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(54) **A ship, in particular a ro-ro ship.**

(57) The invention concerns ships, particularly intended for the carriage of ro-ro cargo. It provides ships with high level of safety in the damage condition, easily meeting the requirements of the new rules based on the probabilistic concept, entering into force on 1 February 1992.

A ship according to the invention embodies the characteristics of having double sides (2) at least on part of its length, terminated at least at the first continuous deck above the bullhead deck and having double decks (4, 10) at least the bullhead deck (4), whereas the double sides and double decks are sufficiently densely subdivided by watertight bullheads into watertight compartments whilst cargo spaces (6 and 7) below the double decks (4 and 10) are provided with efficient air -escapes (8 and 9). The height of the double decks is preferably not greater than the height of deck stiffeners of an adequate single deck while the breadth of the double sides (2) is preferably not greater than B/10.

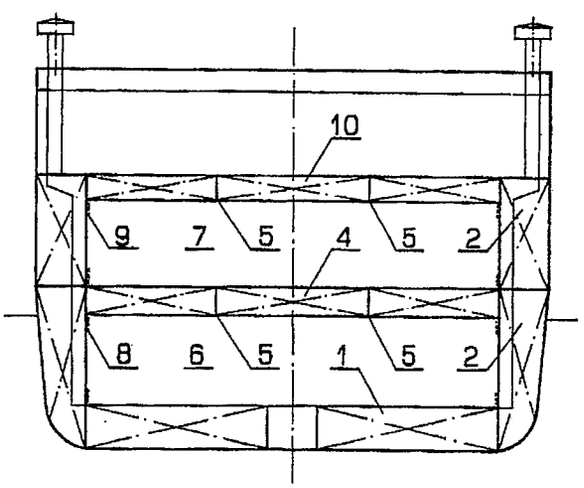

fig.2

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A subject of the invention is a ship, particularly of ro-ro type. The invention is applicable in shipbuilding, particularly of those ships having no transverse watertight bullheads in cargo spaces and meeting the requirements concerning ship survivability in the damage conditions. There are known cargo ships having no transverse watertight bullheads, intended primarily for the cariage of roll-on/roll off cargo. They have usually the following watertight compartments: double bottom, forepeak, after-peak, engine room and wing tanks. The fore and aft collision bullheads and wing tanks are terminated as a rule at the first deck above the deepest load line.

There have been so far no subdivision requirements for cargo ro-ro ships. That is why wing tanks on such ships were applied in view of ballasting and frequently due to psychological reasons rather than due to subdivision considerations. They could save the ship only in cases of shallow damages in way of those tanks.

There are known car-passenger ferries /of ro-ro type/ subject to subdivision and damage stability requirements contained in the 1974 SOLAS Convention. Space below the bullhead deck on such ferries as usually densely subdivided by transverse bullheads, extending from side to side. In such a case wing tanks are not applied and many of the compartments below the bullhead deck is rather used for cargo nor other purposes. On the remaining passenger ro-ro ships, below the bullhead deck, wing compartments of breadth B/5 are applied which are relatively short and cross-connected to avoid asymmetrical flooding.

The above solutions do not provide sufficient safety for passenger ro-ro ships in case of collision. On the centrary, these solutions appear to be extremely dangerous as they do not secure a ferry against the rapid capsize in case of sea water entering onto the bullhead deck. A good evidence for this was the capsizing of the "European Gateway" in 1982 and the "Herald of Free Enterprise" in 1987, to mention only the two recent most famous disasters.

In the light of the new requirements concerning the ship subdivision based on the probabilistic approach, an index of subdivision is an objective measure of ship safety in the damage condition. The rules are to enter into force as early as in 1992 and all dry cargo ships, including ro-ro ships, will have to meet these requirements. Similar rules will also be in force for passenger ships.

The new probablistic rules require the same level of safety irrespective of dry cargo ship type. Thus new ro-ro ships will have to be equally safe /have the same indices of subdivision/ as the remaining dry cargo ships. For present ro-ro ships in service, values of the indices of subdivision are very low, if not marginal, frequently not exceeding a value of 0.1 whilst for other cargo ships this index is above 0.5.

