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(54) Integral stabilizer system for vessels

(57) A stabilization system for vessels that comprises at least one pair of stabilizer elements (E) each arranged on a side of the vessel and well under its water line, each of said stabilizer elements being hinged to the hull (C) of the vessel such that they can be made to rotate (XX') between a deployed, active, position and a non-deployed, inactive, position in which they are received in corresponding housings (A) provided in the hull and the configuration of said stabilizer elements (E) being such that, in the aforesaid inactive position, they define, together with the rest of the hull (C), a surface without interruption of continuity. Movement between said active and inactive positions is achieved by actuating means provided inside the hull or mounted on the outside thereof, but inside said housings (A) for receiving the aforesaid stabilizer elements.

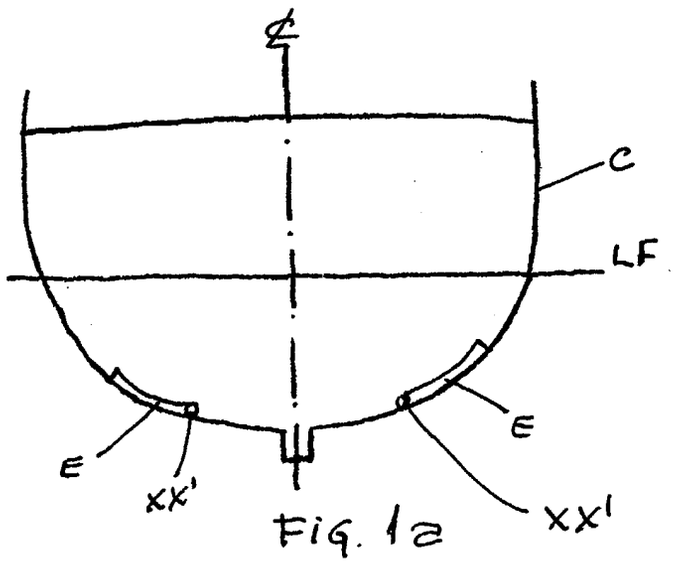

Fig. 1a

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Description

Field of the invention

[0001] The present invention relates to a stabilizer system for damping the movement, primarily the rolling, of vessels that are stationary or that are travelling at low speed and, in particular, to a system of this type that, when inactive, does not interrupt the continuity of the vessel hull surface.

Background of the invention

[0002] In the case of a vessel that is stationary or that is travelling at low speed, the rolling movement generated by the sea's transverse component causes great inconvenience for the vessel's occupants and restricts anchoring areas in the case of passenger and recreational craft. In the case of working vessels, such as fishing boats, oceanographic vessels, and hospital and military ships, a marked rolling movement in many cases reduces operational capabilities and safety.

[0003] To prevent these drawbacks, stabilization systems have been developed for vessels with the aim primarily of minimizing the rolling effect. Systems of this type known to the applicant include the following:

Bilge keels: these constitute the most primitive and simplest system and consist of two surfaces fixed to the vessel's bilge that are usually aligned with the current lines and limit the rolling movement by offering resistance to the oscillating movement of the vessel in a direction transverse to its length. They are an economic but only moderately effective solution and constitute an increase in resistance to the forward movement of the vessel by forming an increase in the careen.

Dynamic stabilizers: those that can be termed "fixed" generally consist of fins with a hydrodynamic cross section that project from the vessel's sides, below the water line. Usually actuated by electrohydraulic means in order to generate a rotational movement about a geometric axis perpendicular to the surface of the hull, they are controlled by signals emitted by devices that detect the rolling movement of the vessel. The direction of the torque generated by the hydrodynamic lift of said fins is the opposite of that of the vessel's rolling movement and therefore the latter is damped. A dynamic stabilizer system has been developed for low speed or for a stationary vessel, based on the sudden rotary movement of the stabilizer fins. In addition to offering resistance to forward movement, this method has limitations arising from the small damping effect of the fin and also constitutes an increase in resistance under the vessel's normal conditions of operation.

[0004] As it is necessary for the water to strike the profile at a specific velocity for the fin to fulfil its stabilizing function, this type of dynamic stabilizer is effective only when the vessel is moving, and its configuration and arrangement on the hull are usually calculated to have maximum efficiency at cruising speed with small wavelets.

[0005] This is an effective system, but its technical complexity results in a high financial cost. In addition, as in the case of bilge keels, its installation means an increase in the careen and therefore they offer resistance to forward movement in all conditions.

