preset water level corresponding to a 10cm distance from the bottom of the compartment. In the case when the actual water level reaches the preset level, the actuation device is activated and opens the passageway for delivery of foaming material into the compartment.

The actuation device may comprise a block element of solvable material for instance made of salt, which disintegrates in presence of water. In accordance with this embodiment of the invention, the block element may be arranged in the passageway and when the water dissolutes the salt, the passageway is opened for the foaming material to enter the compartment. The presence of a solvable block element provides a simple and automatic release of the foaming material.

The safety system may combine both the use of sense and response means that is operable in response to exposure to water (for instance in response to a preset hydrostatic pressure) and a solvable block element disintegratable when exposed to water. The idea is to introduce a fail-safe solution in case the main working principle of the actuation device is not working as planned. The actuation device may then comprise sensing and response means which is operable in response to water exposure such as for instance a preset hydrostatic pressure when the actual water level reaches a first preset water level, and further that the actuation device in addition comprises the block element of solvable material which disintegrates in presence of water when the actual water level reaches a second preset water level. The solvable block element here represents the fail-safe solution in the event where the actuation device does not respond properly, for instance to the hydrostatic pressure, and with the provision of two preset water levels, the disintegration of the solvable material at the second preset water level will ensure the discharge of foaming material if the actuation device does not respond when the first water level is reached. Possibly other combinations are feasible; two solvable block elements at different preset levels, two different sense and response means each operable in response to different water characteristics or being arranged at different preset levels.

As mentioned the passageway may comprise an opening or a fluid path, and may be provided by a pipe structure such as a piece of pipe, pipe line or plural pipes which may have various shapes to enable the flow of foaming material from the source of foamable material to the compartment where the water level is rising. The actuation device may be connected to the pipe structure for instance at the end portion of the pipe structure extending into the compartment to control the flow of foaming material into the compartment.

In one embodiment the pipe structure comprises a main pipe connected to the source of foamable material, either directly to the source or via an intermediate structure. The main pipe may be provided with several branch pipes, wherein each branch pipe may be arranged with an end portion extending into the designated compartment and the actuation device is operable for distribution of the foaming material through an end portion opening into the individual compartments.

The passageways may be arranged into all compartments of the vessel (or plane) or into dedicated compartments depending on the size of the vessel and overall provision of the vessel (or plane).

The safety system may be installed on a vessel, boat, ship or other floating structure when building the boat to deliver the boat or vessel with a ready installed safety system or may be provided as a set for retrofitted installment on a vessel. The same options also apply when the safety system is provided on a plane

In some circumstances, it may be desirable to prepare the safety system so that the foaming material filling the compartment is easy to remove once the emergency situation is handled and/or to ensure that the foaming material is maintained in the compartment or part of compartment that it is meant to be filled. The safety system may then have provisions for facilitating the later removal of the foam material and /or for keeping the foam material in place. The safety system may comprise a capturing device for collection of the foaming material that enters the compartment through the passageway. The capturing device ensures that the foaming material is held in place inside the compartment or in a restricted space within the compartment. The capturing device ensures that the foaming material does not expand beyond the compartment or some designated portion of the compartment. Should an uncontrolled or erroneous release occur, the capturing device restricts the foaming material from entering unauthorized places other than the intended volume of the compartment. Further the capturing device may be arranged for the facilitating the removal of the foam material from the compartment as the foam material when contained in the capturing device provides an easier and cleaner removal of the foam material. For this purpose, various kind of fabric or sheets capable of collecting the foam material filling the compartment may be suitable for

provision of the capturing device. The capturing device may be shaped as a bag or have any other configuration occupying minimal space and capable of receiving and supporting the foam material when removing the foam material from the compartment. The capturing device may be attached surrounding the opening of the passageway into the compartment to provide a simple filling of the capturing device.

In some applications, there might be a need for manual operation of the safety system for instance to allow an operator to control the release of foaming material into a compartment independent of the water level of the compartment. In one embodiment, the actuation device may be operably controlled by a signal from a control panel so as to allow an operator to control the release of foaming material into at least one compartment. The actuation device may then be operable in response to a signal from a control panel to allow an operator to control the release of foaming material into at least one compartment independent of the water level of the compartment.

These and other characteristics of the invention will be clear from the following description of an exemplary embodiment, given as a non-restrictive example, with reference to the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic illustration of one embodiment of the safety system as installed on a vessel.

Fig. 2 is a schematic illustration of another embodiment of the safety system as installed on a vessel.

Fig. 3 is a schematic illustration of an aspect of the embodiment of the safety system as shown on fig 1.

Fig. 4 is a schematic illustration of an aspect of the embodiment of the safety system as shown on fig 2.

Fig. 5 is an overall view illustrating another embodiment of the safety system as installed on an aircraft.

Fig. 6 is a plane view from above of the embodiment as shown on fig 5.

Fig. 7 shows a section of the schematic illustration on fig 5.

