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(54) **Propeller support for a propulsion unit**

(57) A propeller support (1) for a propulsion unit adapted to be used for securing at least one propeller (11) to a hull (13) of a propulsion unit (10), the propulsion unit (10) comprising a stern (13a) in turn including a transom (13b), the support (1) comprising a supporting body (2) suitable to bear at least one portion of the axis line (12); an anchor block (3) suitable to enable fastening of the support (1) to the hull (13); and a connecting structure (4) having a major extension direction (4a) and adapted to rigidly connect the supporting body (2) to the anchor block (3); a rudder (4b) adapted to enable the sailing unit (10) to be steered, wherein the anchor block (3) is secured to the hull (13) at the stern (13a) of the propulsion unit (10) and wherein the supporting body (2), connecting structure (4), propeller (11) and rudder (4b) are placed after the transom (13b) relative to the fluid flow direction during the advancing movement of the propulsion unit (10).

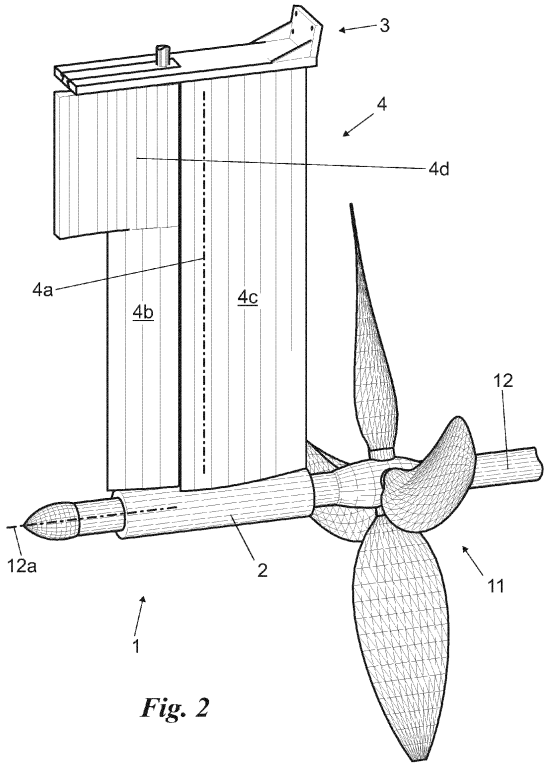

Fig. 2

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Description

[0001] The present invention relates to a propeller support for a sailing unit of the type pointed out in the preamble of the first claim.

[0002] In particular, the support is suitable to enable the propeller to be supported and secured to the hull of sailing units provided with an outboard motor, such as ships and motorboats.

[0003] It is known that sailing units can have an outboard motor or, alternatively, an inboard motor. In the first case it is made up of a single block containing motor, propeller and propeller shaft which is fastened to the outside of the hull at the stern. On the contrary, in units having an outboard motor said three components are disposed as follows: the motor is inside the hull and, more specifically, in the lower part of the hull; the propeller is disposed under the hull at the stern and is connected to the motor through the propeller shaft, also referred to as "axis line", which is suitably inclined to the waterline of the sailing unit.

[0004] In the last-mentioned type of sailing units, in order to maintain the propeller in the correct position, provision is made for a support which is fastened to the lower part of the hull and enables the axis line and the propeller to be held up by the hull thereby allowing their rotation. In detail, the support and therefore the propeller are disposed at the rudder that consists of a blade or plate rotating around an axis usually perpendicular to the waterline. In detail, the propeller is placed before the rudder, i.e. the water flow first meets the support, then the propeller, and the rudder only at the end.

[0005] Propeller supports presently used consist of a body usually of tubular form such shaped that it provides the lowest possible resistance to the advancing motion of the unit enabling correct flowing of the fluid. To this aim the support is subjected to careful studies adapted to create an element that is as much streamlined as possible and at the same time resistant to the huge forces to which it is submitted, such as propeller and support's weight, inertia due to the sailing unit rolling, forces due to the fluid pressure during motion of the unit.

[0006] The known art mentioned above has some important drawbacks.

[0007] A first problem is represented by the angle of inclination of the transmission axis and therefore the propeller that is only a compromise between a high inclination that would allow the presence of propellers of bigger sizes and a reduced inclination that would ensure a high propelling efficiency (defined as the ratio between the kinetic energy of the sailing unit and the thrust energy of the propeller). In conclusion, known supports lead to have an angle of inclination that is only a compromise of the aforesaid aspects and not an optimisation of same which therefore result in low propelling efficiency and reduced sizes of the propeller.

[0008] A fault connected with the above described problems and belonging to known supports is therefore represented by the reduced efficiency of the motor in the sailing unit.

[0009] A further defect belonging to propeller supports presently known consists in the fact that as they are directly in contact with water, they cause deviation of the flow striking on the propeller and the rudder, and therefore worsening of the hydrodynamic qualities of the sailing unit.

[0010] In addition to the above problems, this flow deviation gives rise to decay of the sailing unit performances because it produces both a consumption increase and a reduction in the maximum speed.

[0011] These problems are further increased by the presence of the rudder causing an incorrect flowing of the fluid coming out of the propeller and therefore a reduction in the propelling efficiency and the maximum speed.

[0012] This aspect also causes an incorrect operation of the rudder leading to a reduction in the turning radius of the unit. In particular, if the speed exceeds a given threshold referred to as stalling speed, the rudder is no longer able to steer the unit that therefore becomes ungovernable.

[0013] Another important problem connected with an incorrect flow consists in that cavitation phenomena are generated that cause quick deterioration of the support, the propeller and the hull and therefore call for particularly strong and expensive building materials.

[0014] Said problems connected with strength and hydrodynamic features therefore involve a high manufacturing and planning cost for the propeller support.

