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(54) STABILIZER FOR BOATS

STABILISATOR FÜR BOOTE

STABILISATEUR POUR BATEAUX

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Description

[0001] The present invention relates to a stabilizer of the type specified in the preamble of the first claim.

[0002] In particular, the invention relates to an anti-roll and / or anti-pitching stabilizer, or rather, a system for damping and therefore reducing any oscillation of a marine vehicle (hereinafter simply referred to as a boat) around its longitudinal axis (also known as the roll axis). and / or around its own transverse axis (also called pitch axis).

[0003] As is known, in ships and boats, rolling and pitching are motions endowed with natural recall forces and for this reason characterized by an oscillatory trend. Rolling and pitching can be caused, in addition to wave motion, by the displacement of weights on board and other forces transversal to the diametrical plane such as propulsion and steering. These oscillations can be characterized by high angular amplitudes and therefore are very dangerous for stability and safety.

[0004] This motion can be counteracted and reduced through a wide range of systems acting on the recall and damping components such as anti-roll winglets, anti-roll boxes or gyroscopic systems.

[0005] The anti-roll winglet, usually installed in pairs (one on each side), is a passive stability system. It causes an increase in hydrodynamic resistance.

[0006] The anti-roll boxes use the same basic principle of load sharing. In this case, the weight is obtained through tanks filled with a liquid (usually water) and placed in the center or along the sides of the hull.

[0007] The gyroscopic system exploits the physical principle of the gyroscope. It is composed of rotating masses in rotation around an inclined axis according to the indications coming from a mechanical system sensitive to oscillating movements, counteracting the roll of the ship.

[0008] The known technique described includes some important drawbacks.

[0009] In particular, the systems known to date and in detail the anti-roll winglet are particularly rigid, or rather, they are difficult to adapt to the particular rolling conditions in which the boat is found.

[0010] Another drawback, especially of anti-roll boxes and gyroscopic systems, is represented by the complexity of installation and assembly that make these solutions expensive and therefore scarcely used (usually the anti-roll winglets are preferred).

[0011] In an attempt to solve the aforementioned drawbacks, in recent years some fins controlled by an engine have been devised so as to allow to vary the inclination of the fins with respect to the longitudinal axis and therefore their incidence. Examples of this solution are described in the following documents ITUD20090057, WO2019021094, US2016288885, US2007125287 and GB2550123.

[0012] These solutions are however of little use since they have brought to light further drawbacks.

[0013] In fact, some of them have an engine housed inside the hull, causing a reduction in free space (a particularly significant problem in boats, especially if they are small in size).

[0014] Furthermore, part of the kinematics and in some cases the engine are located externally to the hull and therefore subject to rapid wear and therefore to high failure rates due to the particular chemical aggressiveness of the working environment.

[0015] A further problem is that these solutions are of marginal application as they are bulky and leave kinematics and engines exposed to an aggressive atmosphere, with the possibility of a high failure rate.

[0016] In this situation, the technical task underlying the present invention is to design a stabilizer for boats (in detail an anti-roll stabilizer) capable of substantially obviating at least part of the aforementioned drawbacks.

[0017] Within the scope of said technical task, an important object of the invention is to obtain a stabilizer which is simple to assemble and install.

[0018] Another important object of the invention is to have a stabilizer characterized by an improved resistance to wear and therefore of high duration and low failure frequency.

[0019] The technical task and the specified aims are achieved by a stabilizer as claimed in the annexed claim 1. Examples of preferred embodiment are described in the dependent claims.

[0020] The characteristics and advantages of the invention are clarified below by the detailed description of preferred embodiments of the invention, with reference to the accompanying drawings, in which:

Fig. **1** shows, in scale, a stabilizer according to the invention;
Fig. **2** illustrates, in scale, a second view of the stabilizer;
Fig. **3** presents, in scale, an exploded view of an assembly of the stabilizer; and
Fig. **4** displays, in scale, a section of the stabilizer according to the invention when in use.

[0021] In this document, measurements, values, shapes and geometric references (such as perpendicularity and parallelism), when associated with words such as "about" or other similar terms such as "approximately" or "substantially", are to be considered as except for measurement errors or inaccuracies due to production and / or manufacturing errors and, above all, except for a slight deviation from the value, measurement, shape or geometric reference to which it is associated. For instance, these terms, if associated with a value, preferably indicate a divergence of not more than 10% of the value.

[0022] Moreover, when used, terms such as "first", "second", "higher", "lower", "main" and "secondary" do not necessarily identify an order, a priority of relationship or a relative position, but can simply be used to clearly distinguish between their different components.