DETAILED DESCRIPTION

Fig. 1 shows an example of a safety system according to the invention where compartment 2 of a vessel is provided with a source of foamable material 3, in the illustration shown as two tanks filled with foamable material which may be contained in the tanks in a pressurized state. The foamable material comprises a single component material or a two component material, and in the shown illustration each of the two tanks is filled with each of the two component material. A passageway, here shown as a pipe element 4 is connected to the two tanks at one end and extending into the compartment at the other end. An actuation device 5 is arranged to control the flow of foaming material from the source of foamable material and through the pipe element 4. The actuation device 5 is operable in response to a preset water level 6 and as seen in fig 1, the position of the actuation device 5 in the compartment 2 determines this preset level. If the water level of the compartment is rising and the water level reaches the actuation device 5, the water exposure triggers an operation of the actuation device 5 which responds to allow the foaming material into the compartment 2 through the pipe element 4 for curing into a foamed material. The preset level may be chosen by arranging the actuation device 5 a distance from the floor so that water may be present on the floor without incurring the activation or triggering of the actuation device 5.

The actuation device 5 may comprise sense and response means which is operable for instance in response to hydrostatic pressure so that the rising of water reaching the actuation device 5 triggers the flow of foaming material from the source of foamable material 3 through the pipe element 4 and into the compartment 2. The actuation device may be arranged as a valve device operable set to control the delivery of foam through the pathway and into the compartment 2. The valve device may comprise a valve body initially arranged for closing the pathway, and may be set for opening the pathway as a response to the sensing means detecting water.

In another embodiment the actuation device 5 may comprise a block element of solvable material such as salt which is formed as a tablet and which disintegrates in the presence of water and opens the pipe element 4 to allow foaming material from the source of foamable material 3 into the compartment.

In accordance with yet another embodiment of the invention the actuation device may comprise sensing and response means that is operable in response to hydrostatic pressure when the actual water level reaches a first preset water level, (for instance corresponding to the preset water level 6), as well as comprising a block element 8 of solvable material which disintegrates in presence of water, wherein the solvable material is positioned at a second preset water level 7 as

illustrated . By this arrangement an additional precautionary measure is introduced, and if the actuation device 5 for some reason does not respond, for instance to the hydrostatic pressure, and the water continues rising, the foaming material will be allowed into the compartment when the actual water level reaches the second preset water level 7 and the solvable material disintegrates to open the pipe element 4 and inject the foamable material 3 into the compartment 2.

The arrangement of the safety system as shown in figure 1 may be retrofitted into an existing vessel. Even though the vessel is shown arranged with an entity comprising a source of foamable material 3, pipe element 4 and actuation device 5 fitted for each compartment, the skilled person will realize that the set up may be customized according to need and size of boat. The outlay of the shown entity of source 3, pipe element 4 and actuation device 5 makes for a compact solution which is easily installed on both commercial and leisure vessel of various size.

Fig 2 shows another embodiment of the safety system implemented with a central configuration where the source of foamable material is provided as a common source for the possible discharge of material 3 into the compartments 2. A passageway here shown as main pipe 10 connected to the two tanks runs along the length of the vessel 1 and is provided with several branch pipes 11 that extend from the main pipe 10 and into the compartment to locate the actuation device 5 in a position corresponding to the preset water level. The outlay as illustrated in fig 2 where the safety system has the outlay of a central distribution is suitable for installment on vessels during the building of the boat, and may be ready installed when the vessel is presented to the customer.

Fig 3 shows an embodiment of the safety system where a capturing device 20 is arranged in the compartment 2 for collection of foaming material that enters the compartment through the passageway illustrated by the pipe element 4. The capturing device 20 ensures that the foaming material is held in place inside the compartment 2 and provides for easy removal of the foam material from the compartment. The capturing device 20 which in the illustration has a bag shaped configuration may be attached surrounding the opening of the passageway/pipe element for facilitating the simple filling of the capturing device. The capturing device may be provided in various shapes using different kind of fabric or sheets capable of collecting the foam material filling the compartment. The capturing device may be shaped as a bag as shown or have any other configuration occupying minimal space. Further, that the capturing device is capable of collecting the foam material and keeping it within the compartment as well as providing sufficient supporting for the foam material when later removing the foam material from the compartment. In figure 3 the capturing device is for illustrative purposes shown in a mid-ship and in a bow compartment. As the skilled person will realize, all

compartments may be provided with the capturing device. In other circumstances, some elected compartments may be provided with the capturing device. The safety system may of course also be provided without the capturing device.

Fig 4 shows the installation of the capturing device 20 in the embodiment of the safety system as illustrated in fig 2. For illustrative purposes, the capturing device 20 is shown arranged in two of the compartments 2.

Fig 5 is an illustration of the safety system as installed on an air craft 50 as a safety measure for emergency landing or crashing into water. The outlay of the safety system is similar to the one shown in fig 2 and is shown having a central configuration where the two sources 31, 32 of foamable material are provided as a common source for the possible discharge of material 3 into the compartments 2. In the illustration on fig 5, the compartment 35 located in the body of the air craft is shown as a common compartment, it is of course also possible to divide the common compartment into separate compartments following the pattern of the vessel in fig 1 and 2. Another compartment 36 is located in the wings of the air craft 50. A passageway, here shown as main pipe 10 is connected to the two tanks and runs along the length of the aircraft 1 with dividing part of the main pipe 10 occupying the compartment 36 of the wings. The main pipe 10 is provided with several branch pipes 11 that extend from the main pipe 10 and into the compartment to locate the actuation device 5 in a position corresponding to the preset water level.

