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Morita et al.

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[45] **July 9, 1974**

[54] **SAFETY DEVICE FOR SHIP**

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[51] **Int. Cl.** **B63b 43/14**
[58] **Field of Search** ..... 114/123, 68, 49; 9/2 A

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Attorney, Agent, or Firm—Fleit, Gipple & Jacobson

[57] **ABSTRACT**

A ship safety device comprising normally-folded inflatable gas bags secured to broadsides of a ship, which gas bags are connected to a pressure-gas source through a valve for selective inflation in emergency. Each gas bag has a flange, which is secured to the ship broadside by fixtures, and two folding portions extending in the longitudinal direction of the ship for facilitating the folding thereof in an easily inflatable and deflatable fashion.

9 Claims, 10 Drawing Figures

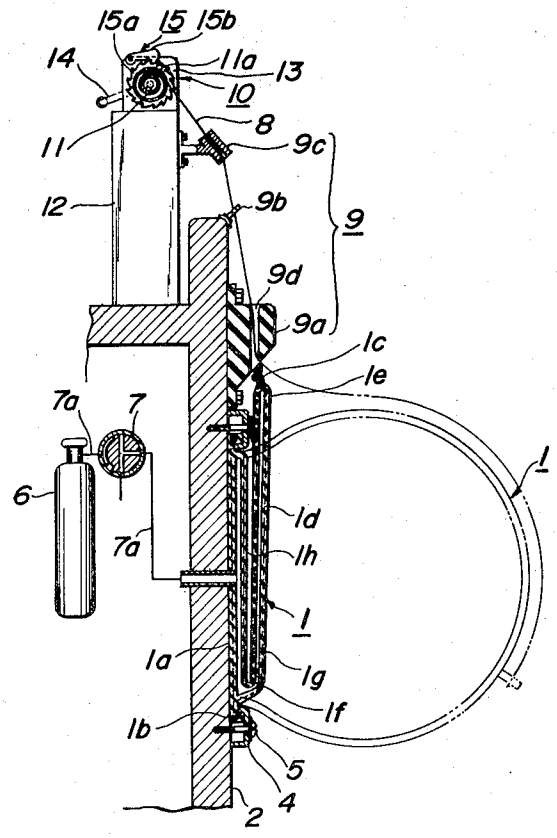


FIG_1

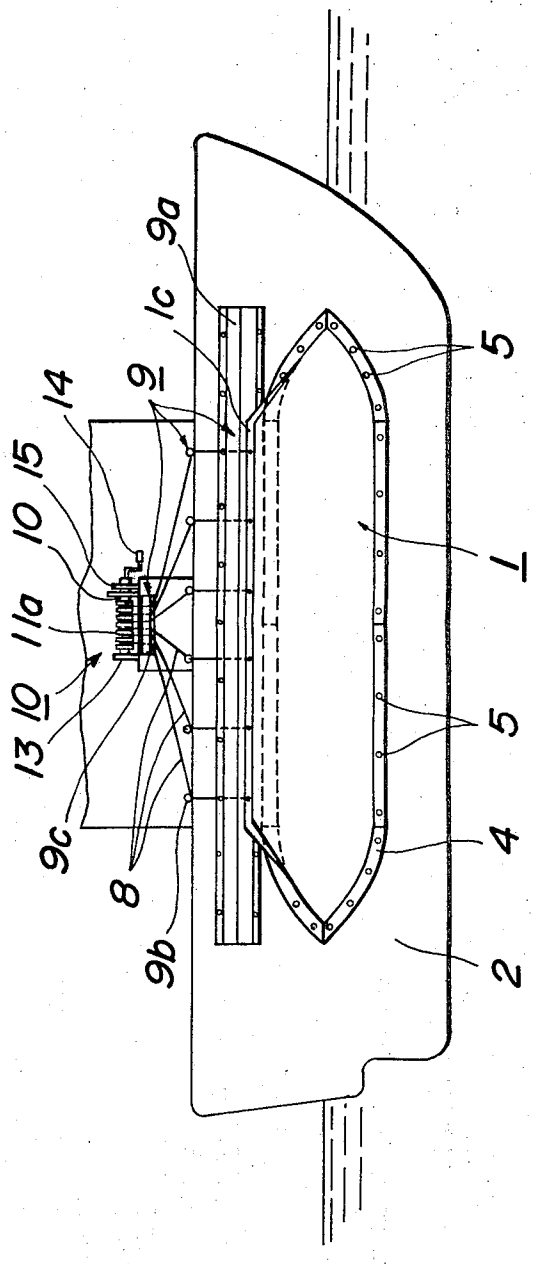


FIG_2

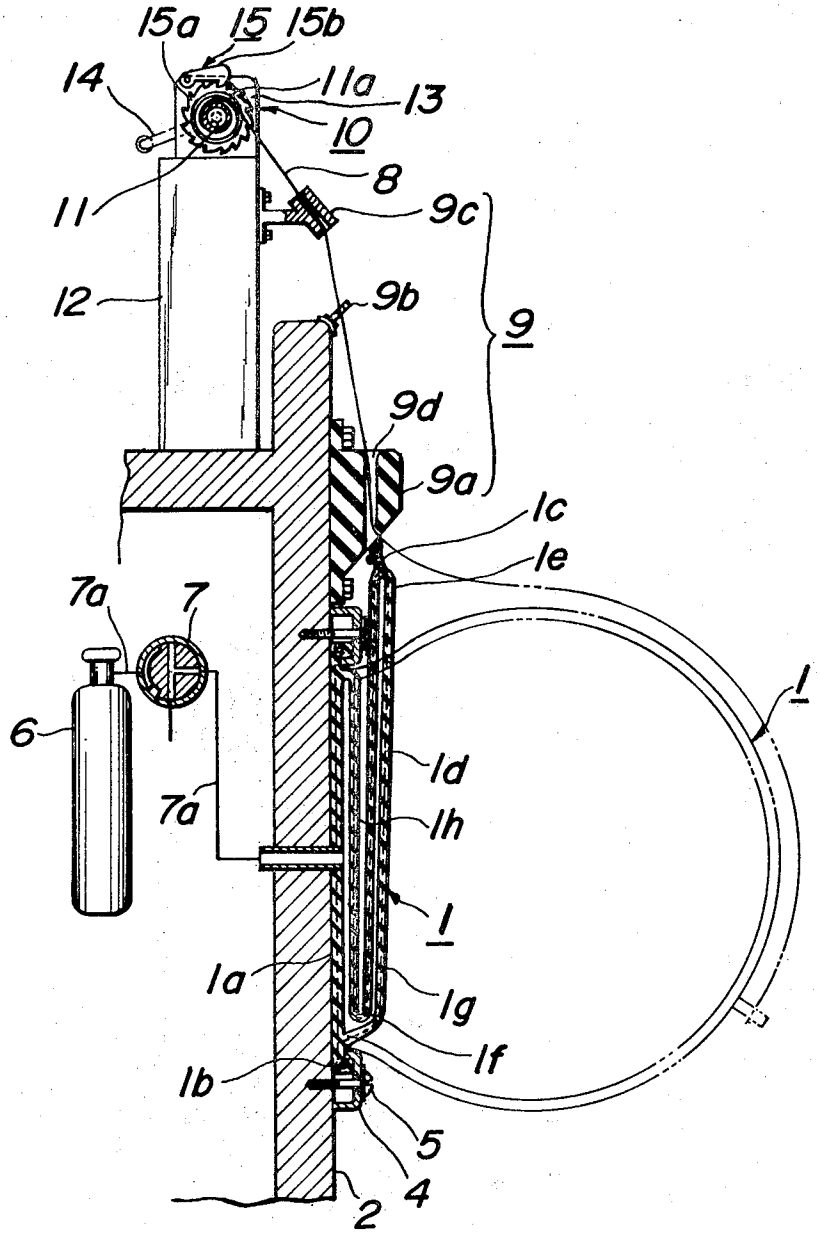

15a
15
15b
14
11a
13
10
8
11
9c
12
9b
9
9d
9a
1c
1e
7a
7
1
6
1d
7a
1h
1
1a
1g
1f
1b
5
4
2

