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

(57) The disclosure relates to a propulsion system for a marine vessel, comprising a transom bracket configured to be connected with a transom of the marine vessel, and a drive unit, the drive unit is arranged to be moved in relation to the transom bracket to move the drive unit in the water and out of the water, the drive unit is connected with the transom bracket via a connecting

arm having a first pivot joint connected with the transom bracket and a second pivot joint connected with the drive unit, 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.

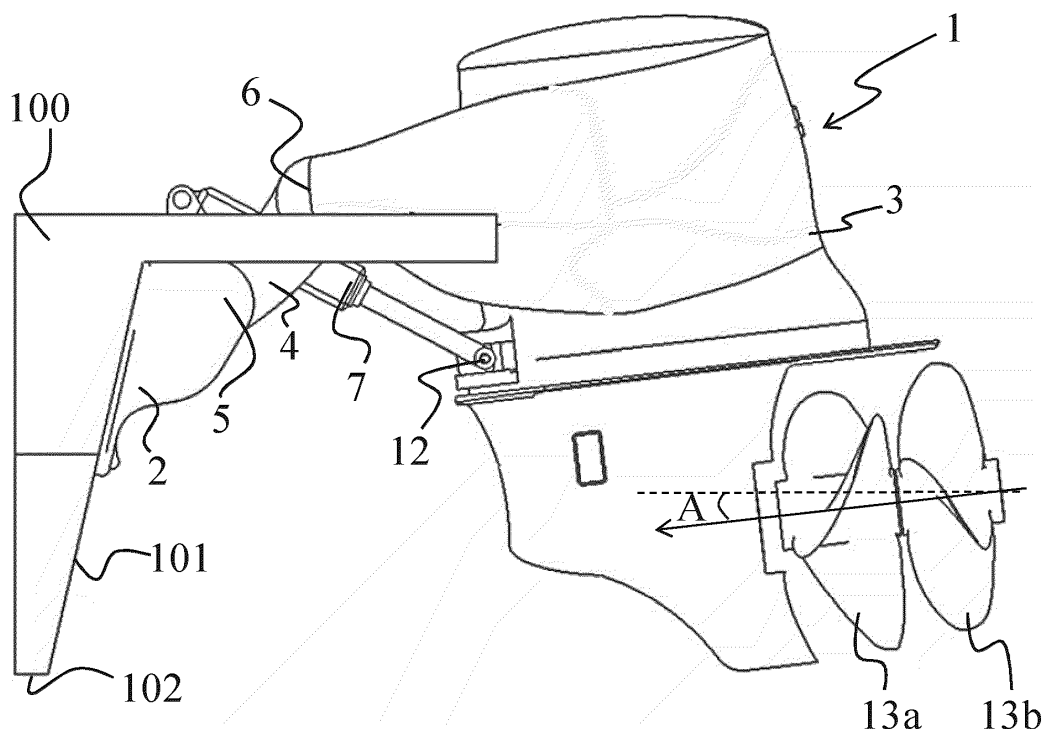


FIG. 2

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. These known trim devices does not take into account where the marine vessel is sailing both is sailing in normal draft and in reduced draft situations.

SUMMARY

[0003] According to a first aspect of the disclosure, a propulsion system for a marine vessel, comprising a transom bracket configured to be connected with a transom of the marine vessel, and a drive unit, the drive unit is arranged to be moved in relation to the transom bracket for moving the drive unit in the water and out of the water, the drive unit is connected with the transom bracket via a connecting arm having a first pivot joint connected with the transom bracket and a second pivot joint connected with the drive unit, 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. The first aspect of the disclosure may seek to provide a propulsion system ensuring an improved thrust by the propulsion system under different trim situations of the drive unit independently of the water depth. A technical benefit may include that the drive unit may be trimmed in different trim positions 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 maintaining 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.

[0004] Optionally in some examples, including in at least one preferred example, the drive unit is configured to be moved by the connecting arm is 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.

[0005] Optionally in some examples, including in at least one preferred example, the drive unit is configured to be moved by the drive unit is 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.

[0006] Optionally in some examples, including in at least one preferred example, the drive unit is configured to be moved by the drive unit is 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.

[0007] Optionally in some examples, including in at least one preferred example, the drive unit is configured to be moved by the connecting arm is 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.

[0008] Optionally in some examples, including in at least one preferred example, a rotation motor is arranged in the first pivot joint and/or in the second pivot joint. A technical benefit may include a reliable and secure way to either pivoting the first pivot joint and/or the second pivot joint.

[0009] Optionally in some examples, including in at least one preferred example, a linear actuator is arranged between the transom bracket and the connecting arm, or between the connecting arm and the drive unit. A technical benefit may include a reliable and secure way to either pivoting the first pivot joint and/or the second pivot joint.

[0010] Optionally in some examples, including in at least one preferred example, a plurality of linear actuators are arranged between the transom bracket and the connecting arm, or between the connecting arm and the drive unit. A technical benefit may include that both the first pivot joint and the second pivot joint are rotated by the linear actuators. In addition, a reliable and safe movement of the drive unit in relation to the transom bracket is ensured. By implementing the linear actuators, it is furthermore obtained that they may be reduced in size so that a more compact design is obtained while still being able to withstand the force at any degree.

[0011] Optionally in some examples, including in at least one preferred example, the first pivot joint has a first axis and the second pivot joint has a second axis, and the first axis and the second axis is defining an arm axis extending along the connecting arm between the first axis and the second axis.

[0012] Optionally in some examples, including in at least one preferred example, a first linear actuator is arranged between the transom bracket and the connecting arm, the first linear actuator having a first actuator exten-

sion extending between the transom bracket and the connecting arm, wherein the arm axis and the first actuator extension intersect independently of any movement of the drive unit. A technical benefit may include that a higher degree of control of the movement of the drive unit is obtained.

[0013] Optionally in some examples, including in at least one preferred example, a second linear actuator is arranged between the connecting arm and the drive unit, the second linear actuator having a second actuator extension extending between the connecting arm and the drive unit, wherein the arm axis and the second actuator extension never intersect independently of any movement of the drive unit. A technical benefit may include that a higher degree of control of the movement of the drive unit is obtained.

[0014] Optionally in some examples, including in at least one preferred example, a hydraulic system is arranged for powering the linear actuator(s). A technical benefit may include ensuring reliable power source to powering the linear actuators.

[0015] Optionally in some examples, including in at least one preferred example, the rotation motor and the linear actuator(s) are configured to pivot the connecting arm around the first pivot joint and/or the drive unit around the second pivot joint. A technical benefit may include that a reliable and safe movement of the drive unit in relation to the transom bracket is ensured.

[0016] Optionally in some examples, including in at least one preferred example, a gearing unit is arranged in the first pivot joint and/or in the second pivot joint. A technical benefit may include a reliable and safe movement of the drive unit in relation to the transom bracket is ensured.