[0015] Another important fault of known supports is that, due to their location and fastening to the hull, particular hooking means such as welding operations or holes for bolts, adapted to bear all efforts acting on the support is required, which means however gives rise to regions that become brittle in the hull and, more specifically, in the immersed part of the hull constituting the region that is the most subjected to wear and deterioration in the sailing unit.

[0016] Under this situation, the technical task underlying the present invention is to conceive a propeller support for a sailing unit capable of substantially obviating the mentioned drawbacks.

[0017] Within the scope of this technical task, it is an important aim of the invention to provide a support enabling the propeller to be disposed at an optimal position without complicated and expensive hooking means being required.

[0018] Another important aim of the invention is to provided a propeller support that does not involve decay of the sailing unit performances. In particular, the invention aims at obtaining an almost ideal flow coming out of the propeller.

[0019] Therefore an also important object of the invention is to design a propeller support that does not impair the turning operations of the sailing unit, i.e. that does not adversely affect the sailing unit's propelling efficiency,

turning capability, consumption and maximum speed.

[0020] The technical task mentioned and the aims specified are achieved by a propeller support for sailing unit as claimed in the appended claim 1.

[0021] Preferred embodiments are highlighted in the sub-claims.

[0022] The features and advantages of the invention are hereinafter clarified by the detailed description of a preferred embodiment of the invention, with reference to the accompanying drawings, in which:

Fig. 1 shows a sailing unit provided with the propeller support according to the invention;
Fig. 2 shows a portion of Fig. 1 highlighting the support;
Fig. 3 shows the assembling step of the propeller support according to the invention;
Fig. 4 is a section view of a detail of support 1;
Fig. 5 shows another planing sailing unit provided with the propeller support according to the invention;
Fig. 6 is a detail of the sailing unit according to the invention; and
Fig. 7 shows a further planing sailing unit provided with the propeller support according to the invention;
Fig. 8a is a variant of the planing sailing unit provided of the support;
Fig. 8b is the section A-A in Fig. 8a;
Fig. 8c is the section B-B in Fig. 8a;
Fig. 8d is a front view highlighting the exhaust of the sailing unit of Fig. 8a, in particular the view highlighted with letters C-C in Fig. 8a.

[0023] With reference to the drawings, the propeller support for sailing unit according to the invention is generally denoted at **1**.

[0024] In particular, this support 1 is adapted to be used for fastening at least one propeller **11** to a sailing unit **10**, ensuring correct support of same. In particular, this propeller support is guaranteed by the presence of a single supporting element 1 that, by itself, ensures the propeller steadiness during operation.

[0025] In conclusion, the sailing unit 10 is advantageously provided with a single supporting element for the propeller 11 exactly consisting of support 1.

[0026] Support 1 is preferably usable on a sailing unit 10 having an inboard motor and, in more detail, a sailing unit 10 having an inboard motor of the planing type, i.e. on a unit 10 the hull **13** of which lifts up from the water due to its particular shape and/or to particular wing tailpieces that, as the speed increases, reduce the immersed part of the hull 13 and consequently the aerodynamic resistance of the sailing unit 10. Alternatively, the sailing unit 10 is of the displacement type.

[0027] The propeller 13 on the contrary preferably remains always immersed, and therefore it is called subcavitating or transcavitating, as known to those skilled in the art.

[0028] Sizing and planning of the different components, and fastening of support 1 to unit 10 described in detail below, are adapted to ensure the right positioning of the "axis line" **12**, i.e. of the mechanical member, usually a shaft, intended for motion transmission from the motor, disposed inside hull 13, to the propeller 11.

[0029] The axis line 12 is preferably secured to the propeller by the double-diameter threaded support **14**.

[0030] In detail, support 1 enables the axis line 12 to be disposed in such a manner that it forms a given angle of inclination α included between the axis **12a** of the axis line 12 and the waterline **10a**, i.e. with the line determined by intersection of the waterplane of the sailing unit 10 with the outer surface of hull 11. Preferably the angle of inclination α is advantageously included between 15° and 0° and, more preferably, angle a is substantially included between 12° and 8°.

[0031] The propeller support 1 comprises a supporting body **2** adapted to bear at least one portion of the axis line 12; an anchor block **3** adapted to enable fastening of support 1 to hull 13; and a connecting structure **4** adapted to connect the supporting body 2 to the anchor block 3 in a rigid and fixed manner. In detail the supporting body 2, anchor block 3 and connecting structure 4 are fastened to each other both in a releasable manner and in an unreleasable manner. Preferably, fastening between body 2 and structure 4 is of the unreleasable type and is obtained by welding or other similar solutions adapted to perform the aforesaid function.

[0032] The supporting body 2 consists of an element adapted to internally house at least one portion of the axis line 12 enabling said line to be supported in the correct position, i.e. inclined by the above described angle of inclination a. In detail, the supporting body 2 surrounds at least one portion of the axis line 12, as shown in Figs. 1 and 2 and in some cases also at least one portion of propeller 11.

[0033] It has rotation bearings such as ball bearings or brasses, not shown in the figure, adapted to enable rotation of the axis line 12 and therefore the propeller 11 relative to the supporting body 2.

[0034] Body 2 is preferably placed after the propeller 11 relative to the fluid flow direction during the advancing motion of the sailing unit 10. By this expression it is intended that the supporting body 2 relative to propeller 11 is such disposed that, when the sailing unit 10 is moving forward, the fluid flow first crosses the propeller 11 and only subsequently body 2.

[0035] Alternatively, body 2 is placed before the propeller 11, as shown in Fig. 8a.

[0036] When fastened to the supporting body 2, support 1 exhibits the connecting structure 4 connecting the supporting body 2 to the anchor block 3 in a rigid and fixed manner. In particular, fastening between body 2 and the connecting structure 4 is obtained in such a manner that both the supporting body 2 and the connecting structure 4 are placed after the propeller 11 relative to the fluid flow direction during the advancing motion of said sailing unit. Preferably, the outgoing flow first meets

body 2 and subsequently structure 4.