FIG_3

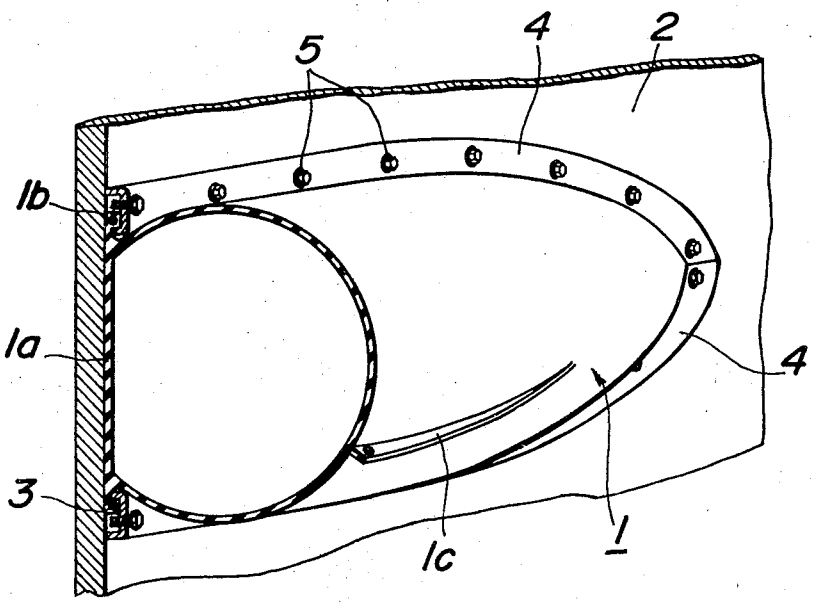


FIG_4

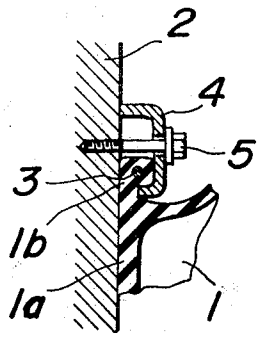


FIG_5

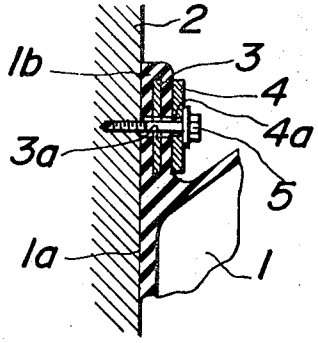


FIG_6

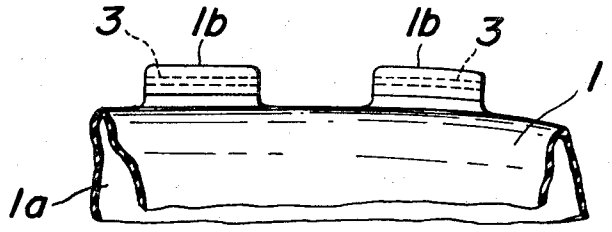


FIG_7

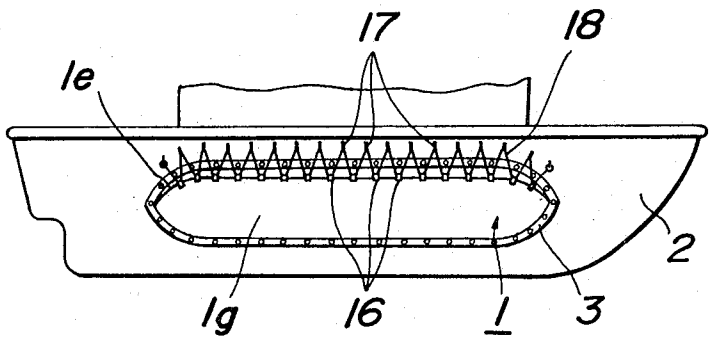


FIG_8

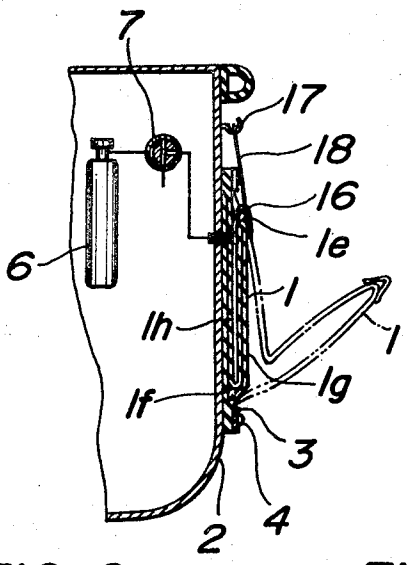


FIG_9

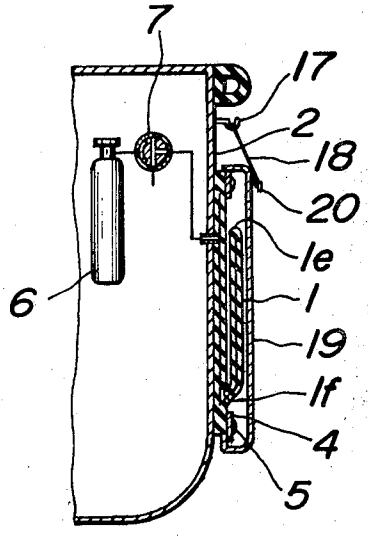
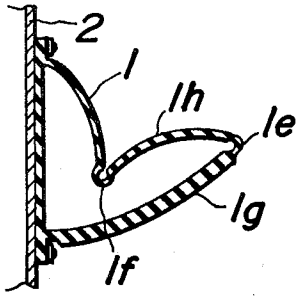


FIG_10



SAFETY DEVICE FOR SHIP

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a safety device for ship, and more particularly to a ship safety device comprising one or more inflatable gas bags secured to broadsides of a ship which bags are selectively inflated and deflated by feeding a gas therein and removing the gas therefrom.

1. Description of the Prior Art

When comparatively small ships lose their control in a rough sea due to engine failure or other reasons, they are susceptible to upset. In fact, a number of upsets of comparatively small ships are reported every year.

It has been known that ships can be made more resistive to upset by providing inflatable gas bags which are normally folded at broadsides thereof and inflated in case of emergency by forcing a pressure-gas therein for giving additional buoyancy to the ships. The inventors of the present invention have found that conventional gas bags for such purpose have the following shortcoming.

Belts or bands have been used for securing the safety gas bag to the ship being protected. The use of such belts or bands tends to cause breakage of the gas bags or separation of the gas bags from the ship in the rough sea. Thus, installations with the fastening belts or bands do not provide reliable operation of the safety gas bags. With conventional safety gas bags, when they are not in use, they are merely folded without paying reasonable attention to their resistance to cruising and without fully considering the ease of inflation. Furthermore, the conventional