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DE 198 54 872 C 2

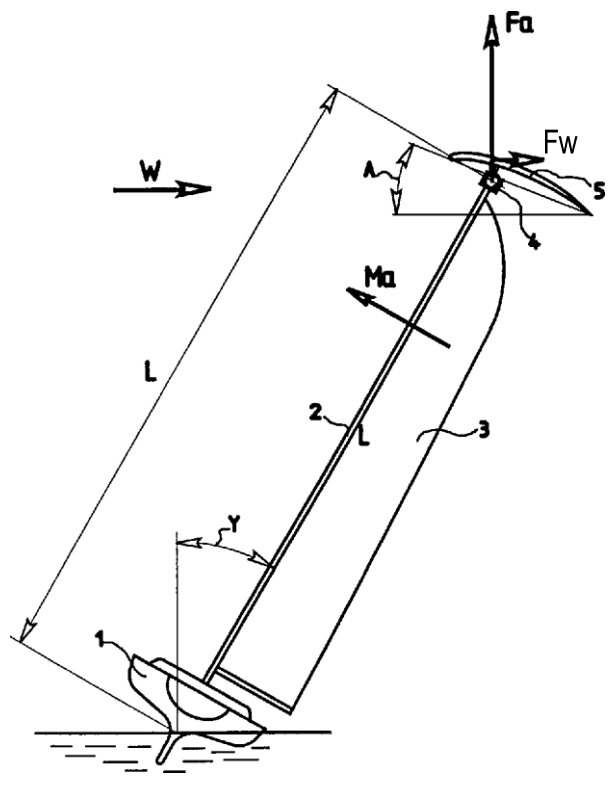
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Publications considered for the assessment of patentability:
 DE-PS 8 75 617
 DE 195 33 033 A1
 DE 195 12 948 A1
 DE 37 07 081 A1
 US 44 97 272

- ⑤4 Device for aerodynamic heel stabilization of a sailing yacht
- ⑤7 Device for aerodynamic heel stabilization of a sailing yacht with the following features:
 - With at least one mast (2) firmly connected to the vessel (1), to which one or more sails (3) are attached, which generate propulsion
 - With at least one wing (5) which is arranged at the top of the mast (2) by means of a bracket (4) and is angularly movable about three axes
 - With means for stabilizing the wing (5) triaxially to the wind direction at an angle of attack (A) and thus generating a stability moment (Ma) through the aerodynamic lift of the wing (5).



DE 198 54 872 C 2

Description

[0001] The invention relates to a device for aerodynamic heel stabilization of a sailing yacht.

[0002] Numerous devices are known to stabilize the heeling of sailing ships, such as devices for automatically hoisting the sails or tilting the mast., DE 195 12 948 A1. The sailing device described in patent DE-PS 875 617 uses rigid sails that can be swiveled to reduce heeling. Another device, US 4 497 272, uses mastless sails that have static and dynamic buoyancy. The published patent application DE 37 07 081 A1 describes a sailing mast for a sailing vessel with a main sail and a slat arranged at the upper end section of the mast, with which the aerodynamically effective area is to be increased. A combination of propulsion and buoyancy surfaces for sailing vehicles, in particular watercraft, is described in the published patent application DE 195 33 033 A1. With the horizontally arranged sail surfaces, the sideways tilting force can be fully or predominantly compensated.

[0003] Based on this state of the art, the object of the invention is to provide a device for aerodynamic stabilization of the heeling of a sailing yacht, that

- is compatible with any type of sailing equipment of the ships and significantly increases their safety in strong and stormy winds and other extreme conditions,
- operates independently of the wind direction,
- does not complicate the control of the operating area and does not change the usual control activity of the crew.

[0004] This object is achieved by a device for aerodynamic heel stabilization of a sailing yacht having the features of claim 1.

[0005] The stabilization device according to the invention has, among other things, the following advantages: The wing, which is rotatably mounted on the mast tip with a bracket, generates a righting moment that reduces the ship's heeling and that increases with the increase in the wind.

[0006] In the following, the invention is explained in more detail by means of examples with reference to the figures:

[0007] Fig. 1 Sailing yacht with stabilization device attached to the top of the mast and effective forces and moments

[0008] Fig. 2 Sailing yacht with stabilization device

[0009] Fig. 3 Stabilization device with rotating console

[0010] Fig. 1 shows a wing 5 mounted on the top of the mast 2 of a sailing yacht 1. The wing 5 can rotate in the horizontal and vertical plane with respect to the mast 2. The wing 5 is oriented in the horizontal plane against the wind direction W and balances in the vertical plane at the angle of attack A, at which the maximum lift force F_a occurs. The control devices that stabilize the wing 5 with respect to the wind W at various vessel heeling angles Y are not shown in this figure.

[0011] Fig. 1 shows the effective forces (F_a , F_w) acting on the sailing yacht 1. The figure clearly shows the function of the stabilizing device,

5 Under the influence of wind W, the heeling of the sailing yacht 1, angle Y between the mast and the vertical, occurs. At the same time, an aerodynamic lift force F_a is generated on the wing, which depends on the wind speed W, the angle of attack A, and the aerodynamic properties K of the wing.

[0012] The righting moment M_a depends on the degree of the buoyancy force F_a , the angle of heel Y and the mast height L. The higher the wind speed W and the angle of heel Y, the higher the buoyancy force F_a and accordingly the stability moment M_a .

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$$M_a = F_a L (\sin Y - 1/K \cos Y)$$

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$$\text{where } K = F_a / F_w$$

[0013] Fig. 3 schematically shows a stabilizing device with a wing arranged on a bracket 7 rotating around the mast 2. It has advantages compared to the stabilizing device according to Fig. 1.

