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(54) **A PROPULSION SYSTEM WITH A RAISABLE LINEAR ACTUATOR**

(57) The present disclosure relates to a propulsion system (1) for a marine vessel (60), the propulsion system (1) comprising a drive unit (10), a transom bracket (20) for attaching the drive unit (10) to the marine vessel (60), a linear actuator (30) for moving the drive unit (10), the linear actuator (30) comprising a drive end (31) that is connected to the drive unit (10) and a transom end (32), the propulsion system (1) further comprising a movable attachment (40) for movably connecting the transom end (32) of the linear actuator (30) to the transom bracket (20). The disclosure further relates to a marine vessel (60).

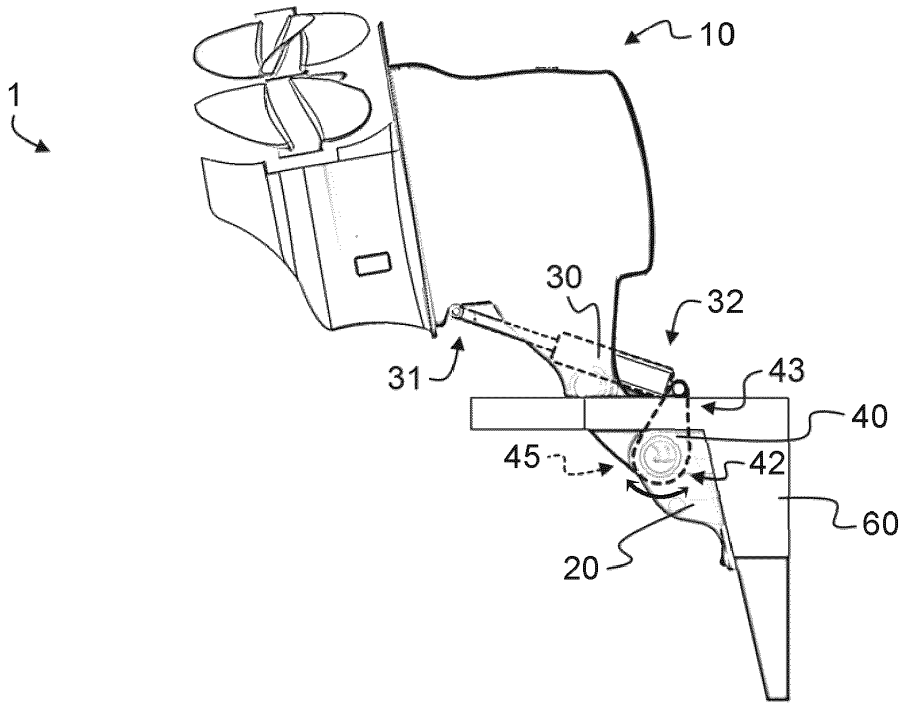

FIG. 1

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Description

TECHNICAL FIELD

[0001] The disclosure relates generally to marine propulsion. 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, sailboats, boats, ships, among other vessel types. Although the disclosure may be described with respect to a particular vessel, the disclosure is not restricted to any particular vessel.

BACKGROUND

[0002] Marine vessels may be provided with one or more drive units to propel the marine vessel in water. There exist various solutions to suspend a drive unit, some of which solutions are configured to move the drive unit. For example, the prior art solutions may allow the drive unit to be partly or completely raised above the water line of the vessel. Some prior art solutions may allow the drive unit to be rotated with respect to the vessel, e.g. to control the thrust angle of the drive unit.

[0003] Prior art solutions are marred with various drawbacks such as bulky, complex and high-cost designs and/or a relatively high demand for repair and service.

SUMMARY

[0004] According to a first aspect of the disclosure, there is provided a propulsion system for a marine vessel, the propulsion system comprising a drive unit, a transom bracket for attaching the drive unit to the marine vessel, a linear actuator for moving the drive unit, the linear actuator comprising a drive end that is connected to the drive unit and a transom end, the propulsion system further comprising a movable attachment for movably connecting the transom end of the linear actuator to the transom bracket.

[0005] The first aspect of the disclosure may seek to minimise marine growth on the linear actuator and other components of the propulsion system. In addition, corrosion may be avoided or minimised and reparability may be increased. Thus, the need for repair and service may be reduced. The linear actuator may be a hydraulic cylinder, a pneumatic cylinder, or an electric actuator.

