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(54) **Sail device for vessels**

(57) The present invention relates to a sail device for vessels formed by a sail (1) comprising three layers: two outer layers (1a, 1b) and an intermediate layer (1c), and a securing structure (2) for securing the sail (1) comprising a mast (2a) and a boom (2b); where the intermediate layer (1c) is attached both to the boom (2b) and to the mast (2a); where the outer layers (1a, 1b) are attached to the intermediate layer (1c) at least partially leaving the lower edge of said outer layers (1a, 1b) close to the

boom (2b) free; and where the intermediate layer (1c) has a smaller surface with respect to the surface of each of the two outer layers (1a, 1b); such that it allows considerably improving the lift of the sail vessel itself, in addition to improving the turning and maneuvering speed of the vessel by means of an extremely simple device which has a broad industrial application in the nautical sector.

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Description

Technical Field of the Invention

[0001] The present invention relates to a sail device for vessels, where said device has an application in the sea transport and in aquatic sports such as competitions with regattas, sailboards, etc.

[0002] The purpose of this sail device is to optimize the pull or lift of sail vessels, such that it allows the vessel to move forward at a greater speed with respect to traditional sail vessels by means of using said device; where additionally that increase in the lift is achieved in a simple manner, without complex additional elements with respect to traditional sails, and easy to implement in current vessels.

Background of the Invention

[0003] By way of introduction, sails used by vessels today are usually made with a thin single layer of textile material, and where said layer is coupled to a structure of the vessel itself; generally speaking, the structure is formed by a vertical mast and by a lower horizontal pole coupled to the mast known as a boom, such that the textile layer is attached both to the mast and to the boom.

[0004] Once the layer is coupled to the structure of the vessel, it acts like a thrust element and exerts a lift when the layer is unfurled and in the operating position.

[0005] By making the sail with a single layer, the profiles of the suction area (sail profile area known as a leeward side), and of the pressure area (sail profile area known as a windward side) are similar in surface when the sail is in the operating position, which implies that the pull or lift of said sail are not high and this directly results in the speeds that the vessel can reach not being high.

[0006] When improving the lifts of sails, a solution consisting of sails formed by two layers of textile material which resort to the presence of elements such as masts, axles, rigid ribs, ropes or other similar elements, such that they confer to the sails a wing-type aerodynamic geometric shape profile, which improves the lifts.

[0007] The wing-type aerodynamic profile generally comprises a curved geometry resembling that of a drop of water, but in which the area of the leeward side is convex and that of the windward side is considerably planar, such that when a fluid passes over said profile, the fluid in the windward side area circulates more quickly and a reduction in pressure occurs, in contrast the fluid in the leeward side area circulates more slowly and an increase in pressure occurs; in which said combination of pressures generates the mentioned lifts and cause a determined thrust in a determined direction.

[0008] Unlike what occurs in a plane wing, where the position of the upper side and the lower side always have the same configuration in relation to the apparatus to lift; in the case of sails for vessels, the situation of the leeward side and windward side must necessarily change position

according to if the sail is located port side or starboard side of the vessel, because in the event that the position of the sail does not change (Figures 7A and 7B), there would be a position in which the vessel could not move forward and would even tend to travel backwards given that lifts would be in the direction opposite that of the course of the vessel.

[0009] For this reason, these two-layer sails necessarily require the presence of said additional control or adjustment elements which can adapt the surfaces of the leeward side and windward side to the relative position of the sails in relation to the vessel.

[0010] In view of the aforementioned background and of the drawbacks existing in relation to improving the lift of a sail, a new sail device which avoids the aforementioned drawbacks in that it improves lifts by increasing the speed of the vessel, all by means of a device formed by simple elements requiring minimal manipulation force by the user, which can be applied to current vessels and does not have additional control elements that may substantially increase the price of the product is necessary.

Description of the Invention

[0011] The present invention relates to a sail device for vessels which considerably solves the aforementioned drawbacks and allows substantially improving the lift of the sail vessel itself, in addition to improving the turning and maneuvering speed of the vessel by means of an extremely simple device which has a broad industrial application in the nautical sector.

