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(54) **PROPULSION SYSTEM FOR A MARINE VESSEL**

(57) The present disclosure relates to a propulsion system for a marine vessel, comprising a transom bracket being configured to be connected with a transom of the marine vessel, a drive unit being rotatably connected with the transom bracket so as to be pivotable from a lowered position into a raised position, or vice versa, and a trim arrangement being arranged between the transom

bracket and the drive unit to adjust a trim angle of the drive unit when in the lowered position, wherein a support face is arranged on the transom of the marine vessel or at the transom bracket, and the drive unit comprises a support member arranged opposite the support face in the lowered position whereby the support face is configured to support the support member.

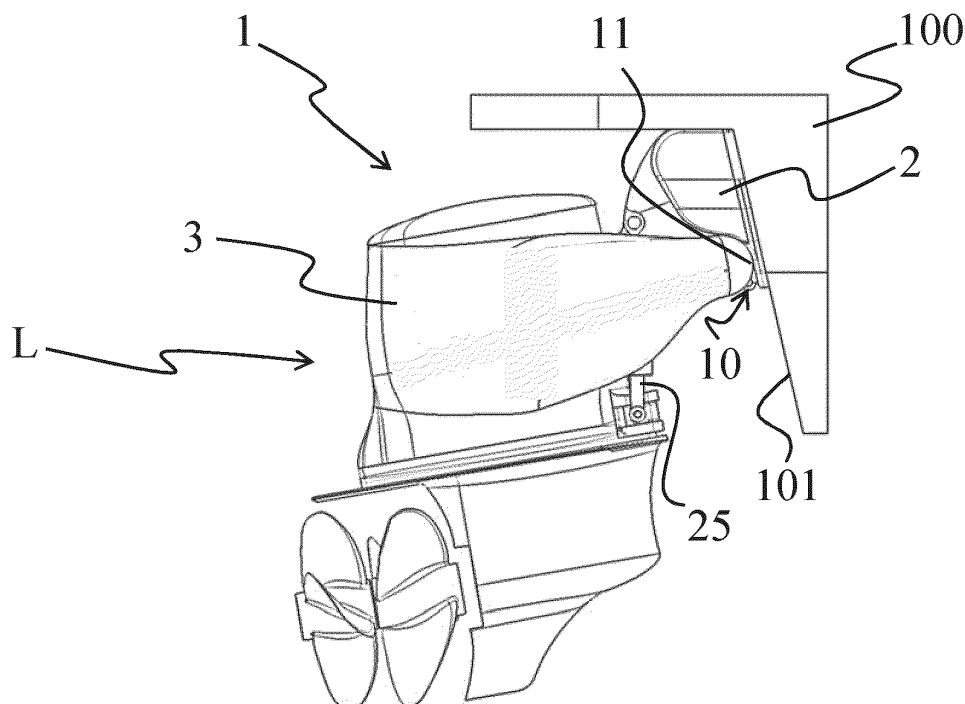


FIG. 1

Description

TECHNICAL FIELD

[0001] The disclosure relates generally to a propulsion system. In particular aspects, the disclosure relates to a propulsion system for a marine vessel. The disclosure can be applied to marine vessels, such as water crafts, motorboats, work boats, sport vessels, boats, ships, among other vessel types. Although the disclosure may be described with respect to a particular marine vessel, the disclosure is not restricted to any particular marine vessel.

BACKGROUND

[0002] Propulsion systems for marine vessels are known. These propulsion systems having a drive unit which may be trimmed so as to improve the marine vessel's performance and energy consumption to power the drive unit. However, when the drive unit is being positioned in different trim angles during high speed and/or during acceleration of the marine vessel the different parts of the transom bracket and pivot joints may be constructed to absorb great forces.

SUMMARY

[0003] According to a first aspect of the disclosure, a propulsion system for a marine vessel, comprising a transom bracket being configured to be connected with a transom of the marine vessel, a drive unit being rotatably connected with the transom bracket so as to be pivotable from a lowered position into a raised position, or vice versa, and a trim arrangement being configured to adjust a trim angle of the drive unit when in the lowered position, wherein a support face is arranged on the transom of the marine vessel or at the transom bracket, and the drive unit comprises a support member arranged opposite the support face in the lowered position whereby the support face is configured to support the support member. The first aspect of the disclosure may seek to minimise the forces exerted by the drive unit onto the transom bracket and the joints. A technical benefit may include enhanced mechanical strength between the drive unit and the marine vessel so that the marine vessel may be propelled at high acceleration, at high speed in different trim angles, without requiring strong mechanical joints and linkages between the marine vessel and the drive unit.

[0004] Optionally in some examples, including in at least one preferred example, the transom bracket comprises a first pivot hub part and a second pivot hub part, the first pivot hub part and the second pivot hub part comprises a first pivot joint, the drive unit being pivotable around the first pivot joint. A technical benefit may include providing a structure of the transom bracket being able to support the drive unit.

[0005] Optionally in some examples, including in at

least one preferred example, the first pivot hub part and the second pivot hub part have an outer geometry enabling that the drive unit can be pivoted around the first pivot joint. A technical benefit may include that the drive unit may be pivoted freely around the first pivot joint without interference with transom bracket.

[0006] Optionally in some examples, including in at least one preferred example, a section of the first pivot hub part and the second pivot hub part each have a section radius and a segment of the drive unit has a segment radius, the section radius and the segment radius being substantially equal to match each other in different trim angles of the drive unit when in the lowered position. A technical benefit may include that a section of the the first pivot hub part and the second pivot hub part is shaped so as to allow the drive unit to be moved in relation to the first pivot hub part and the second pivot hub part while they support the shape of the support member even in different trim angles. The drive unit may be moved freely in relation to the transom bracket.

[0007] Optionally in some examples, including in at least one preferred example, the support face is arranged for receiving the support member in different trim angles of the drive unit. A technical benefit may include that the support face is configured to absorb any force directed from the drive unit irrespective of the trim angle of the drive unit.

[0008] Optionally in some examples, including in at least one preferred example, the support face comprises a rigid, semi-rigid or an elastic material or a combination thereof. A technical benefit may include that the potential peak forces and impacts may be absorbed so as to minimize damage to the support member and surrounding areas, and/or absorb any vibrations.

[0009] Optionally in some examples, including in at least one preferred example, a support element is arranged at the support face, the support element is made of a rigid, semi-rigid or an elastic material or a combination thereof. A technical benefit may include that the potential peak forces and impacts may be absorbed so as to minimize damage to the support member and surrounding areas. Additionally, the support elements may be replaced if damaged.

[0010] Optionally in some examples, including in at least one preferred example, the drive unit is connected with the transom bracket via a connecting arm, the connecting arm being connected with the transom bracket via the first pivot joint and connected with the drive unit via a second pivot joint, wherein the drive unit is configured to be moved in the water and out of the water by the connecting arm pivots around the first pivot joint or the drive unit pivots around the second pivot joint or the connecting arm and the drive unit pivot around both pivot joints. A technical benefit may include that the drive unit may be trimmed in different trim angles of the drive unit independently water depth. Additionally, the drive unit may be moved up and down as well as translated rearwards compared to the transom bracket while maintain-

ing an improved angle of thrust. The disclosure can be used with advantage if a reduced draft is desired, such as when maneuvering in shallow waters close to a beach.

[0011] Optionally in some examples, including in at least one preferred example, the connecting arm comprises an arm support member, the arm support member is arranged opposite the support face in the lowered position of the drive unit whereby the support face is configured to support the arm support member in different angles of the drive unit. A technical benefit may include enhanced mechanical strength between the drive unit and the marine vessel so that the marine vessel may be propelled at high acceleration, at high speed in different trim angles, without requiring strong mechanical joints and linkages between the marine vessel and the drive unit.

[0012] Optionally in some examples, including in at least one preferred example, the connecting arm is configured to be pivoted around the first pivot joint in a clockwise direction or an anticlockwise direction independently of any pivoting of the drive unit around the second pivot joint. A technical benefit may include providing movement freedom to the drive unit.