There is no possibilities whatsoever to increase so markedly the indices of subdivision for ro-ro ships within the presently applied concept of their watertight subdivision, that is through a considerable increase in freeboard or by the application of removable transverse bullheads in holds intended for ro-ro cargo. Such solutions are clearly contradictory with their basic operational features.

A ship according to the invention embodies the characteristics of having double sides at least on part of its length, terminated at least at the first continuous deck above the bullhead deck and of having double decks; at least a bullhead deck, whereas the double sides and decks are sufficiently densely subdivided by water-tight bullheads into watertight compartments, whilst cargo spaces are provided with efficient air-escapes /deaerators/ placed at side tops of these cargo spaces.

The breadth of the double sides is preferably not greater than 8/10, the double sides are subdivided into wing tanks by transverse bullheads, and cargo spaces are of constant breadth.

The height of the double decks is preferably not greater than the height of deck stiffeners for adequate single decks; the double decks are transversely and longitudinally subdivided by watertight bullheads. The double bottom is preferably of minimum height required by the rules.

The benefits of the invention are twofold:

I. from design and operation standpoints: the invention makes it possible to obtain high indices of subdivision, required by the new subdivision regulations, thus it makes it possible building of safe ro-ro ships without impairing their successful operational features based on non-subdivided horizontal cargo spaces.

II. from technical standpoint:

a/ the invention does not decrease the cargo space. The double decks make use of the space on underside of the decks, contained between the huge deck stiffeners, useless for cargo. Confinement of this space by relatively thin watertight shell plating, replacing the thick flanges of deck stiffeners, changes this useless space into a double buoyant deck of considerable volume. Due to this reason, hitherto broad wing compartments below the bullhead deck can be replaced by relatively narrow double sides terminated at least at the first deck above the bullhead deck thus improving functionality of cargo spaces;

b/ the invention does not increase the weight of the ship thus keeping the same deadweight;

c/ the invention improves overall ship

strength;

d/ smooth sides make cargo handling and insulation easier.

The invention as shown in Fig.1 and 2. Fig.1 presents cross-section of a ro-ro ship with two double buoyant decks.

The ship in Fig.1 has double bottom 1 of minimum height described by the rules, double sides 2 throughout the whole length of the ship, terminated at the main deck 3. The ship has double bullhead deck 4 of height corresponding to the height of deck stiffeners of an adequate single deck.

Double sides 2 are horizontally subdivided by the shell of the bullhead deck and are transversely subdivided by watertight bullheads. The double bullhead deck 4 has two longitudinal bullheads and is transversely subdivided at the same places as the double sides. Holds 6 and 7 have efficient air-escapes 8 and 9 distributed along the ship sides. Corresponding opposite tanks in the double bottom 2 are cross-connected or flooded by use of the ballast system.

The ship in Fig.2 has - in addition to the ship shown in Fig.1 - double main deck 10. The double sides 2 in this case are of lesser breadth, keeping the same breadth of holds 6 and 7 as in the case of the ship in Fig. 1. As a result, the breadth of the ship is now slightly lesser than before.

Claims

1. A ship, particularly of a ro-ro type, having inside watertight compartments like double bottom forepeak, after-peak and engine room, characterized in that at least on part of its length it has double sides (2) terminated at least at the first continuous deck above the bullhead deck and has double decks, at least the bullhead deck (4), the double sides and double decks are sufficiently densely subdivided into watertight compartments and cargo spaces (6 and 7) have efficient air-escapes (8 and 9) located at side tops of these spaces.

2. The ship according to claim 1, characterized in that that the double sides (2) have the preferable breadth not greater than B/10 and are subdivided by bullheads into smaller compartments whilst cargo spaces (6, 7) have constant breadth.

3. The ship according to claim 1, characterized in that double decks (4, 10) have the preferable height not greater than the height of deck stiffeners of adequate single decks and are subdivided longitudinally (5) and transversely into watertight compartments.

4. The ship according to claim 1, characterized in that double bottom (1) has the preferable height corresponding to a minimum height according to the rules.