[0012] The sail device for vessels proposed by the invention comprises:

- a sail comprising three layers: two outer layers and an intermediate layer,
- a securing structure for securing the sail, comprising a mast and a lower horizontal pole known as a boom,

such that the intermediate layer is attached both to the boom and to the mast in a manner similar to the layer of traditional sails, where the outer layers are attached to the intermediate layer at least partially leaving the lower edge of said outer layers close to the boom free, and where the intermediate layer has a smaller surface with respect to the surface of each of the two outer layers.

[0013] These technical features must be analyzed at length in order to observe the technical effect obtained from combining them:

- First of all, the intermediate layer is secured to the structure in a traditional manner known in the state of the art,
- the outer layers are attached to the intermediate layer except in the lower area, such that in said lower area the outer layers are not attached to the intermediate layer, and it allows air currents to enter the

space between the intermediate layer and the respective outer layers,

- and since the intermediate layer has a smaller surface with respect to the surface of the two outer layers, the outer layers adapt, forming the leeward side and windward side sail profiles.

[0014] Therefore, the profile of the sail is as similar as possible to the aerodynamic profile of a plane wing: asymmetrical and having a determined thickness, such that it allows automatically adapting the position of said profile to the relative situation of the sail in relation to the vessel, i.e., the profile automatically changes direction when the sail goes from being port side to being starboard side, and vice versa. All this is achieved in a very simple manner without additional elements in the sail, simply the presence of the two outer layers and the intermediate layer.

[0015] The configuration and formation of the aerodynamic profile is achieved by means of introducing air in one of the hollows formed between one of the outer layers and the intermediate layer, such that this hollow swells and is configured as the leeward side profile; complementarily, the other outer layer is pushed towards the intermediate layer, which as it has a smaller surface than the outer layers, deforms somewhat and both layers (the intermediate and the outer layers) configure the windward side profile. The profiles can be switched by simply rotating the bearing structure of the sail object of invention.

[0016] In other words, the intermediate layer of the sail always affords freedom of movement to the layer forming the leeward side profile whether it is located in the left or right part of the sail indistinctly; and it limits, however, the possible movement of the windward side profile, which cannot exceed the limit of the surface defined by the intermediate layer, which adopts an approximately planar shape, such that the larger surface of the outer layer forming the leeward side profile (in comparison with the surface of the outer layer forming the windward side) increases the dynamic pressure of the wind in that area and at the same time reduces the static pressure, and as a consequence, a lift of the sail is achieved that is significantly greater with respect to the lift created by a sail having a single layer with similar general dimensions and belonging to the current state of the art.

[0017] It must be clarified that the feature referring to the intermediate layer having a smaller surface with respect to the surface of each of the two outer layers, in view of the effects it produces, this smaller surface of the intermediate layer refers to the projection of the outer layers on the intermediate layer, because in the event that the intermediate layer becomes longer and/or the outer layers do not reach the lower part of the intermediate layer, this excess surface of the intermediate layer does not affect the aforementioned technical effects and is not considered as effective surface of said intermediate layer.

[0018] The presence of the intermediate layer allows automatically adjusting the direction of the aerodynamic profile of the sail to the situation of the latter, according to if the sail is located port side or starboard side of the vessel, such that the leeward side is always automatically facing the wind; such that the outer layer which, with the sail being port side, acted like a layer having greater surface goes on to acting, when the sail is on starboard side, like a layer of smaller surface; and the same occurs with the other outer layer of the sail, but the reverse situation.

[0019] Therefore the device object of invention comprises simple elements and allows automatically adjusting the direction of the aerodynamic profile formed by the sail without the need for additional mechanisms, such as masts, axles, rigid ribs, ropes or lines. Therefore the application of said device is suitable for large vessels, sports vessels (such as sailboards), etc. The sail is easily mountable, removable, and portable, similar to that of a sail having a single layer. Additionally, the sail device object of the invention is applicable to any sail of a vessel; i.e., to a single sail, which can be the main sail or another sail of the vessel, part or even all the sails of the vessel.

[0020] Is contemplated the possibility that a plurality of cross ties are located within and perpendicular to the outer layers, such that they configure an aerodynamic profile specific for determined functions; i.e., they limit the expansion of the outer layer forming the leeward side profile to achieve the desired aerodynamic profile, is contemplated.

[0021] Based on this preferred embodiment, there can be two possible alternatives:

- The plurality of cross ties start from an outer layer to the intermediate layer; i.e., they are initially formed in one of the outer layers and end in the intermediate layer, or in contrast
- the plurality of cross ties start from an outer layer to the other outer layer; being initially formed in an outer layer and ending in the other outer layer.