[0017] Optionally in some examples, including in at least one preferred example, the gearing unit is a planetary gearing unit arranged in the first pivot joint and/or in the second pivot joint. 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, a motor or a step motor is arranged for powering the gearing unit and/or planetary gearing unit. A technical benefit may include a reliable and safe movement of the drive unit in relation to the transom bracket is ensured. Moreover, the first pivot joint can be engaged and disengaged actively, which enabling the trim function at the second pivot joint to be performed without affecting the first pivot joint.

[0019] Optionally in some examples, including in at least one preferred example, the gearing unit and/or the planetary gearing unit and/or the linear actuator(s) are configured to move the drive unit by pivoting the connecting arm around the first pivot joint and/or by pivoting the drive unit around the second pivot joint. A technical benefit may include a reliable and safe movement of the drive unit in relation to the transom bracket is ensured.

[0020] Optionally in some examples, including in at

least one preferred example, a slew drive is arranged is arranged in the first pivot joint and/or in the second pivot joint. A technical benefit may include a reliable and safe movement of the drive unit in relation to the transom bracket is ensured. Additionally, by implementing the slew drive less noise when running the slew drive may be obtained.

[0021] Optionally in some examples, including in at least one preferred example, the connecting arm is configured to be pivoted around the first pivot point in maximum 200 degrees, preferably maximum 180 degrees. A technical benefit may include that the drive unit may be moved up of the water while being translated rearwards. The first pivot joint may provide the tilt function of the drive unit.

[0022] 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.

[0023] 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.

[0024] Optionally in some examples, including in at least one preferred example, the one or more propellers comprises an angle of thrust.

[0025] Optionally in some examples, including in at least one preferred example, a control unit being operatively connected with the drive unit, the first pivot joint, the second pivot joint, the linear actuator, the rotation motor, the electric motor, the hydraulic system and/or the step motor. A technical benefit may include that the movement of the drive unit in relation to the transom bracket may be controlled so that optimum sailing may be obtained independently of depth of water.

[0026] Optionally in some examples, including in at least one preferred example, the first pivot joint is hollow and the second pivot joint is hollow enabling routing of rigging and/or wiring to and from the drive unit via the pivot joints. A technical benefit may include guiding harness, wiring, cables, tubes and/or rigging via the first pivot joint and the second pivot joint whereby the harness, wiring, cables, tubes and/or rigging may be protected and thereby the risk for damage is minimized.

[0027] According to a second aspect of the disclosure, a marine vessel comprising a transom and a propulsion system as mentioned above.

[0028] 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

[0029] Examples are described in more detail below with reference to the appended drawings.

FIGS. 1-2 show in a side view the drive unit being translated rearwards according to an example.

FIGS. 3-5 show in a side view different trim of the drive unit according to an example.

FIGS. 6-9 show different view of an example of a connecting arm according to an example.

FIGS. 10-11 show different view of another example of a connecting arm according to an example.

FIGS. 12-13 show different view of another example of a connecting arm according to an example.

FIG. 14 shows a view of another example of a connecting arm according to an example.

FIG. 15 shows a view of another example of the propulsion system according to an example.

DETAILED DESCRIPTION

[0030] 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.

[0031] **FIG. 1** is an exemplary view of a propulsion system 1 for a marine vessel 100 according to an example. The propulsion system 1 comprises a transom bracket 2 configured to be connected with a transom 101 of the marine vessel 100, and a drive unit 3. The drive unit 3 is arranged to be moved in relation to the transom bracket 2 for moving the drive unit 3 in the water and out of the water. 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.

[0032] In **FIG. 1**, the drive unit 3 has been moved rearwards while it has been tilted up by rotating the connecting 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 connecting arm 4 so that a positive trim angle A is obtained of the drive unit 3.

[0033] 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. 1**, the connecting arm 4 has been pivoted in an anticlockwise direction around the first pivot joint 5.

[0034] 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. 1**, the drive unit 3 has been pivoted in an anticlockwise direction around the second pivot joint 6.

[0035] 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. 1**, 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 positions 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 connecting 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.

[0036] In an example, the drive unit 3 comprises one or more propellers. In **FIG. 1**, 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.

[0037] In **FIG. 1**, the first propeller 13a and second propeller 13b have an angle of thrust A, indicated by the angle between the dotted line and the arrow in **FIG. 1**. The drive unit 3 has been pivoted in the anticlockwise 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.

[0038] In **FIG. 1**, a linear actuator 7 is arranged between the connecting arm 4 and the drive unit 3. The linear actuator 7 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 7 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 7 transfer force to pivot the drive unit 3 around the second pivot joint 6.

[0039] In **FIG. 2**, 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. 1**. In addition, the drive unit 3 has been rotated in anticlockwise direction around the second pivot joint 6 of the connecting 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.

[0040] Compared to **FIG. 1**, the connecting arm 4 in **FIG. 2** 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.

[0041] In addition, the drive unit 3 may also be positioned so that it is raised out of the water in a parked position, when not in use, for instance when the marine vessel 100 is in the harbour or at the beach.

[0042] In **FIG. 3**, the drive unit 3 is positioned in neutral trim. The drive unit 3 is positioned in its low position where the connecting arm has been pivoted around the first pivot joint 5 in a clockwise direction. In addition, the drive unit 3 has been pivoted around the second pivot joint 6 of the connecting arm so as to be in a neutral trim where the angle of thrust of the first propeller 13a and the second propeller 13b are zero.

[0043] In **FIG. 4**, the drive unit 3 has been pivoted in a clockwise direction around the second pivot joint 6 so as to position the drive unit 3 in a negative trim having a negative angle of thrust A of the first propeller 13a and the second propeller 13b. The connecting arm has in **FIG. 4** not been pivoted around the first pivot joint 5. Hence, the drive unit 3 has been trimmed but not tilted.

[0044] In **FIG. 5**, the drive unit 3 has been pivoted in an anticlockwise direction around the second pivot joint 6 so as to position the drive unit 3 in a positive trim having a positive angle of thrust A of the first propeller 13a and the second propeller 13b. The connecting arm has in **FIG. 5** not been pivoted around the first pivot joint 5. Hence, the drive unit 3 has been trimmed but not tilted.

[0045] By the disclosure it is obtained that the drive unit 3 may be positioned freely in relation to the transom bracket 2 both in rotation but also vertical movements as well as horizontal movements.

[0046] The rotation of the connecting arm 4 around the first pivot joint 5, and the rotation of the drive unit 3 around the second pivot joint 6 may be provided different ways. In **FIGS. 6-9**, an example is shown, where a number of linear actuators 7 are arranged. Two linear actuators 7 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 7 may be hydraulic cylinders. The linear actuators 7 are arranged to pivot the drive unit around the second pivot joint 6 by extracting the cylinders or retracting the cylinders. In **FIG. 6**, the connecting arm 4 is not pivoted around the first pivot joint 5 whereby the connecting arm 4 is positioned along the transom bracket

2. In **FIG. 7**, 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 7' is connected with the connecting arm 4 at one end and at the opposite end to the transom bracket 2. The linear actuator 7' is arranged to pivot the connecting arm 4 around the first pivot joint 5 by extracting the cylinder or retracting the cylinder. In **FIG. 7**, the cylinder has been extracted so that the connecting arm 4 is rotated in the anticlockwise direction. The additional linear actuator 7' is assisting in raising and lowering the connecting arm 4 and thereby the drive unit. In **FIG. 8** is shown that the connecting arm 4 may have two parts spaced apart so that the additional linear actuator 7' may be arranged in the space between the two parts. Hereby a compact design of the connecting arm 4 and the transom bracket 2 is obtained. As shown in **FIG. 8**, the first pivot joint 5 may be hollow. In **FIG. 9**, the example is shown in a side view. The linear actuators 7 may be longer than the additional linear actuator 7'. A hydraulic system may be arranged for powering the linear actuator(s). The hydraulic system may be arranged in the drive unit or at the marine vessel.