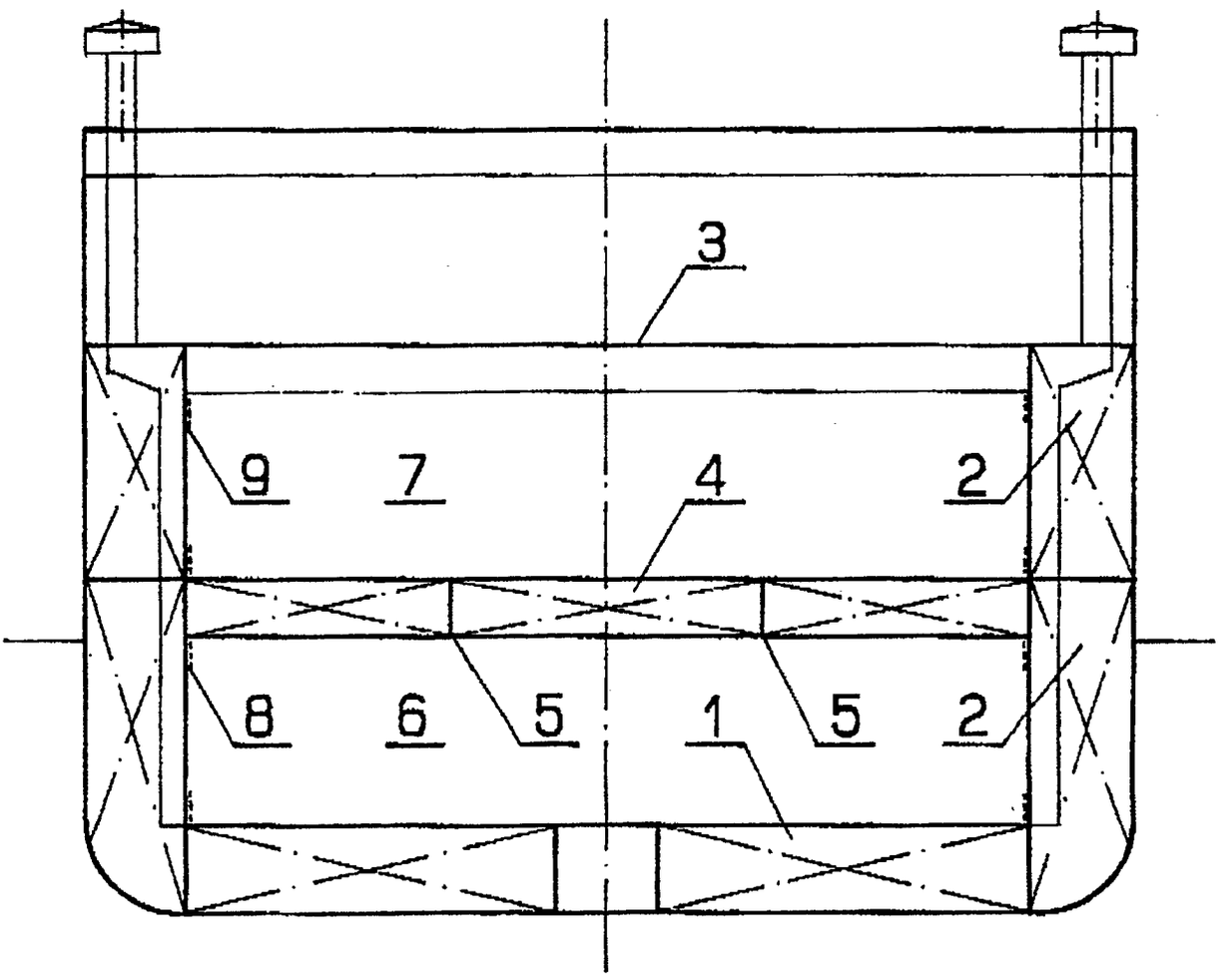

fig.1

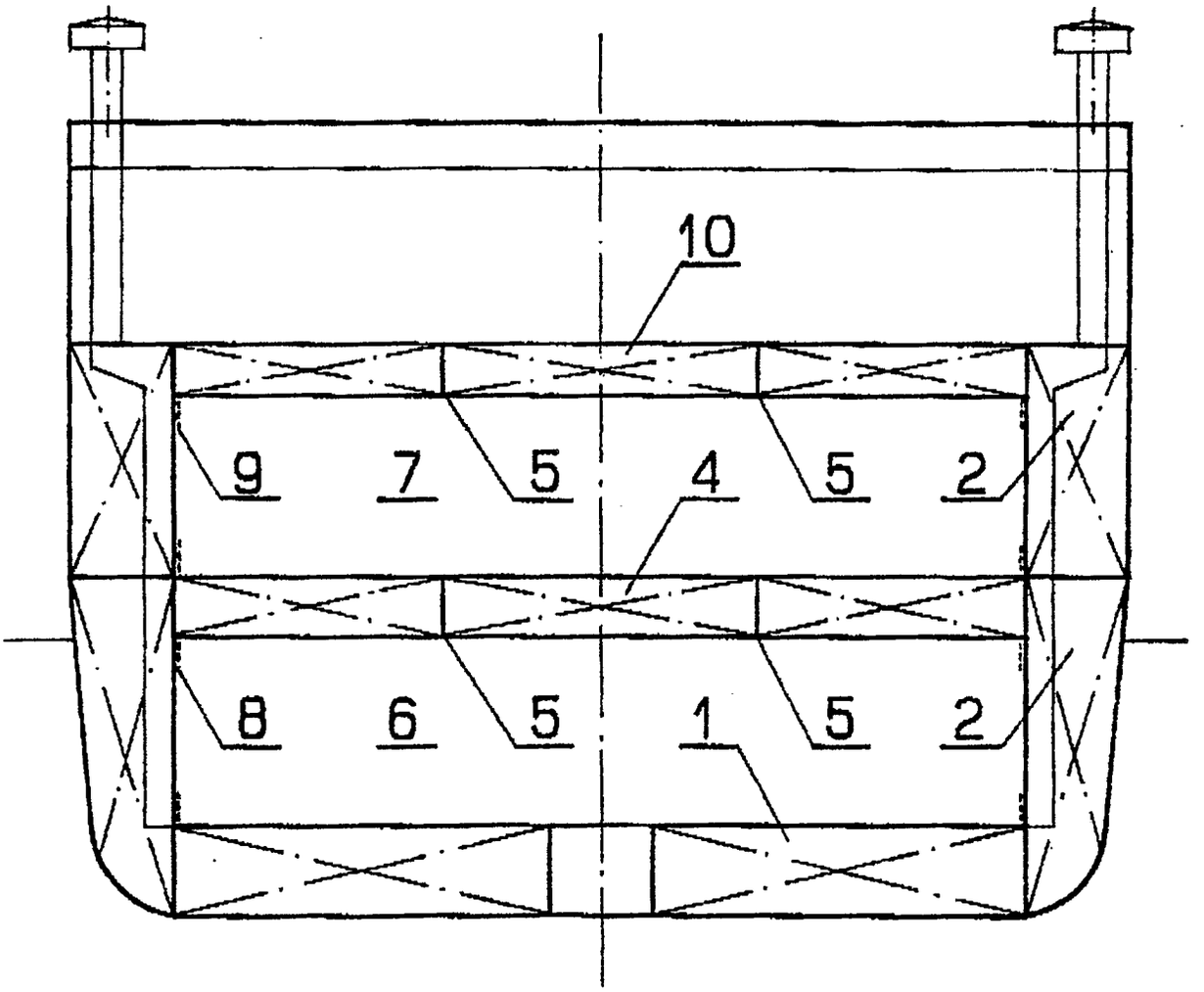

fig.2

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EUROPEAN SEARCH REPORT

Application Number

EP 91 10 8047

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X,Y	FR-A-4 573 46 (DINSE) * the whole document *	1,3,4.,2.	B 63 B 43/12
Y,A	FR-A-3 552 42 (CANARD) * the whole document *	2.,1,3,4.	
A	FR-A-1 525 601 (GRUNBERG) * the whole document *	1.	
A	A GROUP OF AUTHORITIES: "MARINE ENGINEERING" 1971, SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS, NEW YORK,NY. * page 696, right-hand column, paragraph 1 * * page 700, right-hand column, paragraph 9 *	1.	
A	A GROUP OF AUTHORITIES: "SHIP DESIGN AND CONSTRUCTION" 1969, SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS, NEW YORK,NY. * page 41, left-hand column, paragraph 2; figure 1 *	1.	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

B 63 B

The present search report has been drawn up for all claims

Place of search	Date of completion of search	Examiner
The Hague	22 August 91	DE SENA Y HERNANDORE

CATEGORY OF CITED DOCUMENTS

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