[0023] Unless otherwise specified, as results in the following discussions, terms such as "treatment", "computing", "determination", "calculation", or similar, refer to the action and/or processes of a computer or similar electronic calculation device that manipulates and/or transforms data represented as physical, such as electronic quantities of registers of a computer system and/or memories in, other data similarly represented as physical quantities within computer systems, registers or other storage, transmission or information displaying devices.

[0024] The measurements and data reported in this text are to be considered, unless otherwise indicated, as performed in the International Standard Atmosphere ICAO (ISO 2533:1975).

[0025] With reference to the drawings, the stabilizer according to the invention is globally indicated with the number **1.**

[0026] It is designed to counter (or rather dampen and therefore reduce) any oscillation and in particular the roll and/or pitch of a boat **10.**

[0027] The boat 10 comprises a hull **11** and preferably means of propulsion such as for instance one or more sails and / or one or more propellers.

[0028] The stabilizer 1 comprises a fin **2** capable of being at least partially and, in detail, totally immersed in a fluid (or rather in water) so as to counteract said oscillation (preferably said roll).

[0029] The fin 2 defines a compartment **2a** inside the fin 2 itself and a longitudinal axis **2b.** The compartment 2a is preferably watertight.

[0030] The fin 2 has a substantially wing profile suitably having in use (or rather when the stabilizer 1 is constrained to the boat 10) leading edge facing the bow of the boat 10.

[0031] Said wing profile can be symmetrical or asymmetrical.

[0032] Alternatively, or in addition, the wing profile can be zero or positive bearing incidence.

[0033] The blade 2 comprises a casing **21** defining said wing profile and in some cases a reinforcing skeleton of said casing 21.

[0034] The stabilizer 1 comprises a hinge **3** adapted to constrain the fin 2 to the hull 11 and defining an axis of rotation **3a** between the fin2 and hull 11.

[0035] The axis of rotation 3a is substantially perpendicular to the tangent to the profile of the hull 11 at the point / area of constraint of the fin 2 to the hull 11.

[0036] The axis of rotation 3a is substantially perpendicular to the longitudinal axis 2b.

[0037] The fin 2, by rotating around the rotation axis, defines, suitably in use, a reference position in which the longitudinal axis 2b is almost parallel to the longitudinal axis of the hull 11; and a plurality of deviated positions wherein the longitudinal axis 2b is deviated with respect to the longitudinal axis of the hull 11 defining a deviation angle. It can be seen that the fin 2 can rotate in both directions starting from the reference position of maximum deviated angles, preferably almost equal to each other. Preferably the blade 2 can assume any angle of deviation and therefore the rotation around the axis 3a can be 360°.

[0038] The hinge 3 comprises a stator body **31** capable of being rigidly constrained, in detail integrally, to the hull 11 and a rotor body **32** capable of being rigidly constrained, in detail integrally, to the fin 2 and to rotate with respect to the stator body 31 around the axis of rotation 3a.

[0039] The stator body 31 can comprise a pin **311** defining the rotation axis 3a and suitably a bushing **312** capable of engaging the pin 311 to the hull 11.

[0040] The bushing 312 is sealed so as to prevent water from entering the hull 11. Between rotor body 32 and fin 2, sealing elements can be provided to prevent water from entering the fin 2 and therefore into the compartment 2a.

[0041] The stabilizer 1 comprises an engine **4** housed, suitably totally, in the compartment 2a.

[0042] The engine 4 can be electric.

[0043] The engine 4 can comprise a reducer.

[0044] The engine 4 can comprise an encoder.

[0045] The stabilizer 1 may comprise a shaft **5** capable of transmitting motion from the engine 4.

[0046] The engine 5 defines a rotary axis.

[0047] The rotary axis can be substantially parallel to the rotation axis 3a. Alternatively it can be incident to the rotation axis 3a.

[0048] The stabilizer 1 comprises a kinematic chain **6** housed, suitably totally, in the compartment 2a and capable of taking the motion from the engine 4 (to be precise from the shaft 5) and to control the rotation of the fin 2 with respect to the hull 11. The kinematic chain 6 comprises at least one pair of wheels, preferably toothed. Said wheels can be cylindrical and / or conical.

[0049] Said at least one pair of wheels can be of motion reduction.

[0050] In detail, the kinematic chain 6 comprises a first pair **61** of wheels capable of picking up the motion from said motor 4 (in detail from the shaft 5) and a second pair **62** of wheels suitable for picking up the motion from the first couple 61 and transmitting it to the fin 2 suitably through the rotor body 32.

[0051] The first pair 61 can be of motion reduction.

[0052] The second pair 62 can be of motion reduction.