[0047] In another example, a rotation motor is arranged in connection with the first pivot joint. The rotation motor is configured to rotate the connecting arm around the first pivot joint in a clockwise and anticlockwise direction. A rotation motor may also be arranged in connection with the second pivot joint. The rotation motor is configured to rotate the drive unit around the second pivot joint in a clockwise and anticlockwise direction.

[0048] In **FIG. 10**, another example is shown. A gearing unit 8 is arranged in the first pivot joint 5 and a motor or a step motor 9 is arranged for powering the gearing unit 8. The gearing unit 8 may have different designs and may be a planetary gearing unit. The gearing unit 8 together with the step motor is configured to rotate the connecting arm 4 around the first pivot joint 5 in a clockwise and anticlockwise direction. A gearing unit may also be arranged in the second pivot joint and a motor or a step motor may be arranged for powering the gearing unit. The gearing unit together with the step motor may be configured to rotate the drive unit around the second pivot joint 6 in a clockwise and anticlockwise direction. In **FIG. 10**, two linear actuators 7 are arranged between the connecting arm 4 and the drive unit for rotating the drive unit around the second pivot joint 6. In **FIG. 11**, a side view of the gearing unit 8 arranged in connection with the first pivot joint 8 is shown.

[0049] In **FIGS. 12-13**, another example is shown where a slew drive 11 is arranged in connection with first pivot joint 5 for rotating the connecting arm 4 around the first pivot joint in the clockwise and anticlockwise directions. Two linear actuators 7 are arranged between the connecting arm 4 and the drive unit for rotating the drive unit around the second pivot joint 6.

[0050] In **FIG. 14**, another example is shown a double gearing unit or a double planetary gearing unit 10 is ar-

ranged with individual step motors 9 in connection with the pivot joints 5, 6.

[0051] In another example, the double gearing unit or double planetary gearing unit may be powered by a step motor.

[0052] In another example, a hydraulic radial piston motor may be arranged in the second pivot joint.

[0053] According to the disclosure, many different combinations of rotating either the first pivot joint and/or the second pivot joint are feasible.

[0054] In an example, the drive unit may comprise an electric motor for powering the one or more propellers.

[0055] The propulsion system may further comprising a kick up function.

[0056] The propulsion system may further comprise two or more transom brackets 2 configured to be connected with the transom of the marine vessel, and two or more drive units 3, each drive unit 3 is arranged to be moved in relation to the transom bracket 2 to move the drive unit 3 in the water and out of the water, each 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.

[0057] In addition, the propulsion system may also comprise a control unit being operatively connected with the drive unit, the first pivot joint, the second pivot joint, the linear actuator, the rotation motor, the electric motor, the hydraulic system and/or the step motor.

[0058] In FIG. 15, another example of the propulsion system 1 is shown. The first pivot joint 5 has a first axis and the second pivot joint 6 has a second axis, and the first axis and the second axis is defining an arm axis 25 extending along the connecting arm 4 between the first axis and the second axis. The first axis and the second axis are extending perpendicular to the arm axis 25. In addition, a first linear actuator 7' is arranged between the transom bracket 2 and the connecting arm 4, the first linear actuator 7' having a first actuator extension 30 extending between the transom bracket 2 and the connecting arm 4. The arm axis 25 and the first actuator extension 30 intersect independently of any movement of the drive unit 3. Hence, the arm axis 25 and the first actuator extension 30 will cross each other at any pivoting of the connecting arm 4 around the first pivot joint 5 and any pivoting around the second pivot joint 6. Moreover, a second linear actuator 7 is arranged between the connecting arm 7 and the drive unit 3, the second linear actuator 7 having a second actuator extension 31 extending between the connecting arm 4 and the drive unit 3. The first arm axis 25 and the second actuator extension 31 never intersect independently of any movement of the drive unit 3. As mentioned previously, two second linear actuators 7 may be arranged between the connecting arm 4 and the drive unit 3. By the present example where each pivot joint is pivoted by the linear actuators, and where the arm axis 25 and the first actuator extension 30 always intersect or cross, an improved control of the movement of

the drive unit 3 is obtained.

[0059] Furthermore, the first pivot joint 5 may be hollow and the second pivot joint 6 may be hollow enabling routing of rigging and/or wiring to and from the drive unit 3 via the pivot joints 5, 6. Optionally in some examples, including in at least one preferred example, the harness, wiring, cables, tubes and/or rigging is guided from first pivot joint 5, along the connecting arm 4 and via the second pivot joint 6 to the drive unit 3 or vice versa. A technical benefit may include that the harness, wiring, cables, tubes and/or rigging is guided via the first pivot joint along the connecting arm and via the second pivot joint whereby the harness may be protected and thereby the risk for damage is minimized.

[0060] The disclosure also relates to a marine vessel comprising a transom and a propulsion system 1 as described above.

[0061] Certain aspects and variants of the disclosure are set forth in the following examples numbered consecutive below.

[0062] Example 1: A propulsion system (1) for a marine vessel, comprising

a transom bracket (2) configured to be connected with a transom of the marine vessel, and a drive unit (3),
the drive unit (3) is arranged to be moved in relation to the transom bracket (2) for moving the drive unit (3) in the water and out of the water,
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),
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).

[0063] Example 2: The propulsion system (1) of example 1, wherein 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).

[0064] Example 3: The propulsion system (1) of example 1, wherein 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).

[0065] Example 4: The propulsion system (1) of example 1, wherein 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.

[0066] Example 5: The propulsion system (1) of any of the preceding examples, wherein a rotation motor is arranged in the first pivot joint (5) and/or in the second pivot joint (6).

[0067] Example 6: The propulsion system (1) of any of the preceding examples, wherein a linear actuator (7) is arranged between the transom bracket (2) and the connecting arm (4), or between the connecting arm (4) and the drive unit (3).

[0068] Example 7: The propulsion system (1) of any of the preceding examples, wherein a plurality of linear actuators (7) are arranged between the transom bracket (2) and the connecting arm (4), or between the connecting arm (4) and the drive unit (3).

[0069] Example 8: The propulsion system (1) of any of the examples 1-7, wherein the first pivot joint (5) has a first axis and the second pivot joint (6) has a second axis, and the first axis and the second axis is defining an arm axis (25) extending along the connecting arm between the first axis and the second axis.