safety gas bags are designed for manual operation; namely, the gas bags are manually unfolded in the case of emergency, and they are manually folded after the emergency condition is over. Such manual operation is not only inefficient, but also quite dangerous. If the gas bags are secured to outer broadside surfaces of the ship, crewmen have to stretch themselves from the deck for manually folding and unfolding the gas bags while the ship is cruising or moving in the rough sea.

Therefore, an object of the present invention is to obviate the aforesaid shortcoming of the conventional ship safety device using gas bags.

SUMMARY OF THE INVENTION

According to the present invention, there is provided a ship safety device having one or more inflatable gas bags secured to broadside of a ship, characterized in that a flange is formed along the periphery of a mounting portion of each gas bag which mounting portion is to be held in contact with the ship broadside, and each gas bag is secured to the ship by fastening the flange to the ship broadside by fixtures. Two folding portions are formed on the wall of the gas bag in parallel with the cruising direction of the ship, so that the gas bag may be folded along such folding portions during the normal cruising of the ship. The folding portions may be formed in such a manner that the upper portion of the gas bag extending from the upper one of the two folding portions is folded inside while covering the entire folded bag with the lower portion of the gas bag, which lower portion extends from the lower one of the two folding portions to lower edge of the flange of the gas bag. To facilitate the folding and unfolding of the gas bag, a plurality of ropes may be secured to the gas bag at one ends thereof, while connecting the opposite ends of the ropes to a winch drum on board the ship and extending the intermediate portions of the ropes through a guide means of the ship.