[0013] Optionally in some examples, including in at least one preferred example, the drive unit is configured to be pivoted around the second pivot joint in a clockwise direction or an anticlockwise direction independently of any pivoting of the connecting arm around the first pivot joint. A technical benefit may include providing movement freedom to the drive unit.

[0014] Optionally in some examples, including in at least one preferred example, the connecting arm is configured to be pivoted around the first pivot joint in a clockwise direction or an anticlockwise direction at the same time as the drive unit is pivoted around the second pivot joint in a clockwise direction or an anticlockwise direction. A technical benefit may include providing movement freedom to the drive unit.

[0015] Optionally in some examples, including in at least one preferred example, the first pivot joint is arranged at a first end of the connecting arm, the second pivot joint is connected at a second end of the connecting arm. A technical benefit may include providing movement freedom to the drive unit.

[0016] Optionally in some examples, including in at least one preferred example, the arm support member is arranged at the second end. A technical benefit may include that the force of the drive unit may be absorbed between the arm support member and the support face rather than in the joint and the connecting arm itself. Hence, the mechanical strength of the joint and/or the connecting arm may be reduced.

[0017] Optionally in some examples, including in at least one preferred example, the trim arrangement comprises a linear actuator having an actuator end, the actuator end being connected with the connecting arm. A technical benefit may include a reliable and safe movement of the drive unit in relation to the transom bracket

is ensured.

[0018] Optionally in some examples, including in at least one preferred example, the linear actuator is connected with the drive unit and the connecting arm. A technical benefit may include that the drive unit may be trimmed in different trim angles by rotating the drive unit around the second pivot joint.

[0019] Optionally in some examples, including in at least one preferred example, the drive unit comprises an electric motor. A technical benefit may include to provide an environmental and sustainable power solution to drive unit while minimizing noise from the motor.

[0020] Optionally in some examples, including in at least one preferred example, the drive unit is configured to be tilted around the first pivot joint and/or trimmed around the second pivot joint. A technical benefit may include providing movement freedom to the drive unit.

[0021] Optionally in some examples, including in at least one preferred example, the drive unit comprises one or more propellers. A technical benefit may include well-known solution to propel and drive the marine vessel through the water.

[0022] Optionally in some examples, including in at least one preferred example, the support face has a first side and a second side, the first side and/or the second side has a side support face projecting outwards from the support face so that the side support face can support the support member in a transverse direction in relation to a longitudinal extension of the marine vessel. A technical benefit may include that drive unit is supported during turning of the marine vessel, which again also limit the requirements for strong mechanical joints and linkages between the marine vessel and the drive unit.

[0023] According to a second aspect of the disclosure, a marine vessel comprising a transom and a propulsion system as described above.

[0024] The disclosed aspects, examples (including any preferred examples), and/or accompanying claims may be suitably combined with each other as would be apparent to anyone of ordinary skill in the art. Additional features and advantages are disclosed in the following description, claims, and drawings, and in part will be readily apparent therefrom to those skilled in the art or recognized by practicing the disclosure as described herein.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025]

FIGS. 1-2 show in a side view an exemplary propulsion system according to an example.

FIG. 3 shows an exemplary transom bracket on a transom.

FIG. 4 shows an enlarged side view of an exemplary part of the transom bracket according to an example.

FIGS. 5-7 show in a side view different trim angles of the drive unit according to an example.

FIGS. 8-9 show in a side view the drive unit being

translated rearwards according to an example.

FIG. 10 shows an exemplary connecting arm arranged in connection with a transom bracket.

FIG. 11 shows an example of a support face in a cross-sectional view.

DETAILED DESCRIPTION

[0026] The detailed description set forth below provides information and examples of the disclosed technology with sufficient detail to enable those skilled in the art to practice the disclosure.

[0027] **FIG. 1** is an exemplary view of a propulsion system 1 for a marine vessel 100 according to an example. The propulsion system comprising a transom bracket 2 being configured to be connected with a transom 101 of the marine vessel 100 and a drive unit 3 being rotatably connected with the transom bracket 2 so as to be pivotable from a lowered position L into a raised position, or vice versa. The drive unit may be pivoted between the lowered position and the raised position by a tilt arrangement. The propulsion system 1 also comprises a trim arrangement 25 being configured to adjust a trim angle of the drive unit 3 when in the lowered position L. The trim arrangement 25 may be arranged between the transom bracket and the drive unit, or via different intermediate parts or components arranged between the transom bracket 2 and the drive unit. The term "arranged between" means in this context both directly between or indirectly via intermediate parts and components. Hence, the trim arrangement does not necessarily be directly connected with the transom bracket. A support face 10 is arranged on the transom of the marine vessel or at the transom bracket 2 as shown in **FIG. 1**. The drive unit 3 comprises a support member 11 arranged opposite the support face 10 in the lowered position L whereby the support face 10 is configured to support the support member 11. When the drive unit 3 is in the lowered position L it is configured to propel the marine vessel by for instance pushing the marine vessel by rotating one or more propellers. By incorporating the support face 10 on the transom bracket 2 or at the transom as well as the drive unit comprises a support member 11 an enhanced mechanical strength between the drive unit and the marine vessel is obtained so that the marine vessel may be propelled at high acceleration, at high speed in different trim angles, without requiring strong mechanical joints and linkages between the marine vessel and the drive unit.

[0028] In the example shown the support face 10 is arranged at the transom bracket 2. However, in other examples the support face or support faces may be arranged directly on the transom of the marine vessel.

[0029] In **FIG. 1**, the drive unit 3 is shown in the lowered position L and having a negative trim angle. In **FIG. 2**, the drive unit 3 is shown with positive trim angle.

[0030] To enable that the drive unit may be pivoted around the transom bracket the drive unit 3 in an example may be connected with the transom bracket 2 via a pivot

joint. The pivot joint may be arranged at the support member 11.

[0031] In **FIG. 3**, a transom 101 of the marine vessel 100 is shown. On the transom 101 a transom bracket 2 is mounted. In the example, the transom bracket 2 is connected with a connecting arm 4. The connecting arm 4 is pivotable connected with the transom bracket 2 via a first pivot joint. The connecting arm 4 is arranged in a center or space of the transom bracket 2.

[0032] The transom bracket 2 comprises a first pivot hub part 50 and a second pivot hub part 51, the first pivot hub part 50 and the second pivot hub part 51 comprises the first pivot joint, the drive unit being pivotable around the first pivot joint. The transom bracket 2 also comprises a base plate 52. In the example the support face comprises two support faces 10 arranged on the base plate 52 between the first pivot hub part 50 and the second pivot hub part 51. The connecting arm 4 is connected with the transom bracket via the first pivot joint and is connected with the drive unit via a second pivot joint.

[0033] The first pivot hub part 50 and the second pivot hub part 51 are configured to support the drive unit 4 whereby they have a structure enabling the carry the load and forces exerted from the drive unit. The first pivot hub part 50 and the second pivot hub part 51 may be made of the rigid material.

[0034] Furthermore, as seen on **FIG. 3**, the first pivot hub part 50 and the second pivot hub part 51 have an outer geometry enabling that the drive unit can be pivoted around the first pivot joint without colliding with the transom bracket or parts thereof. The drive unit thereby have freedom to be rotated and at the same time being supported by the transom bracket.

[0035] Moreover, a section 55 of the the first pivot hub part and the second pivot hub part each has a section radius and a segment 56 (seen on **FIG. 5**) of the drive unit 3 has a segment radius, the section radius and the segment radius being substantially equal to match each other in different trim angles of the drive unit 3 when in the lowered position L. Hereby is obtained that the drive unit 3 may be moved freely within a range of trim angles in the lowered position without being hindered by the transom bracket and still being supported by the transom bracket.

[0036] The support face 10 or support faces 10 may comprise a rigid, semi-rigid or an elastic material or a combination thereof. In addition, a support element may be arranged at the support face(s) 10 or on the support face(s). The support element may be made of a rigid, semi-rigid or an elastic material or a combination thereof.