[0070] Example 9: The propulsion system (1) of example 8, wherein a first linear actuator (7') is arranged between the transom bracket (2) and the connecting arm (4), the first linear actuator having a first actuator extension (30) extending between the transom bracket and the connecting arm, wherein the arm axis (25) and the first actuator extension (30) intersect independently of any movement of the drive unit.

[0071] Example 10: The propulsion system (1) of any of the examples 8-9, wherein a second linear actuator (7) is arranged between the connecting arm and the drive unit (3), the second linear actuator having a second actuator extension (31) extending between the connecting arm and the drive unit, wherein the arm axis and the second actuator extension (31) never intersect independently of any movement of the drive unit.

[0072] Example 11: The propulsion system (1) of any of examples 6-10, wherein a hydraulic system is arranged for powering the linear actuator(s).

[0073] Example 12: The propulsion system (1) of any of the examples 5-11, wherein the rotation motor and the linear actuator(s) are configured to pivot the connecting arm (4) around the first pivot joint (5) and/or the drive unit (3) around the second pivot joint (6).

[0074] Example 13: The propulsion system (1) of example 1, wherein a gearing unit (8) is arranged in the first pivot joint (5) and/or in the second pivot joint (6).

[0075] Example 14: The propulsion system (1) of example 10, wherein the gearing unit (8) is a planetary gearing unit arranged in the first pivot joint (5) and/or in the second pivot joint (6).

[0076] Example 15: The propulsion system (1) of example 13 or 14, wherein a hydraulic system is arranged for powering the gearing unit and/or planetary gearing unit (8).

[0077] Example 16: The propulsion system (1) of ex-

ample 13, wherein a motor or a step motor (9) is arranged for powering the gearing unit and/or planetary gearing unit (8).

[0078] Example 17: The propulsion system (1) of any of the examples 13-16, wherein the gearing unit and/or the planetary gearing unit (8) and/or the linear actuator(s) (7) are configured to move the drive unit (3) by pivoting the connecting arm around the first pivot joint (5) and/or by pivoting the drive unit (3) around the second pivot joint (6).

[0079] Example 18: The propulsion system (1) of example 1, wherein a slew drive (11) is arranged in the first pivot joint (5) and/or in the second pivot joint (6).

[0080] Example 19: The propulsion system (1) of example 18, wherein the slew drive (11) and/or the linear actuator(s) (7) are configured to move the drive unit (3) by pivoting the connecting arm around the first pivot joint (5) and/or by pivoting the drive unit (3) around the second pivot joint (6).

[0081] Example 20: The propulsion system (1) of example 1, wherein a double gearing unit or a planetary gearing unit (10) is arranged with individual step motors (9) in connection with the pivot joints.

[0082] Example 21: The propulsion system (1) of example 1, wherein a double gearing unit or a double planetary gearing unit (10) and a step motor (9) are arranged in connection with the connecting arm (4).

[0083] Example 22: The propulsion system (1) of example 1, wherein a hydraulic radial piston motor is arranged in the second pivot joint (6).

[0084] Example 23: The propulsion system (1) of any of the preceding examples, 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.

[0085] Example 24: The propulsion system (1) of any of the preceding examples, wherein the connecting arm (4) is arranged in a center of the drive unit (3).

[0086] Example 25: The propulsion system (1) of any of the examples 1-23, wherein two connecting arms are arranged between the transom bracket (2) and the drive unit (3).

[0087] Example 26: The propulsion system (1) of example 25, wherein the two connecting arms are arranged with a mutual distance between them.

[0088] Example 27: The propulsion system (1) of any of the examples 25-26, 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 drive unit pivots around the second pivot joint.

[0089] Example 28: The propulsion system (1) of any of the preceding examples, wherein the connecting arm taper from the first pivot joint (5) towards the second pivot joint (6).

[0090] Example 29: The propulsion system (1) of any of the preceding examples, wherein the linear actuator (7) has an actuator end, the actuator end being connect-

ed with the connecting arm (4).

[0091] Example 30: The propulsion system (1) of any of the preceding examples, wherein the connecting arm (4) is configured to be pivoted around the first pivot point (5) in maximum 200 degrees, preferably maximum 180 degrees.

[0092] Example 31: The propulsion system (1) of any of preceding examples, wherein the linear actuator (7) is connected with the drive unit (3) and the connecting arm (4) and/or the transom bracket (2) and the connecting arm (4).

[0093] Example 32: The propulsion system (1) of any of the preceding examples, wherein the linear actuator (7) is connected with the drive unit (3) in a distance below the second pivot joint (6).

[0094] Example 33: The propulsion system (1) of example 32, wherein the linear actuator is connected with the drive unit (3) via a drive pivot joint (12).

[0095] Example 34: The propulsion system (1) of any of the preceding examples, wherein the drive unit (3) comprises an electric motor.

[0096] Example 35: 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).

[0097] Example 36: The propulsion system (1) of any of the preceding examples, wherein the drive unit comprises one or more propellers.

[0098] Example 37: The propulsion system (1) of example 36, wherein the one or more propellers are configured to push the marine vessel in a forward motion of the marine vessel.

[0099] Example 38: The propulsion system (1) of example 36, wherein the one or more propellers are configured to pull the marine vessel in a forward motion of the marine vessel.

[0100] Example 39: The propulsion system (1) of any of the examples 36-38, wherein the drive unit (3) comprises a first propeller (13a) and a second propeller (13b).

[0101] Example 40: The propulsion system (1) of example 39, wherein the first propeller (13a) is arranged to be counter-rotating compared to the second propeller (13b).

[0102] Example 41: The propulsion system (1) of any of the examples 36-40, wherein the one or more propellers comprises an angle of thrust.

[0103] Example 42: The propulsion system (1) of any of the preceding examples, further comprising a kick up function.

[0104] Example 43: The propulsion system (1) of any of the preceding examples, further comprises one or more transom brackets (2) configured to be connected with the transom of the marine vessel, and one or more drive units (3),

each drive unit (3) is arranged to be moved in relation to the transom bracket (2) to move the drive unit (3) in the water and out of the water,

each 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).

[0105] Example 44: The propulsion system (1) of any of the preceding examples, further comprising a control unit being operatively connected with the drive unit, the first pivot joint, the second pivot joint, the linear actuator, the rotation motor, the electric motor, the hydraulic system and/or the step motor.

[0106] Example 45: The propulsion system (1) of any of the examples 1-44, wherein the first pivot joint is hollow and the second pivot joint is hollow enabling routing of rigging and/or wiring to and from the drive unit via the pivot joints

[0107] Example 46: A marine vessel comprising a transom and a propulsion system (1) of any of the preceding examples.

[0108] 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.

[0109] 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.

[0110] 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.

[0111] 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.

[0112] 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, comprising

a transom bracket (2) configured to be connected with a transom of the marine vessel, and a drive unit (3),

the drive unit (3) is arranged to be moved in relation to the transom bracket (2) for moving the drive unit (3) in the water and out of the water, 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), 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).