[0006] Since the transom end of the linear actuator is movably connected to the transom bracket, the transom end of the linear actuator may be brought to various desired positions when the drive unit is operated to propel the vessel, and may be brought to other desired positions when the drive unit is not operated to propel the vessel. The transom end of the linear actuator may be brought to a raised position when the drive unit is not operated to propel the vessel. Merely as one example, the transom end of the linear actuator may be brought to a position above the water line of the vessel while the vessel is docked. This may entail that most of the linear actuator is brought to a position above the water line. Parts of the propulsion system that are positioned above the water line of the vessel may be less susceptible to growth and corrosion. Furthermore, the transom end of the linear actuator may be brought to a position that facilitates repair.

[0007] The transom end of the linear actuator may be connected to the drive unit at a position that is above the water line of the vessel. The transom end of the linear actuator may be connected to the drive unit at a position that is above the water line of the vessel when the drive unit is at least partly raised above the water line of the vessel. Thereby, the entire linear actuator may be brought to a position above the water line of the vessel.

[0008] Optionally, the movable attachment is adapted to selectively raise and lower the transom end of the linear actuator. Thus, as explained above, the transom end of the linear actuator may for example be brought to a vertically higher position to minimise growth. The movable attachment may be movable between a raised attachment position and a lowered attachment position.

[0009] Optionally, the movable attachment is pivotally connected to the transom bracket. A technical benefit may include a compact, sturdy and cost-effective design.

[0010] Optionally, the movable attachment is adapted to raise the transom end of the linear actuator to a position above the water line of the marine vessel. Referring to the above, such a solution may for example minimise marine growth on the linear actuator.

[0011] Optionally, the movable attachment is adapted to raise the transom end of the linear actuator to a position vertically above the transom of the marine vessel. Such a solution may yet further minimise marine growth. In addition, such a solution may be beneficial for reparability and inspection of the linear actuator.

[0012] Optionally, the movable attachment comprises an attachment actuator end that is connected to the transom end of the linear actuator and an attachment transom end that is connected to the transom bracket.

[0013] Optionally, the propulsion system is configured such that the transom end of the linear actuator is movable to a position vertically above the attachment actuator end of the movable attachment. Depending on the marine vessel design, and how the propulsion system is attached to the marine vessel, such a solution may entail that at least a portion of the drive unit may be raisable above the water line of the vessel.

[0014] Optionally, the propulsion system comprises an attachment actuator for causing the movable attachment to move, optionally rotate. The attachment actuator may be a rotary attachment actuator comprising an electric motor.

[0015] Optionally, the drive unit is pivotally attached to the marine vessel. This way, the thrust angle of the drive unit may be controlled, which may be beneficial for efficiency and for obtaining desired propulsion behaviour. In addition, the drive unit may in a relatively simple manner be raised at least partly above the water line of the

vessel.

[0016] Moving the drive unit to control its thrust angle may be referred to as a trimming the drive unit. Moving the drive unit to at least partly raise it above the water line of the vessel may be referred to as tilting the drive unit.

[0017] Optionally, the propulsion system comprises a connecting arm that comprises a first pivot joint connected to the drive unit and a second pivot joint connected to the transom bracket. A technical benefit may include that drive unit may be trimmed in different trim angles of the drive unit independently of water depth. Additionally, the drive unit may be moved up and down as well as translated rearwards in relation to the transom bracket while maintaining a desired thrust angle. Thus, the propulsion system may allow for a reduced draft and manoeuvring in shallow waters e.g. close to beaches. A further technical benefit may include a compact, sturdy and cost-effective design

[0018] Optionally, the connecting arm is attached to the movable attachment such that a motion of the connecting arm results in a motion of the movable attachment and thereby of the transom end of the linear actuator. Thus, when the connecting arm is pivoted to move the drive unit, also the transom end of the linear actuator may be moved.

[0019] Optionally, the propulsion system is configured such that the drive unit may be raised and lowered by pivoting the connecting arm about the second pivot joint that is connected to the transom bracket. Thus, advantageously, the connecting arm together with the drive unit may e.g. be raised above the water line of the vessel. The second pivot joint may be aligned with an essentially horizontal axis. The second pivot joint may be aligned with an axis that may be referred to as a tilt axis.

[0020] Optionally, the propulsion system is configured such that at least a part of the drive unit may be raised, by pivoting of the connecting arm about the second pivot j oint, to a position above the water line of the marine vessel, and optionally to a position vertically above the transom of the marine vessel. Optionally, the propulsion system is configured such that at least a part of the drive unit may be raised to a position vertically above the second pivot joint of the connecting arm.