[0037] In **FIG. 4**, an exemplary connecting arm 4 is shown in a side view. The connecting arm 4 is rotated around the first pivot joint 5 so that an arm support member 11' abuts the support face 10. The connecting arm 4 comprises in this example the arm support member 11'.

[0038] **FIGS. 5-7** show in a side view different trim angles of the drive unit according to an example. In **FIG. 5**, the drive unit 3 is positioned in neutral trim. The drive unit

3 is positioned in its lowered position L where the support member 11 is supported by the support face 10 so that it may absorb any forces or impacts from the drive unit. The support face is configured to support the support member in a longitudinal extension (LE) of the marine vessel. In FIG. 6, the drive unit 3 has been pivoted so as to position the drive unit 3 in a negative trim having a negative trim angle. In FIG. 7, the drive unit 3 has been pivoted so as to position the drive unit 3 in a positive trim having a positive trim angle. In all the different trim angles the support member(s) is/are supported by the support faces arranged at the transom bracket 2 so that forces and impacts from the drive unit 3 is transferred to the support face(s) rather than the pivot joints.

[0039] FIG. 8 is an exemplary view of a propulsion system 1 where the drive unit 3 is connected with the transom bracket 2 via a connecting arm 4 having a first pivot joint 5 connected with the transom bracket 2 and a second pivot joint 6 connected with the drive unit 3. The drive unit 3 is configured to be moved in the water and out of the water by the connecting arm 4 pivots around the first pivot joint 5 or the drive unit 3 pivots around the second pivot joint 6 or the connecting arm 4 and the drive unit 3 pivot around both pivot joints 5, 6.

[0040] In FIG. 8, the drive unit 3 has been moved rearwards while it has been tilted up by rotating the connection arm 5 around the first pivot joint 5. In addition, the drive unit 3 has been rotated around the second pivot joint 6 of the connection arm 4 so that a positive trim angle is obtained of the drive unit 3.

[0041] The drive unit 3 is configured to be moved by the connecting arm 4 is pivoted around the first pivot joint 5 in a clockwise direction or an anticlockwise direction independently of any pivoting of the drive unit around the second pivot joint 6. In FIG. 8, the connecting arm 4 has been pivoted in an anticlockwise direction around the first pivot joint 5.

[0042] In addition, the drive unit 3 is configured to be moved by the drive unit is pivoted around the second pivot joint 6 in a clockwise direction or an anticlockwise direction independently of any pivoting of the connecting arm 4 around the first pivot joint 5. In FIG. 8, the drive unit 3 has been pivoted in an anticlockwise direction around the second pivot joint 6.

[0043] The drive unit 3 is configured to be moved by the connecting arm 4 is pivoted around the first pivot joint 5 in a clockwise direction or an anticlockwise direction at the same time as the drive unit 3 is pivoted around the second pivot joint 6 in a clockwise direction or an anticlockwise direction. In FIG. 8, the connecting arm 4 has pivoted in an anticlockwise direction around the first pivot joint 5 and the drive unit 3 has been pivoted in an anticlockwise direction around the second pivot joint 6. Hence, the drive unit 3 may be trimmed in different trim angles by pivoting the drive unit 3 around the second pivot joint 6 and the position in the water of the drive unit may at the same time been obtained by pivoting the connection arm 4 around the first pivot joint 5. Freedom to

position the drive unit 3 in relation the transom bracket 2 is obtained. Additionally, the drive unit 3 may be moved up and down as well as translated rearwards in relation to the transom bracket 2 while maintaining an improved angle of thrust A.

[0044] In an example the drive unit 3 comprises one or more propellers. In FIG. 8, the drive unit 3 comprises a first propeller 13a and a second propeller 13b. In the example, the first propeller 13a and the second propeller 13b are configured to push the marine vessel 100 in a forward motion of the marine vessel 100. In another example the one or more propellers are configured to pull the marine vessel 100 in a forward motion of the marine vessel.

[0045] The drive unit 3 has been pivoted in the anti-clockwise direction around the second pivot joint 6 so that a positive trim angle and thereby angle of thrust A for the first propeller 13a and the second propeller 13b. In an example the first propeller 13a is arranged to be counter-rotating compared to the second propeller 13b.

[0046] In Fig. 8, the trim arrangement is arranged between the transom bracket and the drive unit while being connected with other intermediate components arranged between the transom bracket and the drive unit. More specifically, the trim arrangement comprises in this example a linear actuator 25 being arranged between the connecting arm 4 and the drive unit 3. The linear actuator 25 is configured to pivot the drive unit 3 around the second pivot joint 6 in either the clockwise direction or the anticlockwise direction and thereby a trim angle of the drive unit 3 and the angle of thrust may be set in relation to the circumstance. The linear actuator 25 is connected with the drive unit 3 in a distance below the second pivot joint 6 and is connected with the drive unit 3 via a drive pivot joint 12 so that it is ensured that the linear actuator 25 transfer force to pivot the drive unit 3 around the second pivot joint 6.

[0047] The linear actuator 25 may be a hydraulic cylinder or a pneumatic cylinder. In another example the trim arrangement may comprise a rotatory trim actuator.

[0048] In FIG. 8, the drive unit 3 is in a raised position and translated rearwards whereby the support face(s) 10 on the transom bracket 2 is visible as well as the arm support member 11'. When the drive unit 3 is lowered into the lowered position the support face(s) 10 will again support the arm support member 11'.

[0049] In FIG. 9, the drive unit 3 has been tilted further up by rotating the connecting arm 4 around the first pivot joint 5 compared to in FIG. 8. In addition, the drive unit 3 has been rotated in anticlockwise direction around the second pivot joint 6 of the connection arm 4 so that an improved angle of thrust A of the first propeller 13a and the second propeller 13b is obtained even though the drive unit 3 has been raised to a position being higher than a bottom 102 of the marine vessel 100. Hereby the drive unit 3 may be trimmed to an optimum position irrespective of the sailing in shallow waters since the bottom 102 of the marine vessel 100 is protecting the drive unit

3 and its propellers against impact.

[0050] Compared to **FIG. 8**, the connecting arm 4 in **FIG. 9** has been pivoted further around the first pivot joint 5 in an anticlockwise direction thereby tilting the drive unit 3 upwards. The connecting arm 4 is configured to be pivoted around the first pivot point 5 in maximum 200 degrees, preferably maximum 180 degrees.

[0051] In addition, the drive unit 3 may also be positioned so that it is raised out of the water or at least above the first pivot joint, in a parked position, when not in use, for instance when the marine vessel 100 is in the harbour or at the beach.

[0052] In **FIG. 9**, the drive unit 3 is in a raised position and translated rearwards whereby the support face(s) 10 on the transom bracket 2 is visible as well as the arm support member 11'. When the drive unit 3 is lowered into the lowered position the support face(s) 10 will again support the arm support member 11'.

[0053] The transom bracket 2 may have a first geometry as shown in **FIGS. 8-9** and the drive unit 3 and/or the connecting arm 4 may have a second geometry, the first geometry is designed so as to allow adjustments of trim angles even when the support members are supported by the support face.

[0054] In **FIG. 10**, a number of linear actuators 25 are arranged. Two linear actuators 25 are arranged adjacent to each other and are connected with the connecting arm 4 at one end and is configured to be connected with the drive unit in the opposite end. The linear actuators 25 may be hydraulic cylinders or pneumatic cylinders. The linear actuators 25 are arranged to pivot the drive unit around the second pivot joint 6 by extracting the cylinders or retracting the cylinders. In **FIG. 10**, the connecting arm 4 has been pivoted in an anticlockwise direction around the first pivot joint 5 whereby the connecting arm 4 is projecting from the transom bracket 2. In the example an additional linear actuator 25' is connected with the connecting arm 4 at one end and at the opposite end to the transom bracket 2. The linear actuator 25' is arranged to pivot the connecting arm 4 around the first pivot joint 5 by extracting the cylinder or retracting the cylinder. In **FIG. 10**, the cylinder has been extracted so that the connecting arm 4 is rotated in the anticlockwise direction. The additional linear actuator 25' is assisting in raising and lowering the connecting arm 4 and thereby the drive unit. The additional linear actuator 25' may be part of the tilt arrangement. In another example the tilt arrangement may comprise a rotatory tilt actuator. In addition, the support faces 10 are arranged on the base plate 52 of the transom bracket 2.