[0006] To overcome this drawback of dynamic stabilizers, retractable dynamic stabilizers have been developed that are housed in the vessel's hull when not in use, but said housing obviously takes space away from inside the hull, their operation, for the rest, being identical to that of the fixed dynamic stabilizers mentioned above.

[0007] Antirolling tanks: known also as "water chambers", they are usually placed on both sides of the vessel and intercommunicate via a system of tubes and valves. Their function is to damp rolling under all conditions by means of the transfer of fluid from one side of the vessel to the other, thereby creating a righting torque that opposes the rolling movement of the vessel. This is an effective system, although limited in its application, but its installation involves a high level of complexity, takes volume away from inside the hull and also results in a loss of stability torque in certain circumstances.

[0008] Finned cones: this system consists in suspending, from one or both sides of the vessel, a body of substantially conical or frustoconical shape that is closed via its smaller base, that is usually made of metal and provided with hinged fins on its surface and a weight suspended from its lower part. When the vessel lists towards the side from which the device is suspended, the fins open such that, through the action of weight, the body remains submerged. When the list is to the opposite side, the drag of the water over the surface of the cone opposes the movement. This is a simple, effective system that can be used only when the vessel is stationary. Nevertheless, its installation and operation are awkward, requiring the use of a crane or auxiliary davit.

Summary of the invention

[0009] The object of the present invention is to provide a stabilizer system that is simple and reliable in operation, capable of efficiently reducing the rolling of a vessel that is stationary or that is travelling at low speed without its incorporation adding resistance to forward movement, i.e. without its affecting the speed of the vessel when the system is inactive, in accordance with the characterizing part of Claim 1.

[0010] The object of this invention is achieved by incorporating, on both sides of the boat, an element substantially like a fin that can adopt a first, active or deployed, position, in which it has a surface sufficient to

damp, to the appropriate extent, the rolling of the vessel when the latter is stationary or travelling at low speed, and a second, inactive or non-deployed, position, in which it may be placed by virtue of being hinged by means of a hinge integral with the hull and in which it forms with the latter a surface with no interruption of continuity.

[0011] In said first, active or deployed, condition, the damping effect on rolling is achieved directly by virtue of the high hydrodynamic resistance of said element to the component of the flow normal to its surface area.

[0012] When said stabilizer element is in its aforesaid second, non-deployed, position, with its outer surface flush with the surface of the hull, its resistance to forward movement is practically zero.

[0013] Both the active surface of the abovementioned stabilizer element and its location on the hull, and the number of said stabilizer elements installed on each side, will suit the shapes of the hull and take into account the transverse stability parameters of the vessel.

[0014] Thanks to the incorporation of the stabilization system according to the invention, the following advantages are achieved:

- optimization of the damping effect when the vessel is stationary or travelling at low speed, maximum effectiveness being achieved as compared with other systems;
- simple operation;
- it has no effect on resistance to forward movement;
- it does not require dynamic functioning of the stabilizer elements (although the invention also covers this possibility) ;
- its incorporation into a hull has a very small effect on the interior space, which allows easy installation both in newly constructed vessels and those already in existence;
- as it does not constitute an element that affects the speed of the vessel, it affords the possibility of installing, in certain cases, a number of integral stabilizers in different regions of the hull in order to limit rolling, heaving and pitching movements;
- it requires a marked increase in the amount of energy necessary for the vessel to reach severe angles of list, which constitutes an increase in safety when sea conditions are poor.

[0015] The above and other characteristics and advantages of the invention will become apparent to an expert in the art from reading the following detailed description of the preferred embodiments of the present invention taken together with the attached drawings.

Brief description of the drawings

[0016] In the following text, a description will be given of the invention with reference specifically to the attached drawings, in which:

Fig. 1a is a diagram representing the cross section of a vessel that incorporates the stabilizer system according to the invention, said stabilizers being illustrated in their first, inactive or non-deployed, position; and

Fig. 1 is a diagram, similar to that in Fig. 1a, illustrating the stabilizer elements in their second, active or deployed, position.

Detailed description of the preferred embodiments

[0017] As may be seen in Figs 1a and 1b, each stabilizer element consists essentially of at least one fin E located on each side of the hull C, below the water line, whose configuration is such that, in its inactive, non-deployed (cf. Fig. 1a), condition, in which it is housed in a recess provided in the aforesaid hull C of the vessel, its outer surface is flush with the outer surface of the hull and forms with it a surface without interruption of continuity and with the same profile as said hull C. In this inactive position, as may be seen, said stabilizer fins E offer no resistance to the travel of the vessel.