[0037] The connecting structure 4 has a major extension direction **4a** and is fastened to the anchor block 3 in such a manner that the major extension direction 4a forms with the axis 12a of the axis line 12, an angle included between 60° and 120°, preferably this angle being included between 75° and 105°.

[0038] In order to promote the outflow from propeller 11, the connecting structure 4 has the flow direction lying in a plane passing through the axis line 12a.

[0039] Structure 4 has a section extending along said direction 4a suitably shaped so as to offer the smallest possible resistance to the fluid flow while at the same time ensuring an appropriate strength to structure 4.

[0040] Preferably, the connecting structure 4 substantially has a biconvex section, i.e. a section having the profile defined by coupling of two surfaces of opposite convexity. In detail this section has a central part of greater width adapted to make structure 4 steady, and two suitably connected extremities so as to promote the incident flow coming out of said structure 4.

[0041] In detail, said section of the connecting structure 4, shown in Fig. 4, is asymmetric biconvex, i.e. said surfaces have different curvatures, or preferably symmetric biconvex, i.e. the surfaces have identical shape.

[0042] In addition rudder 4b for the purpose of making the ship steadier, can comprise an upper portion 4d of a so-called fishtail section, in which the concavities change direction, as shown in Fig. 2.

[0043] The connecting structure 4 comprises a rudder **4b** adapted to enable control of unit 10, and a support component **4c** adapted to fixedly and rigidly join body 2 to block 3.

[0044] Rudder 4b and component 4c are such shaped as to define the above described biconvex section. The support component 4c defines a first biconvex section portion close to the extremity of structure 4 on which the flow strikes, while rudder 4b defines a second portion of this section close to the exit extremity of the flow from structure 4. In detail, rudder 4b is disposed after said support component 4c relative to the fluid flow direction during moving forward of the sailing unit 10, i.e. the flow first meets the support component 4c and only subsequently rudder 4b. Rudder 4b defines a portion of the biconvex section that is almost less than 50% of this section and preferably less than 40% of said section. The support component 4c constitutes the remaining portion of the biconvex section and at rudder 4b has a profile adapted to surround at least part of said rudder 4b enabling a relative motion of rudder 4b relative to component 4c, as shown in Fig. 3. Rudder 4b is secured to the support component 4c in a motion-admitting manner through a rotation shaft **4e** so as to enable a relative motion therebetween. In detail, these components are secured to each other through pivot pins or other similar elements adapted to enable rotation of rudder 4b relative to the support component 4c around an axis substantially parallel to the major extension direction 4a of the connecting structure 4.

[0045] Said rotation of rudder 4b is driven by known operating mechanisms **3d** adapted to enable the user of unit 10 to control the unit itself. These operating mechanisms generally consist of a hydraulic jack or the like. In addition, in order to improve the hydrodynamic feature of the support and therefore of the sailing unit, these operating mechanisms are advantageously housed inside the anchor block 3. Alternatively, rudder 4b is separated from the connecting structure, as shown in Fig. 8a. In this case, rudder 4b has shapes as shown in Figs. 8b and 8c. In this case, in addition, the connecting structure 4 can also comprise the exhaust (Fig. 8d) of the ship motors.

[0046] The anchor block 3 is externally fastened to hull 13 through fastening means such as screws or welds, at the stern **13a,** i.e. the hull portion that is on the opposite side relative to the boat bow and constitutes the last part of the hull met by the fluid flow while the sailing unit 10 is moving forward. For instance, in Fig. 1, the anchor block 3 is fastened to the transom **13b** being part of the stern 13a. This transom 13b consists of a surface almost perpendicular to the water line 10a and substantially defining the last portion of the sailing unit 10.

[0047] The stern 13a can then comprise different other elements such as a horizontal small beach or others.

[0048] In detail, the anchor block 3 therefore extends externally of hull 13 and, more specifically, it extends from stern 13b, on the opposite side relative to the bow, enabling the propeller 11 to be placed after the hull 13 relative to the fluid direction during the advancing motion of the sailing unit 10.

[0049] Advantageously, in a manner adapted to improve the water thrust of the watercraft and the hydrodynamic feature of same, the anchor block 3, propeller 11, supporting body 2 and rudder 4b are placed beyond the transom 13b, as shown in Fig. 8a, relative to the fluid flow direction during the advancing motion of the sailing unit 10.

[0050] In addition, suitably rudder 4b is placed beyond the propeller 11, while support 4 is located before the propeller 11, still with reference to the fluid flow direction during the advancing motion of the sailing unit 10.

[0051] The anchor block 3 comprises two distinct elements: a fixed part **3a**, fastened to the stern 13a and a movable part **3b** fastened to the connecting structure 4. In detail, the fixed part 3a is advantageously secured through the fastening means, to the stern above the waterline 10a, i.e. in the stern portion adapted to always remain out of the water; while the movable part 3b is integral with structure 4 and therefore with the supporting body 2.

[0052] The anchor block also comprises releasable junction means **3c** adapted to fasten the two parts 3a and 3b to each other. In detail, this means 3c allows the two parts 3a and 3b to be steadily joined but also enables them to be easily released. This junction means 3a therefore consists of bolts, friction fits or other similar elements

adapted to perform the aforesaid function.

[0053] Preferably, as shown in Fig. 4, the releasable junction means 3c consists of dovetail joints, ensuring steadiness and strength to the junction of parts 3a and 3b. In this case the junction means 3c can be respectively identified as a suitably shaped seat formed in the fixed part 3a and extending in a direction perpendicular to the stern 13a and as the profile conforming in shape to said seat and belonging to the movable part 3b.

[0054] The operating mechanisms 3d too have a quick release of a type known by itself. The invention achieves important advantages.