Fig 6 shows the outlay of the safety system as arranged in the wing compartments.

Fig. 7 shows an enlarged view of a section of safety system as illustrated in fig 5.

The capture device 20 as illustrated in fig 3 and 4 is of course also applicable for the safety system when implemented on an aircraft.

In the above detailed description, various aspects of the method and system have been described with reference to the illustrated exemplary embodiment. Various modifications and variations of the exemplary embodiment, as well as other embodiments of the method and system, are considered to lie within the scope of the present invention as defined in the claims.

CLAIMS

1. A safety system for a vessel comprising
- a source of foamable material and a passageway for distribution of the
foamable material, and
5 -an actuation device (5) arranged to control a flow of foaming material from
the source of foamable material (3) and through the passageway,
-the actuation device (5) is provided operable in response to exposure of
water,
wherein in use the actuation device is arranged in a compartment (2) at a
10 position corresponding to a preset water level in the compartment (2) and
when an actual water level in the compartment (5) reaches the preset water
level, the actuation device (5) is exposed to water and the water exposure
triggers the actuation device to allow the delivery of the foaming material
into the compartment (2) through the passageway.
15
2. A safety system for a vessel in accordance with claim 1,
c h a r a c t e r i z e d i n t h a t the actuation device comprises sensing
means and response means, which response means is operable in response to
20 the exposure of water as detected by the sensing means.
3. A safety system for a vessel in accordance with one of the preceding claims,
c h a r a c t e r i z e d i n t h a t the passageway comprises a pipe structure
(4) extending from the source of foamable material (3) to the compartment
25 and the actuation device (5) is connected to the pipe structure (4),
wherein the actuation device (5) is connected to the pipe structure (4) to
control the flow of foaming material through the passageway into the
compartment (2).
- 30 4. A safety system for a vessel in accordance with claim 3,
c h a r a c t e r i z e d i n t h a t the actuation device is connected at the end
portion of the pipe structure (4) extending into the compartment (2).
- 35 5. A safety system for a vessel in accordance with claim 2 or 3,
c h a r a c t e r i z e d i n t h a t an entity comprising the source of
foamable material (3), the passageway and the actuation device (5) is to
be placed locally in the compartment or in close distance to the compartment.
40 (2).

6. A safety system for a vessel in accordance with one of the preceding claims 1-4,
5 characterized in that the passageway comprises a main pipe (10) connected to the source of foamable material (3), the main pipe is provided with several branch pipes (11), wherein each branch pipe (11) has an end opening into a compartment and the actuation device (5) is operable for distribution of the foaming material through the end opening into the
10 individual compartments (2).
7. A safety system for a vessel in accordance with one of the preceding claims, characterized in that the actuation device (5) comprising the
15 sensing and response means is operable in response to hydrostatic pressure.
8. A safety system for a vessel in accordance with one of the preceding claims, characterized in that it further comprises a capturing device (20) for collection of foaming material that enters the compartment (2) through the passageway.
20
9. A safety system for a vessel in accordance with one of the preceding claims, characterized in that the safety system is ready-installed on a vessel.
- 25 10. A safety system for a vessel in accordance with one of the preceding claims, characterized in that the safety system is provided as a set or kit for retrofitted installment on a vessel.
- 30 11. Vessel comprising a safety system according to one of the preceding claims.