With the aforesaid structure of the ship safety device according to the present invention, the following advantages can be achieved. Firstly, mechanical load to the gas bag is spread throughout the flange, so that the load to the bag is borne by the entire flange without causing any local concentration of the load. Whereby, the risk of the breakage of the gas bag and the separation of the gas bag from the ship is minimized, and highly stable performance of the safety gas bag is ensured. Secondly, resistance of the gas bags to normal cruising is minimized by preventing the folded edge portions of the gas bags from coming into continuous contact with sea water. More particularly, only two folding portions are formed, of which one is disposed within a folded wall of the gas bag while keeping the other folding portion at a position above the ship's draft for preventing the folding portions from interfering with the cruising. Whereby, the walls of the gas bags are normally kept substantially flat, and the gas bag walls are protected from sea water attack for ensuring a long service life and reliable operation under emergency condition. Thirdly, the inflation and deflation, or unfolding and folding, of the safety gas bags are greatly simplified while ensuring its reliable operation in case of emergency, so that the gas bag of the present invention can be folded and unfolded more quickly than those of conventional construction. Furthermore, with the structure of the present invention, the safety of the crewmen for handling the gas bag is considerably improved.

BRIEF DESCRIPTION OF THE DRAWING

For a better understanding of the invention, reference is made to the accompanying drawings, in which:

FIG. **1** is a schematic side view of a ship having a safety device according to the present invention;

FIG. **2** is an enlarged fragmentary sectional view of the ship of FIG. **1**, showing the details of the ship safety device;

FIG. **3** is a partially cut away perspective view, showing the inflated condition of a gas bag in the safety device of the invention;

FIGS. **4** and **5** are partial sectional views, showing different manners in which the gas bag of the invention is secured to the ship;

FIG. **6** is a partial perspective view showing a modified flange of the gas bag of the invention;

FIG. **7** is a side view of a ship, illustrating a different embodiment of the safety device according to the present invention;

FIG. **8** is an enlarged sectional view of the safety device of FIG. **7**;

FIG. **9** is a sectional view similar to FIG. **8**, showing a cover which can be used in the safety device of the invention for protecting a folded gas bag; and

FIG. **10** is a sectional view, illustrating the wall structure of a gas bag which can be used in the safety device of the present invention.

Like parts are designated by like numerals throughout the different figures of the drawing.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIGS. 1 and 2, two gas bags 1 made of suitable elastomeric material, e.g., rubber, are secured to broadsides 2 of a ship. The wall of the gas bag 1 may be reinforced by embedding a reinforcing layer 1*d* which is, for instance, a canvas layer. The wall of the gas bag 1, however, must be flexible enough to allow inflation and deflation thereof by filling or removing a suitable gas therein or therefrom.

As shown in FIGS. 3 and 4, a comparatively thick and flat mounting portion 1*a* is formed in the gas bag wall so as to ensure reliable connection of the bag 1 to the ship by permanently keeping the mounting portion 1*a* in contact with the surface of the ship broadside 2. A flange 1*b* is formed along the periphery of the mounting portion 1*a* of each gas bag 1. The flange 1*b* is preferably strengthened by disposing a reinforcing member 3 therein. In the case of the embodiment of FIG. 4, the reinforcing member 3 is a bead wire, while FIG. 5 shows a reinforcing member 3 made of a flat hard plate member, such as an iron or steel plate.