[0055] In **FIG. 11**, an example of a support face 10 is shown in a cross-sectional view. The support face 10 has a first side 30 and a second side 31, the first side 31 and/or the second side 32 has a side support face 32, 33 projecting outwards from the support face 10 so that the side support face can support the support member in a transverse direction TE in relation to a longitudinal extension the marine vessel. In the present example, a

first support face 32 is projecting outwards from the first side 30 and a second support face 33 is projecting outwards from the second side 31.

[0056] In an example, the drive unit may comprise an electric motor for powering the one or more propellers.

[0057] The propulsion system may further comprising a kick up function.

[0058] The present disclosure also relates to a marine vessel 100 comprising a transom 101 and a propulsion system 1 as described above.

[0059] Certain aspects and variants of the disclosure are set forth in the following examples numbered consecutive below.

[0060] Example 1: A propulsion system (1) for a marine vessel, comprising

a transom bracket (2) being configured to be connected with a transom (20) of the marine vessel, a drive unit (3) being rotatably connected with the transom bracket (2) so as to be pivotable from a lowered position (L) into a raised position, or vice versa, and

a trim arrangement (25) being configured to adjust a trim angle of the drive unit (3) when in the lowered position (L),

wherein a support face (10) is arranged on the transom of the marine vessel or at the transom bracket (2), and the drive unit (3) comprises a support member (11) arranged opposite the support face in the lowered position (L) whereby the support face is configured to support the support member.

[0061] Example 2: The propulsion system (1) of example 1, wherein the transom bracket comprises a first pivot hub part (50) and a second pivot hub part (51), the first pivot hub part and the second pivot hub part comprises a first pivot joint (5), the drive unit being pivotable around the first pivot joint.

[0062] Example 3: The propulsion system (1) of example 2, wherein the first pivot hub part and the second pivot hub part are configured to support the drive unit.

[0063] Example 4: The propulsion system (1) of example 2 and/or 3, wherein the first pivot hub part and the second pivot hub part are made of the rigid material.

[0064] Example 5: The propulsion system (1) of any of the examples 2 to 4, wherein the first pivot hub part and the second pivot hub part have an outer geometry enabling that the drive unit can be pivoted around the first pivot joint.

[0065] Example 6: The propulsion system (1) of example 5, wherein a section (55) of the the first pivot hub part (50) and the second pivot hub part (51) each have a section radius and a segment (56) of the drive unit (3) has a segment radius, the section radius and the segment radius being substantially equal to match each other in different trim angles of the drive unit (3) when in the lowered position (L).

[0066] Example 7: The propulsion system (1) of any of

the preceding examples, wherein the support face (10) is arranged for receiving the support member (11) in different trim angles of the drive unit (3).

[0067] Example 8: The propulsion system (1) of any of the preceding examples, wherein the support face (10) comprises a rigid, semi-rigid or an elastic material or a combination thereof.

[0068] Example 9: The propulsion system (1) of any of the preceding examples, wherein a support element (35) is arranged at the support face (10), the support element is made of a rigid, semi-rigid or an elastic material or a combination thereof.

[0069] Example 10: The propulsion system (1) of any of the preceding examples, wherein the drive unit is pivoted between the lowered position and the raised position by a tilt arrangement.

[0070] Example 11: The propulsion system (1) of any of the preceding examples,

wherein the drive unit (3) is connected with the transom bracket (2) via a connecting arm (4), the connecting arm being connected with the transom bracket (2) via the first pivot joint (5) and connected with the drive unit (3) via a second pivot joint (6),

wherein the drive unit (3) is configured to be moved in the water and out of the water by the connecting arm (4) pivots around the first pivot joint (5) or the drive unit pivots around the second pivot joint (6) or the connecting arm (4) and the drive unit (3) pivot around both pivot joints (5, 6).

[0071] Example 12: The propulsion system (1) of example 11, wherein the connecting arm comprises an arm support member (11'), the arm support member (11') is arranged opposite the support face (10) in the lowered position (L) of the drive unit whereby the support face is configured to support the arm support member in different angles of the drive unit.

[0072] Example 13: The propulsion system (1) of examples 11-12, wherein the connecting arm (4) is configured to be pivoted around the first pivot joint (5) in a clockwise direction or an anticlockwise direction independently of any pivoting of the drive unit around the second pivot joint (6).

[0073] Example 14: The propulsion system (1) of examples 11-12, wherein the drive unit (3) is configured to be pivoted around the second pivot joint (6) in a clockwise direction or an anticlockwise direction independently of any pivoting of the connecting arm around the first pivot joint (5).

[0074] Example 15: The propulsion system (1) of examples 11-14, wherein the connecting arm is configured to be pivoted around the first pivot joint (5) in a clockwise direction or an anticlockwise direction at the same time as the drive unit (3) is pivoted around the second pivot joint (6) in a clockwise direction or an anticlockwise direction.

[0075] Example 16: The propulsion system (1) of any

of the examples 11-15, wherein the first pivot joint (5) is arranged at a first end of the connecting arm (4), the second pivot joint (6) is connected at a second end of the connecting arm.

[0076] Example 17: The propulsion system (1) of example 16, wherein the arm support member (11') is arranged at the second end.

[0077] Example 18: The propulsion system (1) of any of the examples 11-17, wherein the connecting arm (4) is arranged in the center of the drive unit (3).

[0078] Example 19: The propulsion system (1) of example 18, wherein the connecting arm (4) is arranged between the first pivot hub part and the second pivot hub part.

[0079] Example 20: The propulsion system (1) of any of the examples 11-19, wherein two connecting arms are arranged between the transom bracket (2) and the drive unit (3).

[0080] Example 21: The propulsion system (1) of example 20, wherein the two connecting arms are arranged with a mutual distance between them.

[0081] Example 22: The propulsion system (1) of any of the examples 20-21, wherein the two connecting arms have the first pivot joint (5) and the second pivot joint (6) so that the two connecting arms move together around the first pivot joint and/or the second pivot joint.

[0082] Example 23: The propulsion system (1) of any of the examples 11-22, wherein the connecting arm tapers from the first pivot joint (5) towards the second pivot joint (6).

[0083] Example 24: The propulsion system (1) of any of the preceding examples, wherein the trim arrangement comprises a linear actuator (25) having an actuator end, the actuator end being connected with the connecting arm (4).

[0084] Example 25: The propulsion system (1) of any of the examples 11-20, wherein the connecting arm (4) is configured to be pivoted around the first pivot point (5) in a maximum of 200 degrees.

[0085] Example 26: The propulsion system (1) of example 24, wherein the linear actuator (25) is connected with the drive unit (3) and the connecting arm (4).

[0086] Example 27: The propulsion system (1) of example 24 and/or 26, wherein the linear actuator (25) is connected with the drive unit (3) in a distance below the second pivot joint (6).

[0087] Example 28: The propulsion system (1) of example 27, wherein the linear actuator is connected with the drive unit (3) via a drive pivot joint (12).

[0088] Example 29: The propulsion system (1) of any of the examples 1 to 23, wherein the trim arrangement comprises a rotatory trim actuator.

[0089] Example 30: The propulsion system (1) of any of the examples 24 to 28, wherein the linear actuator is a hydraulic cylinder or a pneumatic cylinder.

[0090] Example 31: The propulsion system (1) of any of the preceding examples, wherein the drive unit (3) comprises an electric motor.

[0091] Example 32: The propulsion system (1) of any of the preceding examples, wherein the drive unit (3) is configured to be trimmed and/or tilted around the first pivot joint (5) and/or the second pivot joint (6).

[0092] Example 33: The propulsion system (1) of any of the preceding examples, wherein the drive unit comprises one or more propellers.