[0014] By attaching the wing 5 to the bracket 7, a righting moment M_a is generated even at a ship's heeling angle Y of 0 degrees, thus preventing the heeling angle Y caused by the crosswind W.

$$M_a = F_a L_1 [\sin(Y + Y_1) - 1/K \cos(Y + Y_1)]$$

Reference symbols

- 30 1 Hull
2 Mast
3 Sails
4 Mounting the wing on the mast
5 Wing
35 6 Rotating bracket for the console on the mast
7 Console
A Angle of attack of the wing
Y Heeling angle of the ship
 Y_1 Angle caused by the attachment of the wing to the console ship's heeling
 F_a Lift of the wing
 F_w Aerodynamic drag of the wing
 M_a Stability moment of the wing
W Wind speed
45 L, L_1 Distance between the wing and the center of mass of the ship

Patent claims

1. Device for the aerodynamic stabilization of the heeling of a sailing yacht with the following features:

- With at least one mast (2) firmly connected to the yacht (1), to which one or more sails (3) are attached, which generate propulsion.
- With at least one wing (5) which can be pivoted about three axes at the top of the mast (2) by means of a bracket (4)
- With means for stabilizing the wing (5) triaxially with respect to the direction of the wind at an angle of attack(A), and thus creating a stability moment (M_i) through the

aerodynamic lift of the wing (5).

2. Device according to claim 1, characterized in that the wing (5) is articulated on a bracket (7) which is rotatably mounted around the vertical axis of the mast (2) at the mast tip (6).

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2 pages of Drawings

DE 198 54 872 C 2

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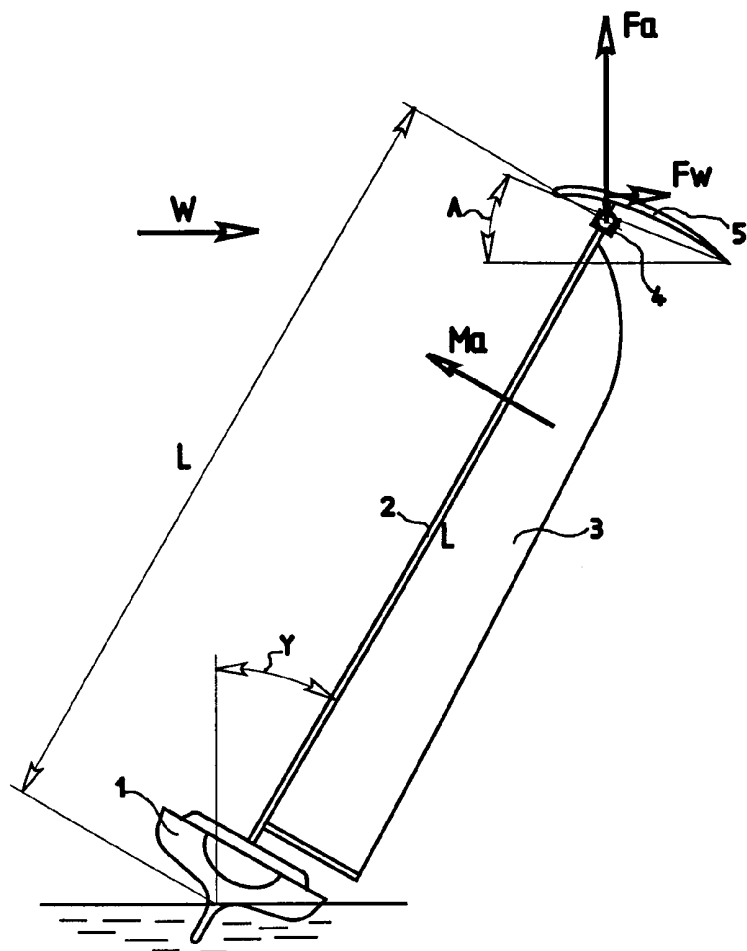


Fig. 1

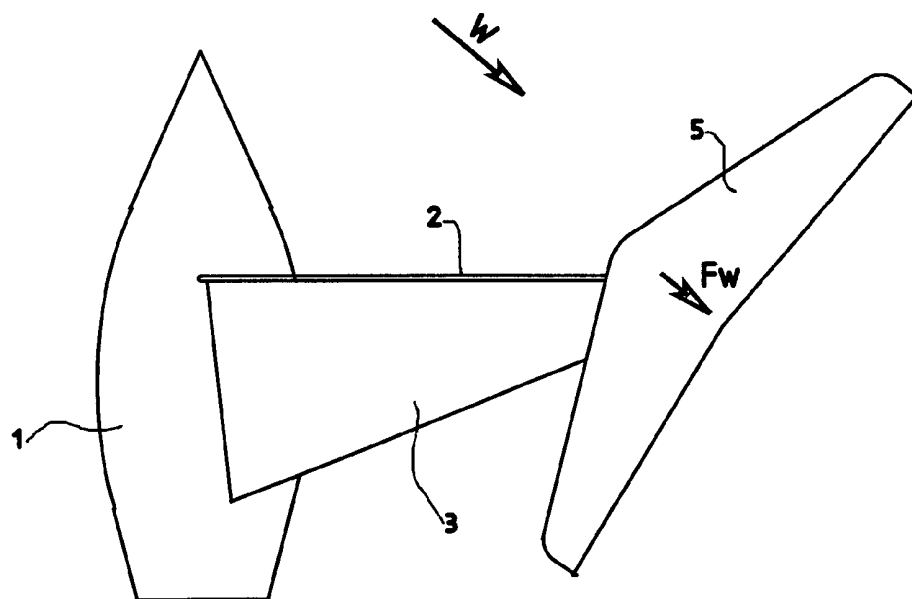


Fig. 2