2. The propulsion system (1) of claim 1, wherein 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).

3. The propulsion system (1) of claim 1, wherein 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).

4. The propulsion system (1) of claim 1, wherein 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.

5. The propulsion system (1) of any of the claims 1-4, wherein a linear actuator (7) is arranged between the transom bracket (2) and the connecting arm (4), and/or between the connecting arm (4) and the drive unit (3).

6. The propulsion system (1) of any of the claims 1-5, wherein a plurality of linear actuators (7) are arranged between the transom bracket (2) and the connecting arm (4), and/or between the connecting arm (4) and the drive unit (3).

7. The propulsion system (1) of any of the claims 1-6, wherein the first pivot joint (5) has a first axis and the second pivot joint (6) has a second axis, and the first axis and the second axis is defining an arm axis (25) extending along the connecting arm (4) between the first axis and the second axis.

8. The propulsion system (1) of claim 7, wherein a first linear actuator (7') is arranged between the transom bracket (2) and the connecting arm (4), the first linear actuator (7') having a first actuator extension (30) extending between the transom bracket (2) and the connecting arm (4), wherein the arm axis (25) and the first actuator extension (30) intersect independently of any movement of the drive unit (3).

9. The propulsion system (1) of any of the claims 7-8, wherein a second linear actuator (7) is arranged between the connecting arm (4) and the drive unit (3), the second linear actuator (7) having a second actuator extension (31) extending between the connecting arm (4) and the drive unit (3), wherein the arm axis (25) and the second actuator extension (31) never intersect independently of any movement of the drive unit (3).

10. The propulsion system (1) of any of claims 6-9, wherein a hydraulic system is arranged for powering the linear actuator(s).

11. The propulsion system (1) of any of the claims 5-10, wherein the linear actuator(s) are configured to pivot the connecting arm (4) around the first pivot joint (5) and/or the drive unit (3) around the second pivot joint (6).

12. The propulsion system (1) of any of any the claims 1-11, wherein the drive unit (3) comprises an electric

motor.

13. The propulsion system (1) of any of the claims 1-12, further comprising a control unit being operatively connected with the drive unit, the first pivot joint, the second pivot joint, the linear actuator(s), the electric motor and/or the hydraulic system. 5
14. The propulsion system (1) of any of the claims 1-13, wherein the first pivot joint (5) is hollow and the second pivot joint (6) is hollow enabling routing of rigging and/or wiring to and from the drive unit (3) via the pivot joints (5,6). 10
15. A marine vessel comprising a transom and a propulsion system (1) of any of the preceding claims. 15