1/7

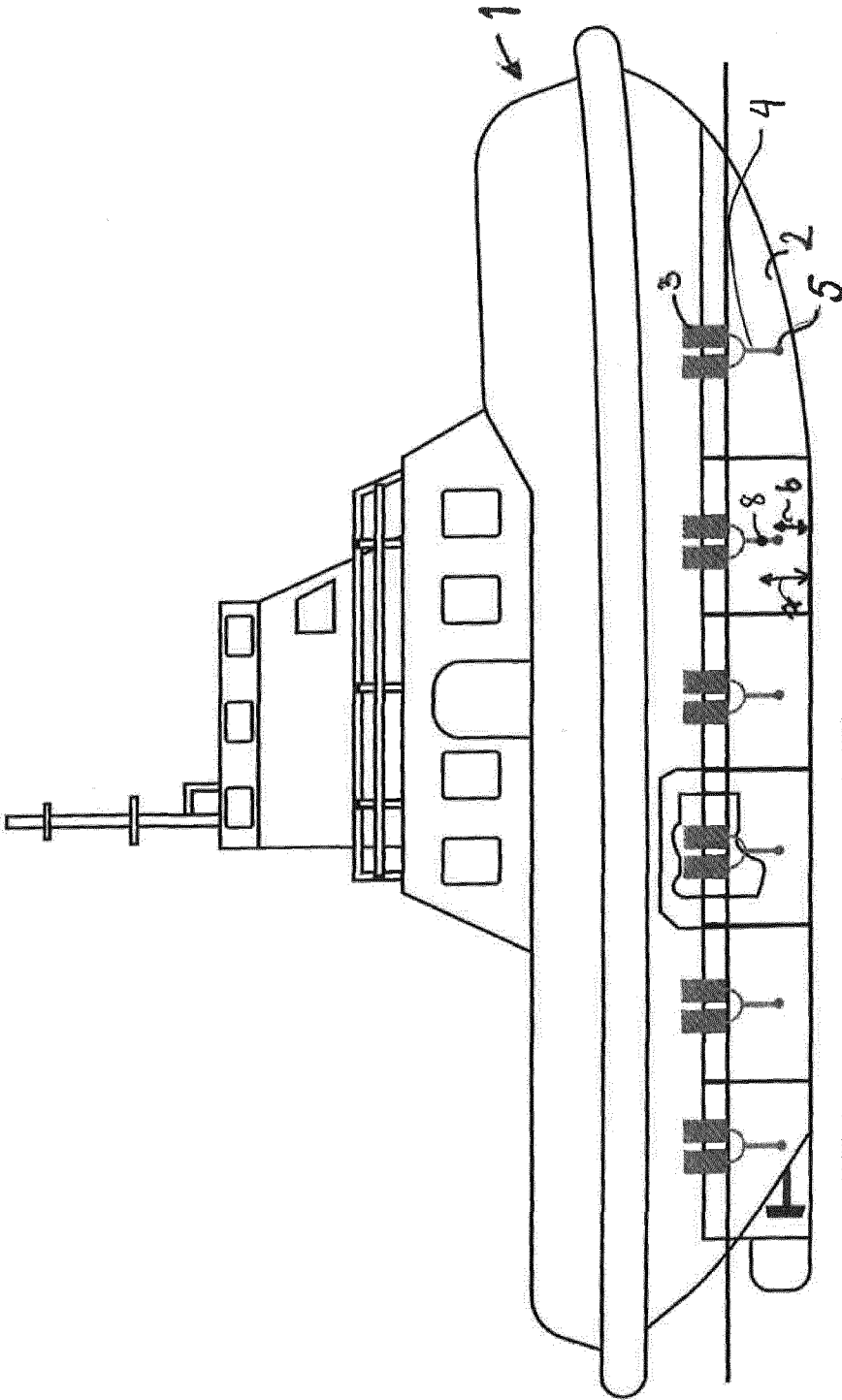


Fig 1

2/7