[0018] Each of said fins E is hinged on an axis XX' (which, in the view in Figs 1a and 1b, would be perpendicular to the plane of the drawing) such that it may be rotated about said axis XX' from the non-deployed position illustrated in Fig. 1a into at least one active, deployed, position as illustrated in Fig. 1b. Said axis XX' is substantially parallel to or forms a slight angle with the horizontal plane of flotation.

[0019] In this figure it is possible to observe, by means of the broken lines, the contour of the leaktight housing A provided inside the hull C on each side of the latter for receiving a fin E in the inactive condition thereof shown in Fig. 1a.

[0020] The hinge articulation whose geometric axis XX' is arranged essentially longitudinally with respect to the hull C comprises a shaft (not shown) supported in rotation at its ends in supports provided on the outside of the housing A and with which said fin E is integral, the leaktightness of said housing A being guaranteed by means of the relevant, customary sealing devices.

[0021] The travel of said fins E from their first, non-deployed or inactive, position to their second, deployed or active position, and vice versa, may be achieved by different means such as electric motors, whose rotation is transmitted to the shaft integral with each fin E via corresponding gears or by means, at least, of a hydraulic cylinder whose shaft is connected to one at least of the ends of said shaft in order to make it rotate. The number of hydraulic cylinders and their arrangement along said shaft will be dictated by the dimensions of the stabilizer fin E.

[0022] Similarly, clamping means (not shown) of known type, for the start and finish of travel, enabling each stabilizer fin E to be immobilized securely in its non-deployed and deployed positions, respectively, are

provided.

[0023] The means for actuating each fin E may be provided in order to rotate each fin from, for example, its non-deployed position to at least one deployed position that is intermediate between the non-deployed position and the totally deployed position of each fin E if desired. In such a case, the aforesaid clamping means must be able to immobilize said fin E in each of said at least one intermediate deployed position.

[0024] The invention also covers the arrangement of said actuating means inside the housing A, and therefore each assembly of the fin E with its rotary shaft and the corresponding actuating and immobilizing means may constitute a stabilizer unit that can be fitted entirely outside the hull, inside said housing for receiving the fin E which, in such a case, will have such dimensions as to receive all the aforesaid stabilizer unit.

[0025] In the operating condition of the stabilizer fins E shown in Fig. 1b, said deployed fins being at a specific angle depending on sea conditions and vessel condition, the fins E will generate hydrodynamic resistance forces F, F' that will give rise to a righting moment that will oppose the rolling movement.

[0026] In an alternative embodiment that is not shown, each of said fins E consists of at least two fin sections hinged such that they can be folded on themselves in order that said fin sections, in the inactive condition, are non-deployed and received in said housing A, said non-deployed sections of the fin E being deployed when the fin is moved from said first, inactive condition to said second, active condition, projecting from said hull C. In this way, each stabilizer element has an increased length in its active condition for a housing A of specific dimensions provided in said hull C.

[0027] Lastly, the invention covers the possibility of increasing the damping effectiveness of the aforesaid stabilizer elements by means of the induced movement thereof about their axis, opposing the rolling movement, such that the speed of the hydrodynamic flow on the stabilizers is increased and consequently the force opposing rolling thereon.

Claims

1. Stabilizer system for vessels of the type comprising stabilizer elements that project from each side of the hull,
   characterized in that it comprises:

   at least one stabilizer element, like a fin (E), mounted in order to rotate with respect to the hull (C) between at least one deployed, active, position, in which it is connected to the hull (C) only by means of a hinged articulation (XX'), and a non-deployed position in which it is received in a housing (A) provided in said hull and in which its outer surface is incorporated into the remainder of said hull without an interruption of continuity;
   actuating means for displacing said at least one stabilizer element (E) between said first, inactive, non-deployed position and said second, active, deployed position, and vice versa; and
   clamping means allowing said at least one stabilizer element to be immobilized in each of its aforesaid first and second positions, respectively.

2. Stabilizer system according to Claim 1, **characterized in that** said hinged articulation (XX') is mounted entirely outside said hull (C) but inside said housing (A).