[0022] Additionally the cross ties can be made from non-elastic materials or from less elastic materials than those used to manufacture the two outer layers.

[0023] Attention must be paid to the design of the leading edge of the sail, corresponding to the area close to the mast, such that this design must reduce the strength induced in the sail itself, and transfers the pulls to the elements adjacent to the latter.

[0024] The possibility that the intermediate layer comprises at least one through cavity like a window is contemplated, having the following advantages:

- They reduce the weight of the intermediate layer, and therefore of the sail as a whole.
- It allows that in the event of there being cross ties, they are attached to respective outer layers and pass through said at least one through cavity of the intermediate layer; such that the cross ties belonging to

the outer layer acting as the leeward side profile pull on the other outer layer and keep it firmly fixed to the intermediate layer.

[0025] Additionally the possibility that at least one of the outer layers comprises bands of more elastic material than the rest of the material of said outer layer, located in the area of the edge away from both the mast and from the boom (known as an outer edge) is contemplated, such that they allow the outer layer forming the leeward side profile to be configured with a determined geometry, limiting the expansion thereof according to the degree of elasticity of said outer layers.

[0026] It is also contemplated that a plurality of strips of band are located in said bands of more elastic material, limiting the maximum extension of said bands more efficiently with respect to the inclusion of just the bands alone, and where the strips of band transmit the stresses of the outer layer to the rear edge, improving the functionality of the sail device object of invention.

[0027] Preferably, the bands of more elastic material comprise a trapezoidal geometry, being narrower in the area close to the mast and wider in the area closer to the boom; maintaining the same proportionality with the sail width in each area.

[0028] The use of bands of elastic material in the rear edge area, such that said material becomes rigid after a determined point, may give rise to simplifying the design of said bands located in the rear edge, and prevents the need to include the strips of bands described above. This same property applied to the whole of the surfaces of the two outer layers may prevent the need to include the bands of more elastic material in the rear edge area, being able to have a sail with an intermediate layer constructed with a rigid material and the outer layers with materials that are flexible to a determined point, where they become rigid.

[0029] The possibility that the outer layers comprise at least one through window is contemplated, such that said at least one through window facilitates the sail swelling and deflating processes, logically without the through windows affecting the correct operation of the sail to prevent the corresponding aerodynamic profile from not being formed and the respective lifts from not being generated.

[0030] The invention additionally contemplates the possibility that the lower edge of the outer layers can end:

- At the same height as the lower edge of the intermediate layer, or
- at a height greater than the lower edge of the intermediate layer; depending on the design of the boom and other elements of the vessel.

[0031] Complementarily, two clearly differentiated areas of the sail can be defined in a preferred embodiment, one located close to the mast, and the other one in the opposite area, such that:

- The area close to the mast comprises the two outer layers and the intermediate layer, and
- the area opposite the mast comprises a single layer like traditional sails.

[0032] In other words, the three-layer sail object of invention coexists in a single sail together with a traditional single-layer sail like a traditional sail. Said variant may affect either all or part of the sails of a vessel.

[0033] Finally, the possibility that the different layers of the sails can be made with a single material or with materials having different thicknesses and characteristics is contemplated in order to achieve interesting combinations of resistance, lightweight, easy folding, portability and others so considered by the designer.

[0034] Therefore, according to the described invention, the sail device for vessels proposed by the invention constitutes an advance in sail devices known until now and solves in a fully satisfactory manner the drawbacks discussed above in improving the lift by increasing the speed of the vessel, using simple elements requiring minimal manipulation force by the user, which can be applied to current vessels and does not have additional control elements that may substantially increase the price of the product, and being able to form one, several or all the sails of a determined vessel.

Description of the Drawings

[0035] To complement the description that is being made and for the purpose of aiding to better understand the features of the invention according to a preferred practical embodiment thereof, a set of drawings is attached as an integral part of said description in which the following has been depicted with an illustrative and non-limiting character:

Figure 1 shows a schematic profile view of the sail device for vessels object of invention.

Figure 2 shows a schematic view of a plan section of the sail, the plurality of cross ties within the outer layers being observed.

Figure 3 shows a schematic view of the profile of an outer layer comprising a plurality of bands and strips of bands located in the rear edge of said layer.