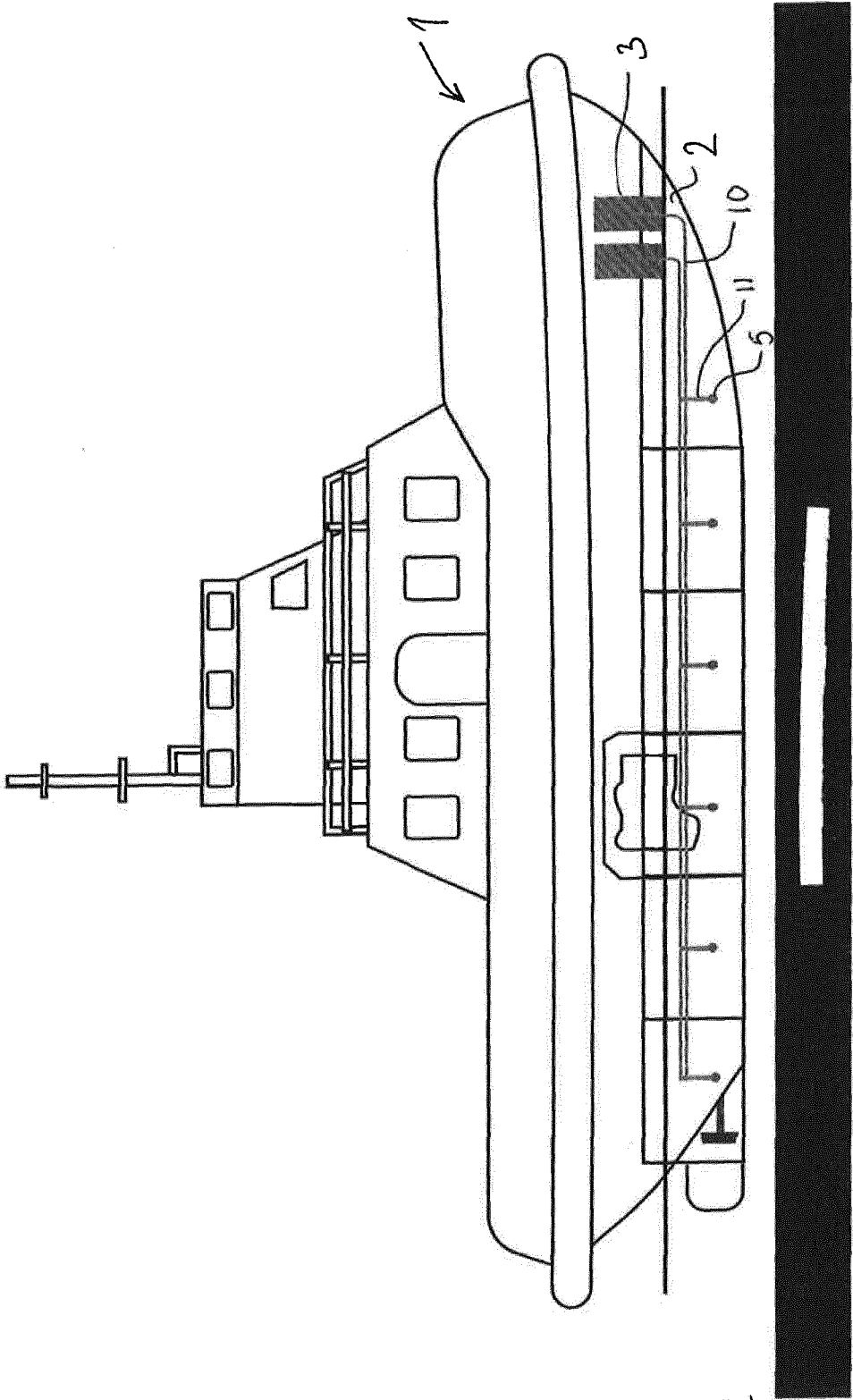


Fig 2

3/7