A plurality of L-shaped fastening fixtures 4 may be bolted to the broadside 2 of the ship by bolts 5 for securing the flange 1*b* of the gas bag 1, as shown in FIG. 4. Thereby, the gas bag 1 itself is firmly connected to the ship. In the embodiment, as shown in FIG. 5, fastening fixtures 4 are made of flat plates each having a bolt hole 4*a*, and the reinforcing plate member 3 of the flange 1*b* of the gas bag 1 has bolt holes 3*a* corresponding to the holes 4*a* of the fixtures. Thus, the gas bag 1 can be firmly secured to the ship broadside 2 by tightening bolts 5, while inserting the flange 1*b* of the gas bag 1 between the fixture plates 4 and the ship broadside 2.

The flange 1*b* of the gas bag 1 is shown as a closed loop in FIG. 1, but the invention is not restricted to such form of the flange. For instance, the flange 1*b* may be cut off at certain intervals, as shown in FIG. 6. Reinforcing members 3 are, of course, provided only in the remaining portions of the flange 1b in the case of the cut away flange of FIG. 6.

In FIG. 3, a holding lug 1*c* is integrally secured to the outer surface of the gas bag 1 in such a manner that, when the gas bag 1 is folded as described hereinafter, the holding lug 1*c* is pulled upwards by ropes. Whereby, the bag 1 is normally held folded, as shown in FIG. 2.

The gas bag 1 is connected to a pressure-gas source 6, such as a gas bomb, through a conduit 7*a* having a valve means 7. The pressure-gas source 6 is carried on board the ship. The valve means 7 is preferably a three-way valve. When the gas bag 1 is folded, the three-way valve 7 connects the gas bag 1 to the atmosphere, as shown in FIG. 2. When it is necessary to quickly inflate the gas bag 1, for instance, under emergency condition, the three-way valve 7 is so turned as to communicate the pressure-gas source 6 with the gas bag 1, so that an additional buoyancy is provided to the ship. When the need for the additional buoyancy is removed, the three-way valve 7 is so turned as to re-communicate the gas bag 1 with the atmosphere. As the gas bag 1 is folded in a manner to be described hereinafter, the gas is removed from the bag 1 to the atmosphere, and the gas bag 1 is deflated.

It is an important feature of the present invention that the gas bag 1 can be selectively inflated and deflated by forcing a gas into it or removing the gas from it. In the foregoing, the valve means 7 for controlling the aforesaid filling and removing of the gas relative to the gas bag 1 is described as a three-way valve. The invention, however, is not restricted to such three-way valve. In fact, any other valve means which can satisfactorily fulfills the aforesaid functions of the three-way valve can be used in the safety device of the invention.

Two longitudinal folding portions 1e and 1f are formed on the wall of the gas bag 1 in parallel to the cruising direction of the ship. Referring to FIGS. 1 and 2, during normal cruising, the gas bag 1 is folded in such a manner that an upper portion 1*h* of the bag 1, extending upwardly from the upper folding portion 1*f*, is kept inside of the folded wall of the bag 1, while a lower portion 1g of the bag 1, extending downwards from the lower folding portion 1*e*, is placed at the outermost surface of the folded bag. Thus, the upper folding portion 1*f* is held at the lower part of the folded bag, while the lower folding portion 1*e* is held at the uppermost part thereof. As a result, the entire gas bag 1 is deflated and folded in a flat form along the broadside 2 of the ship.

FIGS. 1 and 2 also illustrate a folding means, which acts to deflate the gas bag 1 and to fold it in the aforesaid flat form. The folding means includes a plurality of ropes 8 having one ends connected to the holding lug 1*c* of each gas bag 1. The ropes 8 extend through a rope-guide assembly 9, and the opposite ends of the ropes 8 are secured to a drum 11 of a winch 10. The rope-guide assembly 9 consists of a fender 9*a* with holes through which the ropes 8 extend, eyebolts 9*b* secured to the ship broadside 2 and having holes by which the ropes 8 are guided, and a collector 9*c* acting to collect all the ropes 8 at the winch 10. The eyebolts 9*b* may be replaced with suitable pulleys rotatably secured to the ship broadside 2. The fenders 9*a* are secured to the ship broadside 2 above the gas bag 1 but below the eyebolts 9*b*, so as to extend in parallel with the cruising direction of the ship. To protect the ship and to ensure smooth folding of the bag 1, bushes 9*d* made of suitable hard material may be secured to the fender 9*a* at those parts where the ropes 8 pass through. The collector 9*c* is a block made of metal or other hard material and has suitably spaced holes for passing the ropes 8 therethrough. The collector 9*c* is located in front of the winch 10 for the purpose of collecting ropes from the entire span of the fender 9*a* to the limited width of the drum 11 of the winch 10. The structure of the rope-guide assembly 9 is not restricted to the one as shown in FIGS. 1 and 2, but any rope-guide assembly which can ensure smooth winding and unwinding of the plurality of the ropes 8 having one ends secured to the gas bag 1 can be used in the safety device of the present invention.