[0053] Preferably the second pair 62 is interposed between the first pair 61 and the motor 4 along the rotation axis 3a.

[0054] The input wheel of the motion of the first couple 61 is integral with the motor 4 and in detail with the shaft 5.

[0055] The output wheel of the motion of the second couple 62 is substantially coaxial with the input wheel of the motion of the first couple 61 and therefore to shaft 5.

[0056] The motion output wheel of the second pair 62 is hinged idly (for example thanks to a bearing) to shaft 5.

[0057] The motion output wheel of the first pair 61 and the motion input wheel of the second pair 62 are coaxial to each other.

[0058] The motion output wheel of the first pair 61 and the motion input wheel of the second pair 62 are mutually integral.

[0059] Preferably the kinematic chain 6 comprises an output wheel **63** kinematically placed between the at least one pair of wheels (in detail the second pair 62) and the fin 2 (in detail the rotor body 32).

[0060] Said output wheel 63 is toothed.

[0061] It is coaxial with the pin 311 and therefore with the rotation axis 3a.

[0062] The output wheel 63 can be integral with the pin 311.

[0063] The stabilizer 1 comprises a crankcase **7,** suitably watertight, delimiting a portion of the compartment 2a.

[0064] The crankcase 7 contains part of the stator body 31 (in detail of the pin 311) and the whole of the rotor body 32, the engine 4, the kinematic chain 6 and of any shaft 5. The crankcase 7 is integral with the rotor body 32.

[0065] The boat 10 and in detail the stabilizer 1 may comprise a power supply system for the engine 4.

[0066] The power supply system can be a battery and/or a power generator of which, for example, is normally equipped boat 10.

[0067] The power supply system can be placed in compartment 2a (suitably in the crankcase 7).

[0068] Preferably, the power supply system is housed in the hull 11. Consequently, the stator body 31 and in particular the pin 311 comprise a passage channel **313** capable of allowing the power supply system to be housed in the hull 11 to feed the engine 4 housed in the compartment 2a and in detail in the crankcase 7.

[0069] The channel 313 then puts the compartment 2a in communication with the interior of the hull 11.

[0070] The channel 313 is substantially coaxial to the rotation axis 3a.

[0071] The power supply system can comprise cables (in the case of an electric engine 4) or other means for transmitting the power and/or signal between the power supply system and engine 4 through the channel 313.

[0072] For simplicity, said transmission means are not shown in the figure.

[0073] The boat 10 and in detail the stabilizer 1 can comprise one or more oscillation sensors able to detect (suitably in verse and amplitude) at least one oscillation and to be precise at least the roll of the boat 10.

[0074] The oscillation sensors are capable of defining a signal proportional, suitably directly, to the detected oscillation.

[0075] These sensors can be inertial sensors (such as accelerometers or gyroscopes) or geolocation sensors (GPS).

[0076] The oscillation sensors can be integral with the hull 11.

[0077] The boat 10 and in detail the stabilizer 1 can comprise a control device of the engine 4 (or rather the stabilizer 1) and therefore the rotation of the fin 2 around the rotation axis 3a .

[0078] The control device can be constrained to the hull 11. Preferably it is in the compartment 2a and in detail in the crankcase 7.

[0079] The control device can define an automatic operation of the stabilizer 1 and therefore of the engine 4 as a function of a signal coming from said one or more sensors. In this case, the oscillation sensors are in data connection with the control device.

[0080] Alternatively, or in addition, the control device can define a manual operation of the stabilizer 1, or rather, as a function of a command given by the operator through, for example, a steering position of the boat 10. In this case the oscillation sensors can be in connection for data passage with interface means proper to the steering position and capable of allowing an operator to evaluate the oscillation of the boat. The control device can comprise an engine driver 4.

[0081] The driver can be installed in the compartment 2a and preferably in the crankcase 7. Alternatively, it can be housed in the hull 11.

[0082] The operation of the boat 10 and for the accuracy of the stabilizer 1 described above in structural terms it is the following.

[0083] The boat 10, when for example it is underway or stationary, is subjected to wave motion or other external forces which can lead to a roll of the boat itself.

[0084] The oscillation sensors detect the roll and send, for example in the case of automatic operation, a signal to the control device which, in turn, controls the engine 4.

[0085] The engine 4 rotates the shaft 5 which, through the kinematic chain 6, rotates the fin 2 with respect to the hull 11 around the axis of rotation 3a creating a force to compensate for the roll caused by the wave motion.

[0086] The stabilizer 1 and therefore the boat 10 according to the invention achieve important advantages.

[0087] In fact, unlike known devices, the stabilizer 1 has the engine 4 and the kinematic chain 6 inside the fin 2. They are therefore always immersed in water which thus exerts a cooling action.