[0093] Example 34: The propulsion system (1) of example 33, wherein the one or more propellers are configured to push the marine vessel in a forward motion of the marine vessel.

[0094] Example 35: The propulsion system (1) of example 33, wherein the one or more propellers are configured to pull the marine vessel in a forward motion of the marine vessel.

[0095] Example 36: The propulsion system (1) of example 33, wherein the drive unit (3) comprises a first propeller (13a) and a second propeller (13b).

[0096] Example 37: The propulsion system (1) of example 36, wherein the first propeller (13a) is arranged to be counter-rotating compared to the second propeller (13b).

[0097] Example 38: The propulsion system (1) of any of the preceding examples, further comprising a kick up function.

[0098] Example 39: The propulsion system (1) of any of the preceding examples, wherein the transom bracket (2) has a first geometry and the drive unit (3) has a second geometry, the first geometry is designed so as to allow adjustments of trim angles even when the support members are supported by the support face.

[0099] Example 40: The propulsion system (1) of example 1, wherein the trim arrangement is arranged between the transom bracket (2) and the drive unit (3), and/or between any intermediate components or parts between the transom bracket and the drive unit.

[0100] Example 41: The propulsion system (1) of any of the examples 1-40, wherein the support face is configured to support the support member in a longitudinal extension (LE) of the marine vessel.

[0101] Example 42: The propulsion system (1) of any of the examples 1-41, wherein the support face (20) has a first side (30) and a second side (31), the first side and/or the second side has a side support face (32, 33) projecting outwards from the support face (10) so that the side support face can support the support member in a transverse direction (TE) in relation to a longitudinal extension (LE) of the marine vessel.

[0102] Example 43: The propulsion system (1) of example 42, wherein a first support face (32) is projecting outwards from the first side (30) and a second support face (33) is projecting outwards from the second side (31).

[0103] Example 44: A marine vessel comprising a transom and a propulsion system (1) of any of the preceding examples.

[0104] The terminology used herein is for the purpose of describing particular aspects only and is not intended

to be limiting of the disclosure. As used herein, the singular forms "a," "an," and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. As used herein, the term "and/or" includes any and all combinations of one or more of the associated listed items. It will be further understood that the terms "comprises," "comprising," "includes," and/or "including" when used herein specify the presence of stated features, integers, actions, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, actions, steps, operations, elements, components, and/or groups thereof.

[0105] It will be understood that, although the terms first, second, etc., may be used herein to describe various elements, these elements should not be limited by these terms. These terms are only used to distinguish one element from another. For example, a first element could be termed a second element, and, similarly, a second element could be termed a first element without departing from the scope of the present disclosure.

[0106] Relative terms such as "below" or "above" or "upper" or "lower" or "horizontal" or "vertical" may be used herein to describe a relationship of one element to another element as illustrated in the Figures. It will be understood that these terms and those discussed above are intended to encompass different orientations of the device in addition to the orientation depicted in the Figures. It will be understood that when an element is referred to as being "connected" or "coupled" to another element, it can be directly connected or coupled to the other element, or intervening elements may be present. In contrast, when an element is referred to as being "directly connected" or "directly coupled" to another element, there are no intervening elements present.

[0107] Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this disclosure belongs. It will be further understood that terms used herein should be interpreted as having a meaning consistent with their meaning in the context of this specification and the relevant art and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.

[0108] It is to be understood that the present disclosure is not limited to the aspects described above and illustrated in the drawings; rather, the skilled person will recognize that many changes and modifications may be made within the scope of the present disclosure and appended claims. In the drawings and specification, there have been disclosed aspects for purposes of illustration only and not for purposes of limitation, the scope of the disclosure being set forth in the following claims.

Claims

1. A propulsion system (1) for a marine vessel, com-

prising

- a transom bracket (2) being configured to be connected with a transom (20) of the marine vessel,
- a drive unit (3) being rotatably connected with the transom bracket (2) so as to be pivotable from a lowered position (L) into a raised position, or vice versa, and
- a trim arrangement (25) being configured to adjust a trim angle of the drive unit (3) when in the lowered position (L),
- wherein a support face (10) is arranged on the transom of the marine vessel or at the transom bracket (2), and the drive unit (3) comprises a support member (11) arranged opposite the support face in the lowered position (L) whereby the support face is configured to support the support member.
2. The propulsion system (1) of claim 1, wherein the transom bracket (2) comprises a first pivot hub part (50) and a second pivot hub part (51), the first pivot hub part and the second pivot hub part comprises a first pivot joint (5), the drive unit being pivotable around the first pivot joint.
 3. The propulsion system (1) of claim 2, wherein the first pivot hub part (50) and the second pivot hub part (51) have an outer geometry enabling that the drive unit (3) can be pivoted around the first pivot joint.
 4. The propulsion system (1) of claim 3, wherein a section (55) of the the first pivot hub part (50) and the second pivot hub part (51) each have a section radius and a segment (56) of the drive unit (3) has a segment radius, the section radius and the segment radius being substantially equal to match each other in different trim angles of the drive unit (3) when in the lowered position (L).
 5. The propulsion system (1) of any of claims 1-4, wherein the support face (10) is arranged for receiving the support member (11) in different trim angles of the drive unit (3).
 6. The propulsion system (1) of any of the claims 1-5, wherein a support element (35) is arranged at the support face (10), the support element is made of a rigid, semi-rigid or an elastic material or a combination thereof.
 7. The propulsion system (1) of any of the claims 2-6, wherein the drive unit (3) is connected with the transom bracket (2) via a connecting arm (4), the connecting arm being connected with the transom bracket (2) via the first pivot joint (5) and connected with the drive unit (3) via a second pivot joint (6),

wherein the drive unit (3) is configured to be moved in the water and out of the water by the connecting arm (4) pivots around the first pivot joint (5) or the drive unit pivots around the second pivot joint (6) or the connecting arm (4) and the drive unit (3) pivot around both pivot joints (5, 6).

8. The propulsion system (1) of claim 7, wherein the connecting arm comprises an arm support member (11'), the arm support member (11') is arranged opposite the support face (10) in the lowered position (L) of the drive unit whereby the support face is configured to support the arm support member in different angles of the drive unit.
9. The propulsion system (1) of claims 7 and/or 8, wherein the connecting arm (4) is configured to be pivoted around the first pivot joint (5) in a clockwise direction or an anticlockwise direction independently of any pivoting of the drive unit around the second pivot joint (6).
10. The propulsion system (1) of claims 7 and/or 8, wherein the drive unit (3) is configured to be pivoted around the second pivot joint (6) in a clockwise direction or an anticlockwise direction independently of any pivoting of the connecting arm around the first pivot joint (5).
11. The propulsion system (1) of claims 7 to 10, wherein the connecting arm is configured to be pivoted around the first pivot joint (5) in a clockwise direction or an anticlockwise direction at the same time as the drive unit (3) is pivoted around the second pivot joint (6) in a clockwise direction or an anticlockwise direction.
12. The propulsion system (1) of any of the claims 7 to 11, wherein the first pivot joint (5) is arranged at a first end of the connecting arm (4), the second pivot joint (6) is connected at a second end of the connecting arm.
13. The propulsion system (1) of claim 12, wherein the arm support member (11') is arranged at the second end.
14. The propulsion system (1) of any of the claims 1-13, wherein the support face (10) has a first side (30) and a second side (31), the first side and/or the second side has a side support face (32, 33) projecting outwards from the support face (10) so that the side support face (32, 33) can support the support member in a transverse direction (TE) in relation to a longitudinal extension of the marine vessel.
15. A marine vessel comprising a transom and a propulsion system (1) of any of the claims 1-14.