Figure 4 shows a schematic view of the profile of the intermediate layer in which a series of through cavities has been made.

Figure 5 shows a schematic view of a plan section of the sail, two areas being observed: the first area close to the mast formed by the three layers, and the second area away from the mast formed by a single layer.

Figures 6A and 6B show a schematic plan view of the vessel and the sail device acting in two different directions.

Figures 7A and 7B both belong to the state of the art and show a schematic plan view of the vessel and

of the sail acting in two different directions.

Preferred Embodiment of the Invention

[0036] In view of Figure 1, it can be seen how one of the possible embodiments of the sail device for vessels proposed by the invention comprises:

- A sail (1) formed by three layers: two outer layers (1a, 1b) and an intermediate layer (1c), and
- a securing structure (2) for securing the sail (1) formed by a mast (2a) and a boom (2b); such that the intermediate layer (1c) is attached both to the boom (2b) and to the mast (2a), the outer layers (1a, 1b) are attached to the intermediate layer (1c) leaving the lower edge of said outer layers (1a, 1b) close to the boom (2b) free, and where the intermediate layer (1c) has a smaller surface with respect to the surface of each of the two outer layers (1a, 1b).

Figure 1 also shows how the lower edge of the outer layers (1a, 1b) ends at a height considerably greater than the lower edge of the intermediate layer (1c). Figure 2 shows how a plurality of cross ties (3) are located within and perpendicular to the outer layers (1a, 1b), and where said cross ties (3) start from an outer layer (1a) to the intermediate layer (1c), such that they configure a determined aerodynamic profile and limit the expansion of the outer layer forming the leeward side profile.

Figure 2 additionally shows an attachment of the outer layers (1a, 1b) to the intermediate layer (1c) in the area close to the mast (leading edge area), where said attachment is formed such that it reduces the induced resistance in the sail (1) itself, and transfers the pulls to the elements adjacent to it. Figure 5 shows another type of attachment in the leading edge as another possible preferred embodiment.

[0037] With respect to Figure 3, it can be seen how a plurality of bands (4) of more elastic material than the rest of the material of the outer layer (1a, 1b) are located in the area of the edge away from both the mast (2a) and from the boom (2b), i.e., the rear area of the sail (1); and said bands (4) are contemplated with the inclusion of a plurality of strips of band (5), which are located in said bands (4), limiting the maximum extension of the latter.

[0038] Figure 4 shows how the intermediate layer (1c) comprises several through cavities, such that the cross ties (3) not depicted go from one outer layer (1a) to the other outer layer (1b) through said through cavities (6).

[0039] In view of Figure 5, a particular embodiment in which two areas are distinguished can be seen: one located close to the mast (2a), and the other one in the opposite area, where:

- The area close to the mast (2a) comprises the two

outer layers (1a, 1b) and the intermediate layer (1c), and

- the area opposite the mast (2a) comprises a single layer (1d) like traditional sails.

[0040] Figures 6A and 6B show how the sail device object of invention works, where the outer layer (1a, 1b) forming the leeward side profile always automatically facing the wind (w); unlike Figures 7A and 7B, corresponding to a sail (b) of the state of the art, where in Figure 7A the vessel (a) moves forward in one direction (d) due to the configuration of the sail (b), but in Figure 7B the vessel (a) is not able to move forward in another direction (d) due to said configuration of said sail (b).

[0041] In view of this description and set of drawings, the person skilled in the art will be able to understand that the embodiments of the invention that have been described can be combined in many ways within the object of the invention. The invention has been described according to several preferred embodiments thereof, but for the person skilled in the art it will be obvious that many variations can be introduced in said preferred embodiments without exceeding the object of the claimed invention.

Claims

1. Sail device for vessels, **characterized in that** it comprises a sail (1) comprising three layers: two outer layers (1a, 1b) and an intermediate layer (1c), a securing structure (2) for securing the sail (1) comprising a mast (2a) and a lower horizontal pole known as a boom (2b), where the intermediate layer (1c) is attached both to the boom (2b) and to the mast (2a), where the outer layers (1a, 1b) are attached to the intermediate layer (1c) at least partially leaving the lower edge of said outer layers (1a, 1b) close to the boom (2b) free, and where the intermediate layer (1c) has a smaller surface with respect to the surface of each of the two outer layers (1a, 1b).
2. Sail device according to claim 1, **characterized in that** a plurality of cross ties (3) are located within and perpendicular to the outer layers (1a, 1b).
3. Sail device according to claim 2, **characterized in that** the plurality of cross ties (3) start from an outer layer (1a) to the intermediate layer (1c).
4. Sail device according to claim 2, **characterized in that** the plurality of cross ties (3) start from an outer layer (1a) to the other outer layer (1b).
5. Device according to any of the preceding claims,

characterized in that the intermediate layer (1 c) comprises at least one through cavity (6).