[0088] This housing of the engine 4 and kinematic chain 6 in the compartment 2a also allows to minimize the encumbrance of the spaces on board the boat and to reduce the noise perceived by the boats.

[0089] Other advantages are to be identified in the simplicity of installation and therefore of intervention and above all replacement in case of failure.

[0090] These aspects, combined with a high constructive simplicity, allow to have a stabilizer 1 of reduced costs.

[0091] The invention is susceptible of variants falling within the scope of the inventive concept defined by the claims. In this context, all the details can be replaced by equivalent elements and the materials, shapes and dimensions can be any.

Claims

1. A stabilizer (1) adapted to counteract the swinging of a boat (10) **characterized in that** it comprises:

   - a fin (2) adapted to be at least partially immersed so as to counteract said roll and defining a compartment (2a) inside said fin (2);
   - a hinge (3) adapted to connect said fin (2) to the hull (11) of said boat (10);
   - an engine (4) housed in said compartment (2a); and
   - a kinematic chain (6) housed in said compartment (2a) and adapted to take the motion from said engine (4) and to control the rotation of said fin (2) with respect to said hull (11).

2. The stabilizer (1) according to claim 1, comprising a power supply system for said engine (4) housed in said hull (11); and in which a stator body (31) comprises a through channel (313) adapted to allow said power supply system housed in said hull (11) to supply said engine (4) housed in said compartment (2a).

3. The stabilizer (1) according to at least one preceding claim, in which said kinematic chain (6) comprises a first pair (61) of wheels adapted to take the motion from said engine (4) and a second pair (62) of wheels adapted to take the motion from said first pair (61) and transmit it to said fin (2).

4. The stabilizer (1) according to the preceding claim, in which said hinge (3) defines a rotation axis (3a); in which said second pair (62) is interposed between said first pair (61) and said engine (4) along said rotation axis (3a).

5. The stabilizer (1) according to the preceding claim, in which said kinematic chain (6) comprises an output wheel (63) kinematically placed between said second pair (62) and said fin (2).

6. The stabilizer (1) according to at least one preceding claim, in which a rotor body (32), said engine (4) and said kinematic chain (6) are totally housed inside said compartment (2a).

7. The stabilizer (1) according to at least one preceding claim, comprising a control device for said engine (4) housed in said compartment (2a).

8. A boat comprising at least one stabilizer (1) according to at least one preceding claim, in which said hinge (3) comprises said stator body (31) adapted to be bound to said hull (11) and said rotor body (32) integral with said fin (2); and in which said stator body defines a through channel adapted to allow said supply system housed in said hull to supply said engine housed in said compartment of said fin.

Patentansprüche

1. Stabilisator (1), der dazu dient, der Rollbewegung eines Schiffes (10) entgegenzusteuern, **dadurch gekennzeichnet, dass** er Folgendes umfasst:

   - ein Steuerblatt (2), das dazu dient, mindestens teilweise im Wasser eingetaucht zu sein, sodass es der genannten Rollbewegung entgegensteuern kann und einen Raum (2a) im genannten Steuerblatt (2) definiert;
   - ein Scharnier (3), das dazu dient, das genannte Steuerblatt (2) an einem Schiffsrumpf (11) des genannten Schiffes (10) zu befestigen;
   - einen Motor (4), der im genannten Raum (2a) untergebracht ist; und
   - einen Antriebsstrang (6), der im genannten Raum (2a) untergebracht ist und dazu dient, die Kraft des genannten Motors (4) aufzunehmen und die Rotation des genannten Steuerblattes (2) im Verhältnis zum genannten Schiffsrumpf (11) zu steuern.

2. Stabilisator (1) nach Anspruch 1, umfassend ein Versorgungssystem des genannten Motors (4), das im genannten Schiffsrumpf (11) untergebracht ist; wobei ein Statorkörper (31) einen Durchflusskanal (313) umfasst, der dazu dient, es dem genannten Versorgungssystem, das im genannten Schiffsrumpf (11) untergebracht ist, zu ermöglichen, den genannten Motor (4) zu versorgen, der im genannten Raum (2a) untergebracht ist.

3. Stabilisator (1) nach mindestens einem der vorangegangenen Ansprüche, bei dem der genannte Antriebsstrang (6) ein erstes Räderpaar (61) umfasst, das dazu dient, die Kraft des genannten Motors (4) aufzunehmen, und ein zweites Räderpaar (62), das dazu dient, die Kraft des genannten ersten Paares (61) aufzunehmen und sie an die genannte Flosse (2) zu übertragen.