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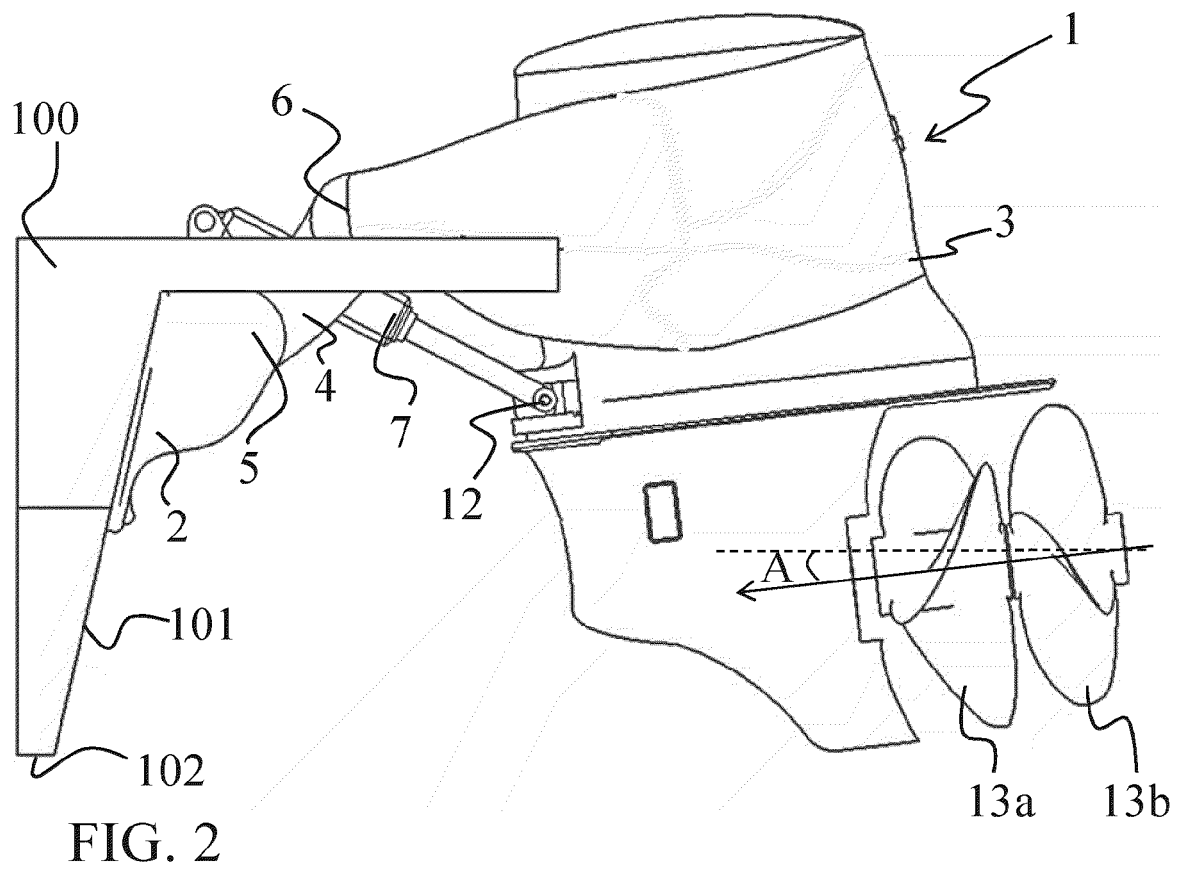
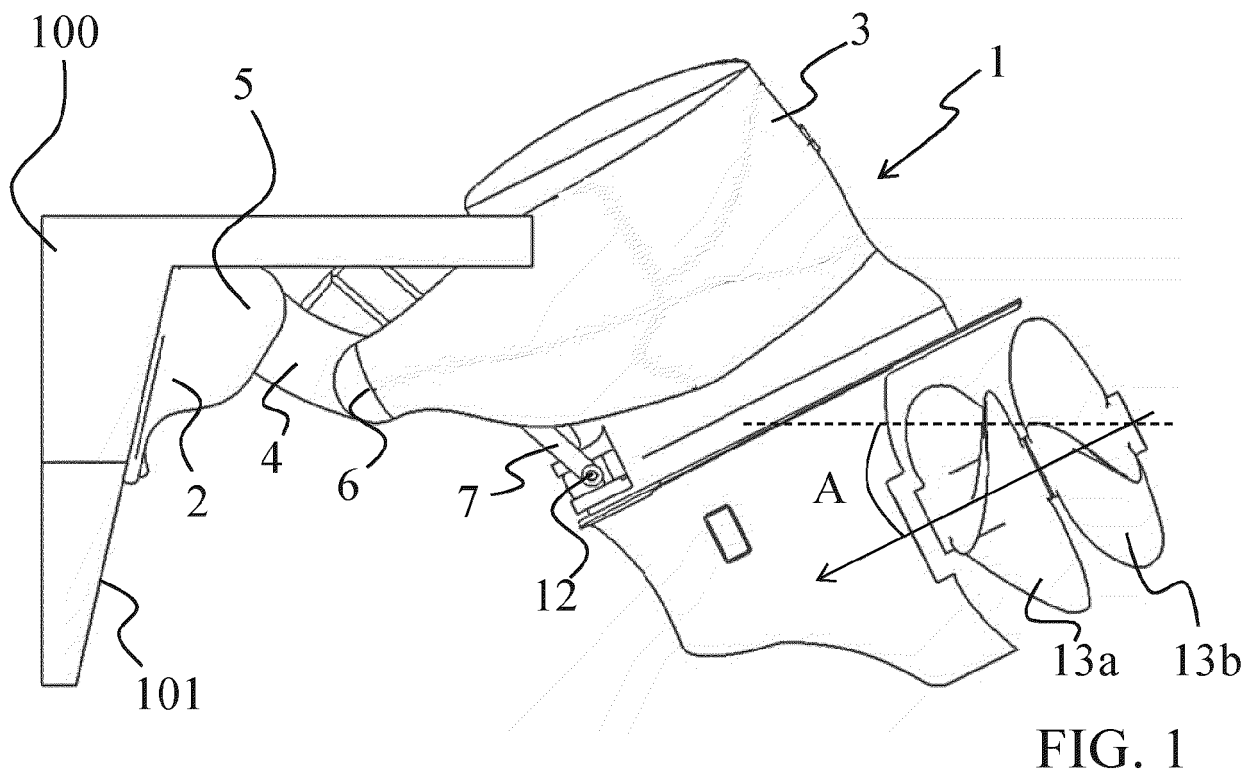
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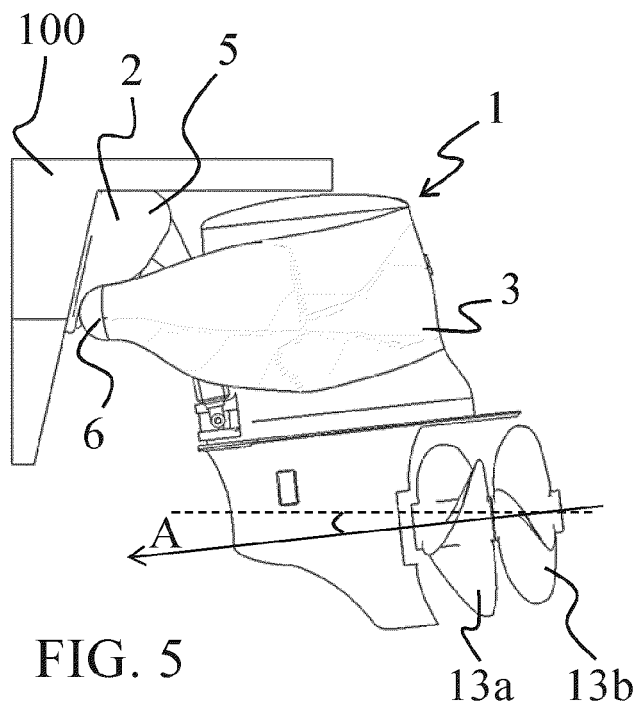
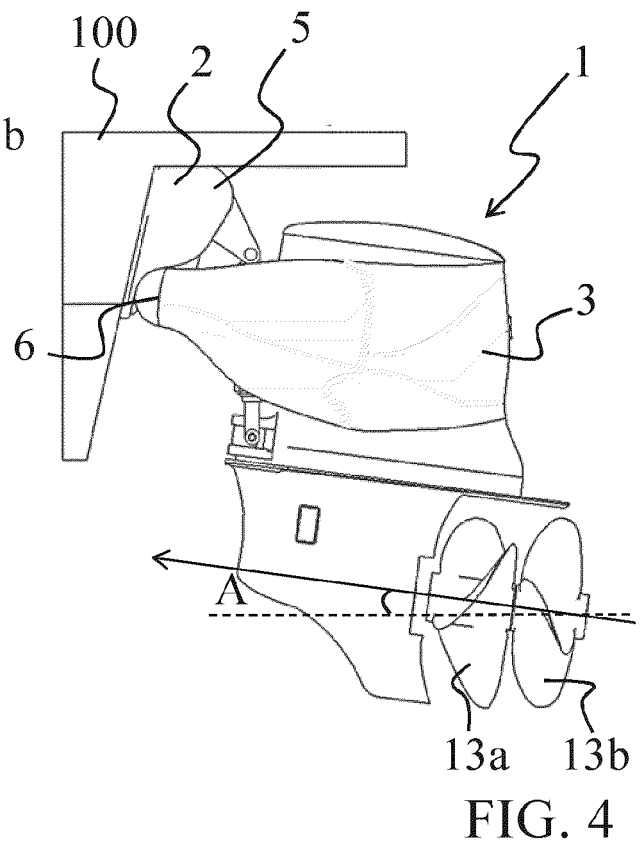
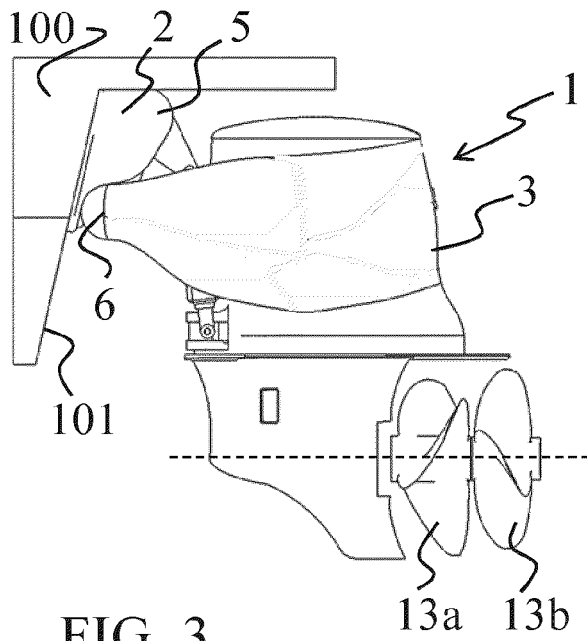
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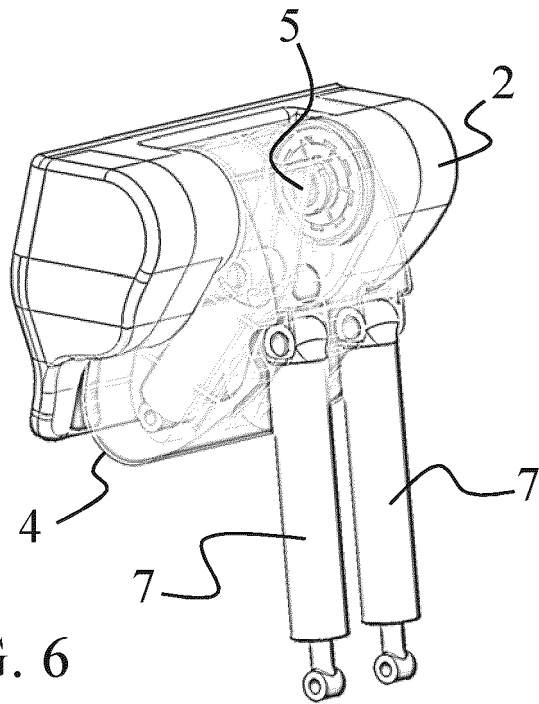