6. Device according to the claims 4 and 5, **characterized in that** the cross ties (3) go from an outer layer (1 a) to the other outer layer (1b) through said at least one through cavity (6). 5

7. Device according to any of the preceding claims, **characterized in that** at least one of the outer layers (1a, 1b) comprises bands (4) of more elastic material than the rest of the material of said outer layer, and located in the area of the edge away from both the mast (2a) and from the boom (2b). 10
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8. Sail device according to claim 7, **characterized in that** a plurality of strips of band (5) are located in said bands (4) of more elastic material, limiting the maximum extension of said bands (4). 20

9. Sail device according to any of claims 7 and 8, **characterized in that** the bands (4) of more elastic material comprise a trapezoidal geometry, being narrower in the area close to the mast (2a) and wider in the area closer to the boom (2b). 25

10. Device according to any of the preceding claims, **characterized in that** the outer layers (1a, 1b) comprise at least one through window. 30

11. Device according to any of the preceding claims, **characterized in that** the lower edge of the outer layers (1 a, 1b) ends at the same height as the lower edge of the intermediate layer (1 c). 35

12. Device according to any of claims 1 to 10, **characterized in that** the lower edge of the outer layers (1a, 1b) ends at a height greater than the lower edge of the intermediate layer (1 c). 40

13. Device according to any of the preceding claims, **characterized in that** the sail (1) comprises two areas, one located close to the mast (2a), and the other one in the opposite area, where the area close to the mast (2a) comprises the two outer layers (1 a, 1 b) and the intermediate layer (1c), and the area opposite the mast (2a) comprises a single layer (1d) like traditional sails. 45
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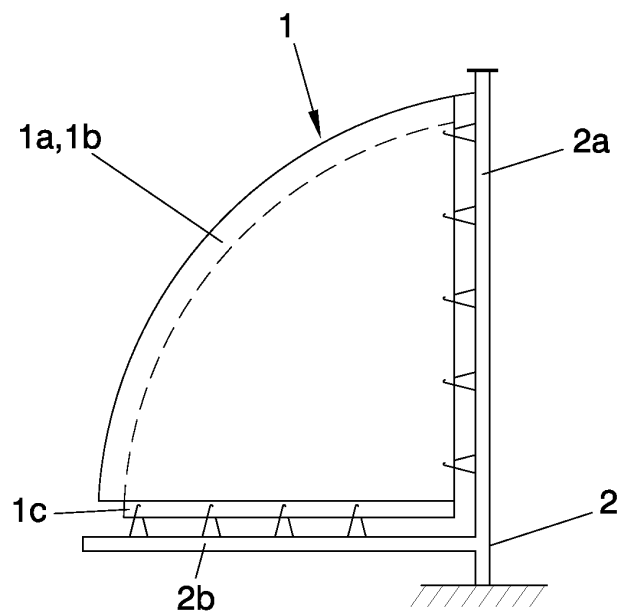