4. Stabilisator (1) nach mindestens dem vorangegangenen Anspruch, bei dem das genannte Scharnier (3) eine Rotationsachse (3a) definiert; wobei das genannte zweite Paar (62) zwischen dem genannten ersten Paar (61) und dem genannten Motor (4) entlang der genannten Rotationsachse (3a) angebracht ist.

5. Stabilisator (1) nach dem vorangegangenen Anspruch, bei dem der genannten Antriebsstrang (6) ein Ausgangsrad (63) umfasst, das kinematisch zwischen dem genannten zweiten Paar (62) und der genannten Flosse (2) angebracht ist.

6. Stabilisator (1) nach mindestens einem der vorangegangenen Ansprüche, bei dem im genannten Raum (2a) ein Rotorkörper (32), der genannte Motor (4) und der genannte Antriebsstrang (6) vollständig untergebracht sind.

7. Stabilisator (1) nach mindestens einem der vorangegangenen Ansprüche, umfassend eine Steuervorrichtung des genannten Motors (4), die im genannten Raum (2a) untergebracht ist.

8. Schiff umfassend mindestens einen genannten Stabilisator (1) nach mindestens einem der vorangegangenen Ansprüche, bei dem das genannte Scharnier (3) den genannten Statorkörper (31), der dazu dient, am genannten Schiffsrumpf (11) befestigt zu werden, und den genannten Rotorkörper (32), der fest mit der genannten Flosse (2) verbunden ist, umfasst; wobei der genannte Statorkörper einen Durchflusskanal definiert, der dazu dient, es dem genannten Versorgungssystem zu ermöglichen, das im genannten Schiffsrumpf untergebracht ist, den genannten Motor zu versorgen, der im genannten Raum der genannten Flosse untergebracht ist.

Revendications

1. Stabilisateur (1) apte à contrebalancer une oscillation d'un bateau (10) **caractérisé en ce qu'**il comprend :

   - une pale (2) apte à être au moins partiellement immergée de manière à contrebalancer ledit roulis et définissant un compartiment (2a) interne de ladite pale (2) ;
   - une articulation (3) apte à contraindre ladite pale (2) à une coque (11) dudit bateau (10) ;
   - un moteur (4) logé dans ledit compartiment (2a) ; et
   - une chaîne cinématique (6) logée dans ledit compartiment (2a) et apte à prélever le mouvement dudit moteur (4) et à commander la rotation de ladite pale (2) par rapport à ladite coque (11).

2. Stabilisateur (1) selon la revendication 1, comprenant un système d'alimentation dudit moteur (4) logé dans ladite coque (11) ; et dans lequel un corps de stator (31) comprend un canal (313) de passage apte à permettre audit système d'alimentation logé dans ladite coque (11) d'alimenter ledit moteur (4) logé dans ledit compartiment (2a).

3. Stabilisateur (1) selon au moins une revendication précédente, dans lequel ladite chaîne cinématique (6) comprend un premier couple (61) de roues aptes à prélever le mouvement dudit moteur (4) et un second couple (62) de roues aptes à prélever le mouvement dudit premier couple (61) et à le transmettre audit aileron (2).

4. Stabilisateur (1) selon la revendication précédente, dans lequel ladite articulation (3) définit un axe de rotation (3a) ; dans lequel ledit second couple (62) est interposé entre ledit premier couple (61) et ledit moteur (4) le long dudit axe de rotation (3a).

5. Stabilisateur (1) selon la revendication précédente, dans lequel ladite chaîne cinématique (6) comprend une roue de sortie (63) placée cinématiquement entre ledit second couple (62) et ledit aileron (2).

6. Stabilisateur (1) selon au moins une revendication précédente, dans lequel un corps de rotor (32), ledit moteur (4) et ladite chaîne cinématique (6) sont entièrement logés à l'intérieur dudit compartiment (2a).

7. Stabilisateur (1) selon au moins une revendication précédente, comprenant un dispositif de commande dudit moteur (4) logé dans ledit compartiment (2a).

8. Bateau comprenant au moins ledit stabilisateur (1) selon au moins l'une des revendications précédentes, dans lequel ladite articulation (3) comprend ledit corps de stator (31) apte à être contraint à ladite coque (11) et ledit corps de rotor (32) solidaire dudit aileron (2) ; et dans lequel ledit corps de stator définit un canal de passage apte à permettre audit système d'alimentation logé dans ladite coque d'alimenter ledit moteur logé dans ledit compartiment de ladite pale.