[0055] A first advantage is achieved by the possibility of providing unit 10 with a propeller 11 of greater sizes than those hitherto usable. In fact, the particular arrangement of support 1 allows the propeller 11 not to be disposed under the hull 13, but in the rear part of the sailing unit 10 and more specifically after the stern 13a relative to the flow during moving forward of unit 1.

[0056] In conclusion, the particular geometry and arrangement of support 1 allow accomplishment of units 10 having maximum speed and greater efficiency as compared with those of the units provided with known supports, the motor being the same.

[0057] Another advantage resides in that the rudder arm/centre of gravity increases. In fact it enables a considerable increase in the performances due to moving away of the stand/flap system from the propeller; the speed increases due to a smaller impedance of the outflow of the propelling water mass generated by the propeller. In addition, moving of the propeller in the vicinity of the stern board provides a lever greater than the propeller thrust, enabling planing to be achieved with a smaller number of revolutions of the motor.

[0058] A further advantage is represented by the fact that support 1, being fastened above the waterline 10a, does not create critical regions in the immersed portion of hull 13 representing the part that is the most subjected to erosion and corrosion.

[0059] In addition, further to elimination of the stand in front of the propeller that in the known art causes a disturbed flow behind the propeller, the stand rudder assembly has a smaller surface than the original rudder surface which gives rise to less downstream counter-compression and increased efficiency.

[0060] A further advantage resides in the possibility of easily assembling and removing almost the whole of support 1 from the sailing unit 10, enabling easy maintenance and/or replacement operations in case of failure of the support itself, the propeller or the axis line 12.

[0061] This advantage is achieved due to the fact that the anchor block 3 consists of two parts 3a and 3b that, thanks to the releasable junction means 3c, can be easily separated allowing removal of the movable part 3b, structure 4 and body 2, leaving the fixed part 3a in the mounted condition.

[0062] In addition, the angle of inclination α of the axis line 12 is advantageous. Due to this particular angle, almost the whole of the propeller thrust can be utilised for advancing of the sailing unit 10 and therefore a high propelling efficiency is obtained.

[0063] Another advantage achieved with support 1 resides in that the particular arrangement of support 1 allows the flow striking on propeller 11 to be almost perfect. This fundamental advantage is obtained by virtue of the fact that in a sailing unit 10 provided with support 1, the fluid flow before striking on propeller 11 does not meet objects that may deviate the flow, impairing the efficiency of the propeller itself.

[0064] Another advantage relates to the fluid outflow from propeller 11, i.e. the flow coming out of the propeller 11. In detail, structure 4 and in particular the support component 4c define at least one first rectilinear stretch adapted to promote said outflow and therefore ensure an optimal outflow from the propeller. In addition, due to arrangement of component 4c before rudder 4b, when the unit changes its direction and therefore the rudder is not in line with the component, the flow coming out of the propeller always meets said first rectilinear stretch.

[0065] A further aspect promoting said outflow is given by the fact that structure 4, due to the arrangement of direction 4a in a plane passing through axis 12a is substantially centred relative to the flow coming out of the propeller and therefore promotes motion thereof.

[0066] This optimal flow on rudder 4b is also obtained due to the particular shape of structure 4 ensuring minimum opposition to the flow of the structure itself.

[0067] In addition the support component 4c, by surrounding part of the rudder, prevents part of the fluid from altering the flow and lowering the quality thereof, due to the fluid penetration between rudder 4b and component 4c,.

[0068] Another advantage resides in that the support component 4c allows a first rectilinear stretch to be defined which is optimal for evacuation of the fluid from the propeller 11, before it meets rudder 4b.

[0069] The possibility of always having an optimal flow offers the further advantage of the absence of cavitation phenomena that would deteriorate support 1 and propeller 11. This advantage offers the possibility of manufacturing supports 1 and propellers 11 using materials of inferior quality as compared with those currently used thus reducing the purchasing costs of same.

[0070] A further advantage is connected with the presence of the support component 4c before rudder 4b always ensuring the high quality of the fluid striking on rudder 4b. This aspect allows the maximum turning angle of a sailing unit 10 to be increased and also the rudder stalling to be avoided. In fact, support 1 enables the rudder 4b to change the advancing direction of the sailing unit 1 irrespective of the speed of unit 10.

[0071] The invention is susceptible of variations falling within the inventive idea.

[0072] For instance, in particular in the biggest ships, two connecting structures 4 can be present being disposed in a V-shaped configuration with symmetry in the

sagittal plane of unit 10 and connected to a single supporting body 2 and two anchor blocks 3, as shown in Fig. 7.

[0073] All of the details can be replaced by equivalent elements and the materials, shapes and sizes can be of any nature and magnitude.

Claims

1. A propeller support (1) for a sailing unit adapted to be used for securing at least one propeller (11) to a hull (13) of a sailing unit (10) and comprising a supporting body (2) suitable to bear at least one portion of the axis line (12); an anchor block (3) suitable to enable fastening of said support (1) to said hull (13); and a connecting structure (4) having a major extension direction (4a) and adapted to rigidly connect said supporting body (2) to said anchor block (3); and **characterised in that** said supporting body (2) and connecting structure (4) are placed after said propeller (11) relative to the fluid flow direction during the forward movement of said sailing unit (10); and **in that** said anchor block (3) is secured to said hull (13) at the stern (13a) of said sailing unit (10).

2. A support (1) as claimed in claim 1, wherein said connecting structure (4) is placed after said supporting body (2) relative to said fluid flow direction.

3. A support (1) as claimed in one or more of the preceding claims, wherein said anchor block (3) is secured to said hull (13) above the water line of said sailing unit (10).

4. A support (1) as claimed in one or more of the preceding claims, wherein said supporting body (2) keeps said propeller (11) in such a position that said axis line (12) has the axis (12a) inclined to said water line (10a) by an angle of inclination (a) included between 15° and 0°.