[0021] It is to be noted that, in this context, vertically above means vertically higher than or higher than. Vertically above does not mean directly above. A vertical line need not intersect e.g. the drive unit and the second pivot joint of the connecting arm when the drive unit is vertically above the second pivot joint.

[0022] Optionally, the connecting arm is rotationally secured to the movable attachment such that the transom end of the linear actuator is moved when the connecting arm is pivoted about its second pivot j oint. Thus, as at least a part of the drive unit is raised the transom end of the linear actuator may also be raised in the same movement.

[0023] Optionally, a thrust angle of the drive unit may be controlled by the linear actuator. Thus, optionally, the linear actuator is arranged to move the drive unit when the latter is in a position to propel the vessel, i.e. when the drive unit is in a tilted down position.

[0024] Optionally, the propulsion system is configured such that a thrust angle of the drive unit may be controlled by pivoting the drive unit about the first pivot joint of the connecting arm. Optionally, the linear actuator is arranged to pivot the drive unit about the first pivot j oint. The first pivot j oint may be aligned with an essentially horizontal axis. The first pivot joint may be aligned with an axis that may be referred to as a trim axis.

[0025] Optionally, the drive unit comprises a support part and a thrust part, wherein the thrust part is rotatable with respect to the support part about a steering axis to direct the thrust of the drive unit. A technical benefit may include that the design of the above described transom bracket and other components may be simplified, as the thrust may be directed by rotating the thrust part with respect to the support part. In other words, the drive unit need not be movably attached to the vessel to allow for directing the thrust for steering purposes.

[0026] Optionally, the drive unit comprises an electric propulsion motor. Thus, the propulsion system may be an electric propulsion system. The propulsion system may be a forward or a rearward drive propulsion system. For example, the propulsion system may be a forward drive electric propulsion system. If the drive unit comprises a support part and a thrust part that is rotatable with respect to the support part about a steering axis to direct the thrust of the drive unit, the propulsion system may be a forward and rearward drive propulsion system. Thus, the propulsion system may be a forward and rearward drive electric propulsion system. The drive unit may comprise one propeller or two contra-rotating propellers.

[0027] Optionally, the transom bracket may be adapted to be adapted to be attached to the marine vessel by bolting. The transom bracket may be configured to be arranged on the aft side of the transom of the marine vessel, and to not extend to the bow side of the transom. The transom bracket may forms the only support between the drive unit and the vessel.

[0028] According to a second aspect of the disclosure, there is provided a marine vessel comprising the propulsion system described herein.

[0029] 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

[0030] Examples are described in more detail below with reference to the appended drawings in which **FIG.**

1 and **2** are exemplary side views of a propulsion system of the present disclosure.

DETAILED DESCRIPTION

[0031] 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.

[0032] The inventive concept of the present disclosure involves movably connecting a linear actuator to a transom bracket of a marine propulsion system. The disclosure may solve the problem of providing a compact, sturdy and long life marine propulsion system that requires less repair and service as compared to prior art solutions.

[0033] **FIG. 1** and **2** show a propulsion system 1 for a marine vessel 60. The propulsion system 1 comprises a drive unit 10 and a transom bracket 20 for attaching the drive unit 10 to the marine vessel 60. **FIG. 1** illustrates the drive unit 10 in a tilted up position whereas **FIG. 2** illustrates the drive unit 10 in a tilted down position. It is to be apprehended that the partially tilted down drive unit 10 of **FIG. 2** may be tilted (pivoted) counter-clockwise another approximately 30 degrees before being positioned in its completely tilted down position. A stern of a vessel 60, comprising a transom to which the transom bracket 20 is secured, is schematically illustrated in **FIG. 1** and **2.**

[0034] As is shown, the propulsion system 1 comprises a linear actuator 30 for moving the drive unit 10. In the present example, the linear actuator 30 is arranged to control the trim of the drive unit 10, and the linear actuator 30 may therefore be referred to as a trim actuator. The present linear actuator 30 is arranged to pivot the drive unit 10 about an axis A2, that may be referred to as a trim axis.

[0035] Referring to the figures, the linear actuator 30 comprises a drive end 31 that is connected to the drive unit 10 and a transom end 32.