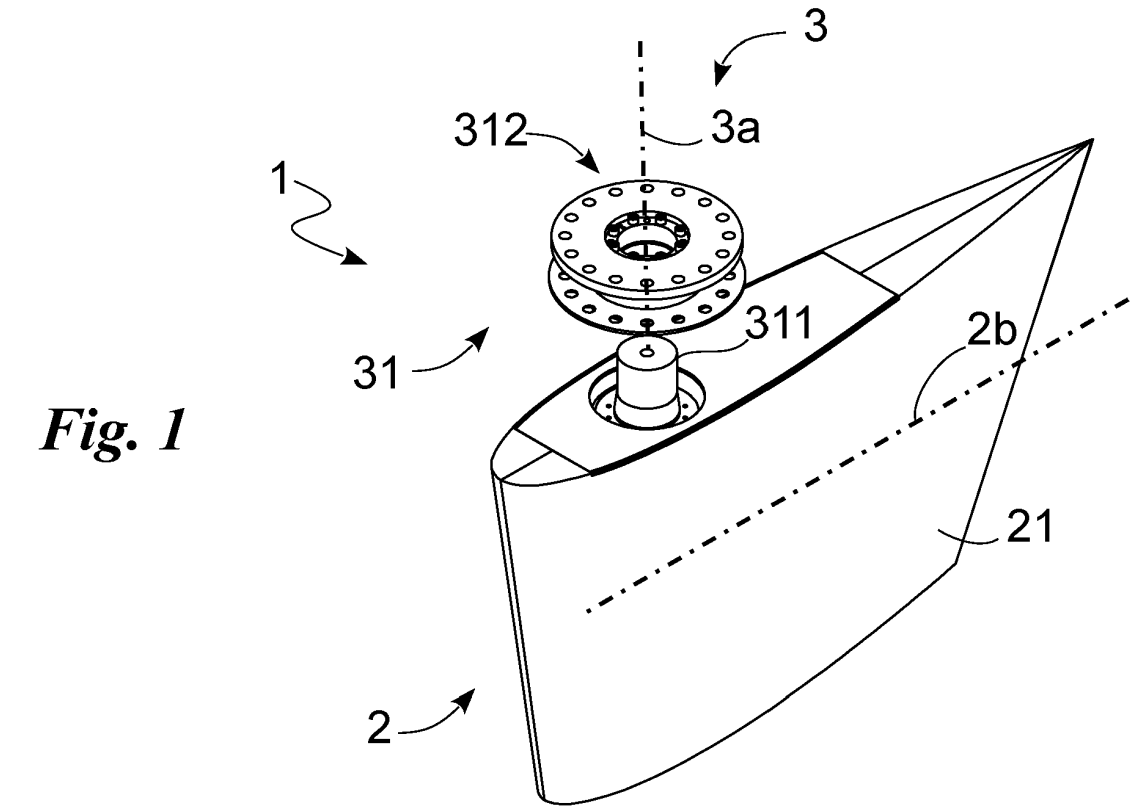


Fig. 1