FIG. 1

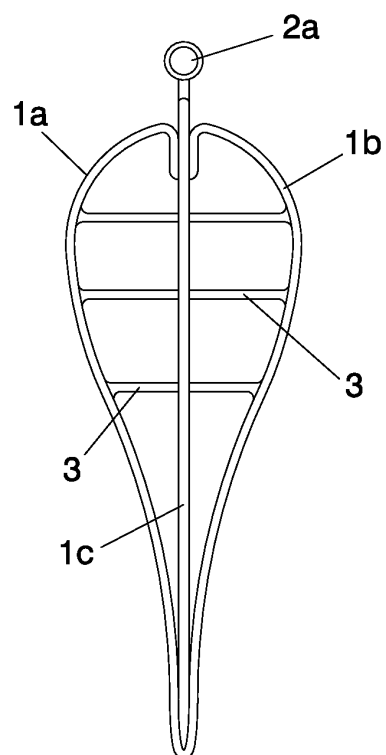


FIG. 2

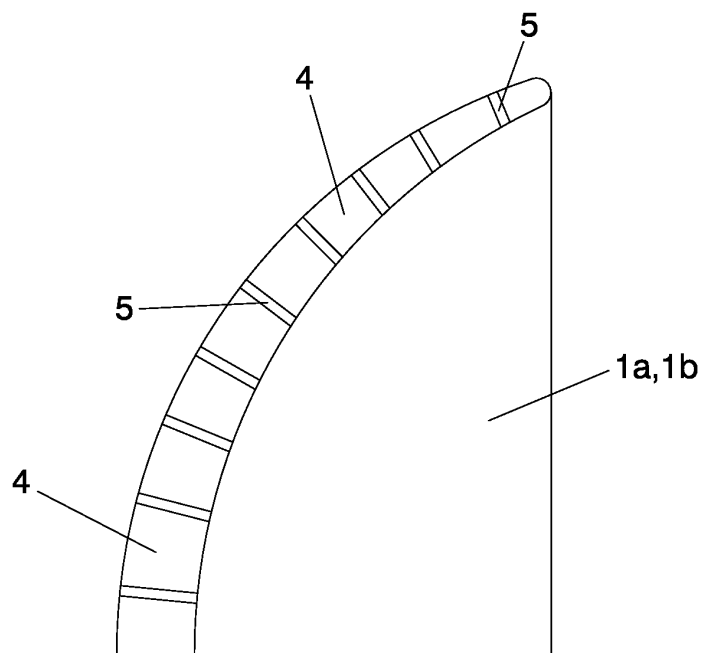


FIG. 3

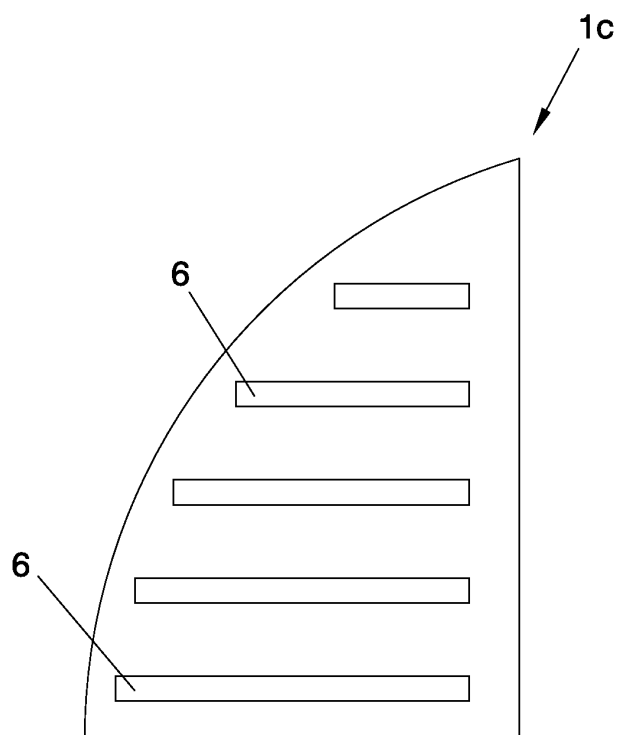


FIG. 4

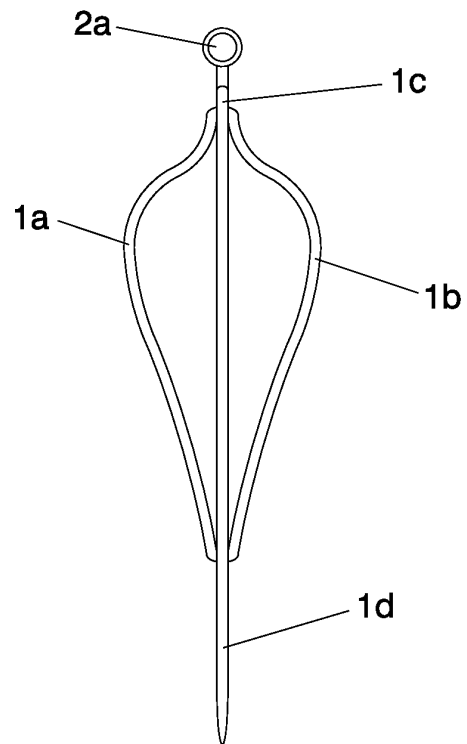


FIG. 5

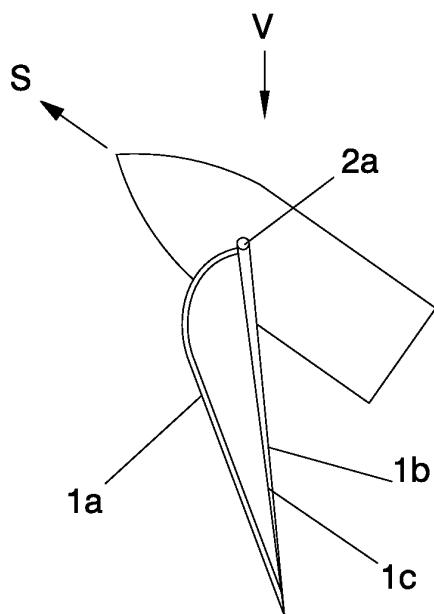


FIG. 6A

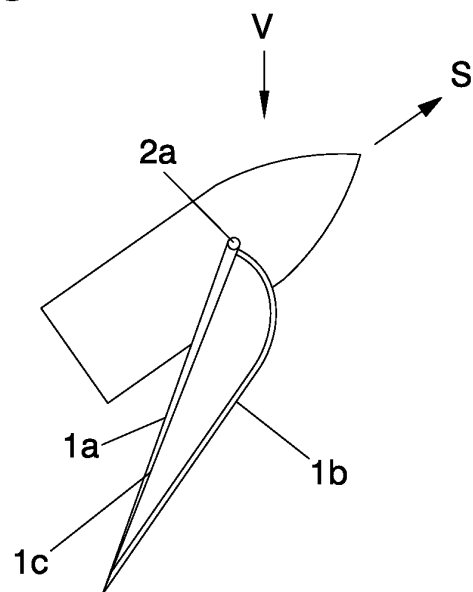


FIG. 6B

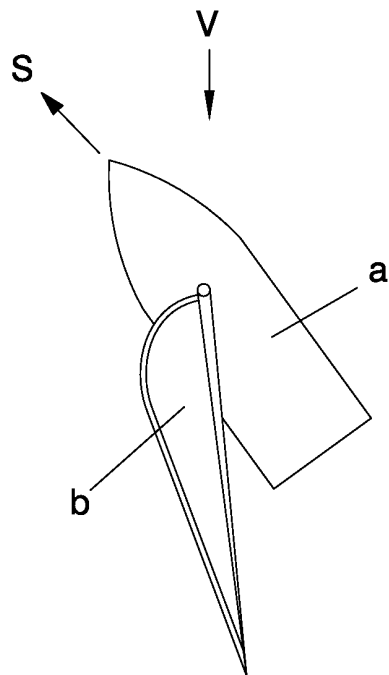


FIG. 7A

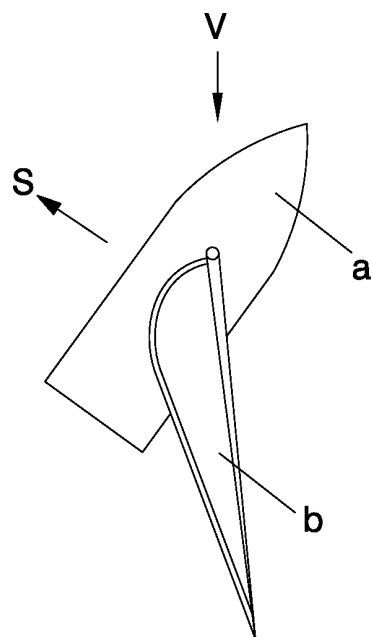


FIG. 7B



EUROPEAN SEARCH REPORT

Application Number
EP 11 38 2088

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	FR 2 036 208 A5 (LACASSE CLAUDE) 24 December 1970 (1970-12-24)	1,2,4-6, 11-13	INV. B63H9/06
Y	* page 2, lines 10-34 *	7	
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			TECHNICAL FIELDS SEARCHED (IPC)
			B63H
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 8 August 2011	Examiner Vermeulen, Tom
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document</p>			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 11 38 2088

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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08-08-2011

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