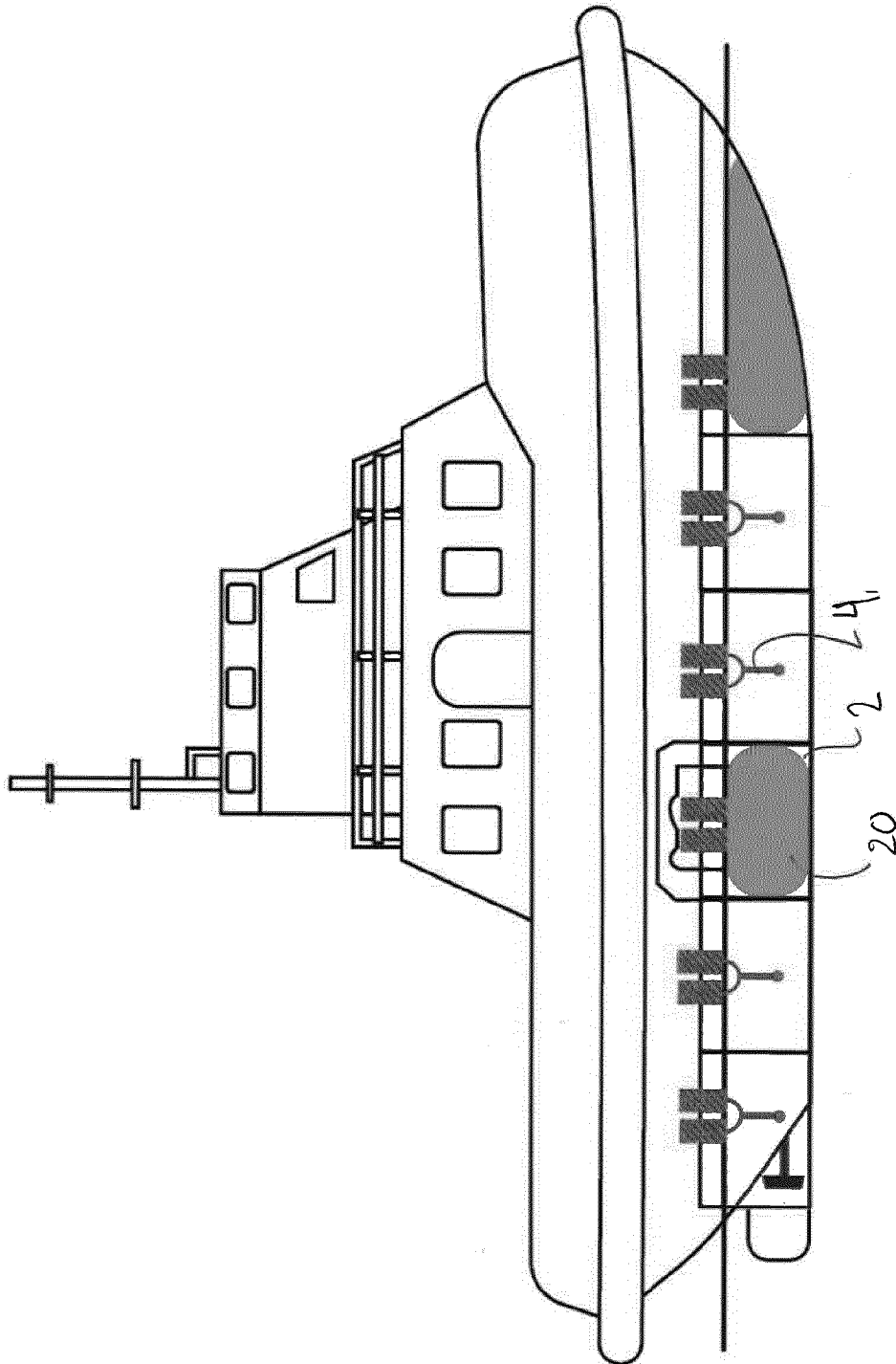
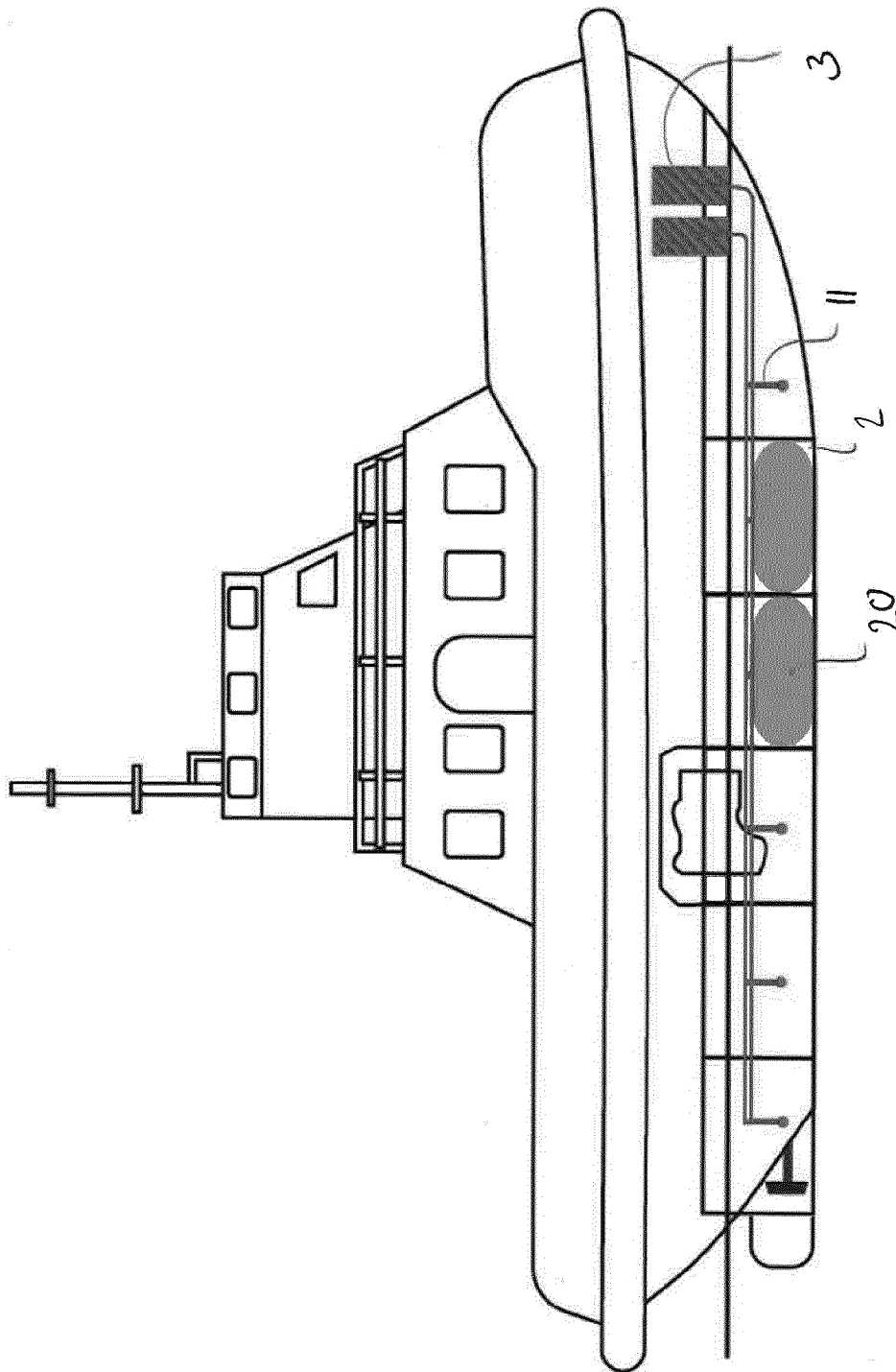