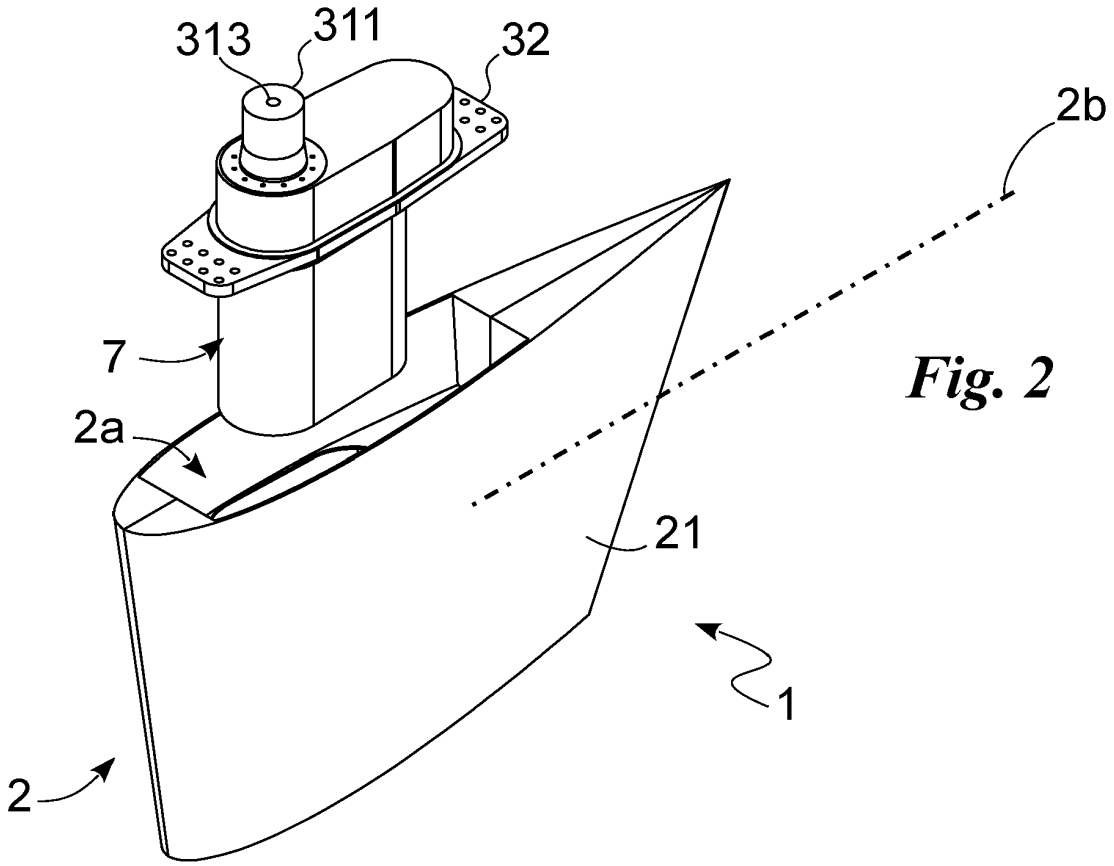
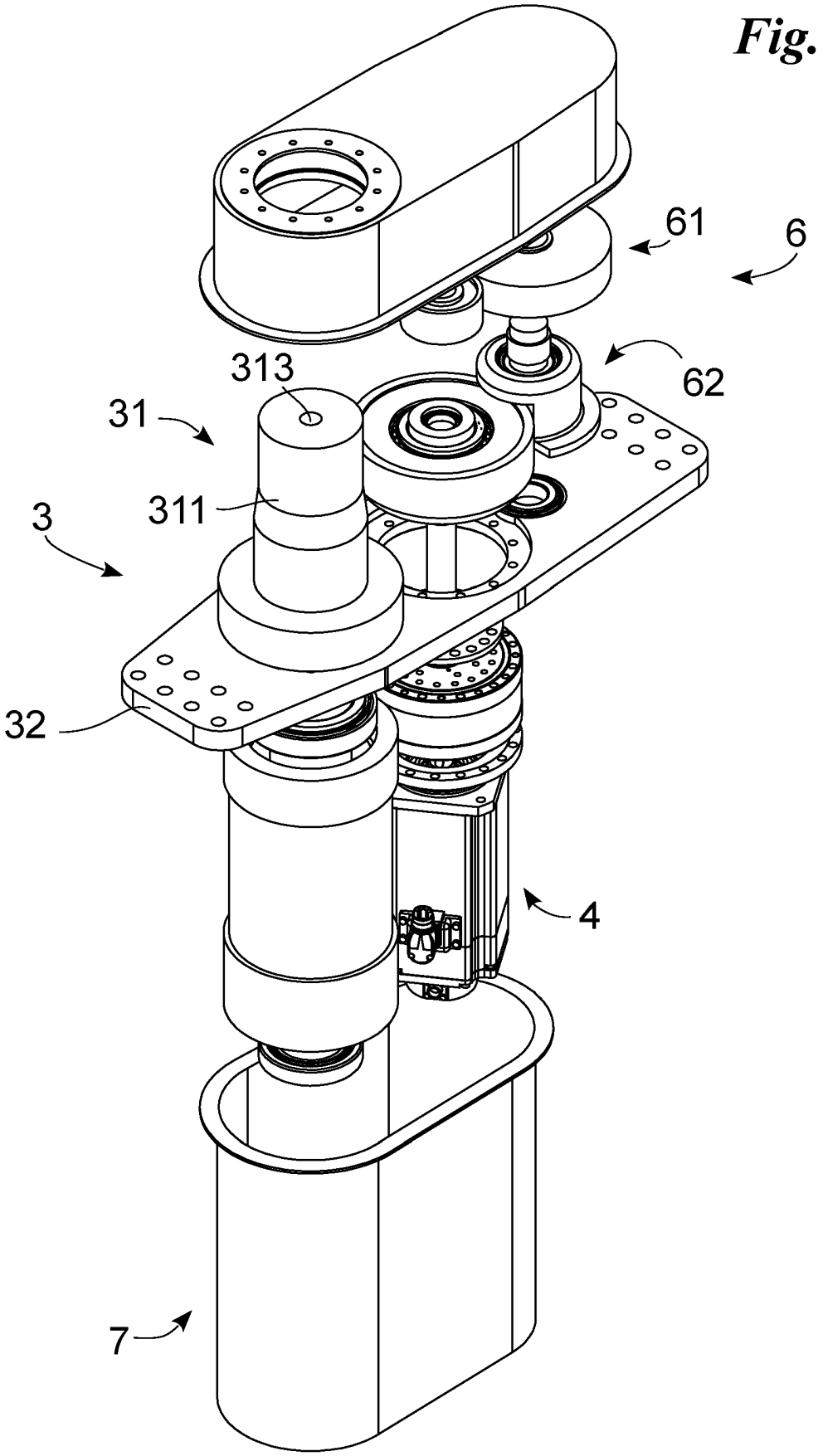