[0036] The propulsion system 1 further comprises a movable attachment 40 for movably connecting the transom end 32 of the linear actuator 30 to the transom bracket 20. A motion, more precisely a rotative motion, or pivoting, of the movable attachment 40 is illustrated by the arc-shaped double headed arrow in **FIG. 1.** Thus, the movable attachment 40 of the present example is pivotally connected to the transom bracket 20.

[0037] As is clear from a comparison of **FIG. 1** and **2,** the movable attachment 40 may selectively raise and lower the transom end 32 of the linear actuator 30. In accordance with the present example, the movable attachment 40 is adapted to raise the transom end 32 of the linear actuator 30 to a position above the water line of the marine vessel 60, and even to a position vertically above the transom of the marine vessel 60.

[0038] As is indicated in **FIG. 1,** the movable attachment 40 may comprises an attachment actuator end 43 and an attachment transom end 42. The attachment actuator end 43 is connected to the linear actuator 30, more precisely to the transom end 32 of the linear actuator 30. The attachment transom end 42 is connected to the transom bracket 20. Thus, the transom end 32 of the linear actuator 30 may be connected to the transom bracket 20, more precisely via the movable attachment 40.

[0039] The present attachment actuator end 43 of the movable attachment 40 is freely rotationally connected to the transom end 32 of the linear actuator 30. The present attachment transom end 42 of the movable attachment 40 is rotationally connected to the transom bracket 20.

[0040] As is only schematically indicated, the propulsion system may comprise an attachment actuator 45 (denoted in **FIG. 1**) for causing the movable attachment 40 to move, in the present example rotate. In other words, the attachment actuator 45 is configured to cause the attachment transom end 42 of the movable attachment 40 to rotate or pivot.

[0041] As is shown, the drive unit 10 may be pivotally attached to the marine vessel 60.

[0042] In the present example, the propulsion system 1 comprises a connecting arm 50 that comprises a first pivot joint 51 and a second pivot joint 52. The connecting arm 50 may as illustrated be elongated. The connecting arm may comprise the respective pivot joints 51, 52 at is opposing ends. The first pivot joint 51 may be connected to the drive unit 10 and the second pivot joint 52 may be connected to the transom bracket 20.

[0043] The propulsion system 1 may be configured such that the drive unit 10 may be raised and lowered by pivoting the connecting arm 50 about the second pivot joint 52 (denoted in **FIG. 2**) that is connected to the transom bracket 20. Such a pivoting motion about the second pivot joint 52 is illustrated by an arc-shaped double headed arrow in **FIG. 2.** Raising and lowering the drive unit 10, e.g. by pivoting the connecting arm 50 about the second pivot joint 52, may be referred to as tilting the drive unit 10. The propulsion system 1 may comprise an undepicted actuator for pivoting the connecting arm 50 about the second pivot joint 52, such as actuator may be referred to as a tilt actuator.

[0044] Referring to **FIG. 1,** the propulsion system 1 may be configured such that the drive unit 10 may be raised (i.e. tilted), by pivoting of the connecting arm 50 about the second pivot joint 52 (tilt axis A1), to a position above the water line of the marine vessel 60 and vertically above the transom of the marine vessel 60. Thus, at least a part (typically at least the thrust part 10b) of the drive unit 10 may be raised above the second pivot j oint 52 (tilt axis A1).

[0045] As is apprehend especially from **FIG. 2,** in the present propulsion system 1 a thrust angle of the drive unit 10 may be controlled by the linear actuator 30. The thrust angle may alternatively be referred to as a trim angle. In the present example, the thrust angle is reduced when the linear actuator 30 is extended and the thrust angle is increased when the linear actuator 30 is retract-

ed.

[0046] Referring again to **FIG. 2,** in the present example the thrust angle of the drive unit 10 is controlled by pivoting the drive unit 10 about the first pivot joint 51 (trim axis A2) of the connecting arm 50. The present linear actuator 30 is arranged to pivot the drive unit 10 about the first pivot joint 51.

[0047] In the present example, the drive unit 10 comprises a support part 10a and a thrust part 10b. When the drive unit 10 is in its tilted down position, the support part 10a is the upper part and the thrust part 10b is the lower, or submerged, part. The thrust part 10b is rotatable with respect to the support part 10a about a steering axis B (denoted in **FIG. 2**) to direct the thrust of the drive unit 10. As is to be apprehended, when the thrust part 10b is rotated about the steering axis B, the thrust may be selectively directed in an essentially horizontal plane. The steering axis B is essentially vertical when the drive unit 10 is in a position to propel the vessel (the drive unit is completely or at least partially tilted down).