5. A support (1) as claimed in one or more of the preceding claims, wherein said angle of inclination (α) is included between 12° and 8°.

6. A support (1) as claimed in one or more of the preceding claims, wherein said connecting structure (4) comprises a support component (4c) adapted to rigidly join said supporting body (2) to said anchor block (3) and a rudder (4b) adapted to enable said sailing unit (10) to be steered and wherein said rudder (4b) is secured to said support component (4c) in a motion-admitting manner.

7. A support (1) as claimed in the preceding claim, wherein said rudder (4b) is disposed after said support component (4c) relative to said fluid flow direction.

8. A support (1) as claimed in the preceding claim, wherein said anchor block (3) comprises a fixed part (3a) secured to said stern (13a), a moving part (3b) secured to said connecting structure (4) and releasable junction means (3c) suitable to mutually secure said parts (3a, 3b).

9. A support (1) as claimed in the preceding claim, wherein said releasable junction means (3c) consist of a dovetail joint.

10. A sailing unit (10) comprising a single element adapted to maintain said propeller (11) in the correct position and wherein said single bearing element is the support (1) as claimed in one or more of the preceding claims.

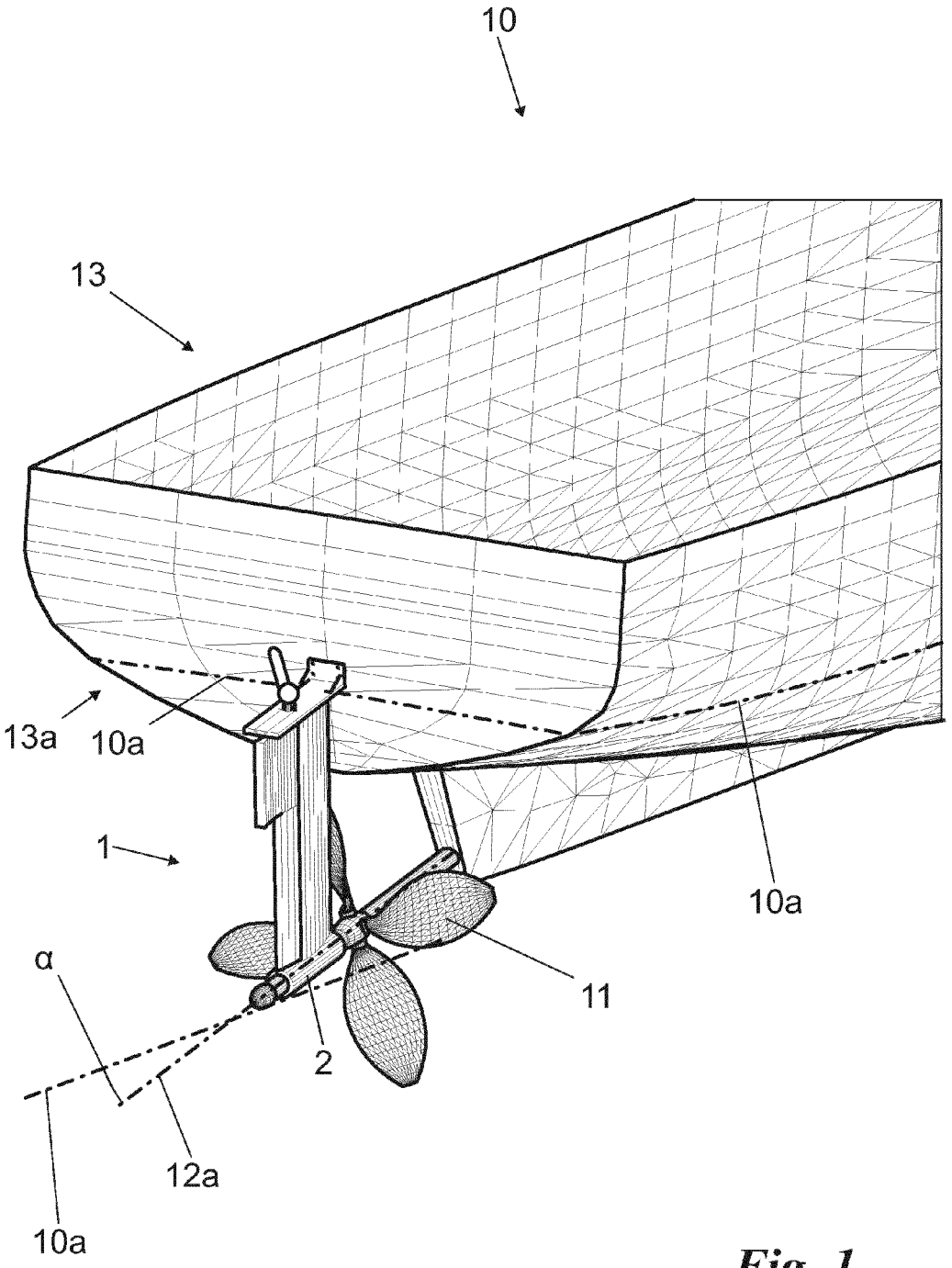


Fig. 1

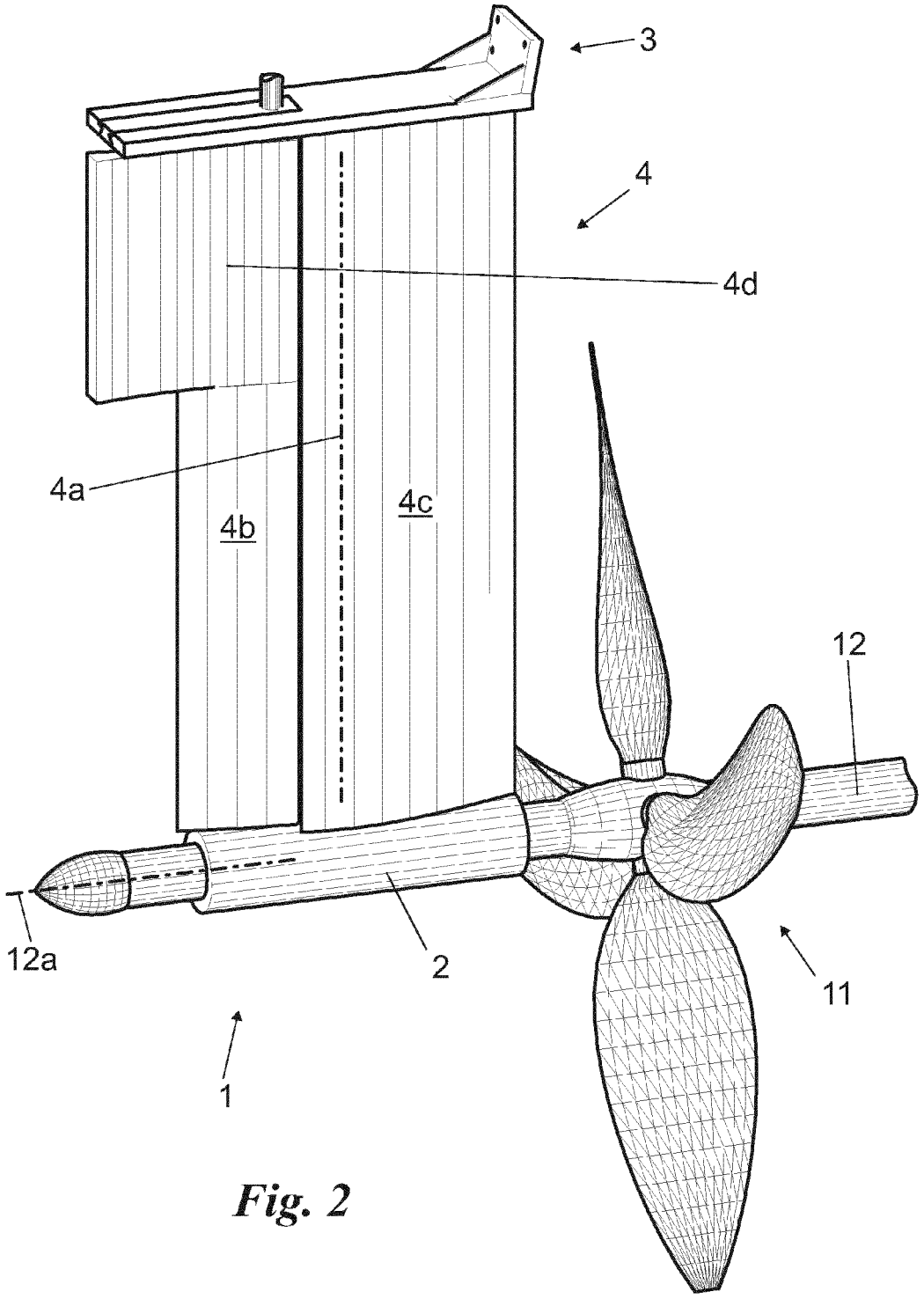


Fig. 2

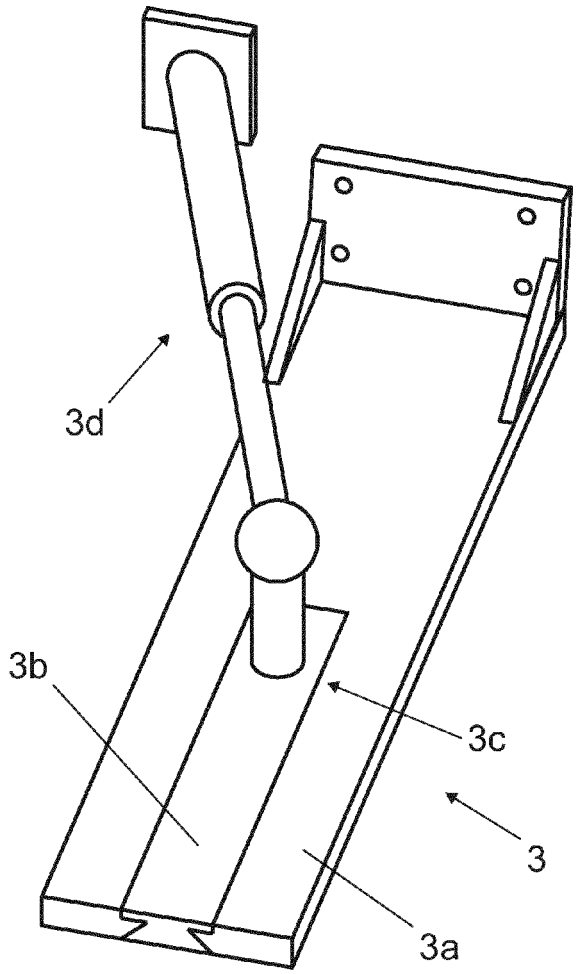
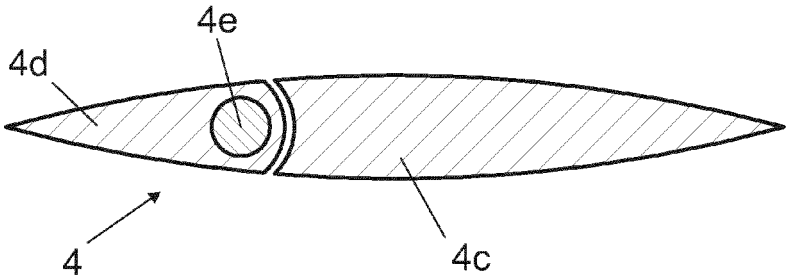