3. Stabilizer system according to Claim 1 or Claim 2, in which said actuating means are arranged outside said hull (C) but inside the abovementioned housing (A).

4. Stabilizer system according to any one of Claims 1 to 3, **characterized in that** each stabilizer element (E) may be clamped in at least one intermediate position between said first and second, non-deployed and deployed, positions, respectively.

5. Stabilizer system according to any one of the preceding claims, **characterized in that** the axis of rotation (XX') of each stabilizer element forms a small angle with the horizontal plane of flotation of the vessel.

6. Stabilizer system according to any one of the preceding claims, **characterized in that** it comprises a number of pairs of stabilizer elements (E) located in different positions along the hull.

7. Stabilizer system according to any one of the preceding claims, **characterized in that** said means for actuating the stabilizer elements are mechanical, electrical or hydraulic or consist of a combination thereof.

8. Stabilizer system according to any one of the preceding claims, **characterized in that** each stabilizer element consists of at least two mutually articulated sections that are in a non-deployed condition when said stabilizer element is in said inactive position, contained in said housing (A) of the hull (C), it being possible to deploy said at least two sections in order to increase the length of said stabilizer element when the latter is placed in said second, active position, projecting from said hull.

9. Stabilizer system according to any one of the preceding claims, **characterized in that** said stabilizer elements, when in said active, deployed, position,

are able to move by rotating about their axis of articulation with the hull, opposing the rolling in order to increase their hydrodynamic effectiveness.

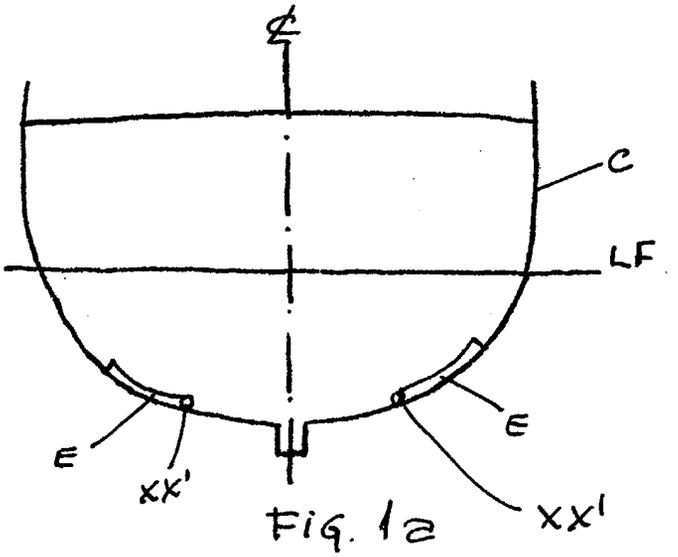

Fig. 1a

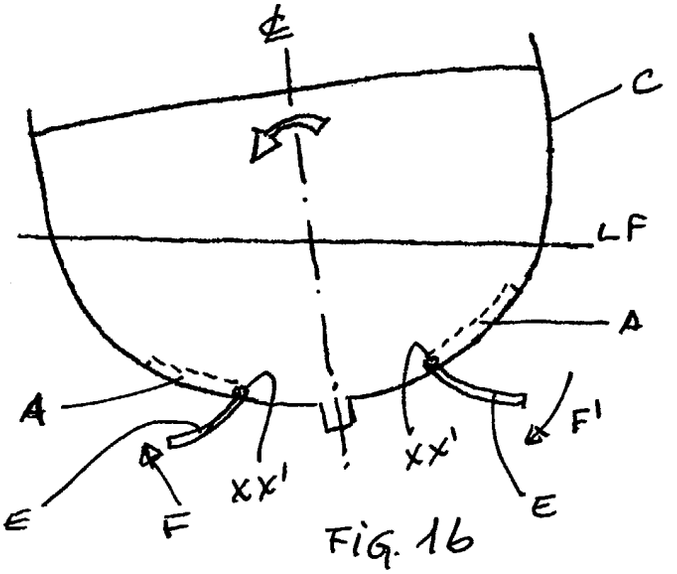

Fig. 1b

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EUROPEAN SEARCH REPORT

Application Number
EP 03 38 0138

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	15 September 2003	DE SENA HERNAND.., A

CATEGORY OF CITED DOCUMENTS

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EUROPEAN SEARCH REPORT

Application Number
EP 03 38 0138

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CATEGORY OF CITED DOCUMENTS

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