FIG. 6

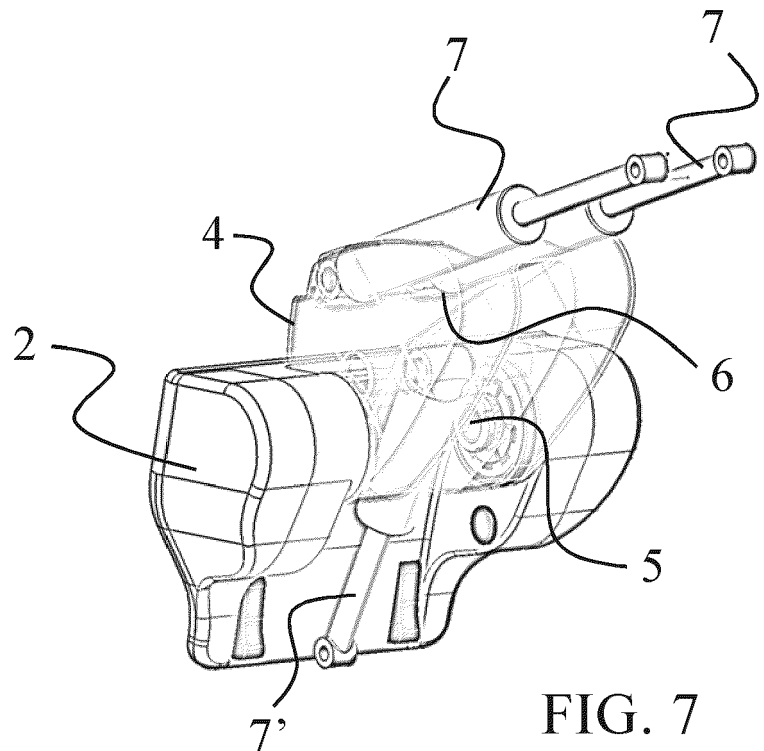


FIG. 7

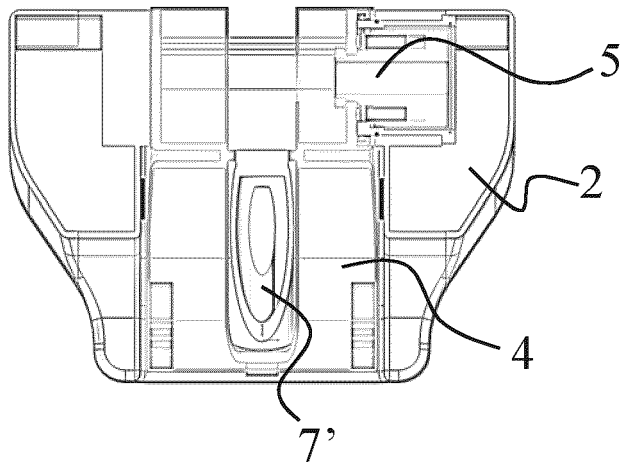


FIG. 8

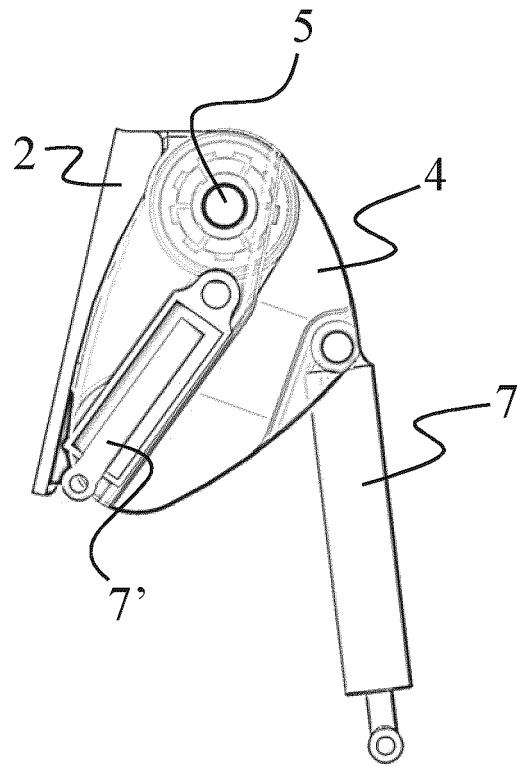


FIG. 9

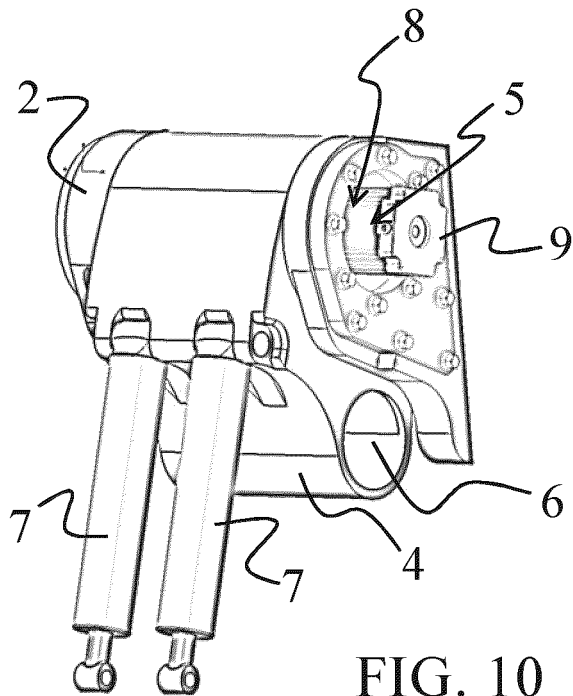


FIG. 10

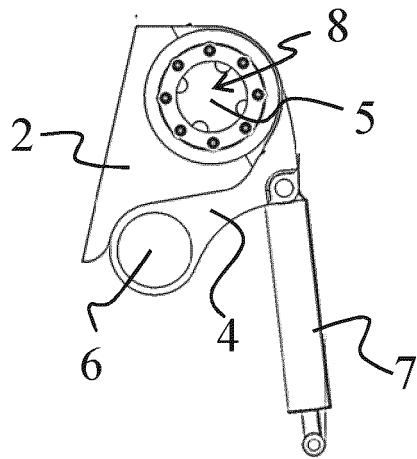


FIG. 11

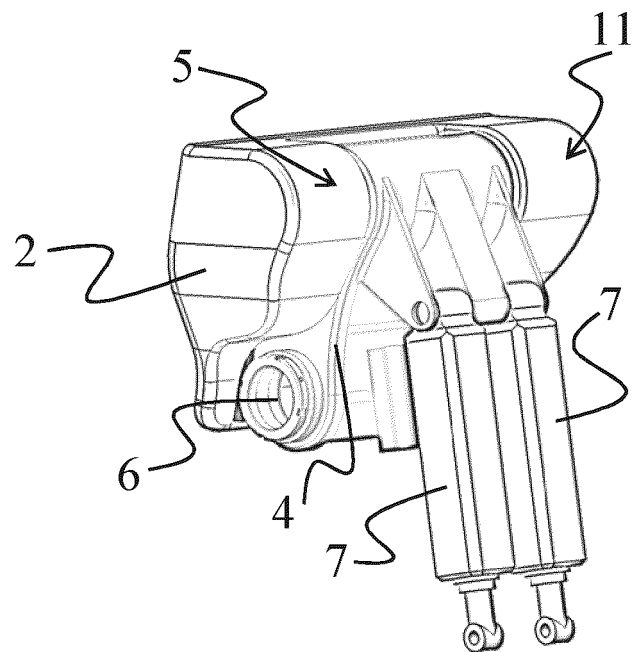


FIG. 12

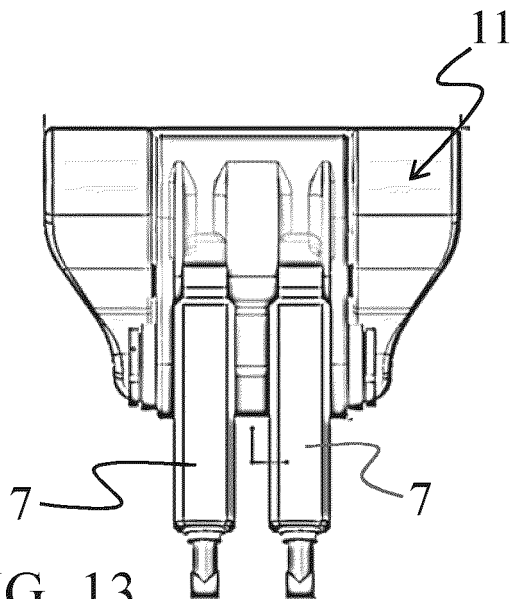


FIG. 13

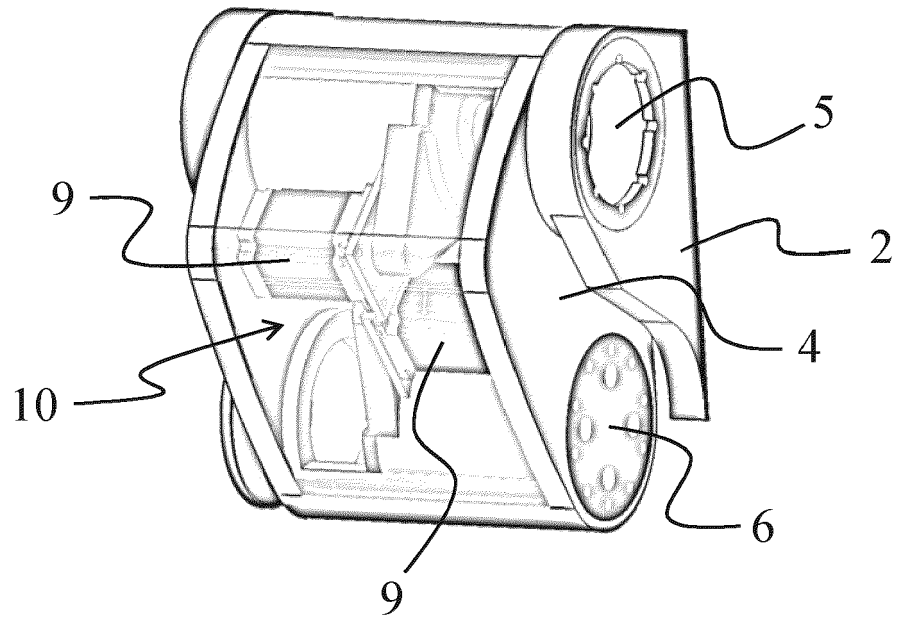


FIG. 14

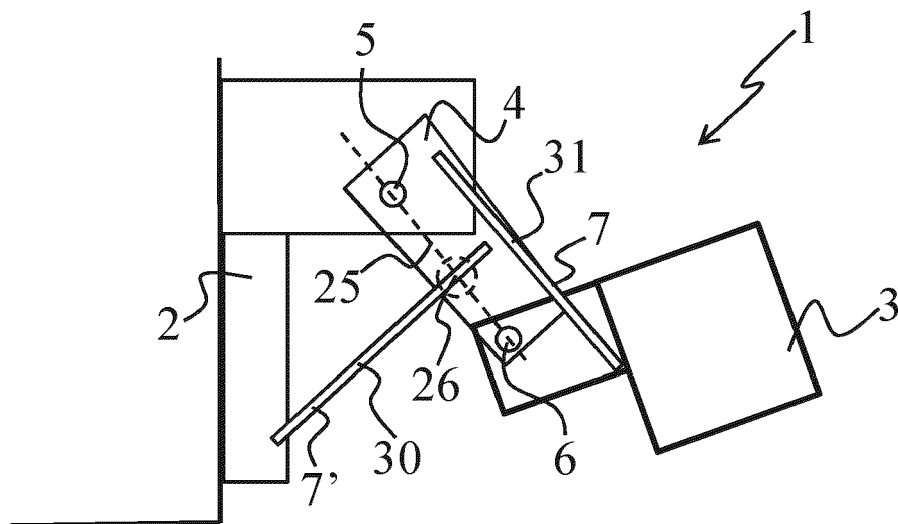


FIG. 15



EUROPEAN SEARCH REPORT

Application Number

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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 10 981 637 B1 (ALBY JEREMY L [US] ET AL) 20 April 2021 (2021-04-20)	1-13,15	INV. B63H20/10
Y	* figures 8-10 *	14	

X	WO 2021/059105 A1 (AS LABRUNA S R L [IT]) 1 April 2021 (2021-04-01)	1-13,15	
Y	* figures 1-10 *	14	

Y	US 2007/232159 A1 (LEE BRUCE R [US]) 4 October 2007 (2007-10-04)	14	
	* figures 11, 12 *		

The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			B63H
Place of search		Date of completion of the search	Examiner
The Hague		2 October 2024	Freire Gomez, Jon
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02-10-2024

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 10981637 B1	20-04-2021	NONE	
WO 2021059105 A1	01-04-2021	EP 4034459 A1 ES 2976017 T3 WO 2021059105 A1	03-08-2022 19-07-2024 01-04-2021
US 2007232159 A1	04-10-2007	NONE	

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82