[0048] The drive unit 10 may comprises an electric propulsion motor, thus the propulsion system 1 may be an electric propulsion system. However, the movable attachment 40 for movably connecting the transom end 32 of the linear actuator 30 may also find use in propulsion systems that use an internal combustion engine.

[0049] Also disclosed are examples according to the following clauses:

1. A propulsion system (1) for a marine vessel (60), the propulsion system (1) comprising

- a drive unit (10),
- a transom bracket (20) for attaching the drive unit (10) to the marine vessel (60),
- a linear actuator (30) for moving the drive unit (10), the linear actuator (30) comprising a drive end (31) that is connected to the drive unit (10) and a transom end (32),
- the propulsion system (1) further comprising a movable attachment (40) for movably connecting the transom end (32) of the linear actuator (30) to the transom bracket (20).

2. The propulsion system (1) of clause 1, wherein the movable attachment (40) is adapted to selectively raise and lower the transom end (32) of the linear actuator (30).

3. The propulsion system (1) of clause 1 or 2, wherein the movable attachment (40) is pivotally connected to the transom bracket (20).

4. The propulsion system (1) of any preceding clause, wherein the movable attachment (40) is adapted to raise the transom end (32) of the linear actuator (30) to a position above the water line of the marine vessel (60), and optionally to a position vertically above the transom of the marine vessel (60).

5. The propulsion system (1) of any preceding clause, wherein the movable attachment (40) comprises an attachment actuator end (43) that is connected to the transom end (32) of the linear actuator (30) and an attachment transom end (42) that is connected to the transom bracket (20), and wherein, optionally, the propulsion system (1) is configured such that the transom end (32) of the linear actuator (30) is movable to a position vertically above the attachment actuator end (43) of the movable attachment (40).

6. The propulsion system (1) of clause 5, wherein the attachment actuator end (43) of the movable attachment (40) is freely rotationally connected to the transom end (32) of the linear actuator (30).

7. The propulsion system (1) of clause 5 or 6, wherein the attachment transom end (42) of the movable attachment (40) is rotationally connected to the transom bracket (20).

8. The propulsion system (1) of any preceding clause, comprising an attachment actuator (45) for causing the movable attachment (40) to move.

9. The propulsion system (1) of any preceding clause, comprising an attachment actuator (45) for causing the movable attachment (40) to rotate.

10. The propulsion system (1) of clause 7 and 9, wherein the attachment actuator (45) is configured to cause the attachment transom end (42) of the movable attachment (40) to rotate.

11. The propulsion system (1) of any preceding clause, wherein the drive unit (10) is pivotally attached to the marine vessel (60).

12. The propulsion system (1) of any preceding clause, comprising a connecting arm (50) that comprises a first pivot joint (51) connected to the drive unit (10) and a second pivot joint (52) connected to the transom bracket (20), the connecting arm (50) optionally being rotationally secured to the movable attachment (40) such that the transom end (32) of the linear actuator (30) is moved when the connecting arm (50) is pivoted about its second pivot joint (52).

13. The propulsion system (1) of clause 12, configured such that the drive unit (10) may be raised and lowered by pivoting the connecting arm (50) about the second pivot joint (52) that is connected to the transom bracket (20).

14. The propulsion system (1) of clause 13, configured such that the drive unit (10) may be raised, by pivoting of the connecting arm (50) about the second pivot joint (52), to a position above the water line of the marine vessel (60), and optionally to a position vertically above the transom of the marine vessel (60).

15. The propulsion system (1) of any preceding clause, configured such that a thrust angle of the drive unit (10) may be controlled by the linear actuator (30).

16. The propulsion system (1) according to any of

clauses 12 to 15, configured such that a thrust angle of the drive unit (10) may be controlled by pivoting the drive unit (10) about the first pivot joint (51) of the connecting arm (50).

17. The propulsion system (1) of clause 16, wherein the linear actuator (30) is arranged to pivot the drive unit (10) about the first pivot joint (51).

18. The propulsion system (1) of any preceding clause, where the drive unit (10) comprises a support part (10a) and a thrust part (10b), wherein the thrust part (10b) is rotatable with respect to the support part (10a) about a steering axis (B) to direct the thrust of the drive unit (10).