Fig. 2

Fig. 3



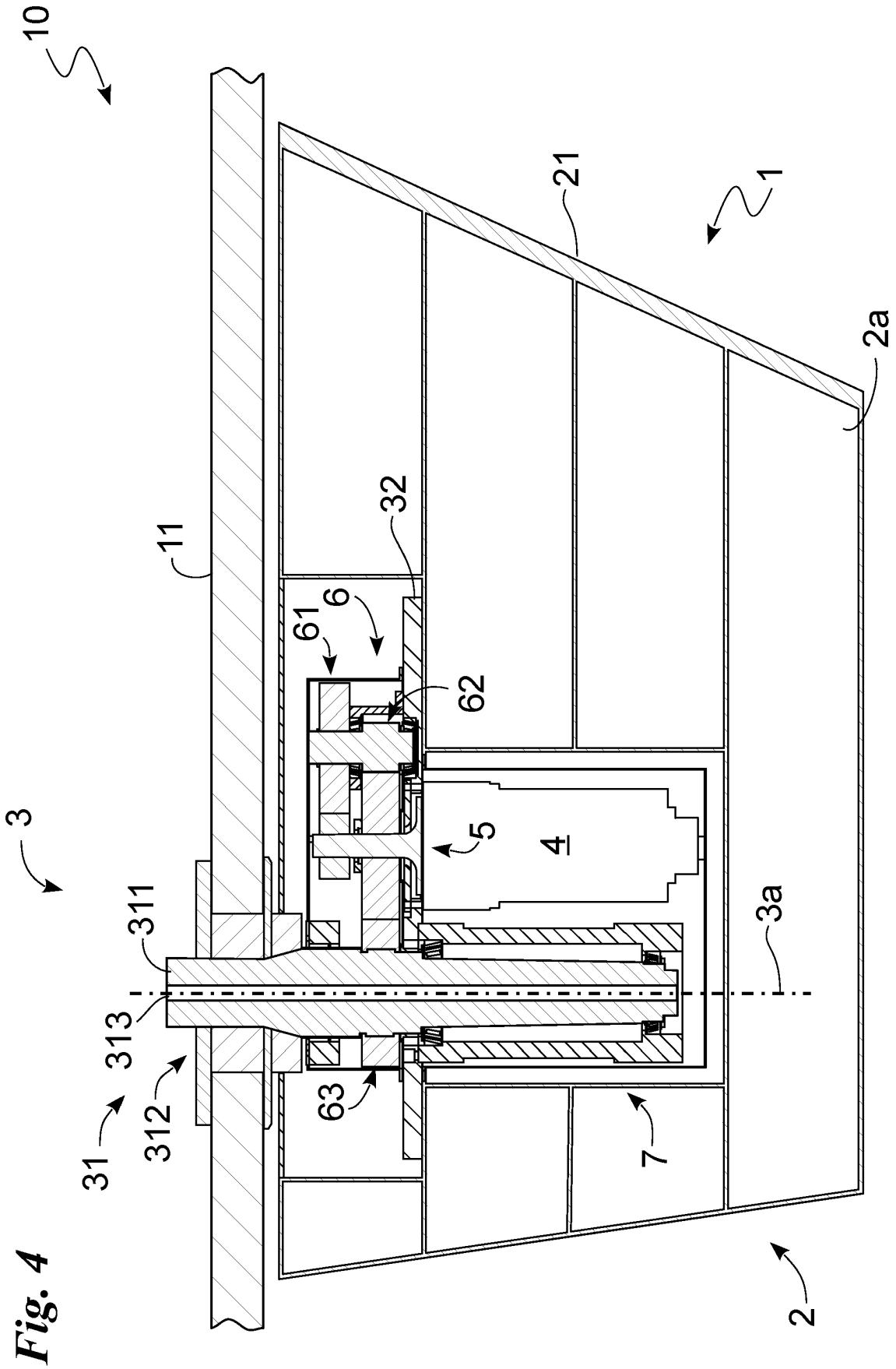


Fig. 4

REFERENCES CITED IN THE DESCRIPTION

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