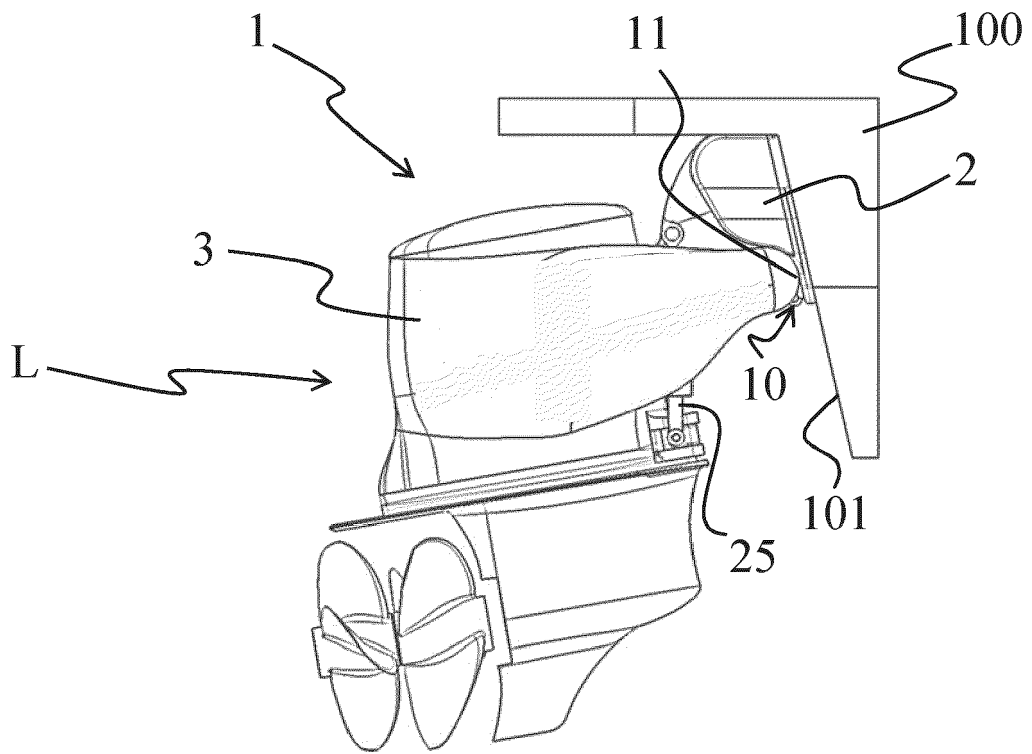


FIG. 1

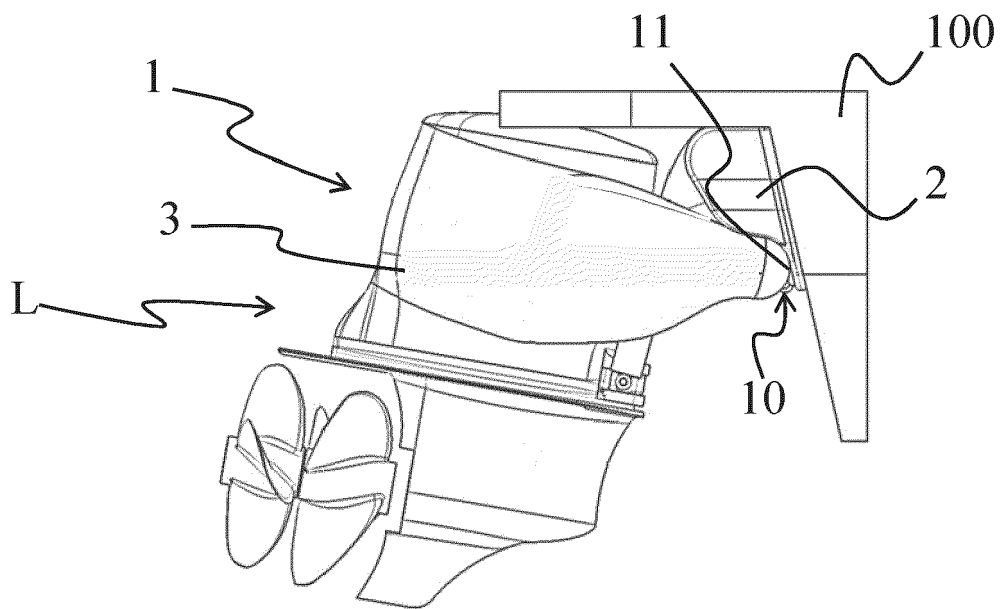


FIG. 2

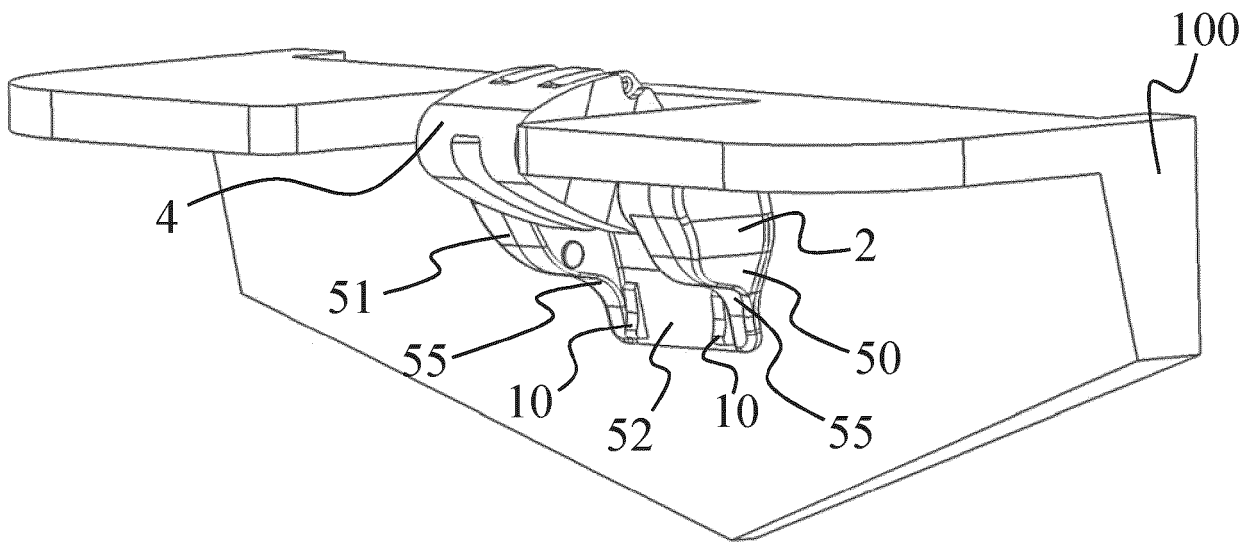


FIG. 3

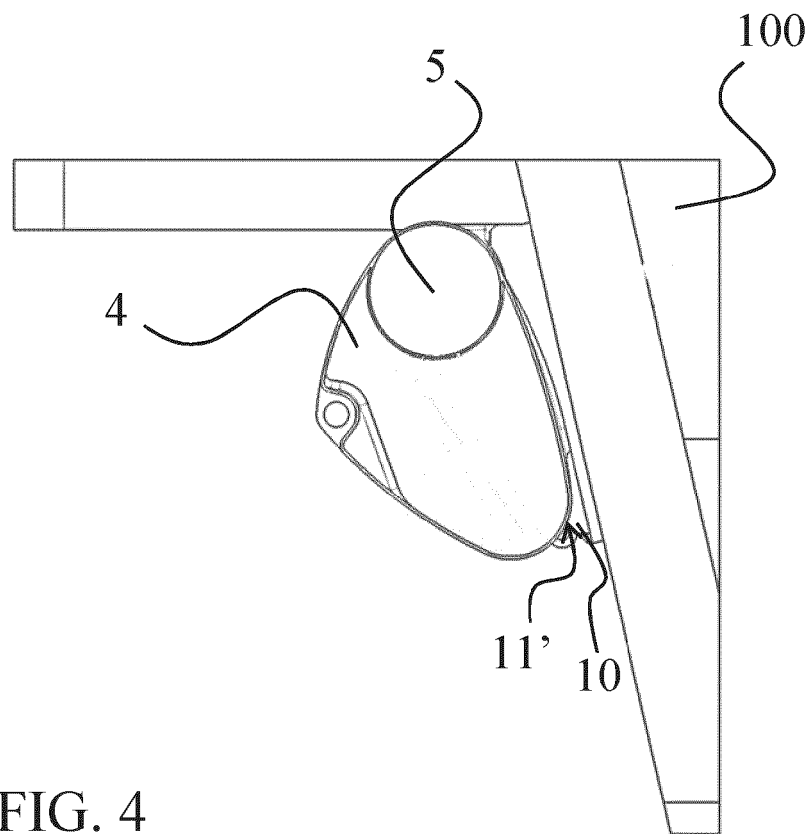


FIG. 4

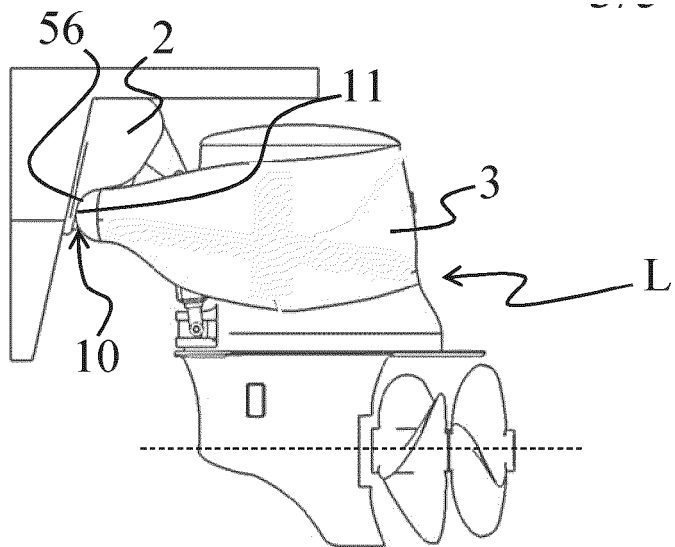


FIG. 5

LE

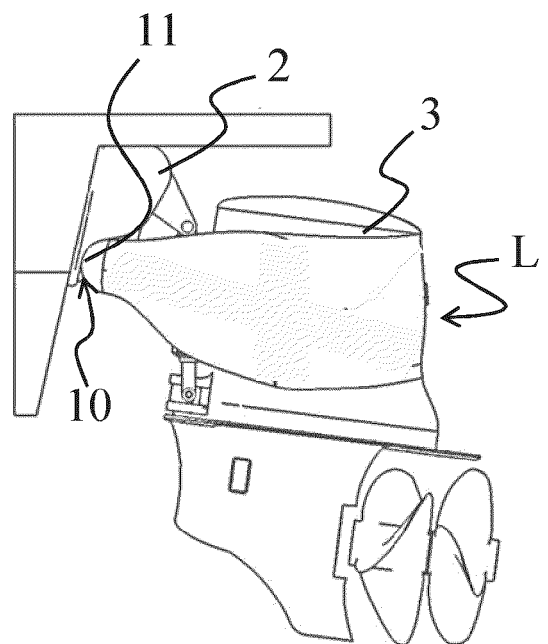


FIG. 6

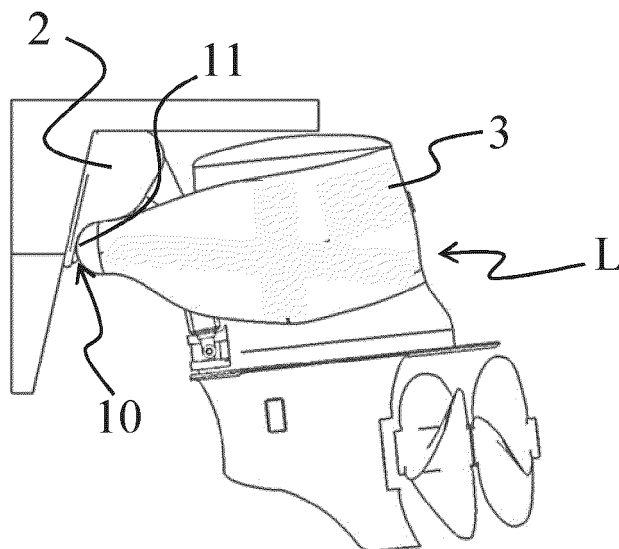


FIG. 7

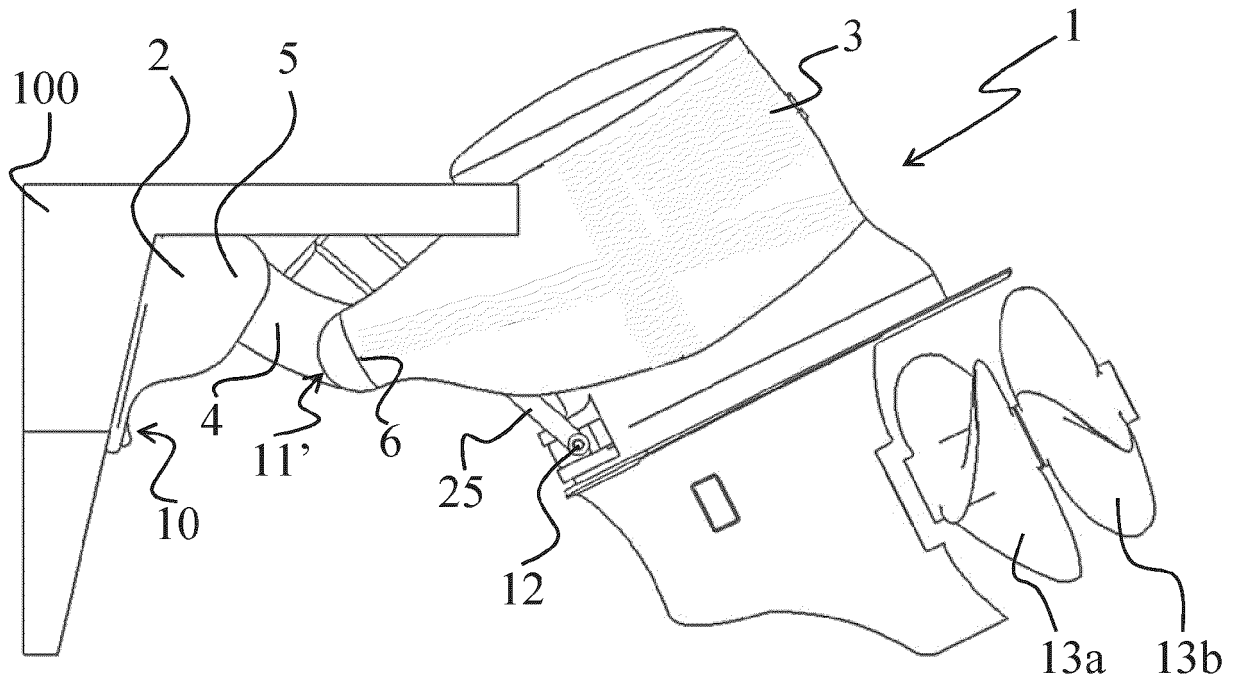


FIG. 8

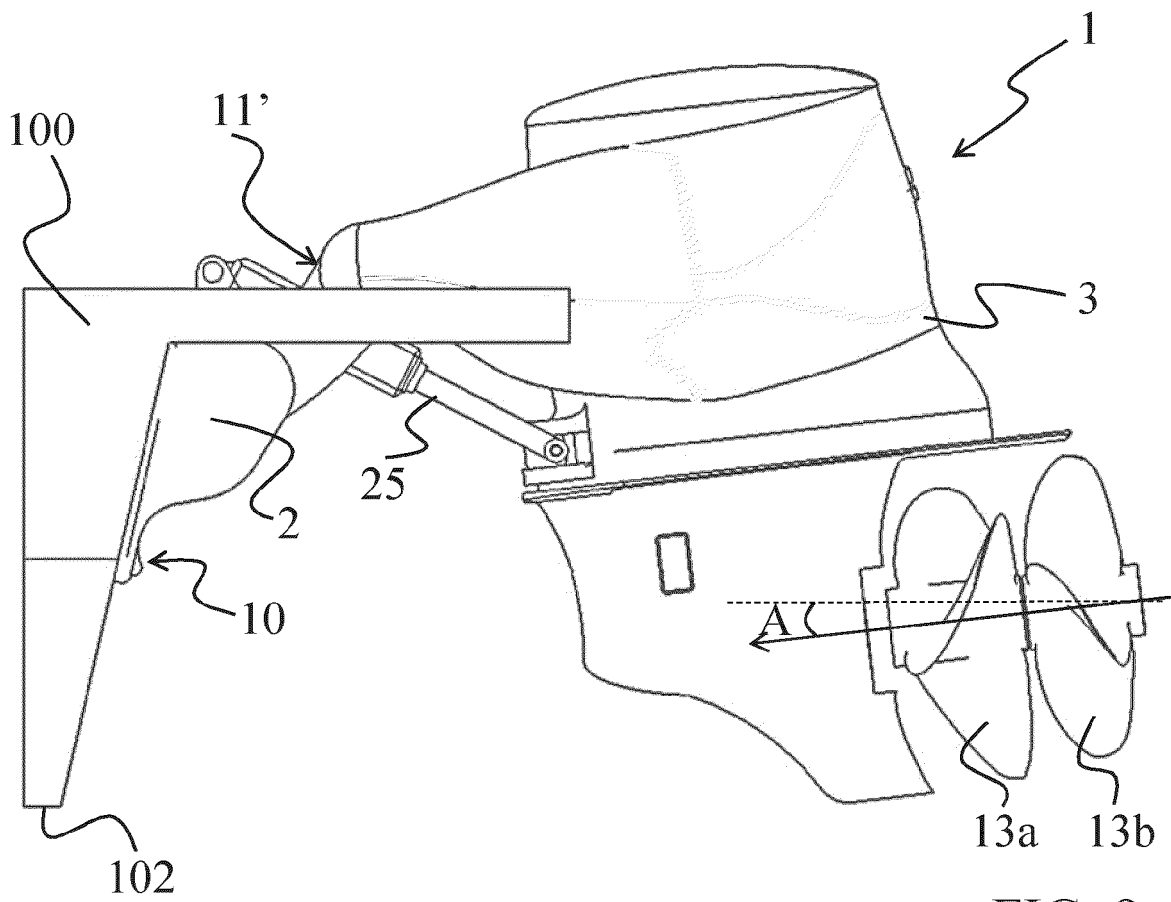


FIG. 9

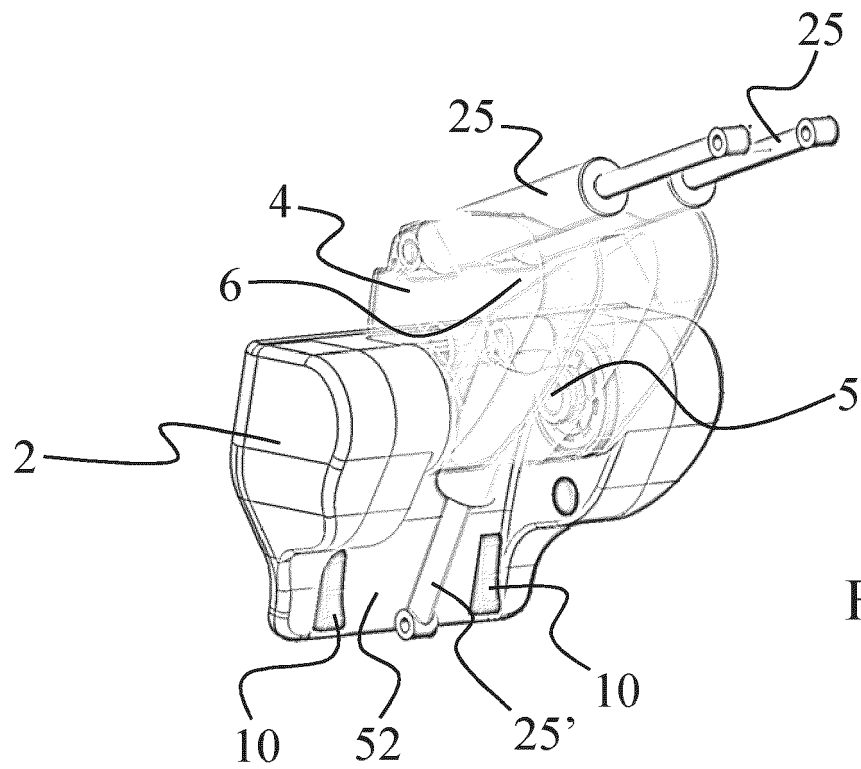


FIG. 10

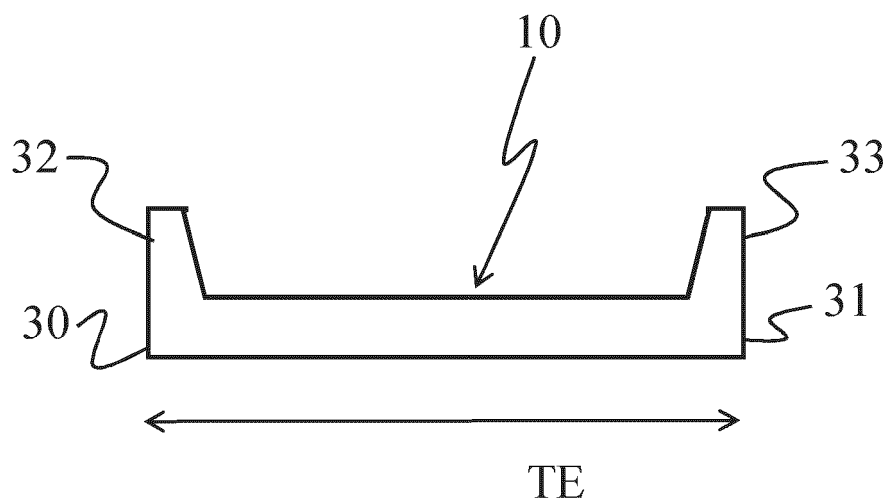


FIG. 11



EUROPEAN SEARCH REPORT

Application Number

EP 24 16 9837

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	US 8 858 279 B1 (WIATROWSKI DARRELL [US] ET AL) 14 October 2014 (2014-10-14) * figures 3, 4, 7-11 *	1-15	INV. B63H20/08 B63H20/32