19. The propulsion system (1) of any preceding clause, wherein the drive unit (10) comprises an electric propulsion motor.

20. A marine vessel (60) comprising the propulsion system (1) of any preceding clause.

[0050] 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.

[0051] 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.

[0052] 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.

[0053] 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.

[0054] 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 (60), the propulsion system (1) comprising

   - a drive unit (10),
   - a transom bracket (20) for attaching the drive unit (10) to the marine vessel (60),
   - a linear actuator (30) for moving the drive unit (10), the linear actuator (30) comprising a drive end (31) that is connected to the drive unit (10) and a transom end (32),
   - the propulsion system (1) further comprising a movable attachment (40) for movably connecting the transom end (32) of the linear actuator (30) to the transom bracket (20).

2. The propulsion system (1) of claim 1, wherein the movable attachment (40) is adapted to selectively raise and lower the transom end (32) of the linear actuator (30), such that the transom end (32) of the linear actuator (30) may be brought to various desired positions when the drive unit (10) is operated to propel the vessel (60) and may be brought to other desired positions, including a position above the water line of the vessel (60), when the drive unit (10) is not operated to propel the vessel (60).

3. The propulsion system (1) of claim 1 or 2, wherein the movable attachment (40) is pivotally connected to the transom bracket (20).

4. The propulsion system (1) of any preceding claim, wherein the movable attachment (40) is adapted to raise the transom end (32) of the linear actuator (30) to a position above the water line of the marine vessel (60).

5. The propulsion system (1) of any preceding claim, wherein the movable attachment (40) is adapted to

raise the transom end (32) of the linear actuator (30) to a position vertically above the transom of the marine vessel (60).

6. The propulsion system (1) of any preceding claim, wherein the movable attachment (40) comprises an attachment actuator end (43) that is connected to the transom end (32) of the linear actuator (30) and an attachment transom end (42) that is connected to the transom bracket (20).

7. The propulsion system (1) of claim 6, configured such that the transom end (32) of the linear actuator (30) is movable to a position vertically above the attachment actuator end (43) of the movable attachment (40).

8. The propulsion system (1) of any preceding claim, comprising an attachment actuator (45) for causing the movable attachment (40) to move or rotate.

9. The propulsion system (1) of any preceding claim, comprising a connecting arm (50) that comprises a first pivot joint (51) connected to the drive unit (10) and a second pivot joint (52) connected to the transom bracket (20), the connecting arm (50) optionally being rotationally secured to the movable attachment (40) such that the transom end (32) of the linear actuator (30) is moved when the connecting arm (50) is pivoted about its second pivot joint (52).

10. The propulsion system (1) of claim 9, configured such that the drive unit (10) may be raised and lowered by pivoting the connecting arm (50) about the second pivot joint (52) that is connected to the transom bracket (20).

11. The propulsion system (1) of claim 10, configured such that at least as part of the drive unit (10) may be raised, by pivoting of the connecting arm (50) about the second pivot joint (52), to a position vertically above the second pivot joint (52) and optionally vertically above the water line of the marine vessel (60), optionally vertically above the transom of the marine vessel (60).

12. The propulsion system (1) of any preceding claim, configured such that a thrust angle of the drive unit (10) may be controlled by the linear actuator (30).

13. The propulsion system (1) according to any of claims 9 to 12, configured such that a thrust angle of the drive unit (10) may be controlled by pivoting the drive unit (10) about the first pivot joint (51) of the connecting arm (50).

14. The propulsion system (1) of any preceding claim, where the drive unit (10) comprises a support part (10a) and a thrust part (10b), wherein the thrust part (10b) is rotatable with respect to the support part (10a) about a steering axis (B) to direct the thrust of the drive unit (10).