The drum 11 of the winch 10 is rotatably mounted on a pair of brackets 13 which are secured to a pedestal 12. A plurality of division plates 11*a* are secured to the drum 11 for providing proper spacings between the adjacent ropes 8. One end of the drum 11 is connected to a handle 14 for turning it and a ratchet gearing 15 for preventing reverse rotation of the drum. The ratchet gearing 15 includes a ratchet wheel 15*a* which is coaxially secured to the drum 11 and a claw 15*b* pivotally secured to one of the brackets 13 so as to selectively en-

gage teeth of said ratchet wheel **15***a*. For deflating and folding the gas bag **1** from its inflated condition, the drum **11** is turned by the handle **14** in a direction for taking up the ropes **8**, until the bag **1** is folded as shown by solid lines of FIG. **2**. In this case, the valve means **7** assumes such an operating position that the gas can be removed from the bag **1** to the atmosphere. On the other hand, in order to inflate the gas bag **1**, the claw **15***b* is disengaged from the teeth of the ratchet wheel **15***a* of the ratchet mechanism **15** for allowing the drum **11** to freely rotate, and the valve means **7** is turned to the position where the pressure-gas source **6** communicates with the gas bag **1**. Whereby, the pressure-gas from the source **6** forces the bag **1** to inflate by filling therein, and as the bag **1** inflates, the ropes **8** are released from the drum **11** of the winch **10**, until the bag **1** assumes the inflated position as shown by the dash-dot lines of FIG. **2**.

The ratchet mechanism **15** and the handle **14** may be replaced with other suitable equipments in the present invention. For instance, the ratchet mechanism **15** can be replaced with a suitable clutch means, and the handle **14** can be replaced with a suitable motor-driven winding means. What is important is to selectively wind and unwind the ropes **8** having one ends secured to the gas bag **1**.

FIGS. **7** to **9** illustrate different mechanisms for keeping a gas bag **1** folded on ship broadside **2**. Referring to FIGS. **7** and **8**, a plurality of eye pieces **16** are secured to the gas bag **1** along its lower folding portion **1***e*. A plurality of hooks **17** are secured to the ship broadside **2** so as to cooperate with the eye pieces **16** of the bag **1**. More particularly, when the gas bag **1** is folded, a rope **18** is extended between the eye pieces **16** and the hooks **17** in zigzag fashion while fastening the opposite ends of the rope **18** to the eye pieces **16** or the hooks **17**, so as to keep the bag **1** folded as shown in FIG. **7**.

FIG. **9** illustrates a modification of the structure of FIG. **8**, by using a cover **19** for holding each gas bag **1** folded. The cover **19** is made of a suitable hard material, such as fiber reinforced plastics (FRP), and it is large enough to cover the entire folded gas bag **1**. As seen in FIG. **9**, lower edge of the cover **19** is secured to the ship broadside **2** by fastening fixtures **4**, which also secure the bag **1** to the broadside **2**. A plurality of hooks **20** are secured to upper outer portion of the cover **19**. A rope **18** may be extended between the hooks **20** of the cover **19** and cooperating hooks **17** secured to the ship broadside **2**, in zigzag fashion, while fastening the opposite ends of the rope **18** to the hooks **17** or **20**, for keeping the cover **19** at a position for holding the gas bag **1** folded, as shown in FIG. **9**.