Fig. 3

Fig. 4



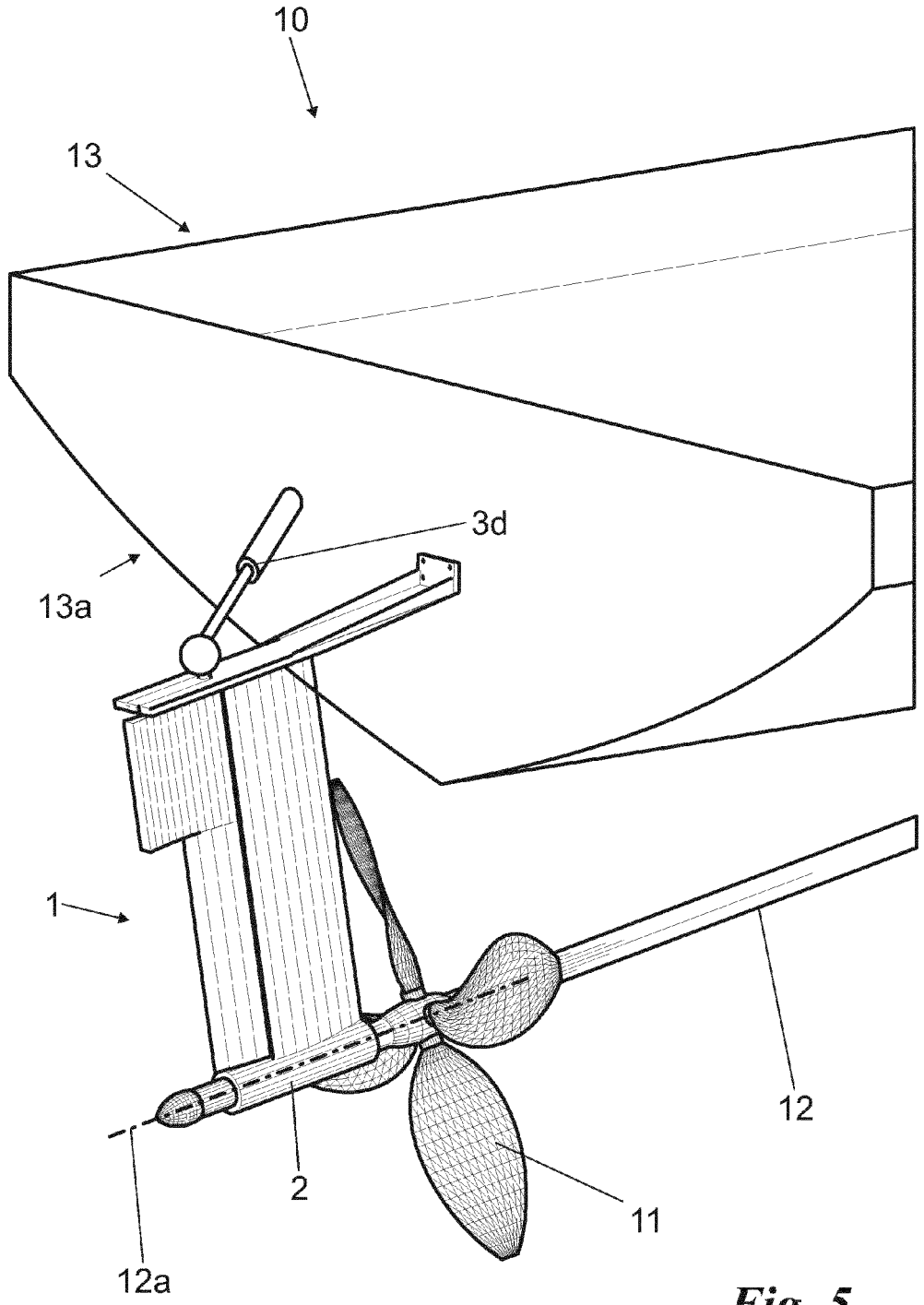


Fig. 5

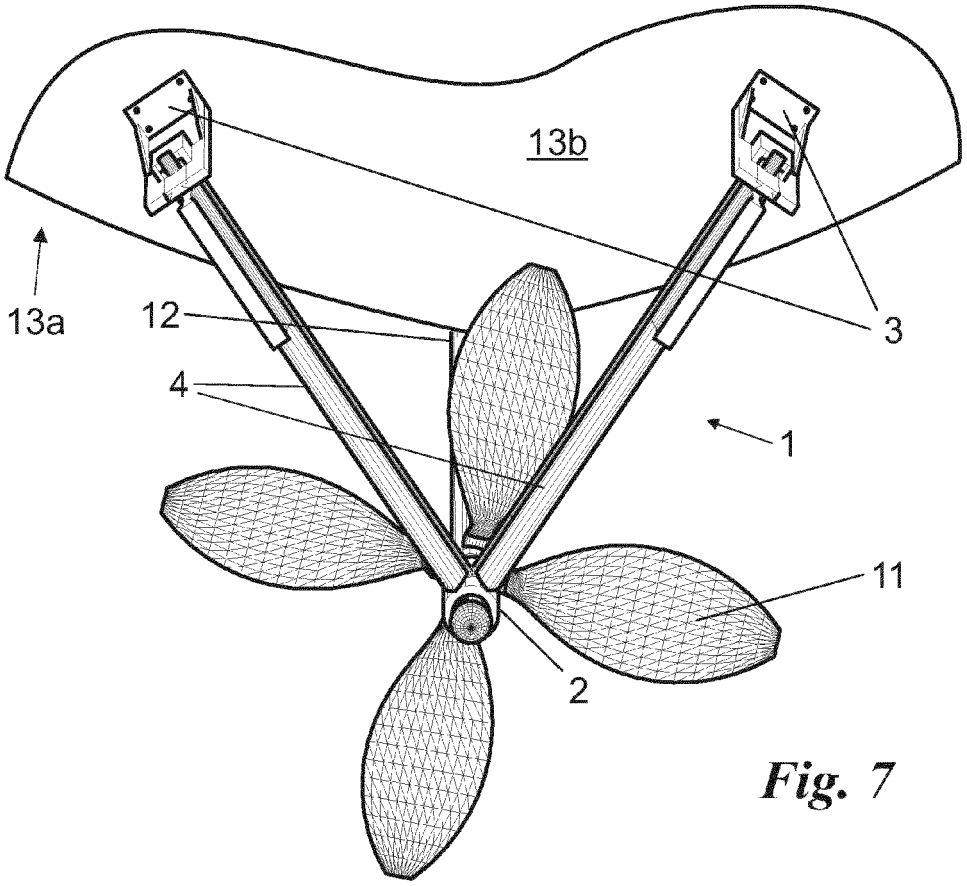
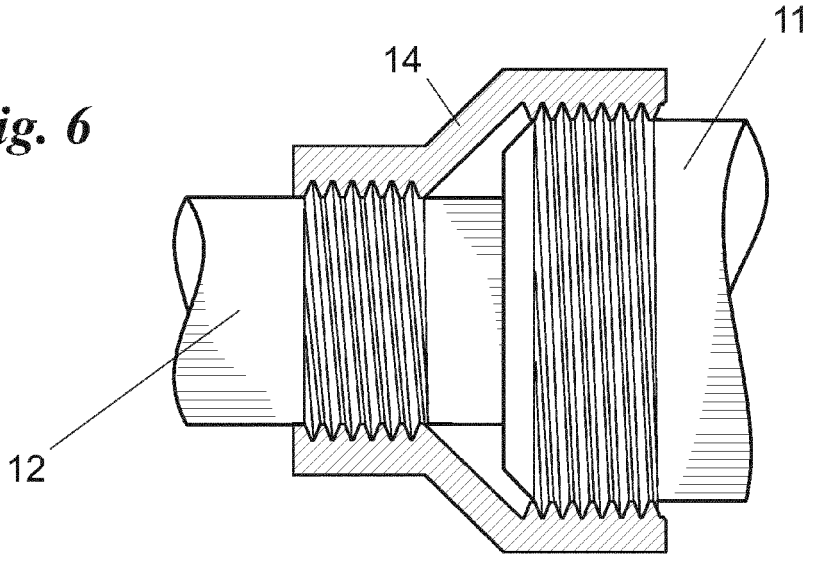


Fig. 7

Fig. 6



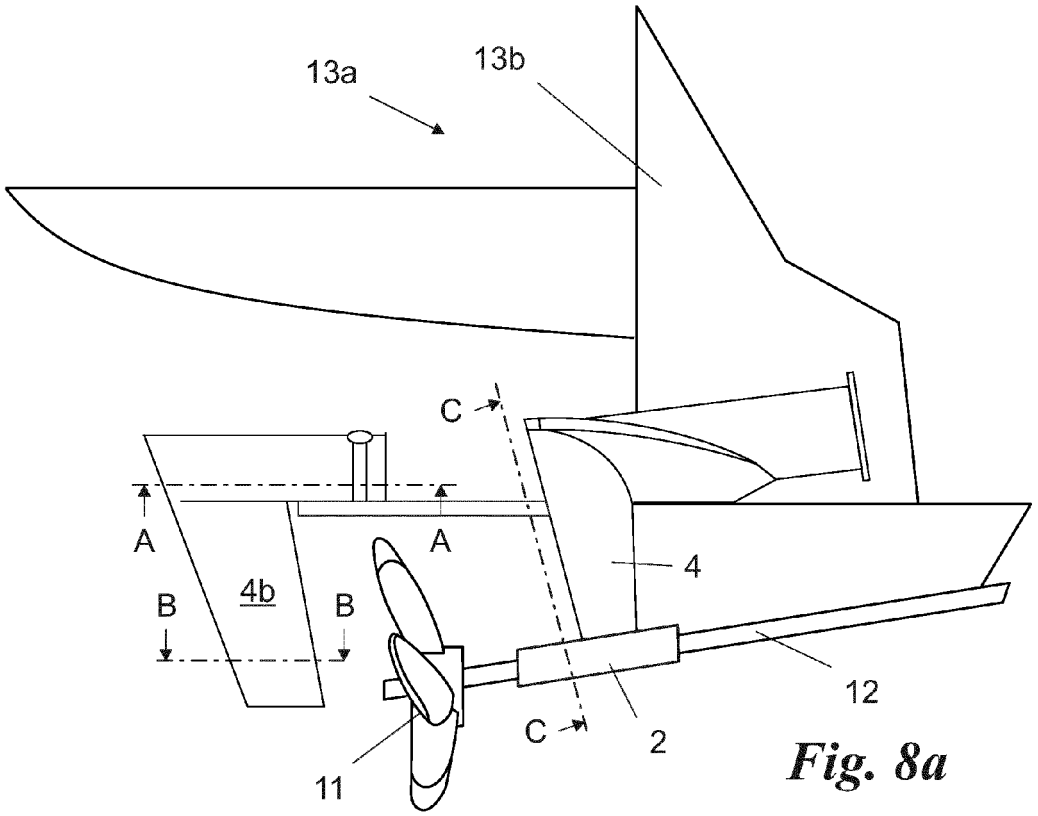


Fig. 8a

Fig. 8b

Fig. 8c

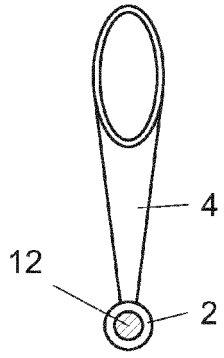


Fig. 8d

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EUROPEAN SEARCH REPORT

Application Number
EP 11 18 5458

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 Y	DE 38 08 710 A1 (BLOHM VOSS AG [DE]) 28 September 1989 (1989-09-28) * the whole document * -----	1,2,4,6, 7,10 5,8,9	INV. B63B3/42 B63H23/32
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