15. A marine vessel (60) comprising the propulsion system (1) of any preceding claim.

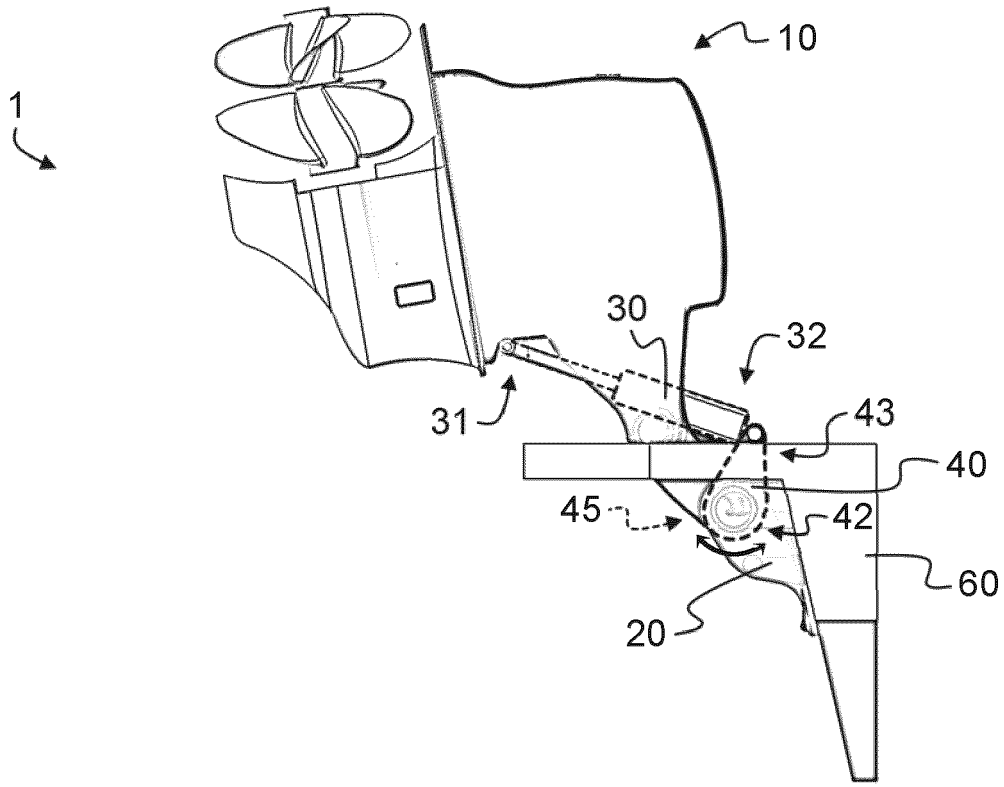

FIG. 1

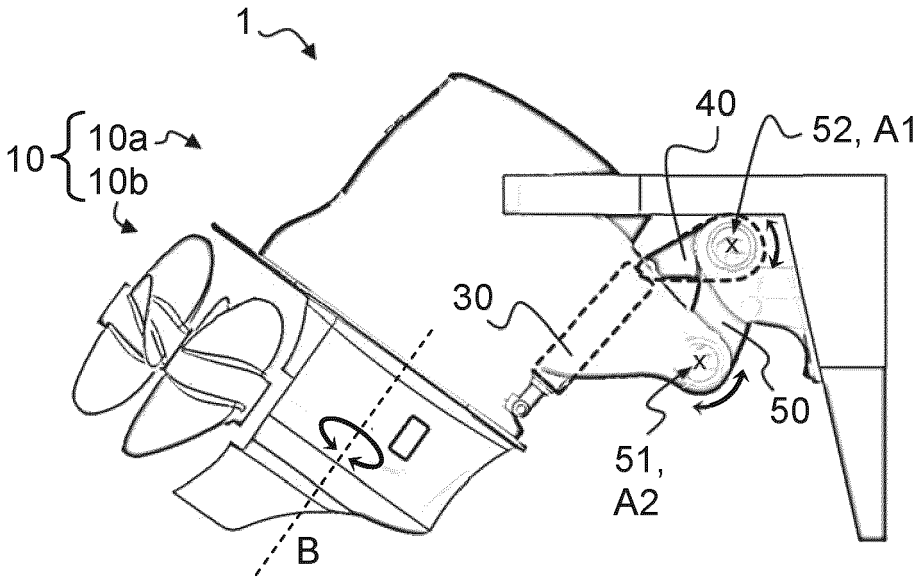

FIG. 2

Europäisches Patentamt
European Patent Office
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EUROPEAN SEARCH REPORT

Application Number
EP 24 16 9830

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	WO 2021/059105 A1 (AS LABRUNA S R L [IT]) 1 April 2021 (2021-04-01) * figures 1-10 *	1-15	INV. B63H20/10
X	US 2017/355432 A1 (MIZUTANI MAKOTO [JP]) 14 December 2017 (2017-12-14) * figures 1-10 *	1-15	

TECHNICAL FIELDS SEARCHED (IPC)

B63H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	1 October 2024	Freire Gomez, Jon

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