To inflate the gas bag **1** of FIGS. **7** and **8** or FIG. **9**, under emergency condition, the rope **18** is released by suitable means, e.g., by cutting it, and a valve means **7** of FIGS. **7** or **8** is so actuated as to communicate a pressure-gas source **6** with the gas bag **1**. Whereby, the gas bag **1** is inflated to provide the ship with an additional buoyancy for stabilizing the ship under the emergency condition.

When the gas bag **1** is made of rubber sheet, the folding portions **1***e* and **1***f* may be vulcanized in a shape as folded or nearly folded, so as to facilitate the aforesaid folding of the finished bag **1** after the inflation by the ropes **8** or rope **18**. It is also possible to reduce the rigidity of the gas bag **1** at the folding portions **1***e* and **1***f* by using thin walls at such portions, as shown in FIG. **10**. The use of the comparatively more flexible folding portions **1***e* and **1***f* of FIG. **10** facilitates the inflation and deflation of the gas bag **1**.

The lower portion **1***g* of the gas bag **1**, which is normally exposed to sea water and outside atmosphere while covering the remainder of the folded bag **1**, can be made of a thick wall or can be formed of FRP or other reinforced material, for the purpose of improving the service life of the gas bag **1**.

We claim:

1. A ship safety device, comprising at least one normally-folded inflatable gas bag secured to broadside of a ship, a pressure-gas source installed on board the ship, and a valved conduit communicating the pressure-gas source to the bag for selective inflation of the bag in case of emergency, said gas bag having a flat mounting portion to be kept in contact with the broadside of the ship and a flange formed along the periphery of the mounting portion, said flange having at least one reinforcing member embedded therein and being fastened to the broadside of the ship by fixtures, said fixtures forming long fixture contact surfaces extending along the flange so as to urge the flange continuously toward the ship broadside.

2. A ship safety device according to claim **1** and further comprising hooks secured to broadside of the ship, eye pieces secured to the gas bag, and a rope extending between the hooks and the eye pieces in zigzag fashion when the gas bag is deflated and folded so as to hold the gas bag folded.

3. A ship safety device according to claim **1** and further comprising a cover member having lower edge integrally secured to lower edge of said flange, hooks secured to broadside of the ship, eye pieces secured to said cover member, and a rope extending between the hooks and the eye pieces in zigzag fashion when the gas bag is deflated and folded so as to hold the gas bag folded by covering the folded gas bag.

4. A ship safety device according to claim **1**, wherein said gas bag is formed by an elastomer bag wall and has two permanent folding veins extending in the bag wall in a direction parallel to the cruising direction of the ship, said two veins defining three gas bag wall sections including one wall section between the two veins, one wall section above, and another wall section below the inter-vein wall section, said three wall sections forming a unitary gas bag upon inflation, while said three wall sections being automatically folded one on the other along the ship broadside upon removal of internal pressure from the gas bag.

5. A ship safety device according to claim **1**, wherein said gas bag has two folding portions extending in parallel to the cruising direction of the ship, and the gas bag is foldable upon deflation in such a manner that upper portion of the gas bag which extends upwardly from the upper one of said folding portions is held adjacent the flat mounting portion, while covering the entire folded gas bag with lower portion of the gas bag, said lower portion extending between the lower one of said folding portions and lower edge of said flat mounting portion.

6. A ship safety device according to claim **5** and further comprising a plurality of ropes, each having one end connected to said gas bag, a winch mounted on board the ship and having opposite ends of the ropes connected thereto, and a rope guide means mounted

on board the ship between the gas bag and the winch so as to guide movement of intermediate portions of said ropes, said winch selectively taking up said ropes for folding the gas bag along said folding portions and selectively releasing said ropes for allowing said gas bag to inflate.

7. A ship safety device according to claim **6,** wherein said valved conduit includes a three-way valve selectively communicating said gas bag either to said pressure-gas source for inflation thereof, or to atmosphere for deflation thereof.

8. A ship safety device according to claim **7** and further comprising a holding lug integrally secured to said gas bag, said ropes being connected to said holding lug.

9. A ship safety device according to claim **5,** wherein said folding portions of said gas bag have thinner walls than the remaining portions of the gas bag.

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