Fig 3

4/7



Fish

5/7

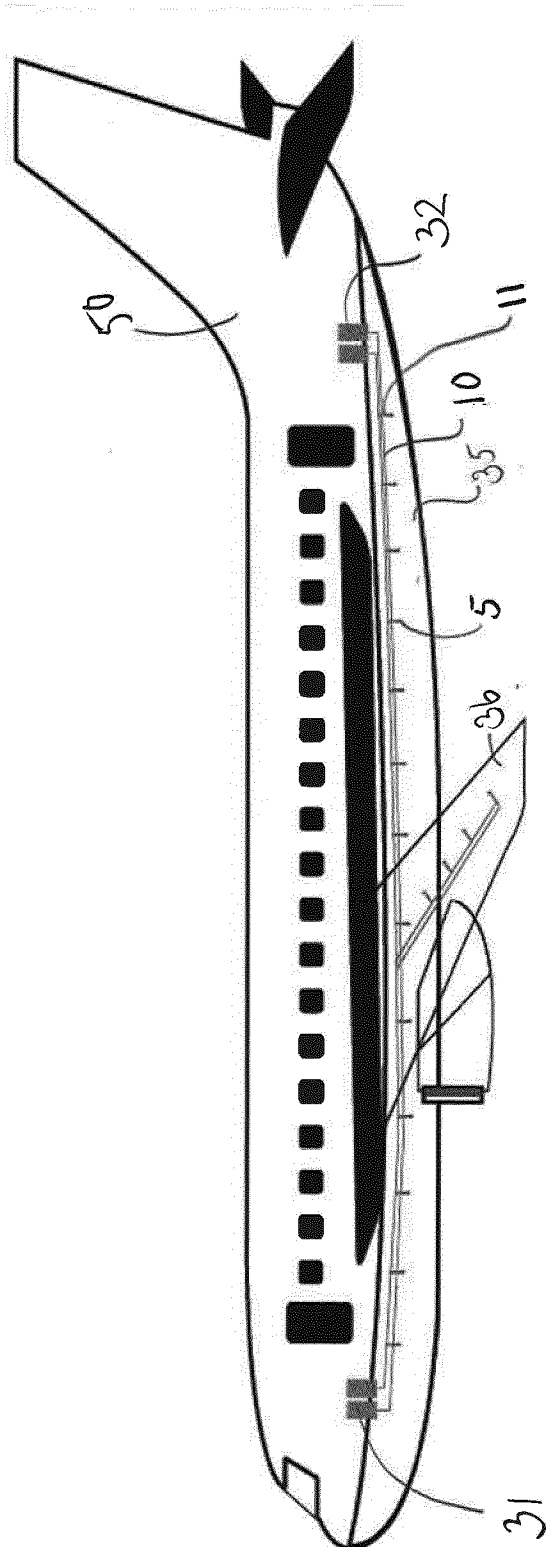


Fig 5

6/7

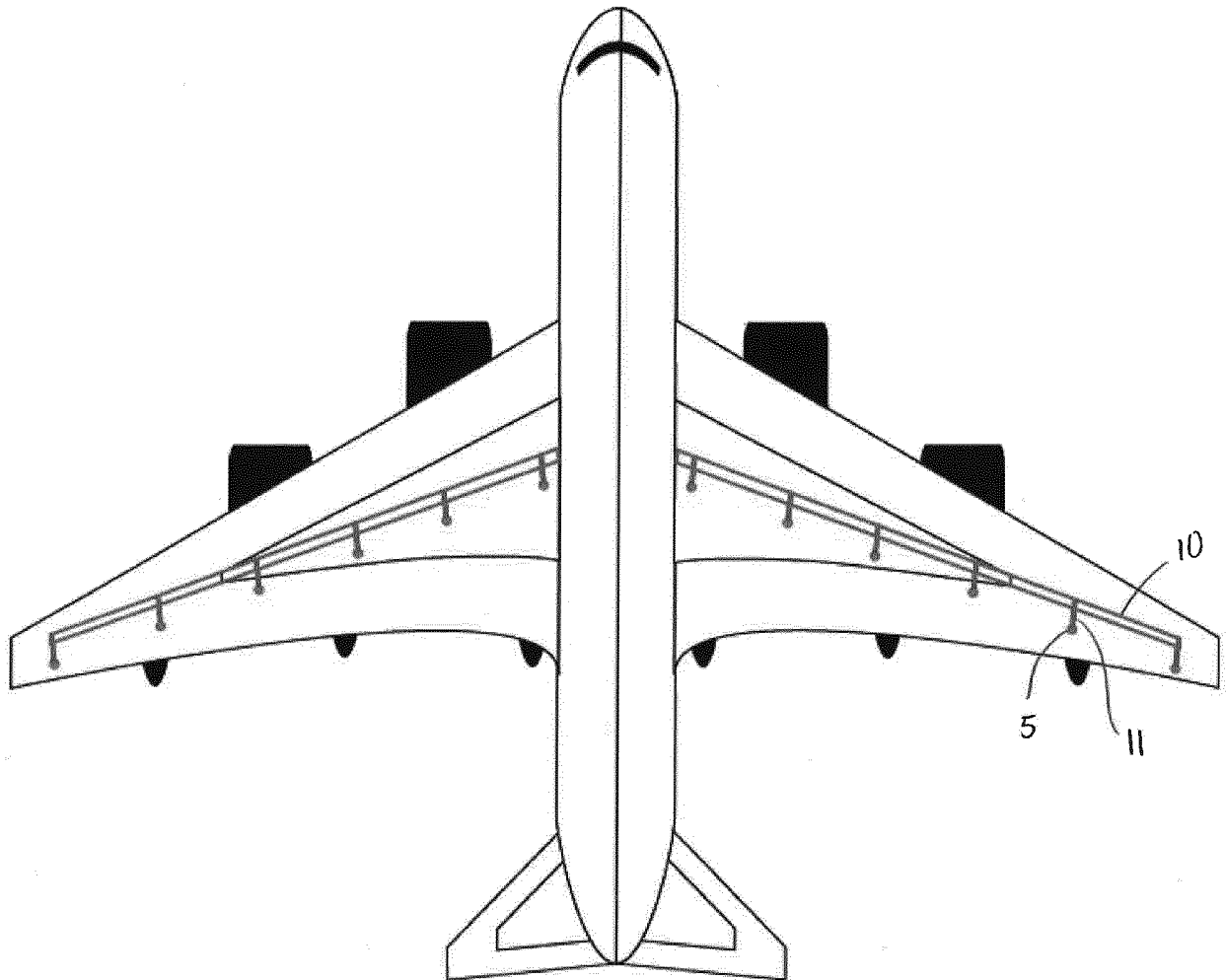


Fig 6

7/7

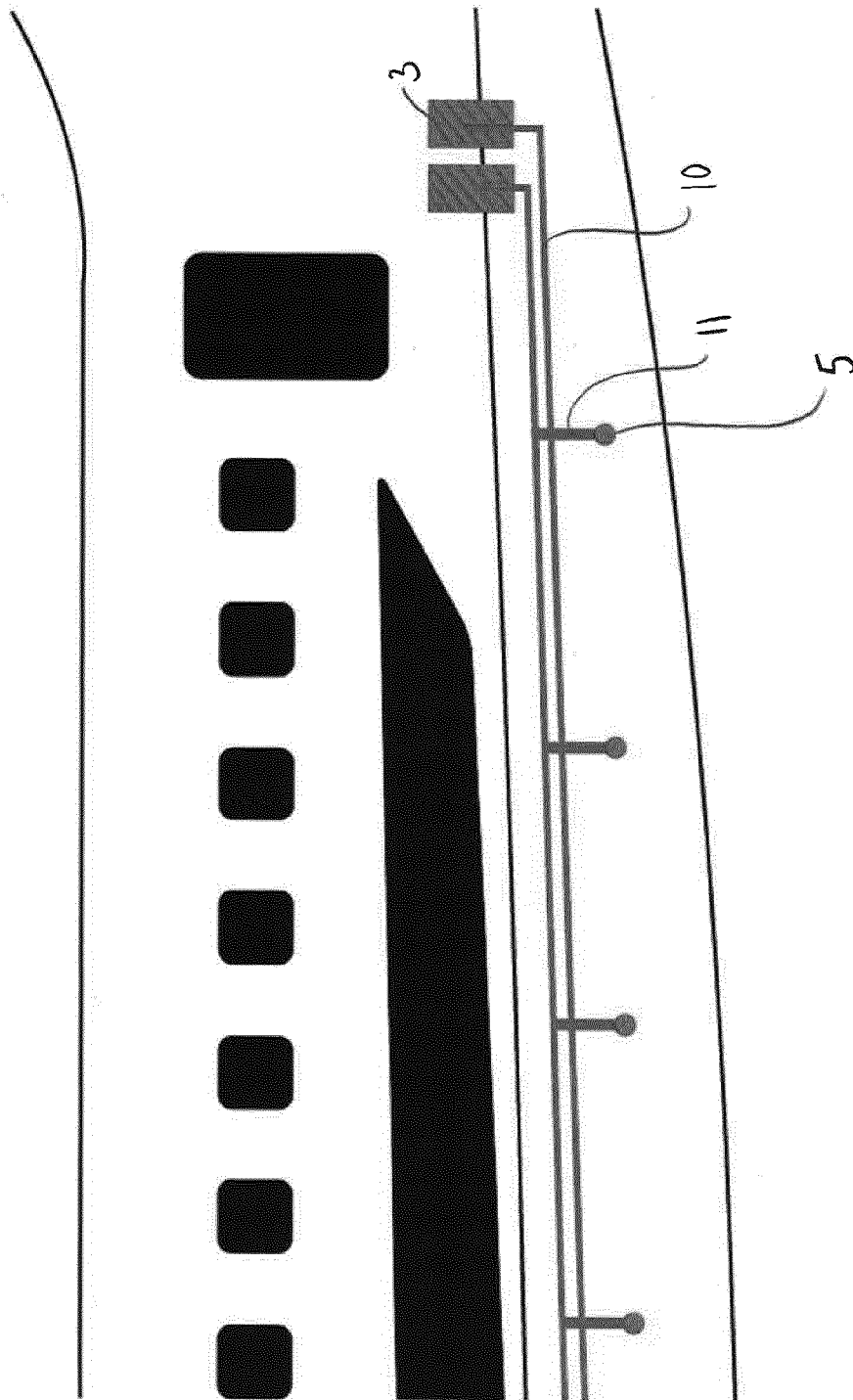


Fig 7

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2018/051437

A. CLASSIFICATION OF SUBJECT MATTER
INV. B63B43/10 B63B43/16
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B63B

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

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

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 098 563 A (WALKER EVAN HARRIS [US]) 8 August 2000 (2000-08-08) claims; figures -----	1-10
X	KR 2012 0050111 A (SAMSUNG HEAVY IND [KR]) 18 May 2012 (2012-05-18) claims; figures -----	1,2,5, 9-11
X	GB 2 418 890 A (NICHOLLS CHRISTOPHER [GB]) 12 April 2006 (2006-04-12) the whole document -----	1-11
X	CN 202 754 118 U (YE LIN) 27 February 2013 (2013-02-27) paragraph [0049]; claims; figures ----- -/-	1-6,11



Further documents are listed in the continuation of Box C.



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

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"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

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

26 March 2018

Date of mailing of the international search report

06/04/2018

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Knoflachner, Nikolaus

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2018/051437

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	KR 2014 0098361 A (SAMSUNG HEAVY IND [KR]) 8 August 2014 (2014-08-08) cited in the application paragraph [0027]; claims; figures -----	1-5,8,11
A	FR 2 476 588 A1 (GREZE ANDRE [FR]) 28 August 1981 (1981-08-28) claims; figures -----	1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2018/051437

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 6098563	A	08-08-2000	NONE	

KR 20120050111	A	18-05-2012	NONE	

GB 2418890	A	12-04-2006	NONE	

CN 202754118	U	27-02-2013	NONE	

KR 20140098361	A	08-08-2014	NONE	

FR 2476588	A1	28-08-1981	NONE	