X	US 6 220 905 B1 (BLANCHARD CLARENCE [US]) 24 April 2001 (2001-04-24) * figures 2-3C *	1-15	
X	US 4 687 448 A (PEIRCE JAMES G [US]) 18 August 1987 (1987-08-18) * figures 1-9 *	1-15	
X	US 2009/170384 A1 (BALOGH DANIEL J [US] ET AL) 2 July 2009 (2009-07-02) * figures 1-4 *	1-15	
A	WO 2020/041908 A1 (MUELLER PETER A [CH]) 5 March 2020 (2020-03-05) * figure 3 *	7-13	TECHNICAL FIELDS SEARCHED (IPC) B63H B63B
A	WO 2021/059105 A1 (AS LABRUNA S R L [IT]) 1 April 2021 (2021-04-01) * figures 1-10 *	7-13	
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 12 September 2024	Examiner Freire Gomez, Jon
CATEGORY OF CITED DOCUMENTS 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		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	

EPO FORM 1503 03.82 (P04C01)

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

EP 24 16 9837

5 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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12 - 09 - 2024

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 8858279 B1	14-10-2014	US 8840439 B1	23-09-2014
		US 8858279 B1	14-10-2014
US 6220905 B1	24-04-2001	JP 2001187598 A	10-07-2001
		US 6220905 B1	24-04-2001
US 4687448 A	18-08-1987	NONE	
US 2009170384 A1	02-07-2009	NONE	
WO 2020041908 A1	05-03-2020	CH 715395 A2	31-03-2020
		WO 2020041908 A1	05-03-2020
WO 2021059105 A1	01-04-2021	EP 4034459 A1	03-08-2022
		ES 2976017 T3	19-07-2024
		WO 2021059105 A1	01-04-2021